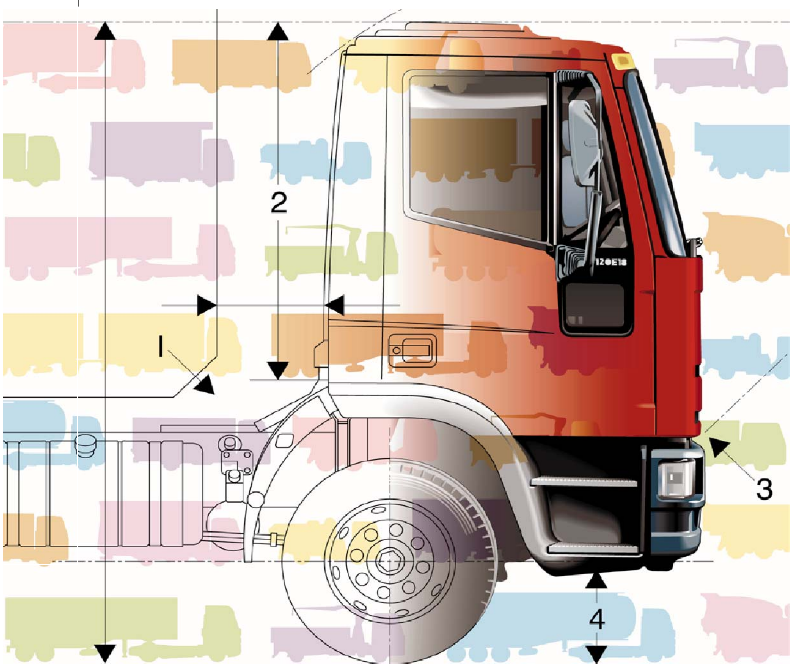
EURO RANGE
BODYBUILDERS INSTRUCTIONS

EURO RANGE



IVECO

EDITION 2002

FOLLOW THESE INSTRUCTIONS CAREFULLY IN ORDER TO PRESERVE THE EFFICIENCY AND RELIABILITY OF ALL VEHICLE COMPONENTS.
OUR PRODUCTS ARE SUBJECT TO CONSTANT DEVELOPMENT; AS A RESULT CERTAIN PARTS OF THIS PUBLICATION MAY NOT BE FULLY UP TO DATE.

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IVECO ENGINEERING
PUBLICATION NR. **603.42.371** - 7TH ED.
PRINTED IN ITALY - 02.2002

Foreword

For the technical information concerning modification of the vehicle, application of bodies and requests for technical documentation, please contact the relevant IVECO Commercial Sector.

These instructions refer to the vehicles of the EuroCargo, EuroTech, EuroStar and EuroTrakker ranges that are currently in production; for vehicles in these ranges that have gone out of production, please refer to the instructions given in previous editions.

For other current models and ones no longer manufactured by IVECO, refer to the instructions contained in the booklet NR. 603. 42.141.

Warning

The following symbols are widely used in this manual and the indications to which they refer should be carefully followed.

Danger to people: failure to fully observe these precautions can involve serious danger for personal safety.

Warning/Precautions: failure to fully observe these precautions involves the risk of serious damage to the vehicle (with resulting loss of warranty conditions) and/or persons.

Contents

SECTION

Alphabetical index to subjects

1. GENERAL SPECIFICATIONS

Index

1.1 General Specifications

Purpose

The purpose of these instructions is to permit modifications and/or fitting genuine IVECO parts while safeguarding the operation, safety and reliability of the vehicle and its components.
The modifications and fittings made in compliance with the following instructions, except for the contents of point 2.1.1, require no specific IVECO approval.
All modifications and fittings not covered in these instructions are to be approved beforehand by IVECO.
IVECO shall not be held liable for any modifications or fittings where approval has not been requested or, if it has, where approval has been rejected or not given.

Departments to be Contacted and Documentation to be Submitted

Whenever equipment has to be constructed and this is not taken into consideration by the specifications contained in this manual, the responsible Departments, which can be contacted through the Sales Management of the Company, will provide the pertinent information. In these cases contact the **IVECO Office in your zone**.

When contacting these bodies two copies of the following documentation must be submitted:

a) Drawing of the vehicle including dimensions of the body or of the modified components or of the new equipment.

b) A break down of the weights, with indications regarding the centre of gravity where necessary.

c) Description of the auxiliary frame, dimensions, fastenings to the chassis of the vehicle.

d) Distribution of the forces and moments acting on the vehicle as a result of the equipment (cranes, cement mixers, hoists, concrete pumps etc.).

Reference must be made on the drawings themselves to all the points which differ from these specifications. Furthermore, the use of the vehicle and the conditions under which it is to be used must be briefly described.

IVECO Technical Documentation Available on Computer

The specific IVECO - THB web site contains technical documentation on the product concerning:

- Instructions for bodybuilders;
- Technical descriptions;
- Bodybuilder drawings
- Chassis, transmission, p.t.o. diagrams;
- Type-approval data.

Access information can be requested directly from the above-mentioned IVECO office.
This same office will be able to provide you with CD-ROMs with the collection of chassis cab diagrams for the various product ranges in CAD - IGS and/or DXF format.

Authorization and Liabilities

The authorizations issued by IVECO concern solely the technical 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;**
- **operation, safety, reliability and generally the good handling of the vehicle as well as the effects the modifications and fitting may have on the performance and specifications of the vehicle.**

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.
- The chassis was used in a way which is not suitable for the equipment or for the intended purpose of the vehicle.
- The specifications, standards or instructions issued by the Manufacturer for the flawless execution of the operations have not be heeded.
- Original spare parts or components which the Manufacturer has made available for specific interventions were not used.

Maintaining Proper Operation of Parts and Vehicle

It is clearly understood that for all authorised modification and applications, the proper functioning of the various parts of the vehicle, the safety of operation and use of the various elements of the vehicle, in compliance with the national and international regulations (EEC Standards) and to the norms pertaining to the prevention of accidents must be guaranteed.

Limits on Modifications

To ensure driving safety and good vehicle operation, the following assemblies in general must not be modified:

- Axles
- Steering system
- Brakes
- Suspension (springs, brackets, anchor bar)
- Chassis
- Power unit
- Coupling devices (hooks, fifth wheels)
- Cab supports, locking and tilting devices
- Electrical system.

Modifications to the above assemblies, where included in these directives, may only be carried out after approval has been received from IVECO.

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.

Instructions for Additional Units

The bodybuilder shall, upon delivering the vehicle, supply the necessary service and maintenance instructions for additional installed units.

Choosing the Chassis

The correct choice of chassis, in the appropriate version, is very important if the outcome of the modification is to be successful.

Before proceeding with the modifications, ensure that the vehicle supplied corresponds to the one requested by checking information given on the order, and in the technical documentation provided by the Manufacturer.

Vehicles Identification

Two examples concerning the identification of the Euro Range of vehicles are given below together with the meaning of the relevant initials:

	Cab Range		**Model**				**Power**		**Version Configuration**		**Gearbox Suspension**		
CHASSIS CAB VEHICLES	**L**	**D**	**I**	**9**	**0**	**E**	**5**	**2**			**/**	**F**	**P**
TRACTOR	**M**	**P**	**4**	**0**	**0**	**E**	**3**	**8**	**T**	**X**	**/**	**P**	
	ML MH MP LD FF M CC		GVW-Vehicles with cab GVC - Tractors for semitrailers (:10 in ton)			EURO	Engine power (x 10 in HP)		C D H K T R V X Y Z W		/TN /P /PT /PS /FP /FT /FS /E		
EXTERNAL NAMEPLATE ON VEHICLE			**I**	**9**	**0**	**E**	**5**	**2**					

CAB RANGE

ML = Medium light
MH = Medium Heavy
MP = Multipurpose
LD = Long distance
FF = Fire fighting
M = Military

CC = Chassis cowl

VERSION

C = Combi
D = Double cab
H = Heavy duty
HM = Heavy mission
K = Kipper
T = Tractor for semitrailers
R = Drawbar
V = Van
X = 6 x 2C Only tractors
Y = 6 x 2P Road
Z = 6 x 4
W = All wheel drive

SUSPENSION

/TN = Only for 6 x 2P vehicles, mechanical rear suspension with fixed 3rd axle (twin wheels)
/P = 4x2, 6x4, 6x2P vehicles, rear air suspension. 6x2P with fixed 3rd axle, single wheels
/PT = Only for 6x2P rear air suspension with fixed 3rd axle, controlled steering
/PS = Only for 6x2P, rear air suspension with fixed 3rd axle (twin wheels)
/FP = 4x2, 6x4, 6x2P, 6x2C, full air suspension
/FT = Only 6x2P, full air suspension with fixed 3rd axle (twin wheels)
/FS = Only 6x2P full air suspension with 3rd single wheel axle, controlled steering
/E = Rubber rear suspension (6x4, U.K. market)

1.2 Dimensions and weights

1.2.1 General Specifications

The dimensions and maximum permissible mass on the axles are indicated on drawings, on technical specifications and, in greater details, on the official documentation issued by the Company.
The kerb weights refer to vehicles with standard equipment. Special equipment may involve considerable modification to the mass and its distribution on the axles.
Lights and rear-view mirrors positioning on our vehicles is designed for widths of 2,500 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 mass of approx. 5%.

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

1.2.2 Determining the Centre of Gravity of the Body and Payload

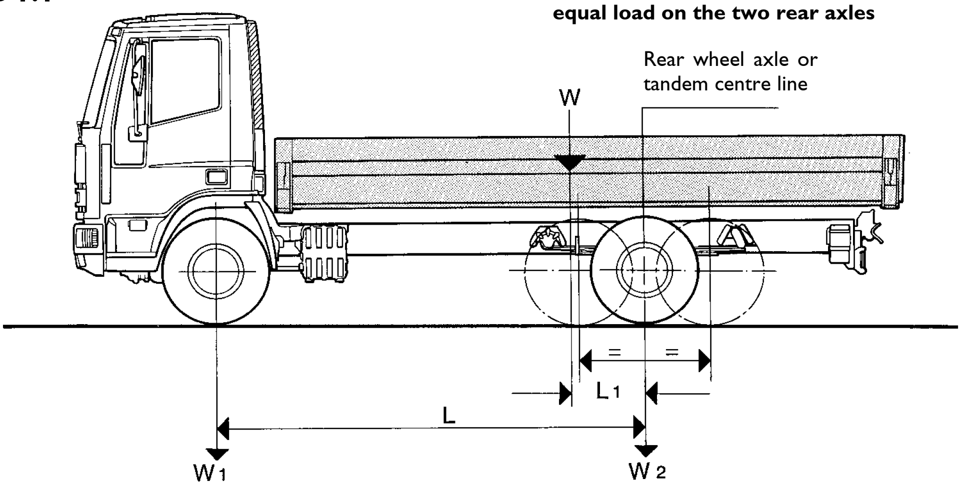
Positioning on longitudinal plane

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 masses and positioning of the single components of the vehicle are given in the chassis and weight distribution diagram.

Figure 1.1

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



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

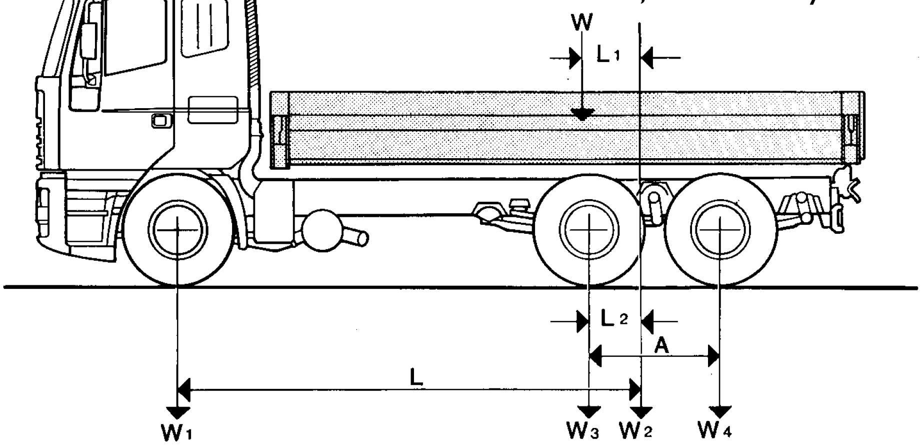
W = Payload + body
W_1 = Share of payload on front axle
W_2 = Share of payload on rear axle (or tandem)
L_1 = Distance of centre of gravity from centre-line of rear axle (or tandem centre-line)
L = Actual wheelbase

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

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

Figure 1.2

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



Example to verify compliance of admitted masses on the axles

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

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

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

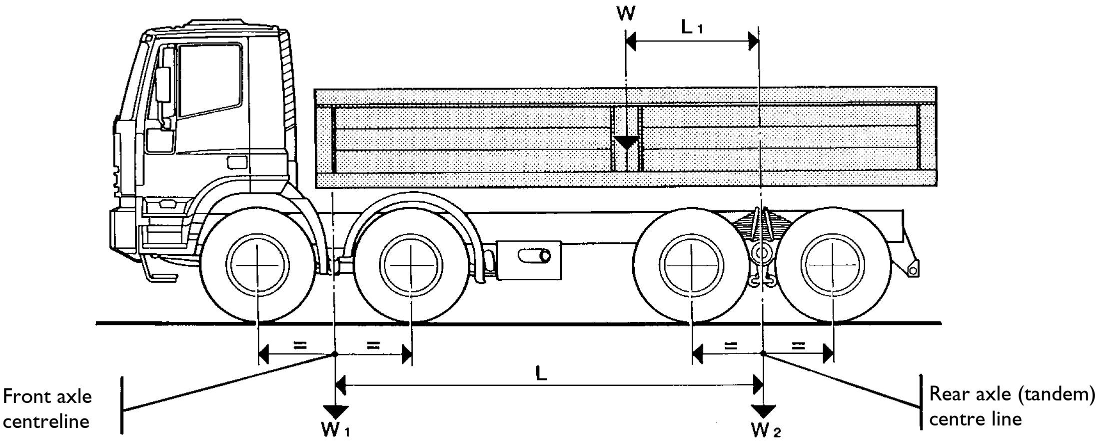
$$W_3 = W_2 \times \frac{(A - L_2)}{A}$$

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

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

Figure 1.3

4 axle vehicles with the same loading on both the front and rear axles



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

W	=	Payload + body
W_1	=	Share of payload on front axles
W_2	=	Share of payload on rear axles (tandem)
L_1	=	Distance of centre of gravity from centreline of rear bogie
L	=	Actual wheelbase

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

respectively $L_1 = L - \dfrac{W_2 \times L}{W}$

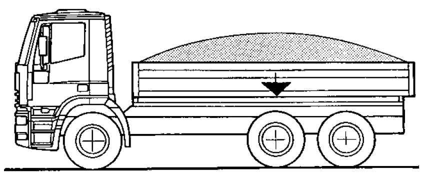
In order to apportion the payload on the axles, it must be uniformly distributed except when the shape of the loading surface itself entails a different distribution of the load.

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

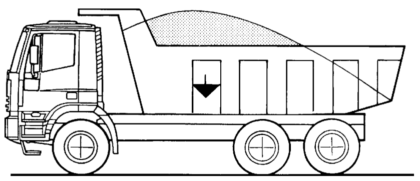
When building bodies or containers, loading and unloading systems for the transported goods must be devised which preclude excessive variations in the distribution of the load and/or excessive loads on the axles, also giving the relevant instructions to the users.

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

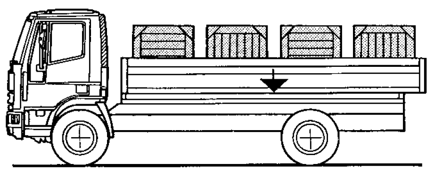
Figure 1.4



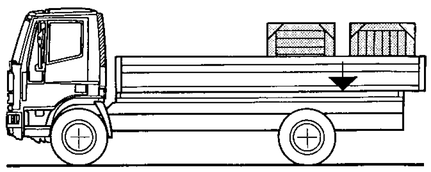
Uniform distribution of the load



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



Uniform distribution of the load



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

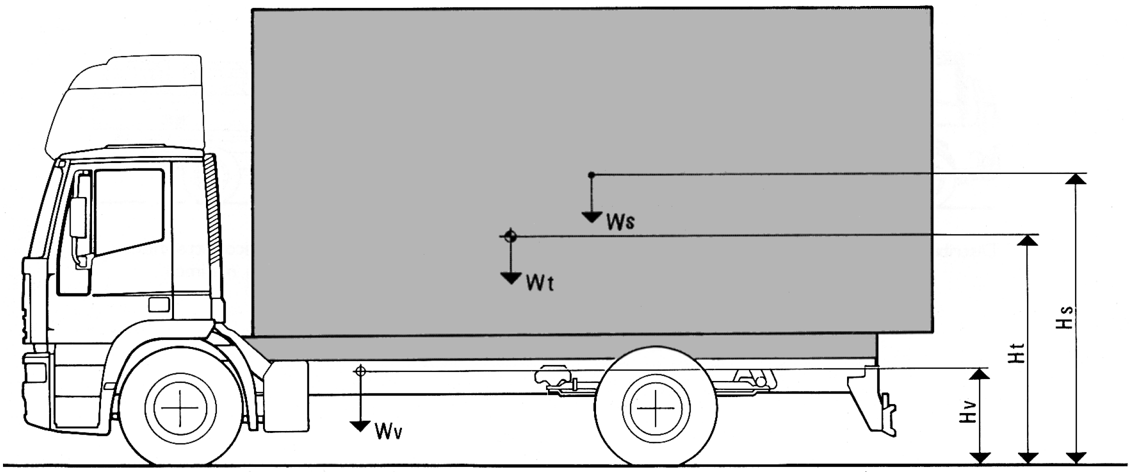
Height of the Centre of Gravity

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. EC Directive 71/320 as amended by the current braking directive regarding breaking) or requested by the Manufacturer to ensure good handling of the vehicle (e.g. transverse stability of the moving vehicle).
In order to comply with the current EC Directive, IVECO provides information for the various models (wheelbase and specific body) on computer, regarding:

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

Figure 1.5

Verification with full load:



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

Wv = Chassis cab vehicle tare weight
Hv = Height of centre of gravity of chassis cab vehicle (laden condition)
Ws = Payload plus superstructure tare
Hs = Height of centre of gravity of body and payload in relation to ground
Wt = Vehicle mass when fully loaded
Ht = Height of centre of gravity of vehicle with full load

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

The height of the centre of gravity indicated in table 1.1 represents values which are not to be exceeded for each given equipment level. These values have been calculated only in terms of the transverse stability of the vehicle and are applicable to a mid wheelbase. Any other possible restrictive specification, e.g. braking regulation, should be taken into consideration.

The values given in table 1.1 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, running path gradual variations, etc.).
Modifications may only be carried out after approval has been received from IVECO.

1.2.3 Observing the Permitted Weights

All limits indicated in our documentation must be adhered to. The mass 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 mass with uniformly distributed loads
- 25% of the total vehicle mass 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 laws and regulations.

Variations in the Permissible Mass

Special exceptions to the maximum permissible mass 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 admissable vehicle load (downrating) may require interventions on some parts, such as the suspension. In these circumstances, the necessary indications may be supplied.

The request for authorisation must include:

- Vehicle type, wheelbase, identification number, designated use.
- Tare 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.

Table 1.1
Maximum heights in relation to the centre of gravity 1) of the payload and cornering stability

MODELS	BASIC EQUIPMENT with anti-roll bars				Max. height (approx.) of centre of gravity of payload (includ. body or equipment) in relation to the ground (mm)
	Front		Rear		
	1	2	1	2	
ML 60; 60P	x		x		2450
ML 60K	x		x		2400
ML 65; 75; 80; 65P; 75P; 80P	x		x		2300
ML 65K; 75K	x		x		2250
ML 65H	x		x		2400
ML 80K	x		x		2350
ML 85H	x		x		2400
ML 95W	x		x		2750
ML 100; 100P	x		x		2200
ML 100K	x		x		2250
ML 100W	x		x		2470
ML 120; 120P	x		x		2400
ML 110EL ; /P	x		x		2200
ML 120K	x		x		2550
ML 120H	x		x		2550
ML 130	x		x		2300
ML 130P; 130FP	x		x		2400
ML 130K; 150K	x		x		2500
ML 135W	x		x		2750
ML 140W	x		x		2500
ML 150	x		x		2350
ML 150P; 150FP	x		x		2400
ML 150H	x		x		2600
ML 170; ML 180	x		x		2550 ; 2400
ML 170P; ML 180; /P	x		x		2650 ; 2500
ML 170K	x		x		2600
ML 260KE	x		-	-	2650
MP 180; 180P	x		x		2650
MP 180FP	x		x		2590
MH / MP 190	x		x		2720
MH / MP 190P	x		x		2750
MP 190FP	x		x		2700
MP 190H	x		x		2720
MP 190W	x		x		2800
MP 240; 240TN; MH 260; TN	x		x	-	2740
MP 240P; PS; MH 260P; PS	x		x	x	2720
MP 240FP; FS	x		x	x	2690
MP 240PT; MH 260PT	x		x	x	2830
MP 240FT	x		x	x	2850
MP 260	x		-	-	2650
	x		SW	-	2650

Table 1.1 (continued)
Maximum heights in relation to the centre of gravity 1) of the payload and cornering stability

MODELS	BASIC EQUIPMENT with anti-roll bars				Max. height (approx.) of centre of gravity of payload (includ. body or equipment) in relation to the ground (mm)
	Front		Rear		
	1	2	1	2	
MP 260P	x		x	x	2720
MP 260FP	x		x	x	2680
MP 260H	x		x	-	2780
MP 260W	x		x	-	2890
MP 330H	x		x	-	2600
MP 330W	x		x	-	2620
MP 380H	x		x	-	2510
MP 380W	x		x	-	2520
MP 340H	x	-	x	-	2290
MP 410H/HB	x	-	x	-	2510

Note:
1) = values referred to the transversal stability of the vehicle comply with further possible restrictions imposed by the regulations in force (e.g. braking system).
x = with standard anti-roll bar
- = without anti-roll bar
SW = anti-roll bar on request

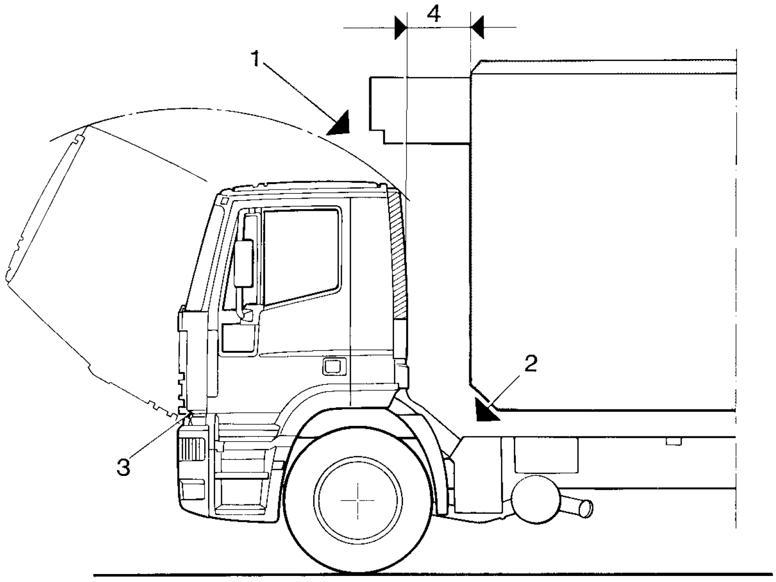
1.3 Instructions for the Correct Functioning of the Parts of the Vehicle and Accessibility for Maintenance

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 fig1.6).

Figure 1.6



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 rotational centre
4 Observe the minimum distance required by the specific documentation

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

- Adequate ventilation of the brakes and battery case (especially in the case of vans) must be guaranteed.
- The positioning of the mud-guards and wheel-arches must allow free movement of the rear wheels even when chains are being used. Sufficient space must also be ensured with lifting axles. Some of our models have 3rd axle steering which also steers in the raised position; and it is necessary to leave space for this function (see point 2.20).
- When vehicle body building has been completed the adjustment of the headlights must be checked for safety and re-adjusted where necessary. In these circumstances it may be necessary to adjust the screw on the headlights or to check the adjustment range of the adjusting device when the vehicle is laden. The adjustment must be carried out in compliance with the instructions given in the Owner's Manual in which the new values, if any, will be included.
- In the case of parts which are supplied loose (e.g. spare wheel, chocks) it will be the responsibility of the bodybuilder to position and secure them in an accessible and safe manner in compliance with possible national laws.

1.4 Legal Provisions and Prevention of Accidents

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 EEC directives. Converted vehicles must also comply with these directives. The only permissible exception is granted where local type approval differs from EEC homologation.

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.

Warning

Components such as seats, upholstery, seals, protective panels etc, may constitute a potential fire risk if exposed to sources of intense heat.

Remove these components before undertaking welding or flame-cutting work.

1.5 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, 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.

1.6 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 expedient for bodybuilders to be equipped with an organization where the following are defined and available:

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

1.7 Vehicle delivery

Before delivering the vehicle to the Customer check that:

- The equipment requested has been correctly fitted.
- The vehicle and equipment is completely ready for service and fully operational.
- The functionality and safety of the vehicle and/or equipment has been respected.
- Information/documentation concerning the equipment has been included.
- New data have been entered on the appropriate plates (where applicable)

Concerning the periodical checks on the vehicle, please remember the instructions for correct battery maintenance referred to on the specific information sheets on the vehicle before delivery to the customer.

The bodybuilder will moreover need to confirm that the operations carried out are in compliance with the latest bodybuilder instructions manual/documentation provided by IVECO and with the requirements of the law.

Guarantee

A guarantee is provided for all our vehicles, under the terms and conditions set out in the relevant documentation. An equivalent guarantee must be provided by the bodybuilder/chassis converter covering the work carried out, by them.

2. CHASSIS MODIFICATIONS

Index

2. Chassis Modifications

2.1 General

2.1.1 General Specifications and Approval of the Company concerning Modifications of the Chassis

Any modifications must be carried out according to the criteria detailed in the following paragraphs. 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 2.2.4, 2.3, 2.4 and 2.6).
- **Holes in the flanges of the side members are not permitted** (except for the items described at point 3.1.2).
- 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 or where rivets are replaced with bolts, the bolt torque must be checked after the vehicle has been driven approximately 500 to 1.000 kms.

IVECO Approval

The following modifications may only be performed following IVECO approval:

a) Modifications to the wheelbase following instructions given at points 2.2.3, 2.2.4, and 2.3.
b) Modifications to the rear overhang within the limitations imposed by weight and national legislation, following instructions given at points 2.2.3, 2.2.4 and 2.4.
c) Work on the braking system (see point 2.14) and on the steering system (after appropriate checks).
d) Modification to the characteristics of the suspension (see point 2.7).
e) Changing mechanical suspension into a pneumatic or mixed suspension (see point 2.7.1.).
f) Modifications to the driver's cab (see point 2.12).
g) Modifications to the exhaust system and to the engine air intake (see point 2.8).
h) Modifications to the engine cooling system (see point 2.9).
i) Modifications to the engine assembly and driving gear (see point 2.3.2).
k) Modifications to the front and rear axles
l) Installation of supplementary axles following the instructions given at point 2.6.
m) Installation of retarder brakes (see point 2.18).
n) Installation of power take-offs (in cases where authorisation is required, see paragraph 4).
o) Changing the dimensions of the tyres (see point 2.13).

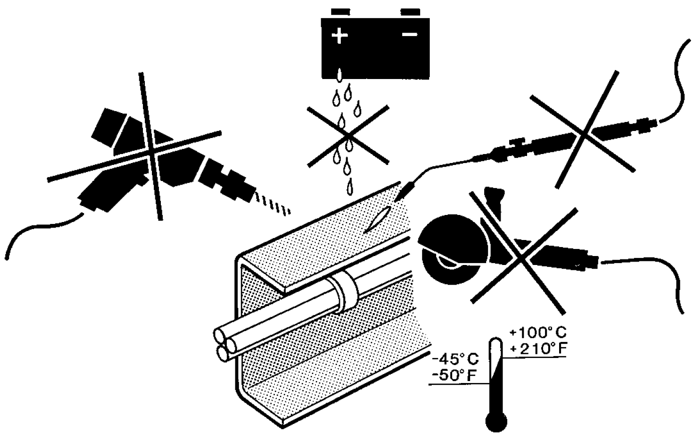
As a general rule, to obtain official approval, the request must contain full documentation illustrating the intended project which must reflect the general and specific specifications contained therein.

It is the responsibility of the bodybuilder to present the intended modification to the proper authorities and to seek their approval whenever called upon to do so by national laws.

2.1.2 Specific Precautions

During the welding, drilling, grinding and cutting operations when working in the proximity of brake lines and particularly **if these are of plastic material or electric wiring**, care must be taken to ensure their protection. Where necessary they should be removed (follow the instructions given in paragraphs 2.2.3 and 2.15).

Figura 2.1



Regarding the electrical equipment remember to:

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

b) Checking the earth connections.
As a general rule the original earth connections of the vehicle must not be changed. If it is necessary to move these connections or to implement further earth points use the existing holes on the chassis as far as possible and:
- Remove, mechanically, and/or with an appropriate chemical product, the paint on the chassis side and on the terminal side creating a resting plane free from indentations or ridges.
- Apply appropriate high conductivity paint between the cable terminal and the metal surface (e.g. galvanizing paint IVECO Part number 459622 by PPG).
- Connect the earth cables within 5 minutes from the application of the paint.

Do not use the IVECO standardised M1 (battery earth connection) M2, M8 (earth connection for starter motor depending on the driving position) points for the earth connections for control switches (e.g. sensors or low absorption devices): See IVECO Workshop manuals.
With regard to the electronic devices, avoid linking earth connections between the devices; only use single wire earths with optimised lengths (as short as possible).

c) Electric wiring.
The wires of the electrical equipment must be connected by waterproof connections of the same type as the original. The additional section of wire must be protected inside an appropriate sheath and suitably attached by clips. The new wiring must not be positioned on the side of the electronic circuits already existing on the vehicle.

For further information regarding the braking and electronic system, refer to chapter 2.14 and 2.15.

2.1.3 Protection against Rust and Painting

All parts of the vehicle (chassis, driver's cab, body etc.) which have been subject to modification must be protected against oxidation and corrosion.

Protection and painting operations must be carried out with due care on all the parts concerned.

In particular the frame, cab and various parts exposed to atmospheric agents and sunlight must be treated with a cycle which includes:

Ironphosphor - degreasing, anti-corrosion, sealing, primer coat and final coat (the enamel type primer can be replaced with powdered paint, the cab body excluded).

Miscellaneous parts (boxes, protective grills etc.) with complex forms (with boxed parts, joints, overlaps and areas not accessible using the traditional spray application) which are attached to the frame must be treated with a cycle which includes:

Ironphosphor - degreasing, electrophoresis or immersion anti-corrosion, enamel or powdered paint.

When joining surfaces by welding and when the electrophoretic stage is not used, it is extremely important to protect the contact surfaces with the electrically weldable paints.

For those parts which are not directly in contact with atmospheric agents (e.g. inside the cab) reduced cycles are acceptable.

Ironphosphor - degreasing, powdered paints or phosphor - degreasing, electrophoresis or phosphor - degreasing, anti-corrosion.

The phosphor - degreasing process may be replaced by degreasing with solvents and wash primer (5 to 10 μm).

Other important operations included are: protection of the open or semi-open boxed parts using oil-wax products by injection using suitable probes, sealing of the joints and overlaps of the areas subject to abrasive action (wheel arches, under body, etc.) using specific product (elastomers, acrylics, etc.) after the anti-corrosion protection.

Parts mounted on the outside of the cab (brackets and bolts in general) must be of stainless steel or protected with "Dacromet". The coupling elements (hinges, handles etc.) used on the frame and/or body (floor panels, tanks etc) must be protected with "Dacromet" or with 12 μm min. galvanising. The same quality of the parts used on the cab must in all cases be guaranteed.

Precautions

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

- Rubber or plastic hoses 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.

Engines with electric and electronic components

- On all the engine and vehicle wiring harness, including earth contacts.
- On all connectors on the sensor/actuator side and wiring harness side.
- On all sensors/actuators, on flywheel, on flywheel revs sensor support bracket.
- On the pipes (plastic and metal) of all the diesel fuel circuit.
- On the complete diesel fuel filter base.
- On the control unit and its respective base.
- On the area inside the sound-proof cover (injectors, rail, pipes).
- On the common rail pump complete with regulator.
- On the vehicle's electric pump.
- On the tank.
- On the front belts and relevant pulleys
- On the power-steering pump and its respective piping.

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

The electronic components and modules must be removed.

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

When modifing the cab the application of noise deadening and insulating materials must be included inside the cab and under the floor to eliminate vibrations, contain noise levels and to restore the original heat insulation levels.

2.2 Specific Instructions

2.2.1 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 sidemember of the vehicle be drilled unless in compliance with the indications given in point 3.1.2.

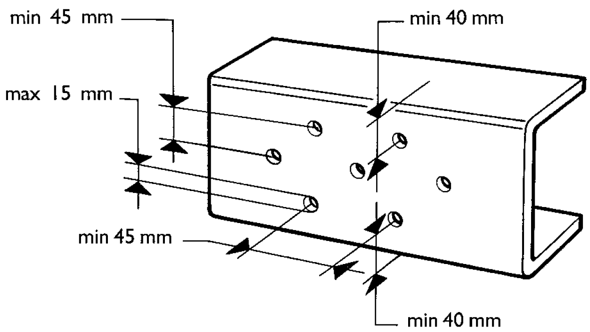
In those cases (installation of shelves, brackets etc.) where it is necessary to drill new holes, they must be drilled in the vertical web of the side member and must be carefully deburred and reamed.

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 relocating spring supports or cross members, the same drilling arrangements must be preserved.

Figure 2.2



2.2.2. Bolts and Rivets

In general, fixings of the same type and class designed for similar fixings of the original vehicle should be used. Use class 10.9 bolts for high-stress fixings (e.g. spring supports, bar connections, shock absorbers etc.). When space permits it use flanged head screws and nuts.

2.2.3 Characteristics of the Materials to be Used when Modifying the Original Chassis

For the modification of the vehicle's chassis and for the reinforcements applied directly to the side members, the material used must correspond both in quality and thickness to that of the original chassis. If material of the specified thickness is not available standard material of the next greater thickness (e.g. 7 mm instead of 6.7 mm) can be used. The material to be used must meet these minimum standards.

Vehicles with a weight rating equal to or lower than ML 180, including ML 260 KE (EuroCargo):

Chassis made of high yield steel	FeE420 (QSt E 420 TM-BS1499 part I grade 46/40)	
Tensile strength	R	≥ 530 N/mm^2 (53 kg/mm^2)
Yield point	R 0.2	≥ 420 N/mm^2 (42 kg/mm^2)
Stretching	A 5	≥ 21%

Vehicles with a weight rating equal to or greater than MP 180 (EuroTech/EuroStar/EuroTrakker):

Chassis made of high yield steel	FeE490 (QSt E 500TM-BS1449 HS 50/45)	
Tensile strength	R	≥ 610 N/mm^2 (61 kg/mm^2)
Yield point	R 0,2	≥ 490 N/mm^2 (49 kg/mm^2)
Stretching	A 5	≥ 19%

As an alternative, only for extending of the rear overhang, Fe510D (QSt 52-3-BS4360, grade 50C) with the following characteristics may be used:

Tensile strength	R	≥ 520 N/mm^2 (52 kg/mm^2)
Yield point	R 0,2	≥ 360 N/mm^2 (36 kg/mm^2)
Stretching	A 5	≥ 22%

For the dimensions and thicknesses, see the information given in the relevant documentation.

2.2.4 Welding the Chassis

The welding operations may be carried out only by specialist, trained personnel using equipment that is suitable to ensure high quality workmanship (see specifications EN 287).

Welding is permitted:

- for joining of the side members if they are lengthened or shortened.
- for the application of reinforcing L section flitch on a side member that is to be modified as detailed below (see Fig. 2.5).

For vehicles equipped with electronic devices (e.g. ABS, EDC, ECAS, etc.) disconnect the connectors of the control units (see wiring diagram in the relevant documentation); see their positioning on the vehicle in section 5 (point 5.2). Should close welding be required, remove the control unit from its position.

During welding earth the welding machine directly to the piece that is to be welded in order to protect the electrical equipment (alternator, batteries). Ensure that the negative pole of the battery has been disconnected.

Plastic pipes must be protected from heat sources and splashes of material during welding. If necessary these parts should be removed.

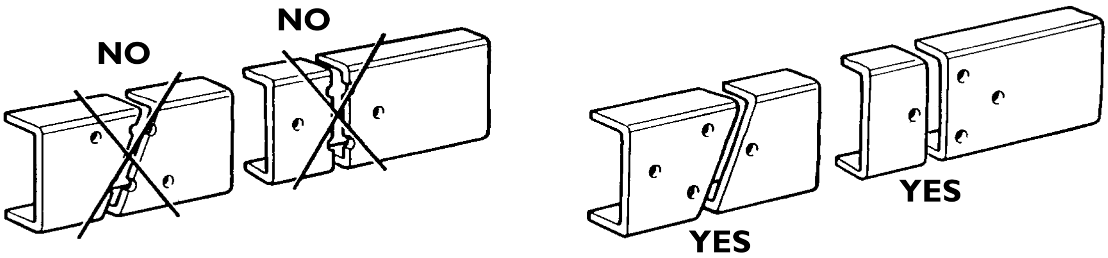
The surfaces of the leaf springs and air springs must be protected against weld splashes during welding. Do not allow the electrodes or conductors to come into contact with the spring.

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 2.1.3.).

The instructions given below should be followed to ensure that welding is carried out correctly.

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 Fig. 2.3.).

Figure 2.3



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 Fig. 2.4).

c) archweld in stretches using carefully dried basic electrodes. The recommended electrodes are:

for FeE420 (BS 1449 HS 46/40): DIN 1913 - E 51 B 1023
FeE490 (BS 1449 HS 50/45): DIN 8529 - EY 4687 Mn 1 Ni B H5

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

For the FeE490 (BS 1449 HS 50/45) material when used with low temperatures, the following are recommended:

PrEN 440 G7 AWS A 5.28 - ER 80S - Ni 1
gas DIN EN439-M21

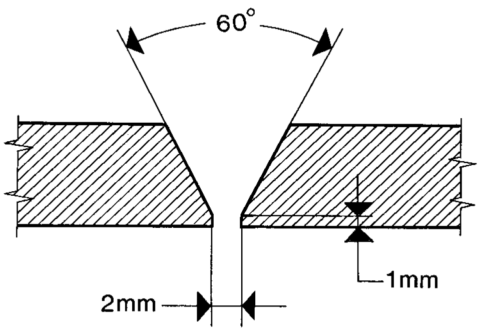
Avoid current overloading. Welding must be free from marginal cuts and waste material.

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.

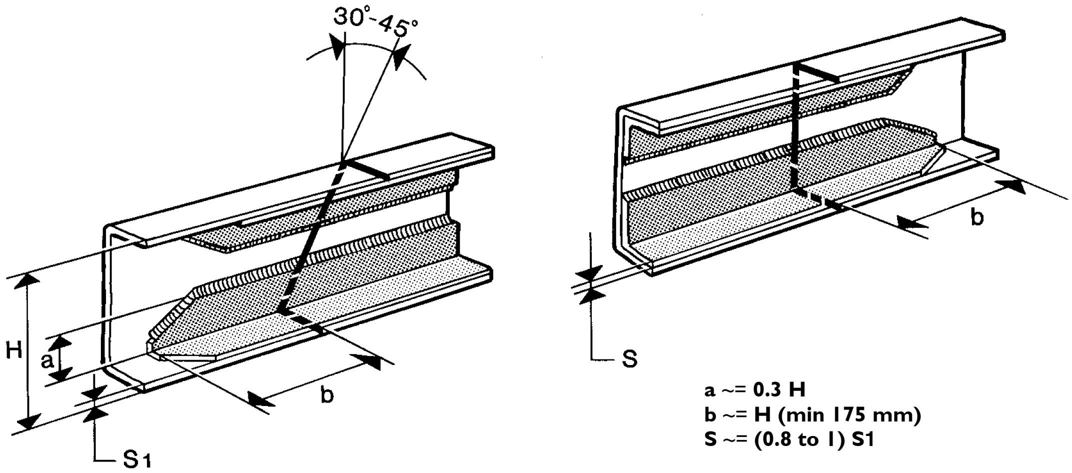
f) Remove excess material resulting from the welding operations by grinding.

Figure 2.4



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 Fig. 2.5. 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.

Figure 2.5



Closing of existing holes

If, when making new holes, the existing holes are found to be too close (see Fig. 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.

2.3 Modifying the Wheelbase

2.3.1 General Specifications

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.
On vehicles with a parallel chassis and constant-section side members, the wheelbase should be modified by repositioning the rear axle (or axles) when the internal reinforcements and their connections to the chassis permit it. The suspensions supports must also be repositioned ensuring that they are positioned where there are crossbars in compliance with the points detailed in 2.2.1.
In other cases the chassis may be cut following the instructions given in point 2.2.4.
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 crossmember 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).

Consequences for steering

The lengthening of the wheelbase, depending on its extent, can affect the steering characteristics. 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). Table 2.1 shows the permitted wheelbase lengthening values for a standard steering system, the maximum permitted load on the front axle and the specified tyre type.
Should longer wheelbase dimensions be needed, for special versions, it will be necessary to envisage 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. The adoption 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.

Table 2.1.
Maximum permitted wheelbase lengthening depending on the load on the front axle and tyre dimensions (ECE - R79/01 regulation or EC Directive 96/2)

Models	Max. load on front axle (observe tyre carrying capacity) (kg)	Kingpin offset (mm)	Permitted tyres [1]	Steering wheel dia. (mm)	Max wheelbase value between 1st steering axle and 1st driving axle (mm)
ML 60-100	Standard	-	Standard and optional	500	6300
ML 120-150-170	Standard	-	Standard and optional	500	6700
ML 60-180	Tector Range	-	Standard and optional	465	6570
MT 180 MT 190	7500	-	Standard and optional	500/530	6700
MH 190	7500	100	S: 1-13 A: 2, 4, 6-9 Sp: 2, 4, 6-11	465	6210
	8000	119	S: 6-15 A: 2, 4, 6-12 Sp: 2, 4, 6-12	465 530	5100 6300
MP 180 MP 190	8000	110	S: 1-13 A: 2, 4, 6-12 Sp: 2, 4, 6-12	500 530	5100 6300
ML 260 KE	7100	-	Standard and optional	500	4190
MH 260/PS	8000	120	S: 1-15 A: 2, 4, 6-12 Sp: 2, 4, 6-12	530	5100
		89	S: 1-11 A: 2, 4 Sp: 2, 4	500	5100
MH 260/P; PT; TN	8000	72	S: 1	500	6100
		120	S: 1-15 A: 2, 4, 6-12 Sp: 2, 4, 6-12	530	
MP 240/P; FP MP 240/FT; PT MP 240; 240/TN MP 260	8000	110	S: 1-15 A: 2, 4, 6-12 Sp: 2, 4, 6-12	500 530	4800 5100
MP 240/FS; PS	8000	110	S: 1-13 A: 2, 4, 6-12 Sp: 2, 4, 6-12	500 530	4200 5100

[1] For tyre type see page 2-14.

Tyre type

Type	Size	Rim	Kingpin offset (mm) Front dead axle S	A	Sp	Front driving axle S	A	Sp	Tyre carrying capacity
1	12.00 R 24	24-8.5	72	-	-	105	-	-	8000
2	13 R 22.5	22.5x9.00	76	84	86	108	116	118	7500/8000
3	12.00 R 20	20x8.5	77	-	-	109	-	-	7500/8250
4	315/80 R 22.5	22.5x9.00	78	86	88	110	118	120	7500/8000
5	11.00 R 20	20-8.5	80	-	-	111	-	-	6500/6700
6	12 R 22.5	22.5x8.25	82	91	93	113	122	124	6700/7100
7	315/70 R 22.5	22.5x9.00	83	91	93	114	122	124	7100/7500
8	295/80 R 22.5	22.5x8.25	84	93	95	115	124	126	6700/7100
9	305/70 R 22.5	22.5x8.25	88	97	99	118	127	129	6700/7100
10	11 R 22.5	22.5x7.50	88	103	99	119	134	130	6300
11	275/80 R 22.5	22.5x7.50	89	104	100	120	135	131	6300
12	275/70 R 22.5	22.5x7.50	93	108	105	124	139	135	6000/6300
13	10.00 R 20	20-7.5	93	-	-	113	-	-	6000
14	14.00 R 20	20-10.0W	109	-	-	142	-	-	9000/10000
15	385/65 R 22.5	22.5x11.75	110	-	-	141	-	-	8250/9000
16	18 R 22.5	22.5x14.00	130	-	-	162	-	-	11200
17	425/65 R 22.5	22.5x13.00	132	-	-	164	-	-	10300

S = Steel wheels
A = Alcoa aluminium wheels
Sp = Speedline aluminium wheels

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.

When prescribed by national regulations the bodybuilder must check that the stress limits are not exceeded. In any event such stress must be no greater than that of a chassis with the original wheelbase assuming that the load is evenly distributed and taking the chassis to be a beam resting on the spring hanger brackets.

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.

Approval

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 dimensions can be found in the relevant technical documentation or in the table from 3.9 to 3.10.
- 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, 6x4 and 8x4 versions the wheelbase may only be modified following specific approval by IVECO. This also applies to the 4x4 and 6x6 versions (all wheel drive) in which the position of the transfer box must be maintained in relation to the front axle.

The conversion must be carried out in compliance with these instructions and the appropriate adjustments (e.g. LAV adjustment) or adaptations made (e.g. change in the layout of the exhaust pipe) and taking those precautions (e.g. adherence to the minimum rear axle load with unladen vehicle) which are normally taken by IVECO for the corresponding original wheelbases.

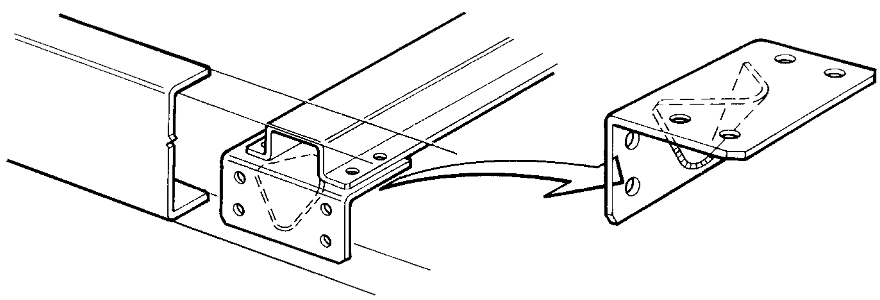
Cross Members

The necessity of applying one or more cross members depends on the extent of 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). Fig. 2.6 shows an example of the application on the models of class 80 or higher of the On-Road Range. 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 1,000 to 1,200 mm.

The minimum distance between the two cross members particularly for off-road vehicles must not be less than 600 mm. The light cross member supporting the transmission is excluded from this limitation.

Figure 2.6



Recommended Procedure

To ensure the success of the operations proceed as follows:

- Arrange the vehicle so that the chassis is perfectly level, using the appropriate stands.
- Remove the transmission shafts, brake lines, electrical wires and any devices that may prevent the work from being carried out efficiently.
- 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 2.2.4.
  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 2.2.4.

Further indications

- Protect the surfaces from oxidation as described in point 2.1.3.
- Restore the electrical and braking systems as described in points 2.14 and 2.15.
  For vehicles with anti-lock brake systems (ABS) follow the instructions given in point 2.14.3.
- For work on the drive line follow the instructions given in point 2.3.2.

2.3.2 Modifying the Drive Line

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

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

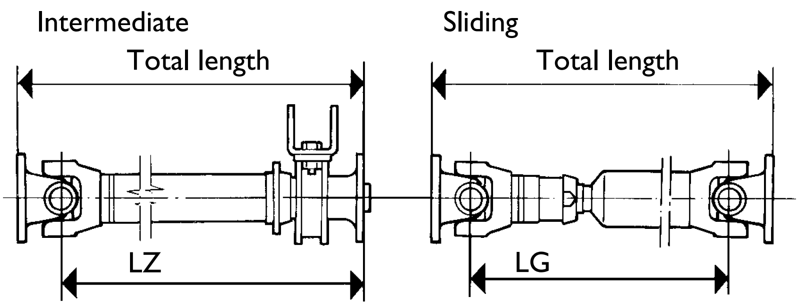
The purpose of the specifications contained in this manual is to ensure the proper functioning of the transmission, to limit its noise and to avoid the build-up of stress transmitted from the engine assembly. In no way does this diminish the responsibility of the bodybuilder for the work he has completed.

Permitted lengths

The maximum operating lengths obtainable for both the intermediate shaft sections and the sliding shafts "LG" or "LZ" (see fig.2.7) 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 2.2.

For the propeller shaft length specified in Table 2.2. 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 2.2.

Figure 2.7



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

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

n_g = Max. prop. shaft speed (rpm)
n_{max} = Max. engine speed (r.p.m.) (see table 4.4)
i_G = Gearbox ratio at top speed
i_V = Ratio of power drive transmission in road gear (only for shafts downstream of transfer case)

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 fall below 800 mm for the sliding sections and 700 mm for the intermediate sections.

Table 2.2.
Obtainable propeller shaft characteristics

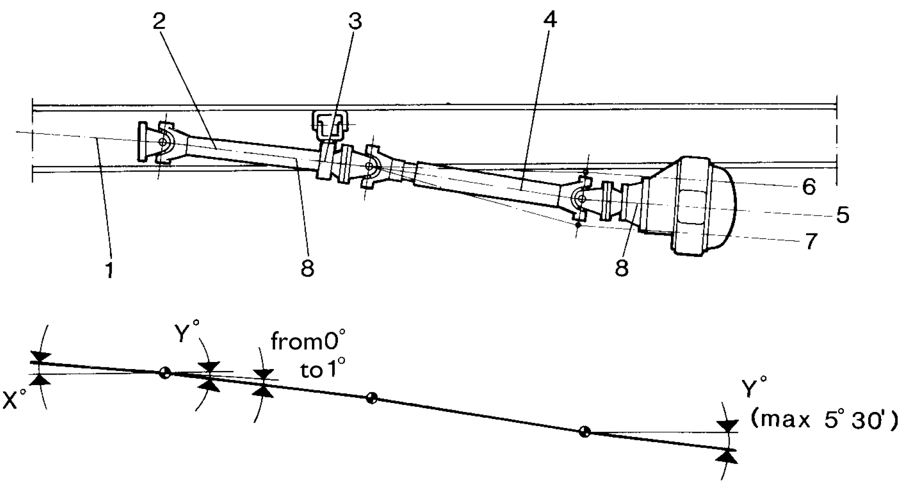
Outer diameter (mm)	Max. operating speed of propeller shaft (rpm)																
	2800	2900	3000	3100	3200	3300	3400	3500	3600	3700	3800	3900	4000	4100	4200	4300	4400
	Feasible lengths Lg or Lz (mm)																
89/90	-	-	1750	1720	1695	1665	1640	1620	1595	1575	1555	1535	1515	1495	1475	1455	1435
100	-	-	1845	1815	1785	1760	1730	1705	1685	1660	1640	1615	1595	1575	1560	1540	1520
110	-	-	1940	1905	1875	1850	1820	1795	1770	1745	1720	1700	1680	1655	1640	-	-
120	2090	2060	2030	1995	1965	1935	1905	1880	1855	1830	1805	1780	1760	1735	1715	1695	1675
130	-	-	2100	2085	2050	2020	1990	1960	1935	1905	1880	1860	1835	1810	1790	-	-
140/142	-	-	2100	2100	2100	2100	2070	2040	2010	1985	1955	1930	1910	1885	1860	-	-

Determining Driveshaft Positions

In the case of drive line which consist of several segments, 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 Fig. 2.8) 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 Fig. 2.8.

Figure 2.8



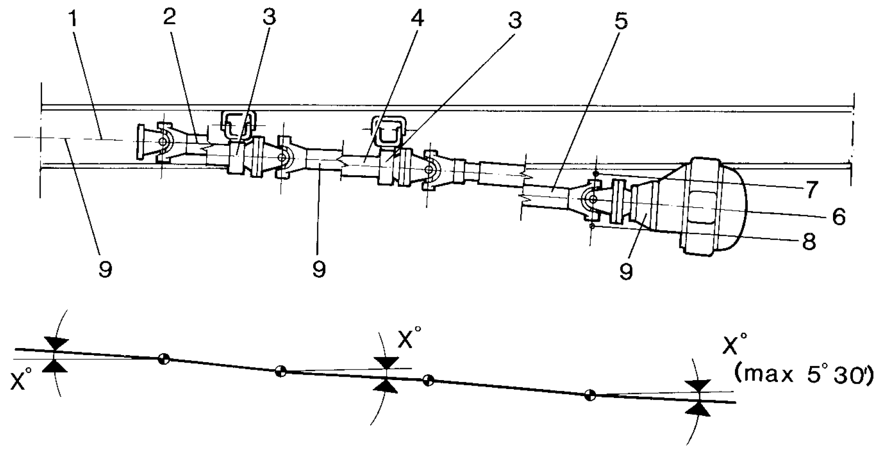
1 Engine, clutch, gearbox axis
2 Intermediate shaft (non sliding)
3 Intermediate shaft support
4 Propeller shaft with sliding end
5 Inclination of rear axle case (static load)
6 Inclination of rear axle case (max. compression)
7 Inclination of rear axle case (unladen)
8 Intermediate shaft and axle case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

The intermediate shaft and the inclination of the rear axle case must be aligned accurately.
The difference in their inclination relative to the engine-clutch-gearbox axis must not vary more than 1°. This may be achieved by placing a wedge between the rear axle case and the spring or, in vehicles equipped with pneumatic suspension and in those with three axles and centre spring, by adjusting the torque arms of the rear axle. The inclination of the rear axle must, however, not be greater than 5.5°.

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

When the lengthening of the wheelbase is substantial, it may become necessary to employ a supplementary intermediate shaft as shown in fig. 2.9. 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 2.9

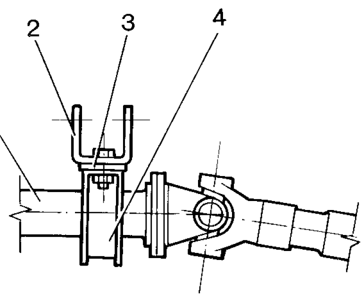


1 Engine, clutch, gearbox axis
2 1st intermediate shaft
3 Intermediate shaft support
4 4. 2nd intermediate shaft
5 Propeller shaft with splined end
6 Inclination of rear axle case (static load)
7 Inclination of rear axle case (max. compression)
8 Inclination of rear axle case (unladen)
9 Gearbox, 2nd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

The elastic supports must consist of supporting plates with a thickness of at least 5 mm in the case of vehicle destined for road use and of at least 7 mm in the case of yard use as indicated in Fig. 2.10 and should be fitted with cross members with characteristics consistent with the original characteristics.

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

Figure 2.10



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.

When modifying the wheelbase of vehicles with all-wheel drive, only the drive line "downstream" of the transfer case can be modified, In this case the specifications given above concern the inclination of the transfer case instead of the engine-gearbox assembly.

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 (dumpers for example).

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

Modifications to the universal joints are not permitted.

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

Important

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

2.4 Modifying the Rear Overhang

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 1.2). 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 originally 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

The extension of the overhang at the rear of the chassis employing body overhang values up to 60% of the wheelbase and shortening down to the minimum serial value of each model require no specific approval by IVECO on condition that the operations are carried out in compliance with these instructions.

2.4.1 Reducing the Overhang

When reducing the length of the rear overhang of the chassis (e.g. in the case of tippers) the last cross member must be moved forward.

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

2.4.2 Increasing the Overhang

Various methods of increasing the length are given in Figs, 2.11 and 2.12.

The connection of the added section is to be carried out in compliance with the specifications given in point 2.2.4.

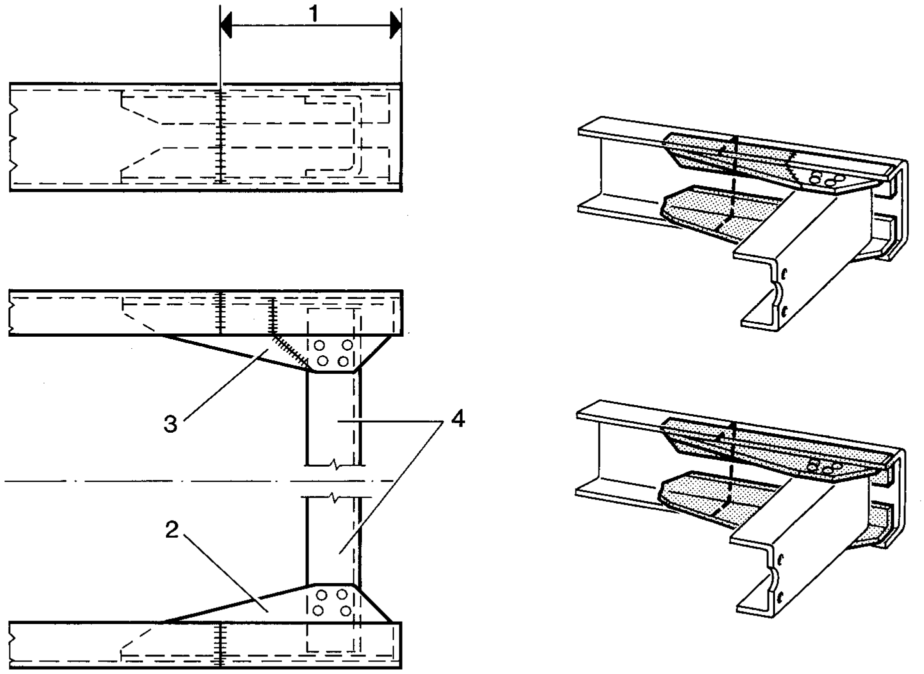
The frame may also be cut straight. The minimum dimensions of the reinforcements that are to be applied to the modified section are indicated in Fig. 2.5.

Fig. 2.11 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 fig 2.11).

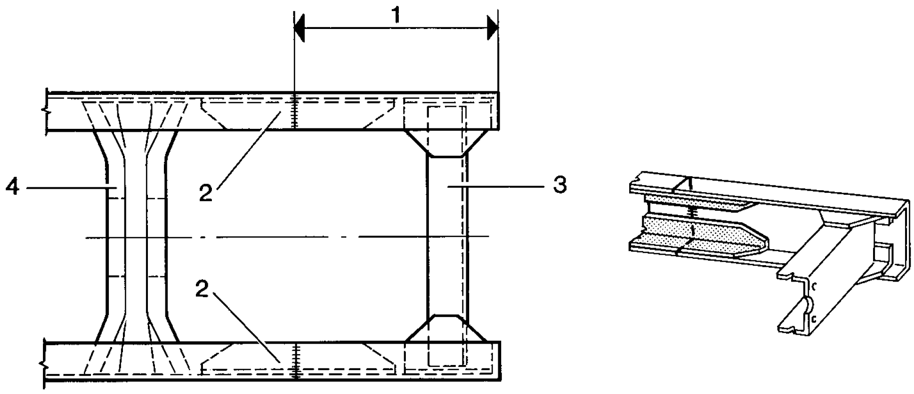
When the increase exceeds 350 mm, Fig. 2.12 shows the procedure to be used.

Figure 2.11



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

Figure 2.12



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

When the extension reaches a certain dimension, it 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 1,200 mm.

2.5 Installing a Towing Device

2.5.1 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 2.5.4 must be taken into account.

The tow hook must be suitable for the permissible load and be of a type approved by National Requirements.

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 depending on local regulations. 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 dimensions of the hook coupling flange not match the holes on the rear cross member of the vehicle, in some case drilling may be authorised on the cross member after mounting adequate reinforcements.

Ball Hooks

When fitting a ball hook IVECO will supply on request, information regarding the points at which the hook structure can be connected to the chassis.

The carrier assembly must conform to current legislative norms and the work carried out will be the responsibility of the bodybuilder. Upon request, IVECO will supply designs for the construction of carrier assemblies specifically planned by IVECO.

Should assembly of a ball-type hook require modification to the underrun bar, such modification must not affect the original stiffness and resistance specifications (local government regulations where these exist should be complied with).

The bodybuilder must, upon request, submit the required documentation to prove compliance with the legal regulations.

Choosing a Hook

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

$$D = 9.81 \times \frac{T \times R}{(T + R) \times 1000} \qquad R = \frac{T \times D \times 1000}{(T \times 9.81) - (1000 \times D)}$$

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

2.5.2 Increasing the Towable Mass

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

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

Among these possible reinforcements to the standard equipment cross member (fig 2.16), instructions concerning the installation of reinforced cross members if available and specifications concerning the braking system (e.g. the addition of an air compressor with a greater capacity) will be included.

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, the same drilling scheme existing on the gusset plate should be followed.

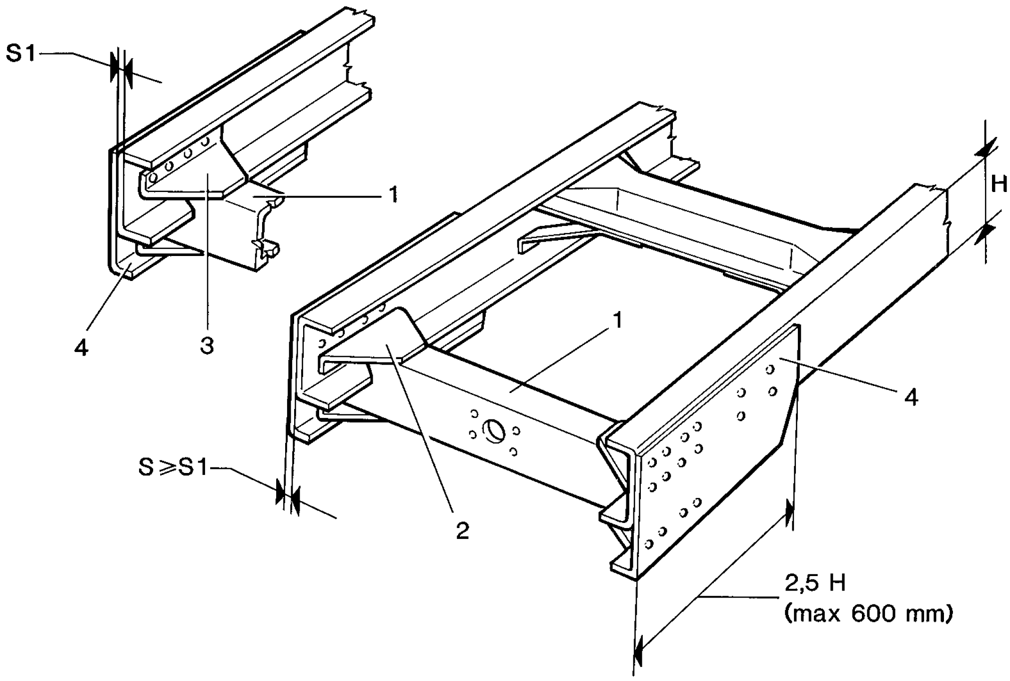
Flanged head screws and nuts or hex head screws of minimum class 8.8 of the next larger diameter with self-locking nuts should be used.

2.5.3 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. Figs. 2.13 and 2.14 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 originally, using the same type (diameter and class) of bolt.

Figure 2.13



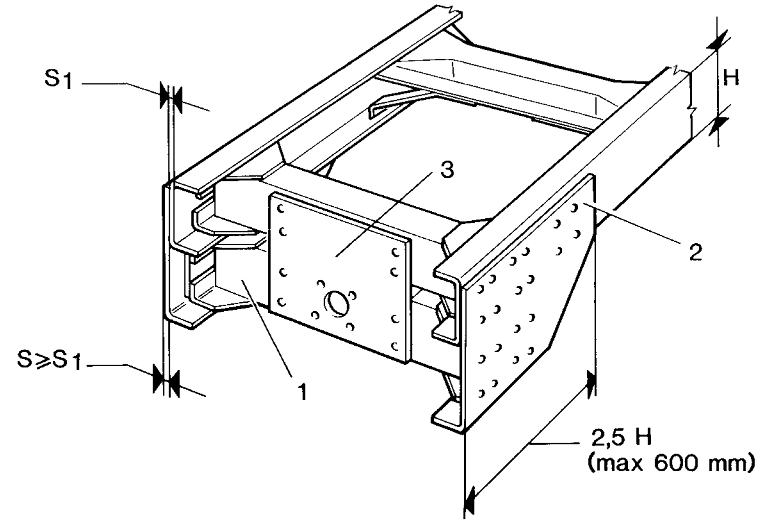
1 Original rear cross member
2 Gusset
3 Upside-down gusset
4 Connecting angle piece

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%.

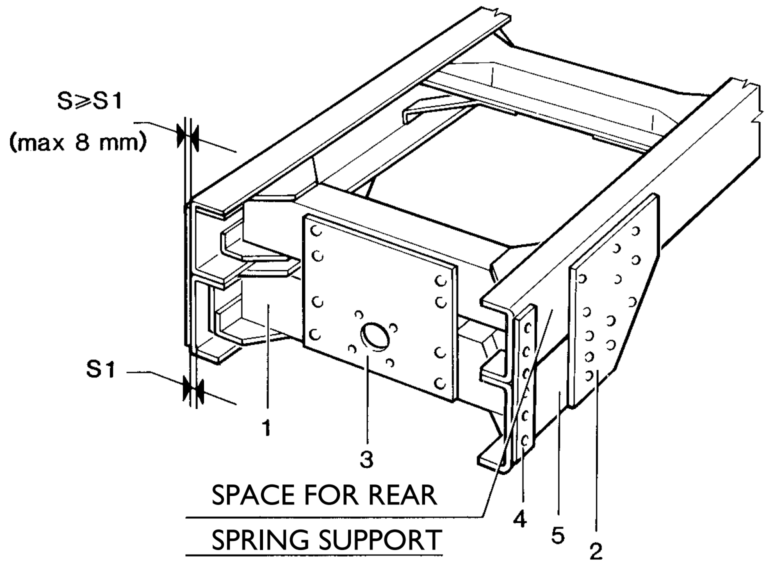
When an additional cross member is installed (see Fig. 2.14) a central joining plate with a thickness commensurate with that of the cross members, must be employed.

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

Figure 2.14



Version for chassis with long overhangs



Version for chassis with short overhangs

1 Original rear cross member
2 Connecting angle piece
3 Connecting plate
4 Gusset plate
5 Pressed steel channel sections (same size as chassis)

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.

Fig. 2.13 illustrates one example of partial lowering of the cross member. Where the upper gusset plates of the cross member is joined to it, ex-factory, with bolts, the plates can be inverted in the new positions in order to allow the original holes in the side members to be used.

Fig. 2.14 shows an example of a lowered supplementary cross member.

When it is necessary to use this type of construction in vehicles with a short overhang (e.g. tipper) the external connection angles must be suitably adapted at the rear suspension support. This may require dismantling of the supports of the auxiliary leaf spring and its subsequent re-installation, when permitted by local regulations, or the application of the version shown in figure 2.14. 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).

2.5.4 Centre Axle Trailers (Rigid Towbar)

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

On those vehicles on which the towing of trailers is permissible within the values established for each model by IVECO, the mass that may be towed with the centre axle trailer and the vertical loads on the cross member indicated in table 2.3 may be authorised on the basis of the dimensions of the flange located on the vehicle cross member.

In addition to this, where the overhang is relatively long, it may be necessary to fit an auxiliary frame with section irons larger than those normally planned (see table 2.4).

If central axle trailers are to be used, the connection of chassis frame to subframe will be carried out from the rear overhang to the front support on the rear suspension with cleat plates or by strengthening the existing connections with shear-resistant reinforcing. For the vehicles with weight range from 65E to 150E having bodywork longitudinal runners with thickness smaller than the value required in these instructions, the cleat plates shall be further fitted beyond the wheelbase centreline.

The values indicated in table 2.3 however, are subject to confirmation on a case by case basis subject to the conditions which will be specified in the authorisation, such as the use of the vehicle, the adoption of a suitable braking system, the installation of a cross member with a greater capacity or reinforced, or of appropriate tow hooks etc.

Table 2.3

Dimensions of flange (mm) (hook class)	Max. vertical loads permitted on hook (kg)		Maximum towable mass (kg) for centre-axle trailers
	Static	Total load* (static+dynamic)	
120x55 (G135 opp. G3)	400 650[1]	1130 1690[1]	4500 6500[1]
140x80 (G140 opp. G4)	900	2340	9000
160x100 (G150	950	2470	9500
G5	1000[2]	2960[2]	12000[2]
G6	1000[3]	4040[3]	18000[3]
81 G5	1000[3]	4400[3]	20000[3]
700G61)	1000[3]	5120[3]	24000[3]

* Indicative values according to standard ISO/TC22/SC15/WG4 Annex A adopting the formula: Fv = 3 . C . 0.6 + S
1 Permissible for vehicles of class ≥ 80E
2 Feasible with reinforced cross member and suitable tow hook
3 Feasible on some models of the heavy range with reinforced rear cross member and suitable tow hook

The value of the maximum vertical load (static + dynamic load transmitted by the trailer to the towing hook) is determined with the following ISO formula:

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

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

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

- a = 1.8 m/sec² for vehicles with pneumatic suspension (or equivalent)
- a = 2.4 m/sec² 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.

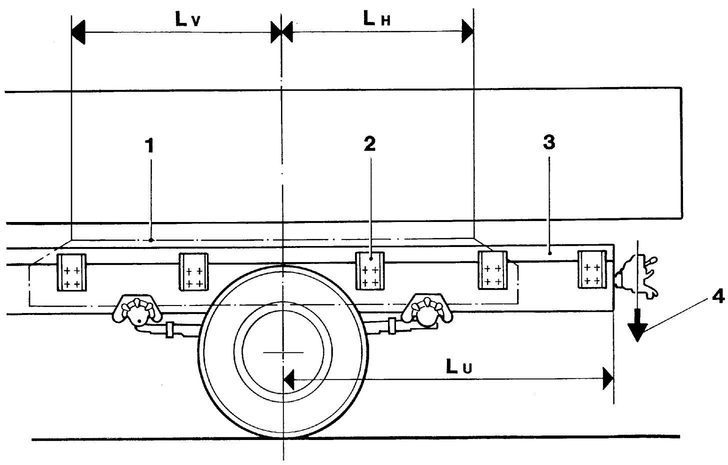
C = Total mass of the trailer (in tons) the S static support load excluded.

S = Static support load (kN)

0,6 = Deceleration factor

Figure 2.15

Chassis reinforcement for central axle trailers adopting the combined reinforcement solution (Fig. 3.4)



1 Combined reinforcement
2 Shear resistant connections
3 Auxiliary frame longitudinal runner
4 Vertical load on tow hook

Table 2.4
Longitudinal runner profiles of the subframe for central axle trailers

MODELS		Wheel base (mm)	Cab	Rear overhang (mm)	Trailer load (R) & static drawbar load (S) of the central axle trailer (kg)											
(Chassis section) (mm)					R ≤ 4 500 S ≤ 400		R ≤ 6 500[2)] S ≤ 650		R ≤ 9 500[2)3)] S ≤ 950		R ≤ 10 500[3)] S ≤ 1 000		R ≤ 12 000[3)] S ≤ 1 000		R ≤ 14 000[3)] S ≤ 1 000	
					Minimum value of subframe section modulus Wx (cm3) as a function of the yield point of the material (N/mm^2)											
					Fe360=240		Fe510=360									
					240	360	240	360	240	360	240	360	240	360	240	360
ML 60	(180,5x65x4)	2700	-	1290	A	A	A	A								
	»	3105	-	1313	A	A	A	A								
	»	3330	-	1830	A	A	A	A								
	»	3690	-	1830	A	A	21	16[1)]								
	»	4185	-	2145	21[1)]	16[1)]	36	19[1)]								
	»	4455	-	2280	21[1)]	19[1)]	36	21[1)]								
	(182,5x65x5)	4815	-	2505	36	16[1)]	57	19[1)]								
ML 60/P	(180,5x65x4)	3690	-	1830	21	16[1)]	36	16[1)]								
	»	4185	-	2145	36	16[1)]	89	31								
	»	4455	-	2280	36	19[1)]	89	36								
	(182,5x65x5)	4815	-	2505	46	16[1)]	89	21								
ML 65	(180,5x65x4)	2700	-	1290	A	A	A	A								
	»	3105	-	1313	A	A	A	A								
	»	3330	-	1830	A	A	21	16[1)]								
	»	3690	-	1830	A	A	21	16[1)]								
	»	4185	-	2145	31	16[1)]	46	19[1)]								
	»	4455	-	2280	31	21[1)]	57	21[1)]								
	(182,5x65x5)	4815	-	2505	36	16[1)]	89	21[1)]								
ML 65/P	(180,5x65x4)	3690	-	1830	36	16[1)]	57	19[1)]								
	»	4185	-	2145	46	19[1)]	89	31								
	»	4455	-	2280	46	21[1)]	89	36								
	(182,5x65x5)	4815	-	2505	57	19[1)]	89	36								
ML 65H	(182,5x65x5)	2700	C	1290	A	A	A	A								
	»	3105	C	1313	A	A	A	A								
	»	3690	C+L	1830	A	A	A	A								
	»	4185	C+L	2145	21	16[1)]	31	16[1)]								
ML 75	(180,5x65x4)	3105	-	1313	A	A	A	A								
	»	3330	-	1830	19[1)]	16[1)]	36	16[1)]								
	»	3690	-	1830	19[1)]	16[1)]	36	16[1)]								
	»	4185	-	2145	36	16[1)]	57	31								
	»	4455	-	2280	46	16[1)]	89	31								
	(182,5x65x5)	4815	-	2505	46	19[1)]	89	31								
ML 75/P	(180,5x65x4)	3690	-	1830	46	16[1)]	89	31								
	»	4185	-	2145	89	31	89	46								
	»	4455	-	2280	89	36	105	57								
	(182,5x65x5)	4815	-	2505	89	31	105	46								
ML 80	(203x65x4)	2700	-	1313	A	A	A	A	A	A	A	A				
	»	3105	-	1313	A	A	A	A	A	A	A	A				
	»	3330	-	1830	A	A	21	16[1)]	46	16[1)]	57	19[1)]				
	»	3690	-	1830	A	A	21	16[1)]	46	16[1)]	57	19[1)]				
	(205x65x5)	4185	-	2145	A	A	A	A	57	36	57	36				
	»	4455	-	2210	31	16[1)]	57	19[1)]	57	36	74	46				
	»	4815	-	2505	36	16[1)]	89	19[1)]	105	46	119	46				
ML 80/P	(203x65x4)	3690	-	1830	36	16[1)]	46	19[1)]	89	46	89	46				
ML 80/FP	»	4185	-	2145	46	19[1)]	89	31	105	57	119	89				
	»	4455	-	2210	57	21[1)]	89	46	135	89	135	89				
	(205x65x5)	4815	-	2505	57	19[1)]	89	31	135	57	135	57				
ML 85H	(203x65x4)	3105	C	1313	A	A	A	A	A	A						
	(205x65x5)	3690	C+L	1830	A	A	A	A	31	A						
	»	4185	C+L	2145	A	A	31	A	57	21[1)]						
	»	4455	C+L	2280	A	A	36	A	57	21[1)]						
ML 95W	(250x70x5)	3240	C	1042	A	A	A	A	A	A	A	A				
ML 100W	»	3690	C	1358	A	A	A	A	A	A	A	A				
ML 100	(203x65x4)	2700	-	1313	A	A	A	A	A	A						
	»	3105	-	1313	A	A	A	A	A	A						
	»	3330	-	1830	21[1)]	19[1)]	31	21[1)]	89	31						
	(205x65x5)	3690	-	1830	A	A	57	46	89	46						
	»	4185	-	2145	36	16[1)]	57	19[1)]	89	36						
	»	4455	-	2280	36	16[1)]	89	19[1)]	105	46						
	»	4815	-	2505	57	19[1)]	89	31[1)]	135	57						
ML 100/P	(205x65x5)	4185	-	2145	89	21[1)]	89	36	135	57						
	»	4455	-	2280	89	31[1)]	105	46	150	89						
	»	4815	-	2505	89	36	135	57	173	89						
ML 110EL[6)]	(205x65x5)	3105	-	1313	A	A	A	A	A	A						
ML 120EL	»	3330	-	1830	A	A	21[1)]	16[1)]	57[1)]	19[1)]						
	»	3690	-	1830	A	A	21[1)]	16[1)]	57[1)]	19[1)]						
ML 110EL[6)]	(207x65x6)	4185	-	2145	36	16[1)]	57	19[1)]	89	36						
ML 120EL	»	4455	-	2280	36	16[1)]	89	19[1)]	105	46						
	»	4815	-	2505	57	19[1)]	89	31[1)]	135	57						
ML 110EL/P[6)]	(205x65x5)	3690	-	1830	36	16[1)]	46	19[1)]	89	46						
	(207x65x6)	4185	-	2145	89	21[1)]	89	36	135	57						
	»	4455	-	2280	89	31[1)]	105	46	150	89						
	»	4815	-	2505	89	36	135	57	173	89						
ML 120	(250x70x5)	3105	-	1313			A	A	A	A			A	A	A	A
	»	3690	-	1740			A	A	A	A			31	16[1)]	36	16
	»	4185	-	2055			A	A	46	16[1)]			89	19[1)]	89	21
	»	4455	-	2190			36	16[1)]	89	19[1)]			89	21[1)]	105	36
	»	4815	-	2460	-		57	19[1)]	89	31[1)]	-		135	46	150	57
	»	5175	-	2685			89	21[1)]	135	46			150	89	173	89
	(252x70x6)	5670	-	3000			89	31[1)]	150	57			173	89	208	89
	»	6570	-	3495			89	31[1)]	135	57			150	89	173	89
	(253,4X70X6,7)	5175	C+L	2685	89	19[1)]	135	36	150	57						
	»	5670	C+L	3000	105	36	150	89	208	89						
	(255,4X70X7,7)	6570	C+L	3495	135	46	173	89	245	105						
ML 120/P	(250x7x5)	4185	-	2055			46	16[1)]	89	21[1)]			89	31[1)]	105	36
ML 120/FP	»	4455	-	2190			36	19[1)]	89	21[1)]			89	36	135	46
	»	4815	-	2460	-		89	21[1)]	135	46	-		150	57	150	89
	(252x70x6)	5175	-	2685			105	36	150	57			173	89	208	105
	»	5670	-	3000			135	36	150	89			208	89	208	89
	»	6570	-	3495			105	36	135	57			173	89	208	89

Notes: see page 2-41

Table 2.4 (continued)
Longitudinal runner profiles of the subframe for central axle trailers

MODELS					Trailer load (R) & static drawbar load (S) of the central axle trailer (kg)											
		Wheel base (mm)	Cab	Rear overhang (mm)	R ≤ 6 500 S ≤ 650		R ≤ 9 500[3] S ≤ 950		R ≤ 12000 [3] S ≤ 1000		R ≤ 14 000[3] S ≤ 1 000		R ≤ 16 000[3] S ≤ 1 000		R ≤ 18 000[3,4] S ≤ 1 000	
(Chassis section) (mm)					Minimum value of subframe section modulus Wx (cm3) as a function of the yield point of the material (N/mm^2)											
					Fe360=240			Fe510=360								
					240	360	240	360	240	360	240	360	240	360	240	360
ML 120H	(250x70x5)	3105	C	1313	A	A	A	A	A	A						
	»	3690	C	1740	A	A	A	A	36	16[1]						
	»	3690	L	1313	A	A	A	A	A	A						
	(252x70x6)	4185	C	2055	A	A	74	19[1]	74	19[1]						
	»	4185	L	1740	A	A	A	A	A	A						
	»	4455	C	2190	A	A	74	19[1]	74	21[1]						
	»	4455	L	1920	A	A	31	A	74	16[1]						
	»	4815	C	2460	74	16[1]	105	31	119	46						
	»	4815	L	2033	A	A	57	19[1]	74	19[1]						
ML 130	(250x70x5)	3105	C	1313	A	A	A	A	A	A	A	A				
	»	3690	L	1313	A	A	A	A	A	A	A	A				
	»	3690	C	1740	A	A	A	A	36	16[1]	46	16[1]				
	»	4185	L	1740	A	A	A	A	36	16[1]	46	16[1]				
	»	4185	C	2055	36	16[1]	57	19[1]	89	21[1]	89	31[1]				
	»	4455	L	1920	A	A	36	16[1]	57	19[1]	89	19[1]				
	»	4455	C	2190	36	16[1]	89	19[1]	89	31[1]	105	46				
	»	4815	C+L	2460	89	19[1]	105	46	135	57	150	89				
	(253,4x70x6,7)	5175	C+L	2685	89	19[1]	135	36	150	57	150	89				
	»	5670	C+L	3000	105	36	150	89	208	89	208	89				
	(255,4x70x7,7)	6570	C+L	3495	135	46	173	89	245	105	245	135				
ML 130/P	(250x70x5)	4185	L	1740	36	16[1]	57	16[1]	89	19[1]	89	21[1]				
ML 130/FP	»	4185	C	2055	859	19[1]	89	31[1]	105	36	135	46				
	(252x70x6)	4455	C	2190	89	31[1]	89	36	105	36	135	46				
	»	4455	L	1920	36	19[1]	57	21[1]	89	31[1]	105	36				
	»	4815	C+L	2460	105	36	135	57	150	89	173	89				
	(253,4x70x6,7)	5175	C+L	2685	89	31[1]	135	46	150	89	173	89				
	»	5670	C+L	3000	135	46	173	89	208	89	245	105				
	(255,4x70x7,7)	6570	C+L	3495	135	57	173	89	145	105	245	135				
ML 135W		3240	C	1042	A	A	A	A	A	A	A	A	-		-	
ML 140W		3690	C	1358	A	A	A	A	A	A	A	A	-		-	
	(252x70x6)	3915	C	1358	A	A	A	A	A	A	A	A	-		-	
ML 150	(250x70x5)	3105	C	1313	A	A	A	A	A	A	A	A	A	A	A	A
	»	3690	L	1313	A	A	A	A	A	A	A	A	A	A	A	A
	»	3690	C	1740	A	A	36	16[1]	46	16[1]	57	19[1]	89	19[1]	89	21[1]
	(252x70X6)	4185	L	1740	A	A	A	A	A	A	46	16[1]	57	16[1]	89	19[1]
	»	4185	C	2055	A	A	89	19[1]	89	21[1]	89	21[1]	105	36	135	36
	»	4455	L	1920	A	A	46	16[1]	89	19[1]	89	19[1]	89	21[1]	89	31[1]
	»	4455	C	2190	46	16[1]	89	19[1]	89	31	135	36	135	46	150	57
	»	4815	L	2033	A	A	57	16[1]	89	19[1]	89	21[1]	105	36	135	36
	»	4815	C	2460	89	19[1]	135	36	150	57	150	89	173	89	208	89
	(253,4x70x6,7)	5175	C+L	2685	89	21[1]	135	46	173	89	208	89	208	89	245	105
	»	5670	C+L	3000	135	46	173	89	245	89	245	119	286	135	317	150
	(255,4x70x7,7)	6570	C+L	3495	105	46	150	57	208	74	208	105	245	105	245	119
ML 150/P	(252x70x6)	4185	L	1740	36	16[1]	89	19[1]	89	19[1]	89	21[1]	89	31	105	36
ML 150/FP	»	4185	C	2055	89	19[1]	105	31[1]	135	36	135	46	150	57	150	89
	»	4455	C	2190	89	21[1]	105	31[1]	135	36	135	46	150	57	150	89
	»	4455	L	1920	36	19[1]	89	21[1]	89	36	135	36	135	46	150	57
	»	4815	L	2033	89	19[1]	89	21[1]	105	36	135	36	135	57	150	89
	»	4815	C	2460	135	36	150	89	173	89	208	89	208	89	245	105
	(253,4x70x6,7)	5175	C+L	2685	135	46	173	89	208	89	245	89	245	105	286	135
	»	5670	C+L	3000	150	89	208	89	245	119	286	135	286	135	317	150
	(255,4x70x7,7)	6570	-	3495	105	57	150	74	208	74	208	105	245	105	245	119
ML 150H	(229x80x6)	3105	C	1133	A	A	A	A	A	A						
	»	3690	C+L	1133	A	A	A	A	A	A						
	(230,9x80x6,7)	4185	C+L	1313	A	A	A	A	A	A						
	(232,9x80x7,7)	4590	C+L	1650	A	A	A	A	A	A						
	»	4815	C+L	1853	A	A	A	A	A	A						
ML 170	(229,5x80x6)	3690	-	1133	A	A	A	A	A	A	A	A	A	A	A	A
	(230,9x80x6,7)	4185	C	1313	A	A	A	A	A	A	A	A	A	A	A	A
	»	4185	L	1133	A	A	A	A	A	A	A	A	A	A	A	A
	(232,9x80x7,7)	4590	C	1650	A	A	A	A	A	A	A	A	A	A	A	A
	»	4590	L	1313	A	A	A	A	A	A	A	A	A	A	A	A
	»	4815	C	1813	A	A	A	A	A	A	A	A	A	A	A	A
	»	4815	L	1539	A	A	A	A	A	A	A	A	A	A	A	A
	»	5175	C	2123	A	A	A	A	A	A	A	A	A	A	A	A
	»	5175	L	1538	A	A	A	A	A	A	A	A	A	A	A	A
	»	5670*	C	2235	A	A	A	A	74	31	89	31	105	46	135	57
	»	5670*	L	1650	A	A	A	A	A	A	A	A	A	A	A	A
	»	6210*	-	2235	A	A	A	A	74	31	89	31	105	46	135	57
	»	6570*	-	2775	A	A	89	31	89	46	105	46	135	57	135	89
ML 170/P	(232,9x80x7,7)	4590	C	1650	A	A	A	A	A	A	A	A	A	A	A	A
	»	4590	L	1313	A	A	A	A	A	A	A	A	A	A	A	A
	»	4185	C	1813	A	A	A	A	A	A	A	A	A	A	A	A
	»	4815	L	1538	A	A	A	A	A	A	A	A	A	A	A	A
	»	5185	C	2123	A	A	A	A	A	A	A	A	A	A	A	A
	»	5185	L	1539	A	A	A	A	A	A	A	A	A	A	A	A
	»	5670*	C	2235	A	A	A	A	74	36	89	36	105	57	135	74
	»	5670*	L	1650	A	A	A	A	A	A	A	A	A	A	A	A
	»	6210*	-	2235	A	A	A	A	74	36	89	36	105	57	135	74
	»	6570*	-	2775	A	A	89	36	89	46	105	57	135	57	150	105
ML 180	(274,5x80x6)	3690	C	1133	A	A	A	A	A	A	A	A	A	A	A	A
	(275,9x80x6,7)	4185	C+L	1313	A	A	A	A	A	A	A	A	A	A	A	A
	(277,9x80x7,7)	4590	C+L	1650	A	A	A	A	A	A	A	A	A	A	A	A
	»	4815	C+L	1853	A	A	A	A	A	A	A	A	A	A	A	A
	»	5175	C+L	2123	A	A	A	A	A	A	A	A	A	A	A	A
	»	5670	C+L	2235	A	A	A	A	16	A	35	A	51	A	81	16
	»	6210	C+L	2235	A	A	A	A	16	A	35	A	51	A	81	16
	»	6570	C+L	2775	A	A	35	A	35	A	51	A	81	16	81	35

Notes: see page 2-41

* Chassis equipped with internal reinforcing.

Table 2.4 (continued)
Longitudinal runner profiles of the subframe for central axle trailers

MODELS (Chassis section) (mm)	Wheelbase (m)	Wheelbase (mm)	Rear overhang (mm)	R ≤ 9 500 S ≤ 950		R ≤ 12 000 S ≤ 1 000		R ≤ 14 000 S ≤ 1 000		R ≤ 16 000 S ≤ 1 000		R ≤ 18 000[4)] S ≤ 1 000		R ≤ 20 000[4)] S ≤ 1 000		R ≤ 22 000[4)] S ≤ 1 000		R ≤ 24 000[4)] S ≤ 1 000	
				Minimum value of subframe section modulus Wx (cm3) as a function of the yield point of the material (N/mm^2) Fe360=240 Fe510=360															
	(m)	(mm)	(mm)	240	360	240	360	240	360	240	360	240	360	240	360	240	360	240	360
MH 190	3,8	3818	1825	A	A	46	A	46	A	46	A	46	A	46	46	46	46	46	46
MP 180; 190	4,2	4223	1195	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
11,5 t on rear axle	4,2	4223	2050	46	A	46	A	46	46	46	46	46	46	46	46	57	46	57	46
	4,5	4493	1285	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	4,5	4493	1780	A	A	46	A	46	A	46	A	46	46	46	46	46	46	46	46
	4,8	4808	2455	46	46	46	46	57	46	88	46	88	46	104	46	116	57	118	73
	5,1	5123	1555	A	A	A	A	A	A	46	A	46	A	46	A	46	A	46	A
	5,1	5123	1960	46	A	46	46	46	46	46	46	46	46	46	46	57	46	57	46
	5,1	5123	2185	46	46	46	46	46	46	57	46	57	46	88	46	88	46	104	46
	5,1	5123	2365	46	46	46	46	57	46	73	46	88	46	104	46	104	57	118	57
	5,7	5708	1960	46	A	46	46	46	46	46	46	46	46	57	46	57	46	73	46
	5,7	5708	2185	46	46	46	46	46	46	57	46	73	46	88	46	88	46	104	46
	6,3	6293	2005	46	46	46	46	46	46	46	46	57	46	57	46	73	46	88	46
	6,3	6293	2365	46	46	57	46	73	46	88	46	104	46	104	57	118	57	134	73
(302,4/212,4x80x6,7)	6,3	6293	2770	88	46	104	46	116	57	134	73	171	88	171	104	184	104	205	118
MH 190	3,8	3818	1825	46	46	46	46	46	46	46	46	46	46	57	46	57	46	73	46
MP 190	4,2	4223	1195	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
13 t on rear axle	4,2	4223	2050	46	46	57	46	57	46	73	46	88	46	88	46	104	46	104	57
	4,5	4493	1285	A	A	A	A	A	A	A	A	A	A	A	A	A	A	46	A
	4,5	4493	1780	46	46	46	46	46	46	46	46	46	46	57	46	57	46	73	46
	4,8	4808	2455	104	46	104	57	118	57	134	88	171	88	171	104	184	104	184	116
	5,1	5123	1555	46	A	46	A	46	A	46	A	46	46	46	46	46	46	46	46
	5,1	5123	1960	46	46	57	46	57	46	73	46	88	46	88	46	104	46	104	57
	5,1	5123	2185	73	46	88	46	104	46	104	46	116	57	118	73	134	88	171	88
	5,1	5123	2365	88	46	104	57	116	57	118	73	149	88	171	88	171	104	184	104
	5,7	5708	1960	46	46	57	46	57	46	73	46	88	46	88	46	104	46	104	57
	5,7	5708	2185	73	46	88	46	104	46	104	57	118	57	134	73	149	88	171	88
	6,3	6293	2005	57	46	57	46	73	46	88	46	88	46	104	46	104	57	118	57
	6,3	6293	2365	104	46	116	57	118	73	149	88	171	88	171	104	184	104	184	116
(302,4/212,4x80x6,7)	6,3	6293	2770	171	88	184	104	184	118	205	118	243	149	243	171	243	171	243	184
MH 190/P	3,8	3818	1847	46	A	46	A	46	46	46	46	46	46	46	46	46	46	57	46
MP 180; 190/P	4,2	4223	1217	A	A	A	A	A	A	A	A	46	A	46	A	46	A	46	A
MP 180; 190/FP	4,2	4223	2072	46	46	46	46	46	46	46	46	57	46	57	46	73	46	88	46
11,5 t on rear axle	4,5	4493	1307	A	A	A	A	46	A	46	A	46	A	46	A	46	A	46	A
	4,5	4493	1802	46	A	46	46	46	46	46	46	46	46	46	46	57	46	57	46
	4,8	4808	2477	46	46	57	46	88	46	88	46	104	46	104	57	118	73	134	88
	5,1	5123	1577	46	A	46	A	46	A	46	46	46	46	46	46	46	46	46	46
	5,1	5123	1982	46	46	46	46	46	46	57	46	57	46	73	46	88	46	88	46
	5,1	5123	2207	46	46	46	46	57	46	73	46	88	46	88	46	104	46	116	57
	5,1	5123	2387	46	46	57	46	73	46	88	46	104	46	104	57	118	57	134	73
	5,7	5708	1982	46	46	46	46	46	46	57	46	73	46	88	46	88	46	104	46
	5,7	5708	2207	46	46	57	46	73	46	88	46	88	46	104	46	104	57	118	57
	6,3	6293	2027	46	46	46	46	57	46	57	46	73	46	88	46	104	46	104	46
	6,3	6293	2387	57	46	88	46	88	46	104	46	116	57	118	73	134	73	171	88
(302,4/212,4x80x6,7)	6,3	6293	2792	88	46	104	57	118	57	134	88	171	88	171	104	184	104	184	118
MH 190/P	3,8	3818	1847	46	46	57	46	57	46	73	46	88	46	88	46	104	46	104	46
MP 190/P	4,2	4223	1217	46	A	46	A	46	A	46	A	46	A	46	46	46	46	46	46
MP 190/FP	4,2	4223	2072	57	46	88	46	88	46	104	46	104	57	116	57	118	73	134	88
13 t on rear axle	4,5	4493	1307	46	A	46	A	46	A	46	46	46	46	46	46	46	46	46	46
	4,5	4493	1802	46	46	57	46	57	46	73	46	88	46	88	46	104	46	104	57
	4,8	4808	2477	104	57	118	73	149	88	171	88	171	104	184	104	184	116	205	118
	5,1	5123	1577	46	46	46	46	46	46	46	46	57	46	57	46	73	46	88	46
	5,1	5123	1982	73	46	88	46	88	46	104	46	104	57	116	57	118	73	134	88
	5,1	5123	2207	88	46	104	57	116	57	118	73	134	88	171	88	171	88	184	104
	5,1	5123	2387	104	57	118	57	134	73	171	88	171	88	184	104	184	104	184	116
	5,7	5708	1982	73	46	88	46	104	46	104	46	116	57	118	57	134	73	149	88
	5,7	5708	2207	104	46	104	57	118	57	134	73	149	88	171	88	171	104	184	104
	6,3	6293	2027	88	46	88	46	104	46	104	57	118	57	134	73	149	88	171	88
	6,3	6293	2387	116	57	134	73	171	88	171	88	184	104	184	104	184	116	205	118
(302,4/212,4x80x6,7)	6,3	6293	2792	171	88	184	104	184	116	243	118	243	149	243	171	243	171	243	184

Notes: see page 2-41

Table 2.4 (continued)
Longitudinal runner profiles of the subframe for central axle trailers

MODELS (Chassis section) (mm)	Wheelbase (mm)		Rear overhang	Trailer load (R) & static drawbar load (S) of the central axle trailer (kg)															
				R ≤ 9 500 S ≤ 950		R ≤ 12 000 S ≤ 1 000		R ≤ 14 000 S ≤ 1 000		R ≤ 16 000 S ≤ 1 000		R ≤ 18 000[4)] S ≤ 1 000		R ≤ 20 000[4)] S ≤ 1 000		R ≤ 22 000[4)] S ≤ 1 000		R ≤ 24 000[4)] S ≤ 1 000	
				Minimum value of subframe section modulus Wx (cm3) as a function of the yield point of the material (N/mm^2) Fe360=240 Fe510=360															
(Chassis section) (mm)	(m)	(mm)	(mm)	240	360	240	360	240	360	240	360	240	360	240	360	240	360	240	360
MH 260P/PS	3,8	3796	1757	104	57	118	57	134	73	149	88	171	88	171	104	184	104	184	116
19 t on rear axles	4,2	4201	1127	46	46	57	46	57	46	73	46	88	46	88	46	88	46	104	46
	4,2	4201	1622	104	57	116	57	118	73	134	88	171	88	171	88	171	104	184	104
	4,2	4201	2117	171	88	184	104	184	104	205	118	243	134	243	149	243	171	243	171
	4,5	4471	1217	57	46	73	46	88	46	88	46	88	46	104	46	104	57	116	57
	4,5	4471	1622	104	57	118	57	134	73	149	88	171	88	171	104	184	104	184	104
	4,5	4471	1802	134	73	171	88	171	88	171	104	184	104	184	116	205	118	243	134
	4,5	4471	2072	171	88	184	104	184	116	205	118	243	134	243	149	243	171	243	171
	4,8	4786	1487	104	46	104	57	118	57	118	73	134	88	171	88	171	88	171	104
	4,8	4786	1712	118	73	149	88	171	88	171	104	184	104	184	104	184	116	205	118
(302,4/212,4/80x6,7)	4,8	4786	2072	171	104	184	104	205	118	243	134	243	149	243	171	243	171	243	184
	5,1	5101	1802	149	88	171	88	171	104	184	104	184	116	205	118	243	134	243	149
MH 260/P/PS	3,8	3796	1757	149	88	171	88	171	104	184	104	184	116	205	118	243	134	243	149
21 t on rear axles	4,2	4201	1127	73	46	88	46	88	46	88	46	104	46	104	57	104	57	116	57
	4,2	4201	1622	134	73	171	88	171	88	184	104	184	104	184	116	205	118	243	118
	4,2	4201	2117	184	118	243	134	243	149	243	171	243	171	243	184	243	184	243	184
	4,5	4471	1217	88	46	104	46	104	46	104	57	116	57	118	57	134	73	134	88
	4,5	4471	1622	149	88	171	88	171	104	184	104	184	104	184	118	205	118	243	134
	4,5	4471	1802	171	104	184	104	184	116	205	118	243	134	243	149	243	171	243	171
	4,5	4471	2072	205	118	243	134	243	149	243	171	243	171	243	184	243	184	313	184
	4,8	4786	1487	118	73	134	88	171	88	171	88	171	104	184	104	184	104	184	116
	4,8	4786	1712	171	88	184	104	184	104	184	116	205	118	243	134	243	149	243	171
(302,4/212,4/80x6,7)	4,8	4786	2072	243	118	243	149	243	171	243	171	243	184	243	184	243	184	344	205
	5,1	5101	1802	184	104	184	116	205	118	243	134	243	149	243	171	243	171	243	171
MH 260/PT	4,2	4201	1127	A	A	A	A	46	A	46	A	46	A	46	A	46	A	46	A
19 t on rear axles	4,2	4201	1622	46	46	46	46	46	46	46	46	57	46	57	46	73	46	88	46
	4,2	4201	2117	73	46	88	46	104	46	104	57	116	57	118	73	134	73	149	88
	4,5	4471	1217	46	A	46	A	46	A	46	A	46	A	46	A	46	46	46	46
	4,5	4471	1622	46	46	46	46	46	46	57	46	57	46	57	46	73	46	88	46
	4,5	4471	1802	46	46	57	46	57	46	73	46	88	46	88	46	104	46	104	57
	4,5	4471	2072	73	46	88	46	104	46	104	57	116	57	118	73	134	88	171	88
	4,8	4759	1487	46	46	46	46	46	46	46	46	46	46	46	46	57	46	57	46
	4,8	4759	1712	46	46	57	46	57	46	73	46	73	46	88	46	88	46	104	46
	4,8	4759	2072	88	46	104	46	104	46	116	57	118	57	134	73	149	88	171	88
(302,4/212,4x80x6,7)	5,1	5101	1802	57	46	57	46	73	46	88	46	88	46	104	46	104	57	116	57
(304,4x80x7,7)	5,7	5686	2432	46	46	46	46	57	46	73	46	73	46	73	46	73	46	88	46
MH 260/PT	4,2	4201	1127	46	A	46	A	46	A	46	A	46	A	46	A	46	46	46	46
21 t on rear axles	4,2	4201	1622	46	46	57	46	57	46	73	46	73	46	88	46	88	46	104	46
	4,2	4201	2117	104	46	116	57	118	57	134	73	149	88	171	88	171	104	184	104
	4,5	4471	1217	46	A	46	A	46	A	46	46	46	46	46	46	46	46	46	46
	4,5	4471	1622	46	46	57	46	57	46	73	46	88	46	88	46	88	46	104	46
	4,5	4471	1802	73	46	88	46	88	46	104	46	104	57	116	57	118	57	118	73
	4,5	4471	2072	104	46	116	57	118	73	134	73	149	88	171	88	171	104	184	104
	4,8	4759	1487	46	46	46	46	46	46	57	46	57	46	57	46	73	46	88	46
	4,8	4759	1712	57	46	73	46	88	46	88	46	104	46	104	46	104	57	116	57
	4,8	4759	2072	104	57	118	57	134	73	149	88	171	88	171	104	184	104	184	104
(302,4/212,4/80x6,7)	5,1	5101	1802	88	46	88	46	104	46	104	57	104	57	118	57	118	73	134	88
(304,4x80x7,7)	5,7	5686	2432	57	46	73	46	73	46	73	46	88	46	104	46	116	46	116	57

Notes: see page 2-41.

Table 2.4 (continued)
Longitudinal runner profiles of the subframe for central axle trailers

MODELS (Chassis section) (mm)	Wheelbase		Rear overhang	Trailer load (R) & static drawbar load (S) of the central axle trailer (kg)															
				R ≤ 9 500 S ≤ 950		R ≤ 12 000 S ≤ 1 000		R ≤ 14 000 S ≤ 1 000		R ≤ 16 000 S ≤ 1 000		R ≤ 18 000[4)] S ≤ 1 000		R ≤ 20 000[4)] S ≤ 1 000		R ≤ 22 000[4)] S ≤ 1 000		R ≤ 24 000[4)] S ≤ 1 000	
				Minimum value of subframe section modulus Wx (cm3) as a function of the yield point of the material (N/mm²)															
				Fe360=240				Fe510=360											
(Chassis section) (mm)	(m)	(mm)	(mm)	240	360	240	360	240	360	240	360	240	360	240	360	240	360	240	360
MH 260/TN	3,2	3218	820	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
19 t on rear axles	4,2	4208	1135	46	A	46	A	46	A	46	A	46	A	46	A	46	46	46	46
	4,2	4208	1630	46	46	46	46	73	46	73	46	73	46	73	46	88	46	104	46
	4,2	4208	2125	73	46	104	46	116	57	116	73	149	73	149	73	149	73	171	88
	4,5	4478	1225	46	A	46	A	46	A	46	46	46	46	46	46	46	46	46	46
	4,5	4478	1630	46	46	57	46	73	46	73	46	73	46	73	46	88	46	104	46
	4,5	4478	1810	73	46	73	46	73	46	88	46	104	46	116	57	116	73	116	73
	4,5	4478	2080	73	46	104	46	116	57	116	73	149	73	149	73	149	73	171	88
	4,8	4793	1495	46	46	46	46	46	46	57	46	73	46	73	46	73	46	73	46
	4,8	4793	1720	57	46	73	46	73	46	73	46	88	46	104	46	116	57	116	73
	4,8	4793	2080	88	46	104	46	116	57	116	73	149	73	149	73	171	88	205	104
	5,1	5108	1810	73	46	73	46	88	46	104	46	116	46	116	57	116	73	149	73
(302,4x80x6,7)	5,7	5693	3025	243	116	284	149	284	149	313	171	344	205	344	205	375	243	407	243
MH 260/TN	3,2	3218	820	A	A	A	A	A	A	A	A	A	A	A	A	46	A	46	A
21 t on rear axles	4,2	4208	1135	46	A	46	A	46	A	46	46	46	46	46	46	46	46	46	46
	4,2	4208	1630	73	46	73	46	73	46	88	46	104	46	104	46	116	57	116	73
	4,2	4208	2125	116	73	149	73	149	73	149	73	171	88	205	104	205	116	243	116
	4,5	4478	1225	46	46	46	46	46	46	46	46	46	46	46	46	57	46	73	46
	4,5	4478	1630	73	46	73	46	73	46	88	46	104	46	116	57	116	73	116	73
	4,5	4478	1810	88	46	104	46	116	57	116	73	116	73	149	73	149	73	171	73
	4,5	4478	2080	116	73	149	73	149	73	171	73	171	88	205	104	205	116	243	116
	4,8	4793	1495	57	46	73	46	73	46	73	46	73	46	88	46	104	46	104	46
	4,8	4793	1720	73	46	88	46	104	46	116	57	116	73	116	73	149	73	149	73
	4,8	4793	2080	116	73	149	73	149	73	171	88	205	104	205	104	205	116	243	116
	5,1	5108	1810	88	46	104	46	116	57	116	73	149	73	149	73	149	73	171	88
(302,4x80x6,7)	5,7	5693	3025	313	171	344	205	344	205	375	243	407	243	407	284	440	284	475	284
MP 240	3,2	3218	820	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
MP 240/TN	4,2	4208	1135	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
(on road)	4,2	4208	1630	A	A	57	A	74	A	74	A	74	A	74	A	89	46	105	46
19 t on rear axles	4,5	4478	1225	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	4,5	4478	1630	A	A	A	A	57	A	74	A	74	A	74	A	74	46	89	46
	4,5	4478	1810	74	A	74	A	74	A	89	46	105	46	105	46	135	46	135	46
	4,5	4478	2080	89	46	105	46	135	46	135	46	150	46	150	57	173	74	173	74
	4,8	4793	1495	A	A	A	A	A	A	A	A	57	A	74	A	74	A	74	A
	4,8	4793	1720	A	A	74	A	74	A	74	A	74	A	89	46	105	46	135	46
	4,8	4793	2080	89	46	105	46	135	46	135	46	150	46	150	57	150	74	173	74
(302,4x80x6,7)	5,1	5108	1810	57	A	74	A	74	A	74	46	89	46	105	46	135	46	135	46
MP 240	3,2	3218	820	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
MP 240/TN	4,2	4208	1135	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
(on road)	4,2	4208	1630	74	A	74	A	74	46	74	46	89	46	105	46	135	46	135	46
21 t on rear axles	4,5	4478	1225	A	A	A	AS	A	A	A	A	A	A	A	A	A	A	A	A
	4,5	4478	1630	57	A	74	A	74	A	74	A	89	A	105	46	105	46	135	46
	4,5	4478	1810	74	A	89	46	105	46	135	46	135	46	135	46	150	46	150	57
	4,5	4478	2080	135	46	150	46	150	46	150	57	173	74	208	74	208	74	208	74
	4,8	4793	1495	A	A	A	A	57	46	74	A	74	A	74	A	74	A	89	46
	4,8	4793	1720	74	46	74	A	74	46	89	46	105	46	135	46	135	46	135	46
	4,8	4793	2080	135	46	135	46	150	46	150	57	173	74	173	74	208	74	208	74
(302,4x80x6,7)	5,1	5108	1810	74	46	89	46	105	46	105	46	135	46	135	46	150	46	150	46

Notes: see page 2-41.

Table 2.4 (continued)
Longitudinal runner profiles of the subframe for central axle trailers

MODELS (Chassis section) (mm)	Wheelbase		Rear overhang	Trailer load (R) & static drawbar load (S) of the central axle trailer (kg)															
				R ≤ 9 500 S ≤ 950		R ≤ 12 000 S ≤ 1 000		R ≤ 14 000 S ≤ 1 000		R ≤ 16 000 S ≤ 1 000		R ≤ 18 000[4] S ≤ 1 000		R ≤ 20 000[4] S ≤ 1 000		R ≤ 22 000[4] S ≤ 1 000		R ≤ 24 000[4] S ≤ 1 000	
				Minimum value of subframe section modulus Wx (cm3) as a function of the yield point of the material (N/mm^2) Fe360=240 Fe510=360															
	(m)	(mm)	(mm)	240	360	240	360	240	360	240	360	240	360	240	360	240	360	240	360
MP 240/P; /FP; /FS; /PS	4,2	4201	1127,5	46	A	74	A	74	46	74	46	74	46	89	46	105	46	105	46
(on road)	4,2	4201	1622,5	135	46	135	57	150	74	150	74	173	74	173	74	208	89	208	89
19 t on rear axles	4,45	4471	1217,5	74	A	74	46	74	46	89	46	105	46	105	46	135	46	135	46
	4,5	4471	1622,5	135	46	135	57	150	74	150	74	173	74	173	74	208	89	208	89
	4,5	4471	1802,5	150	57	150	74	173	74	208	74	208	89	208	105	245	119	245	135
	4,5	4471	2072,5	173	74	208	89	245	105	245	135	286	135	286	135	286	150	317	150
	4,8	4786	1487,5	89	46	105	46	135	46	135	57	150	74	150	74	173	74	173	74
	4,8	4786	1712,5	135	46	150	74	150	74	173	74	208	74	208	89	208	105	245	105
	4,8	4786	2072,5	173	74	208	89	245	105	245	135	286	135	286	135	286	150	317	150
(302,4/212,4x80x6,7)	5,1	5101	1802,5	135	57	150	74	173	74	208	74	208	89	208	105	245	119	245	135
MP 240P; /FP; /FS; /PS	4,2	4201	1127,5	74	A	74	46	74	46	89	46	105	46	105	46	135	46	135	46
(on road)	4,2	4201	16225	135	57	150	74	173	74	173	74	208	89	208	89	245	105	245	119
21 t on rear axles	4,5	4471	1217,5	74	46	89	46	89	46	105	46	135	46	135	46	135	57	150	74
	4,5	4471	1622,5	135	57	150	74	173	74	173	74	208	89	208	89	245	105	245	105
	4,5	4471	1802,5	173	74	173	74	208	89	208	105	245	105	245	135	286	135	286	135
	4,5	4471	2072,5	208	105	245	119	245	135	286	135	286	150	317	150	317	150	343	173
	4,8	4786	1487,5	135	46	135	57	150	57	150	74	173	74	173	74	208	89	208	89
	4,8	4786	1712,5	150	74	173	74	173	74	208	89	208	105	245	105	245	135	245	135
	4,8	4786	2072,5	208	105	245	119	245	135	286	135	286	150	317	150	317	150	343	173
(302,4/212,4x80x6,7)	5,1	5101	1802,5	173	74	173	74	208	89	208	105	245	105	245	135	286	135	286	135
MP 240/FT; /PT	4,2	4201	1127,5	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
(on road)	4,2	4201	1622,5	A	A	57	A	74	A	74	46	74	46	74	46	89	46	105	46
19 t on rear axles	4,5	4471	1217,5	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	4,5	4471	1622,5	A	A	57	A	74	A	74	46	74	46	89	46	89	46	105	46
	4,5	4471	1802,5	74	A	74	46	89	46	89	46	105	46	135	46	135	46	135	57
	4,5	4471	2072,5	89	46	119	46	135	46	135	57	150	74	150	74	173	74	208	74
	4,8	4786	1487,5	A	A	A	A	A	A	46	A	57	A	74	A	74	46	74	46
	4,8	4786	1712,5	57	A	74	A	74	46	74	46	89	46	105	46	105	46	135	46
	4,8	4786	2072,5	89	46	119	46	135	46	135	57	150	74	150	74	173	74	208	74
(302,4/212,4x80x6,7)	5,1	5101	1802,5	74	A	74	46	74	46	89	46	105	46	119	46	135	46	135	57
MP 240/FT; /PT	4,2	4201	1127,5	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
(on road)	4,2	4201	,16225	57	A	74	A	74	46	74	46	89	46	105	46	105	46	135	46
21 t on rear axles	4,5	4471	1217,5	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	4,5	4471	1622,5	57	A	74	A	74	46	74	46	89	46	105	46	105	46	135	46
	4,5	4471	1802,5	74	46	89	46	105	46	119	46	135	46	135	57	150	57	150	74
	4,5	4471	2072,5	135	46	135	57	150	74	150	74	173	74	173	74	208	89	208	105
	4,8	4786	1487,5	A	A	A	A	57	A	74	A	74	46	74	46	74	46	89	46
	4,8	4786	1712,5	74	46	74	46	89	46	89	46	105	46	135	46	135	46	135	57
	4,8	4786	2072,5	135	46	135	57	150	74	150	74	173	74	173	74	208	89	208	105
(302,4/212,4x80x6,7)	5,1	5101	1802,5	74	46	89	46	105	46	105	46	135	46	135	57	150	57	150	74
MP 260	3,2	3218	820	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
(on road)	3,5	3533	1405	A	A	A	A	A	A	A	A	A	A	A	A	A	A	57	A
19 t on rear axles	3,8	3803	1135	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	3,8	3803	1495	A	A	A	A	A	A	A	A	A	A	57	A	74	A	74	A
	4,2	4208	1135	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	4,2	4208	1495	A	A	A	A	A	A	A	A	A	A	57	A	74	A	74	A
	4,2	4208	1630	A	A	A	A	57	A	74	74	A	A	74	A	74	A	89	46
	4,2	4208	1855	74	A	74	A	74	A	89	105	46	46	105	46	135	A	135	46
	4,5	4478	1990	74	A	89	46	105	46	105	135	46	46	135	46	150	46	150	57
	4,8	4793	1495	A	A	A	A	A	A	A	A	A	A	57	A	74	46	74	A
	4,8	4793	1720	A	A	57	A	74	A	74	74	A	A	74	46	89	A	105	46
	4,8	4793	2125	89	46	105	46	135	46	135	150	46	46	150	57	150	46	173	74
(302,4x80x6,7)	4,8	4793	2440	135	46	150	46	150	74	173	208	74	74	208	74	245	74 89	245	105
MP 260/P; /FP	3,8	3796	1127,5	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
(on road)	3,8	3796	1487,5	A	A	A	A	A	A	A	A	57	A	74	A	74	A	74	A
19 t on rear axles	4,2	4201	1127,5	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	4,2	4201	1487,5	A	A	A	A	A	A	a	A	57	A	74	A	74	A	74	A
	4,2	4201	1622,5	A	A	A	A	57	A	74	A	74	A	74	A	89	46	105	46
	4,2	4201	1847,5	57	A	74	A	74	A	89	46	105	46	135	46	135	46	150	46
	4,5	4471	1982,5	74	A	74	A	89	46	105	46	135	46	135	46	150	46	150	57
	4,8	4786	1487,5	A	A	A	A	A	A	a	A	57	A	74	A	74	A	74	A
	4,8	4786	1712,5	A	A	57	A	74	A	74	A	74	A	89	46	105	46	135	46
	4,8	4786	2117,5	74	A	105	46	135	46	135	46	150	46	150	57	175	74	208	74
(302,4x80x6,7)	4,8	4786	2432,5	135	46	150	46	150	57	173	74	208	74	208	74	245	89	245	105

Notes: see page 2-41.

Table 2.4 (continued)
Longitudinal runner profiles of the subframe for central axle trailers

MODELS (Chassis section) (mm)	**Wheelbase**		**Rear overhang**	**Trailer load (R) & static drawbar load (S) of the central axle trailer (kg)**															
				R ≤ 9 500 S ≤ 950		**R ≤ 12 000 S ≤ 1 000**		**R ≤ 14 000 S ≤ 1 000**		**R ≤ 16 000 S ≤ 1 000**		**R ≤ 18 000[4] S ≤ 1 000**		**R ≤ 20 000[4] S ≤ 1 000**		**R ≤ 22 000[4] S ≤ 1 000**		**R ≤ 24 000[4] S ≤ 1 000**	
				Minimum value of subframe section modulus Wx (cm3) as a function of the yield point of the material (N/mm^2) Fe360=240 Fe510=360															
	(m)	**(mm)**	**(mm)**	**240**	**360**	**240**	**360**	**240**	**360**	**240**	**360**	**240**	**360**	**240**	**360**	**240**	**360**	**240**	**360**
MP 260	3,2	3218	820	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
(on road)	3,5	3533	1405	A	A	A	A	A	A	A	A	57	A	74	A	74	A	74	A
21 t on rear axles	3,8	3803	1135	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	3,8	3803	1495	A	A	A	A	57	A	74	A	74	A	74	A	74	A	89	46
	4,2	4208	1135	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	4,2	4208	1495	A	A	A	A	A	A	57	A	74	A	74	A	74	A	74	46
	4,2	4208	1630	57	A	74	A	74	A	74	A	74	46	89	46	105	46	135	46
	4,2	4208	1855	74	A	89	46	105	46	135	46	135	46	135	46	150	46	150	57
	4,5	4478	1990	105	46	135	46	135	46	135	46	150	46	150	57	173	74	173	74
	4,8	4793	1495	A	A	A	A	A	A	57	A	74	A	74	A	74	A	74	46
	4,8	4793	1720	74	A	74	A	74	A	89	46	105	46	105	46	135	46	135	46
	4,8	4793	2125	135	46	135	46	150	46	150	57	173	74	208	74	208	74	208	74
(302,4x80x6,7)	4,8	4793	2440	173	74	208	74	208	74	245	74	245	89	245	105	286	135	286	135
MP 260/P; /PF	3,8	3796	1127,5	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
(on road)	3,8	3796	1487,5	A	A	A	A	46	A	74	A	74	A	74	A	74	46	89	46
21 t on rear axles	4,2	4201	1127,5	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	4,2	4201	1487,5	A	A	A	A	46	A	74	A	74	A	74	A	74	46	89	46
	4,2	4201	1622,5	A	A	74	A	74	A	74	A	89	46	89	A	105	46	135	46
	4,2	4201	1847,5	74	A	74	46	105	46	135	46	135	46	135	46	150	46	150	57
	4,5	4471	1982,5	89	46	105	46	135	46	135	46	150	46	150	57	173	74	208	74
	4,8	4786	1487,5	A	A	A	A	57	A	74	A	74	A	74	A	74	46	89	46
	4,8	4786	1712,5	57	A	74	A	74	A	89	46	105	46	135	46	135	46	135	46
	4,8	4786	2117,5	105	46	135	46	135	46	150	46	150	74	173	74	208	74	208	74
(302,4x80x6,7)	4,8	4786	2432,5	150	46	173	74	208	74	208	74	245	74	245	89	286	105	286	135

Notes: see page 2-41.

Table 2.4 (continued)
Longitudinal runner profiles of the subframe for central axle trailers

MODELS (Chassis section) (mm)	Wheelbase		Rear overhang	Trailer load (R) & static drawbar load (S) of the central axle trailer (kg)															
				R ≤ 9 500 S ≤ 950		R ≤ 12000 S ≤ 1 000		R ≤ 14 000 S ≤ 1 000		R ≤ 16 000 S ≤ 1 000		R ≤ 18 000[4)] S ≤ 1 000		R ≤ 20 000[4)] S ≤ 1 000		R ≤ 22 000[4)] S ≤ 1 000		R ≤ 24 000[4)] S ≤ 1 000	
				Minimum value of subframe section modulus Wx (cm3) as a function of the yield point of the material (N/mm^2) Fe360=240 Fe510=360															
	(m)	(mm)	(mm)	240	360	240	360	240	360	240	360	240	360	240	360	240	360	240	360
MP 190H	3,8	3818	1195	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
(off road)	4,2	4223	1195	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
11,5 t on rear axle	4,5	4493	1285	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	4,5	4493	1780	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	5,1	5123	1555	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	5,1	5123	1960	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	5,1	5123	2185	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	5,1	5123	2365	A	A	A	A	A	A	A	A	A	A	A	A	57	A	74	A
	5,7	5708	1960	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
(304,4x80x7,7)	5,7	5708	2185	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
MP 190H	3,8	3818	1195	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
(off road)	4,2	4223	1195	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
13 t on rear axle	4,5	4493	1285	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	4,5	4493	1780	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	5,1	5123	1555	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	5,1	5123	1960	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	5,1	5123	2185	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	5,1	5123	2365	A	A	A	A	A	A	A	A	A	A	74	A	74	A	74	A
	5,7	5708	1960	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
(304,4x80x7,7)	5,7	5705	2185	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
MP 190W	3,8	3818	1195	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
(off road)	4,2	4223	1195	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
11,5 t on rear axle	4,5	4493	1285	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	4,5	4493	1780	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
MP 190W	3,8	3818	1195	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
(off road)	4,2	4223	1195	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
13 t on rear axle	4,5	4493	1285	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	4,5	4493	1780	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
(214,4/304,4x80x7,7)																			
MP 260H	2,8	2813	865	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
(off road)	3,2	3218	730	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
19 t on rear axles	3,2	3218	865	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	3,2	3218	1225	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	3,5	3533	730	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	3,5	3533	865	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	3,5	3533	1495	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	3,8	3803	1045	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	3,8	3803	1495	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	4,2	4208	1135	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	4,5	4478	1990	74	A	89	A	105	A	135	46	150	46	150	46	150	46	150	57
(304,4x80x7,7)	4,8	4793	1495	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
MP 260H	2,8	2813	865	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
(off road)	3,2	3218	730	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
21 t on rear axles	3,2	3218	865	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	3,2	3218	1225	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	3,5	3533	730	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	3,5	3533	865	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	3,5	3533	1495	A	A	A	A	57	A	74	A	74	A	74	A	74	A	74	A
	3,8	3803	1045	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	3,8	3803	1495	A	A	A	A	57	A	74	A	74	A	74	A	74	A	74	A
	4,2	4208	1135	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	4,5	4478	1990	105	A	135	46	135	46	150	46	150	46	150	57	173	74	208	74
(304,4x80x7,7)	4,8	4793	1495	A	A	A	A	A	A	74	A	74	A	74	A	74	A	74	A

Notes: see page 2-41.

Table 2.4 (continued)
Longitudinal runner profiles of the subframe for central axle trailers

MODELS (Chassis section) (mm)	Wheelbase (m)	Wheelbase (mm)	Rear overhang (mm)	R ≤ 9 500 S ≤ 950		R ≤ 12 000 S ≤ 1 000		R ≤ 14 000 S ≤ 1 000		R ≤ 16 000 S ≤ 1 000		R ≤ 18 000[4)] S ≤ 1 000		R ≤ 20 000[4)] S ≤ 1 000		R ≤ 22 000[4)] S ≤ 1 000		R ≤ 24 000[4)] S ≤ 1 000	
				Trailer load (R) & static drawbar load (S) of the central axle trailer (kg). Minimum value of subframe section modulus Wx (cm3) as a function of the yield point of the material (N/mm²). Fe360=240, Fe510=360															
	(m)	(mm)	(mm)	240	360	240	360	240	360	240	360	240	360	240	360	240	360	240	360
MP 260W	3,5	3528	725	A	A	A	A	A	A	A	AA	A	A	A	A	A	A	A	A
(off road)	3,5	3528	860	A	A	A	A	A	A	A	A	A	A	57	A	74	A	74	A
19 t on rear axles	3,5	3528	1490	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	3,8	3798	1040	A	A	A	A	A	A	A	A	A	A	57	A	74	A	74	A
(304,4x80x7,7)	3,8	3798	1490	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
MP 260W	3,5	3528	725	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
(off road)	3,5	3528	860	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
21 t on rear axles	3,5	3528	1490	A	A	A	A	57	A	74	A	74	A	74	A	74	A	89	A
	3,8	3798	1040	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
(304,4x80x7,7)	3,8	3798	1490	A	A	A	A	57	A	74	A	74	A	74	A	74	A	74	A
MP 260W (off road) 19 t on rear axles	4,2	4203	1490	A	A	A	A	A	A	A	A	A	A	57	A	74	A	74	A
MP 260W (off road) 21 t on rear axles (304,4x80x7,7)	4,2	4203	1490	A	A	A	A	57	A	74	A	74	A	74	A	74	A	74	A
MP 330H	2,8	2813	865	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
(off road)	3,2	3218	865	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
19 t on rear axles	3,2	3218	1225	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	3,2	3218	1495	A	A	A	A	A	A	A	A	57	A	74	A	74	A	74	A
	3,2	3218	1720	57	A	74	A	74	A	74	A	74	A	89	A	105	A	135	46
	3,5	3533	865	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	3,5	3533	1495	A	A	A	A	A	A	A	A	57	A	74	A	74	A	74	A
	3,5	3533	1855	74	A	74	A	89	A	105	A	105	46	135	46	135	46	150	46
	3,8	3803	1495	A	A	A	A	A	A	A	A	57	A	74	A	74	A	74	A
	3,8	3803	1855	74	A	74	A	89	A	105	A	105	46	135	46	135	46	150	46
	3,8	3803	2080	105	A	135	46	135	46	135	46	150	46	150	57	173	74	173	74
	4,2	4208	2080	89	A	135	46	135	46	135	46	150	46	150	57	173	74	173	74
	4,2	4208	2305	135	46	150	46	150	57	173	57	208	74	208	74	245	74	245	89
MP 330H	2,8	2813	865	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
(off road)	3,2	3218	865	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
26 t on rear axles	3,2	3218	1225	A	A	A	A	A	A	57	A	74	A	74	A	74	A	74	A
	3,2	3218	1495	74	A	89	A	89	A	105	A	135	46	135	46	135	46	135	46
	3,2	3218	1720	135	46	135	46	150	46	150	46	150	57	173	74	208	74	208	74
	3,5	3533	865	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	3,5	3533	1495	74	A	89	A	89	A	105	A	135	46	135	46	135	46	135	46
	3,5	3533	1855	150	46	150	57	173	74	208	74	208	74	208	74	245	74	245	89
	3,8	3803	1495	74	A	89	A	89	A	105	A	135	46	135	46	135	46	135	46
	3,8	3803	1855	150	46	150	57	173	74	208	74	208	74	208	74	245	74	245	89
	3,8	3803	2080	208	74	245	74	245	89	245	89	286	105	286	135	286	135	317	135
	4,2	4208	2080	208	74	245	74	245	89	245	89	286	105	286	135	286	135	317	135
(304,4x80x7,7)	4,2	4208	2305	245	105	286	135	286	135	317	135	343	135	343	150	374	150	374	150

Notes: see page 2-41.

Table 2.4 (continued)
Longitudinal runner profiles of the subframe for central axle trailers

MODELS (Chassis section) (mm)	Wheelbase (m)	Wheelbase (mm)	Rear overhang (mm)	R ≤ 9 500 S ≤ 950 240	R ≤ 9 500 S ≤ 950 360	R ≤ 12 000 S ≤ 1 000 240	R ≤ 12 000 S ≤ 1 000 360	R ≤ 14 000 S ≤ 1 000 240	R ≤ 14 000 S ≤ 1 000 360	R ≤ 16 000 S ≤ 1 000 240	R ≤ 16 000 S ≤ 1 000 360	R ≤ 18 000[4)] S ≤ 1 000 240	R ≤ 18 000[4)] S ≤ 1 000 360	R ≤ 20 000[4)] S ≤ 1 000 240	R ≤ 20 000[4)] S ≤ 1 000 360	R ≤ 22 000[4)] S ≤ 1 000 240	R ≤ 22 000[4)] S ≤ 1 000 360	R ≤ 24 000[4)] S ≤ 1 000 240	R ≤ 24 000[4)] S ≤ 1 000 360
				Trailer load (R) & static drawbar load (S) of the central axle trailer (kg) — Minimum value of subframe section modulus Wx (cm3) as a function of the yield point of the material (N/mm²) — Fe360=240, Fe510=360															
MP 330W	3,5	3528	860	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
(off road)	3,5	3528	1490	A	A	A	A	A	A	A	A	57	A	74	A	74	A	74	A
19 t on rear axles	3,5	3528	1850	74	A	74	A	89	A	105	A	105	46	135	46	135	46	150	46
	3,8	3798	1490	A	A	A	A	A	A	A	A	57	A	74	A	74	A	75	A
	3,8	3798	1850	74	A	74	A	89	A	105	A	74	46	135	46	135	46	150	46
(304,4x80x7,7)	3,8	3798	2075	105	A	135	46	135	46	135	46	150	46	150	57	173	74	208	74
MP 330W	3,5	3528	860	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
(off road)	3,5	3528	1490	74	A	89	A	89	A	105	A	135	46	135	46	135	46	135	46
26 t on rear axles	3,5	3528	1850	150	46	150	57	173	74	208	74	208	74	208	74	245	74	245	89
	3,8	3798	1490	74	A	89	A	89	A	105	A	135	46	135	46	135	46	135	46
	3,8	3798	1850	150	46	150	57	173	74	208	74	208	74	208	74	245	74	245	89
(304,4x80x7,7)	3,8	3798	2075	208	74	245	74	245	89	245	89	286	105	286	135	286	135	317	135
MP 340H	4,2	4208	685	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
(off road)	5,0	5018	865	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
19 t on rear axles	5,0	5018	1495	A	A	A	A	A	A	A	A	57	A	74	A	74	A	74	A
	5,8	5828	685	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	5,8	5828	1045	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
(304,4x80x7,7)	5,8	5828	1225	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
MP 340H	4,2	4208	685	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
(off road)	5,0	5018	865	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
21 t on rear axles	5,0	5018	1495	A	A	A	A	57	A	74	A	74	A	74	A	74	A	89	A
	5,8	5828	685	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	5,8	5828	1045	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
(304,4x80x7,7)	5,8	5828	1225	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
MP 380H	3,2	3218	1225	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
(off road)	3,2	3218	1495	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
19 t on rear axles	3,2	3218	1720	A	A	A	A	A	A	57	A	74	A	74	A	74	A	74	A
	3,5	3533	865	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	3,5	3533	1495	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	3,5	3533	1855	A	A	57	A	74	A	74	A	74	A	89	A	105	A	105	A
	3,8	3803	1495	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	3,8	3803	1855	A	A	57	A	74	A	74	A	74	A	89	A	105	A	105	A
	3,8	3803	2080	74	A	74	A	89	A	105	A	135	A	135	A	150	A	150	A
	4,2	4208	2080	74	A	74	A	89	A	105	A	135	A	135	A	150	A	150	A
	4,2	4208	2305	105	A	135	A	135	A	150	A	150	A	173	46	173	74	208	74
(309x80x10	5,7	5693	2710	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E
MP 380H	3,2	3218	1225	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
(off road)	3,2	3218	1495	A	A	A	A	A	A	A	A	57	A	74	A	74	A	74	A
22 t on rear axles	3,2	3218	1720	57	A	74	A	74	A	74	A	89	A	105	A	105	A	135	A
	3,5	3533	865	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	3,5	3533	1495	A	A	A	A	A	A	A	A	57	A	74	A	74	A	74	A
	3,5	3533	1855	74	A	74	A	89	A	105	A	135	A	135	A	135	A	150	A
	3,8	3803	1495	A	A	A	A	A	A	A	A	57	A	74	A	74	A	74	A
	3,8	3803	1855	74	A	74	A	89	A	105	A	135	A	135	A	135	A	150	A
	3,8	3803	2080	105	A	135	A	135	A	150	A	150	A	173	57	173	74	208	74
	4,2	4208	2080	105	A	135	A	135	A	150	A	150	A	173	46	173	74	208	74
	4,2	4208	2305	150	A	150	A	173	57	208	74	208	74	245	74	245	74	245	89
(309x80x10	5,7	5693	2710	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E
MP 380H	3,2	3218	1225	A	A	57	A	74	A	74	A	74	A	74	A	74	A	89	A
(off road)	3,2	3218	1495	105	A	135	A	135	A	135	A	150	A	150	A	150	A	150	46
32 t on rear axles	3,2	3218	1720	150	A	173	57	173	74	208	74	208	74	208	74	245	74	245	74
	3,5	3533	865	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	3,5	3533	1495	105	A	135	A	135	A	135	A	150	A	150	A	105	A	150	46
	3,5	3533	1855	208	74	208	74	245	74	245	74	245	89	245	89	286	105	286	105
	3,8	3803	1495	105	A	135	A	135	A	135	A	150	A	150	A	150	A	150	46
	3,8	3803	1855	208	74	208	74	245	74	245	74	245	46	245	89	286	105	286	135
	3,8	3803	2080	245	89	286	105	286	135	317	135	317	135	343	135	343	150	374	150
	4,2	4208	2080	245	89	286	105	286	135	317	135	317	135	343	135	343	150	374	150
	4,2	4208	2305	343	135	343	150	374	150	374	150	406	173	406	173	474	208	474	208
(309x80x10)	5,7	5693	2710	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E

Notes: see page 2-41.

Table 2.4 (continued)
Longitudinal runner profiles of the subframe for central axle trailers

MODELS	Wheelbase		Rear overhang	Trailer load (R) & static drawbar load (S) of the central axle trailer (kg)															
				R ≤ 9 500 S ≤ 950		R ≤ 12 000 S ≤ 1 000		R ≤ 14 000 S ≤ 1 000		R ≤ 16 000 S ≤ 1 000		R ≤ 18 000 4) S ≤ 1 000		R ≤ 20 000 4) S ≤ 1 000		R ≤ 22 000 4) S ≤ 1 000		R ≤ 24 000 4) S ≤ 1 000	
				Minimum value of subframe section modulus Wx (cm3) as a function of the yield point of the material (N/mm^2)															
				Fe360=240			Fe510=360												
(Chassis section) (mm)	(m)	(mm)	(mm)	240	360	240	360	240	360	240	360	240	360	240	360	240	360	240	360
MP 380W	3,5	3528	860	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
(off road)	3,5	3528	1490	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
19 t on rear axles	3,5	3528	1850	A	A	57	A	74	A	74	A	74	A	89	A	105	A	105	A
	3,8	3798	1490	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	3,8	3798	1850	A	A	57	A	74	A	74	A	74	A	89	A	105	A	105	A
	3,8	3798	2075	74	A	74	A	89	A	105	A	135	A	135	A	150	A	150	A
MP380W	3,5	3528	860	A	A	A	A	A	A	A	A	A	A	A	A	AA	A	A	A
(off road)	3,5	3528	1490	A	A	A	A	A	A	A	A	57	A	74	A	74	A	74	A
22 t on rear axles	3,5	3528	1850	74	A	74	A	89	A	105	A	135	A	135	A	135	A	150	A
	3,8	3798	1490	A	A	A	A	A	A	A	A	57	A	74	A	74	A	74	A
	3,8	3798	1850	74	A	74	A	89	A	105	A	135	A	135	A	135	A	150	A
	3,8	3798	2075	105	A	135	A	135	A	150	A	150	A	173	57	173	74	208	74
MP 380W	3,5	3528	860	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
(off road)	3,5	3528	1490	105	A	135	A	135	A	135	A	150	A	150	A	150	A	150	46
32 ton rear axles	3,5	3528	1850	208	74	208	74	245	74	245	74	245	89	2145	89	286	105	286	105
	3,8	3798	1490	105	A	135	A	135	A	135	A	150	A	150	A	150	A	150	46
	3,8	3798	1850	208	74	208	74	245	74	245	74	245	89	245	89	286	105	286	105
(309x80x10)	3,8	3798	2075	245	89	286	105	286	135	317	135	317	135	343	135	343	150	374	150
MP 410/H; /HB	4,2	4208	685	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
(off road)	5,0	5018	865	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
19 t on rear axles	5,0	5018	1495	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
(309x80x10)	5,8	5828	1225	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
MP 410/H; /HB	4,2	4208	685	A	A	A	A	A	A	A	A	A	A	A	A	AA	A	A	A
(off road)	5,0	5018	865	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
22 t son rear axles	5,0	5018	1495	A	A	A	A	A	A	A	A	46	A	74	A	74	A	74	A
(309x80x10)	5,8	5828	1225	A	A	A	A	A	A	A	A	46	A	74	A	74	A	74	A
MP 410/H; /HB	4,2	4208	685	A	A	A	A	A	A	A	A	A	A	AA	A	A	A	A	A
(off road)	5,0	5018	865	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
32 t on rear axles	5,0	5018	1495	105	A	135	A	135	A	135	A	150	A	150	A	150	A	150	46
(309x80x10)	5,8	5828	1225	105	A	135	A	135	A	135	A	150	A	150	A	150	A	150	46

Notes: see page 2-41.

Table for selection of runner profiles (see Table 2.4)

Section modulus Wx (cm^3)	Recommended section[5)] (or other section with equal moment of inertia and resistance) (C-shaped section) (mm)	Section modulus Wx (cm^3)	Recommended section[5)] (or other section with equal moment of inertia and resistance) (C-shaped section) (mm)
16	80x50x4	135	200x80x7
19	80x50x5	150	200x80x8
21	80x60x5	173	220x80x8
31	100x60x5	208	250x80x8
36	100x60x6	245	250x100x8
46	120x60x6	286	280x100x8
57	140x60x6	317	300x100x8
74	140x70x7	343	320x100x8
89	160x70x7	374	340x100x8
105	180x70x7	406	360x100x8
119	200x80x6	474	400x100x8

A = The chassis runner profile designed for the relevant body is sufficient (e.g. table 3.1 for normal bodies)
C = Normal (short) cab
L = Long cab
E = To be checked case by case
1) = Use runners with greater section modulus when the body requires it (e.g. table 3.1)
2) = For models of class ML 60, ML 65 and ML 75, possible only after fitting a suitable final cross member and an appropriate towing device (modification of chassis end).
3) = For models of class ML 95W, ML 100W, ML 120, ML 130, 135W, ML 140W and ML 150, possible only if fitting a sturdier final cross member and an appropriate towing device. For models ML 150 E27, ML 170 and ML 180, possible up to 9,000 kg using a standard cross member.
4) = For towing central axle trailers featuring high overall mass, particularly in the case of vehicles fitted with a long rear overhang, we recommend that a proper rear cross member be installed in a lowered and forward position (next to the rear suspension rear mountings) in consideration of the high stress exerted on the chassis and the dynamic forces affecting the tractor (load reduction on the front axle).
5) = Should the height of the runner profile be reduced using shear resistant connections, combined section runner profiles can be adopted instead of the specified channel profiles (moment of resistance indicated on table 2.4). Combined section runner pro files can be used (see table below) on condition that flange width and thickness dimensions are not smaller than the corresponding values tabulated on the runner profile section table.
These are instructions of a general nature applying to the materials covered by this manual. Materials with higher mechanical specifications call for the measurement of the overall chassis and subframe bending moment.
However, we recommend that minimum specified values of reinforcement sections for the different types of equipment be observed (for example, see table 3.1 for standard bodies).
6) = In the MLL version, use a section with W min no less than 57 cm^3.

Combined section reinforcement runner profiles (figure 3.4)

	A	B	C or D	E	F	G
Material yield point (N/mm^2)	≤ 320	≤ 320	≤ 240	≤ 240	≤ 360	≤ 360
Max. runner profile height reduction (mm):	40	60	100	120	100	120
Combined reinforcements length (see Fig. 2.15) L_V : L_H :	 $0{,}5.L_U$ $0{,}6.L_U$	 $0{,}5.L_U$ $0{,}6.L_U$	 $0{,}8L_U$ $0{,}95L_U$	 $0{,}85L_U$ $1{,}0.L_U$	 $0{,}8.L_U$ $0{,}95.L_U$	 $0{,}85.L_U$ $1{,}0.L_U$
Example: Combined section as an alternative to the channel section C250x80x8 (mm)	210x80x8	190x80x8	150x80x8 + straight section 15x80	130x80x8 + straight section15x80	150x80x8 + angle section	130x80x8 + angle section
Actual height reduction (mm):	40	52	85	97	92	104

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

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

Vehicles designed to tow central axle trailers for which a final cross member located in a lowered or forward position (next to the rear suspension rear mountings or air springs) is evisaged, do not require particular chassis reinforcing devices. For the subframe, the runner profile dimensions indicated for the different types of equipmen t (e.g. see table 3.1 standard bodies) will be sufficient. The bodybuilder will accurately work out the size and position of the chassis connection structure (see items 2.21 and 2.5.3 and 2.15.3) 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 tractor 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 departures from specifications or the specific solutions to adopt (e.g. underrun bar of the tilt type).

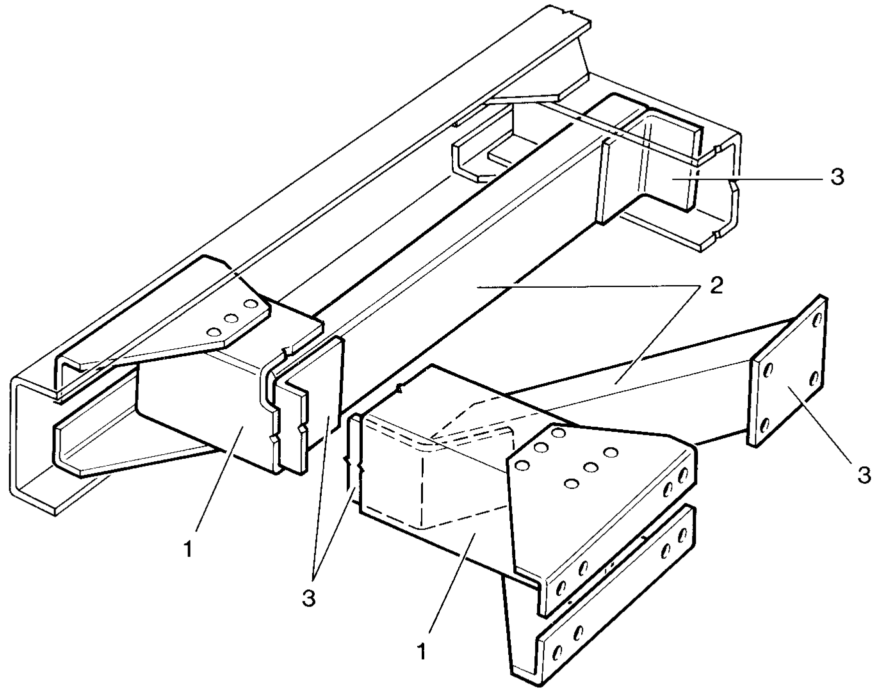
Reinforcement of Standard Rear Cross Member

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

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

1) The mounting of a channel section on the inside of the cross member and joining it to the vertical web of the side member or to the following cross member of the chassis, if it is situated in close proximity, in compliance with the procedures illustrated in Fig. 2.16.

Figure 2.16

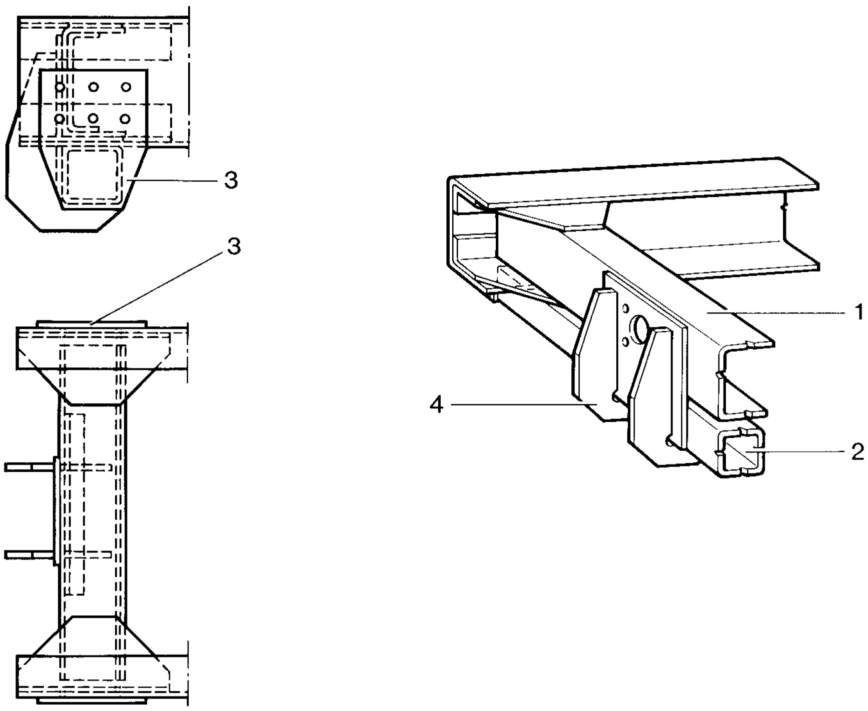


1 Original cross member
2 Reinforcing rail
3 Connecting angle pieces or plates

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 Fig. 2.17.
In vehicles with a short rear overhang, and when auxiliary frame used (e.g. tippers or vehicles having the underrun bar device located below chassis longitudinal member lower flange), the box-section may be mounted on the inside of the sections of the auxiliary frame above the cross member and connected to it by means of a plate, as shown in fig. 2.14.

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 2.17



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

Tow hooks for Central Axle Trailers

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

The values of the trailer loads and of the permissible vertical loads are contained in the technical documentation of the manufacturer of the tow hook or on the production data plate (e.g. DIN 74 051 and DIN 74 052).

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 to this they can imply that the rear cross member should be further reinforced and a subframe runner of larger size be fitted.

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 1.2.1).

2.6 Installing a Supplementary Axle

General Specifications

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

The modification must respect the mass 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.

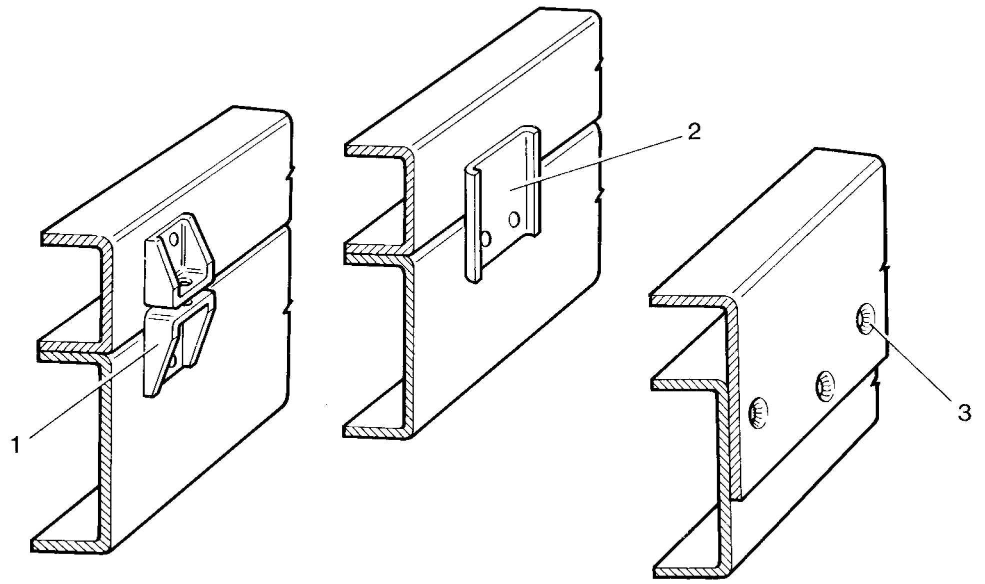
Diagrams of the installation procedure may be submitted for inspection. These proposals must indicate the parts necessary to connect the axle to the chassis as well as the reinforcements to, and modifications of the chassis.

The specifications given in points 2.2 and 2.3 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.

Figure 2.18



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

Chassis Frame Reinforcement

Fig. 2.18 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 rivets or reinforcement bolts must be used and their diameter and distribution must be such to enable the section iron to provide the required strength.

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 section 3.1.2 and those that follow it.

We recommend using a shear resistant connection in the area of the rear overhang up to approximately the mid wheelbase (in any case up to no more than 2 m from the front axle) (see fig. 2.19).

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.

The reinforcement on the chassis can be omitted provided the following static stress values are not exceeded:

Models	**Static stress admitted on chassis (N/mm^2)**	
	on road	**off road**
ML 60 ÷ ML 170; ML 260KE	120	80
MP 180 ÷ MP 410H	150	100

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

If the fitting of such reinforcement is unavoidable, then because of the deterioration of the characteristics of the material following welding, in measuring the stress in the various sections it is necessary to assume a reduction in the characteristics of the material by approximately 15%.

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.

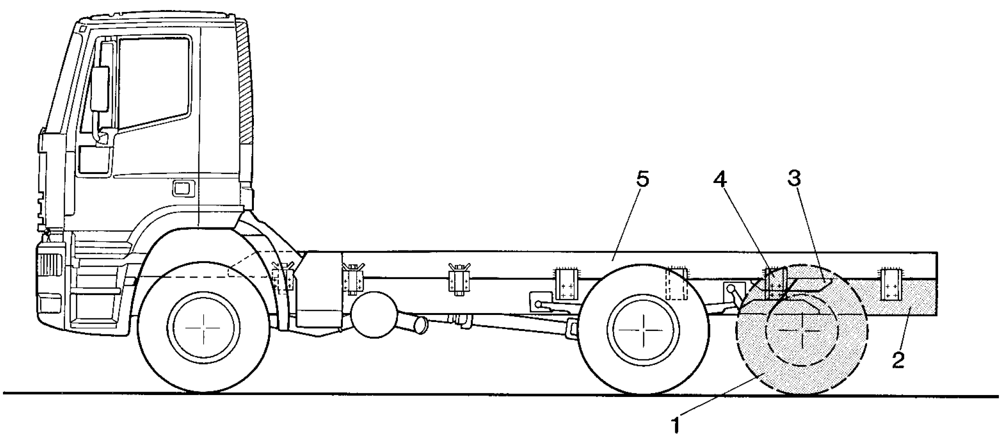
Installing a Rear Supplementary Axle

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 2.4.2. 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.

Fig. 2.19 shows an example of the installation of a rear axle with an extension of the rear overhang.

Figure 2.19



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

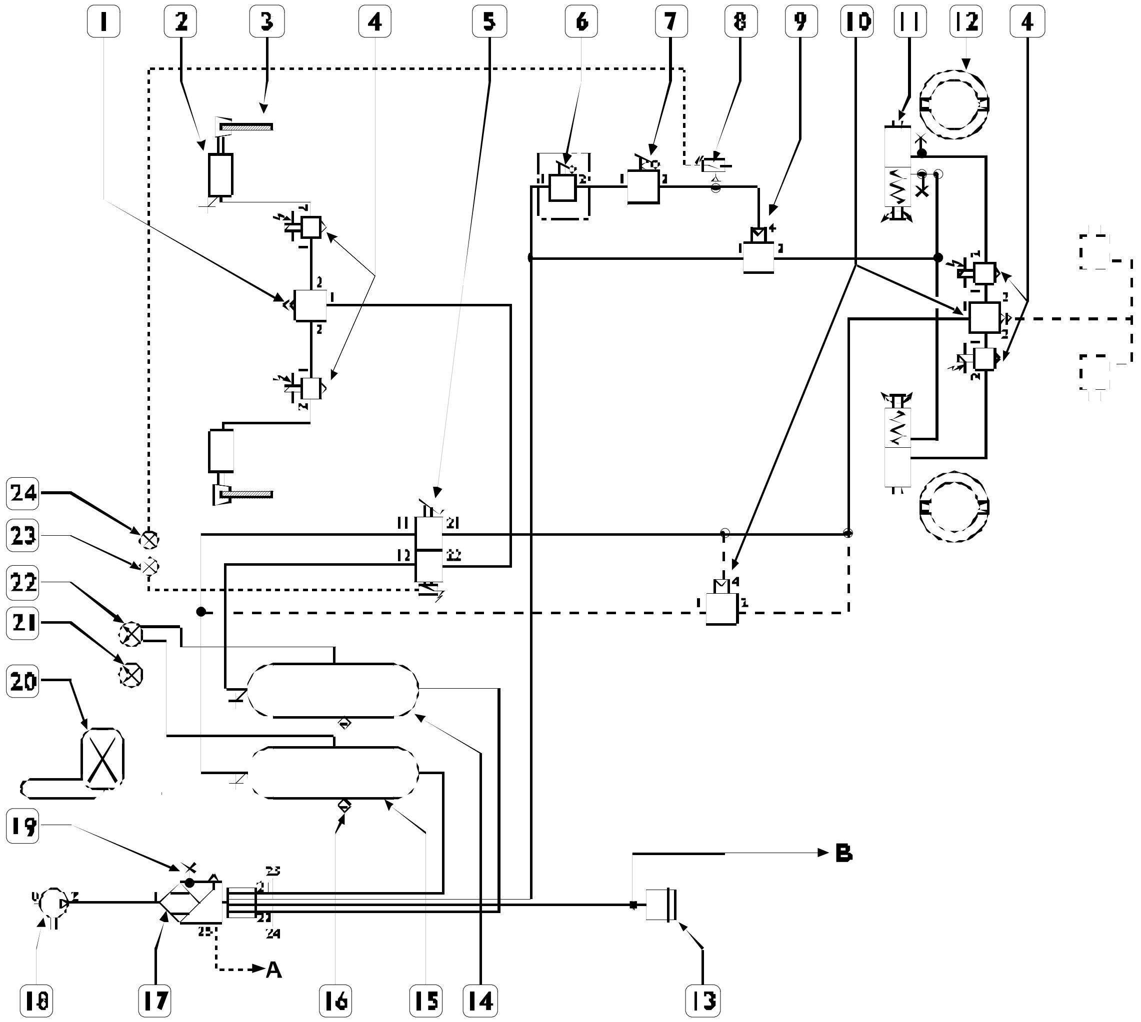
Application of the third rear axle for EuroCargo TECTOR

For models EuroCargo Tector ML150E.. and ML180E.., option 4667 (arrangement for application of the third rear axle) is available. This provides vehicles built with specific components (e.g. four-channel ABS control unit, axle combined brake cylinder, ABS electropneumatic valve, etc.).
Installation of a third axle to vehicles not built with option 4667 must be carried out according to the indications of the diagrams below:

DIAGRAM – BRAKING SYSTEMS WITH OPTION 4667

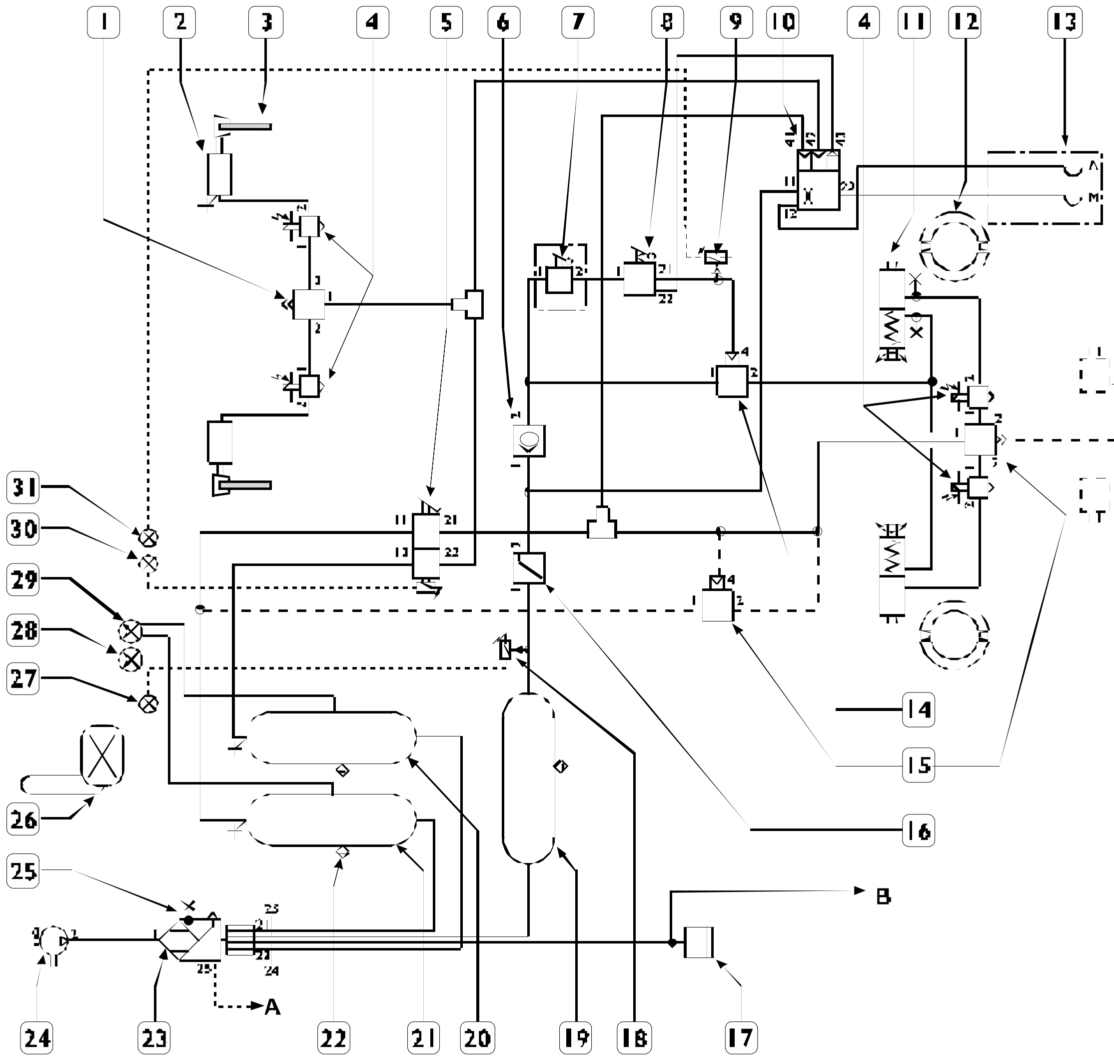
(It is recommended that the axle solenoid valves are inserted in such a way that one solenoid valve controls the right wheel of the driving axle and additional axle, and the other controls the left side)

Figure 2.20 MODELS: 150/EP/EFP option 4667 isolated



1. Quick-discharge valve or proportional reduction valve 1:1,5 (optional) – 2. Axle membrane brake cylinder (type 18 with R 19.5 tyres; type 20 with R22.5 – R20 tyres – 3. Knorr SB6 axle disc brake, ∅ 377 mm, braking surface: 301 cm^2 per wheel – 4. ABS electropneumatic valve – 5. Self-limited, Knorr DX65 7.6 bar brake control Duplex distributor (**) – 6. Parking brake safety valve (optional) – 7. Self-limited, 7.5 bar parking brake control hand distributor – 8. 6.5 bar low pressure indicator switch – 9. Single-control servodistributor – 10. Quick-discharge valve (optional) or single-control servodistributor (optional) – 11. Combined brake cylinder (type 14/7300 with R 19.5 tyres; type 16/7900 with R22.5 – R20 tyres – 12. Rear axle drum brake - ∅ 360 mm, width: 170 mm, braking surface: 988 cm^2 per wheel, full angle of jaw control wedge: 12° - 13. Services safety valve (optional) – 14. Axle air tank (15 l) – 15. Rear axle air tank (15 l) – 16. Manual condensate drain valve – 17. A.P.U. (Drier with 11 bar regulator – Four-way 7.5/6.5 bar protection valve) Knorr ZB45 (**) LA81 (**) AE46 (**) – 18. Single-cylinder compressor, 225/359 cm^3 compressor revs/engine ratio – 19. Pressure control takeoff – 20. Knorr anti-lock electronic control unit (types 0 486 104 or B 486 104 072 – 21. Electric pressure gauge – 22. Pneumatic pressure gauge for 6.5 bar low pressure indicator switches – 23. Stop lights – 24. Parking brake luminous indicator – A. To the pneumatic suspension system – B. Services.
(**) The numeric characters that come after the code refer to features not essential under braking directives.

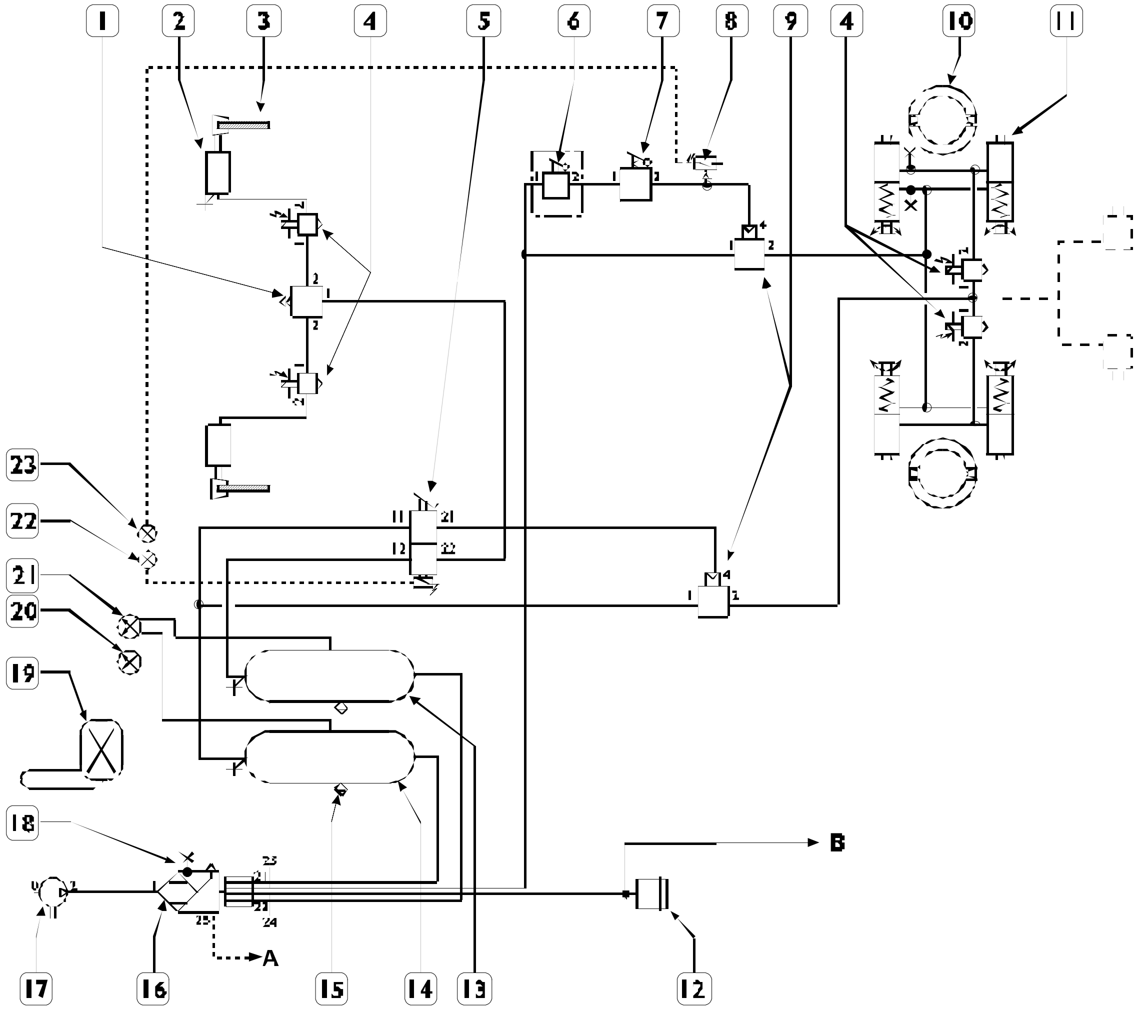
Figure 2.21 MODELS: 150/EP/EFP option 4667 trailing



1. Quick-discharge valve or proportional reduction valve 1:1,5 (optional) – 2. Axle membrane brake cylinder (type 18 with R 19.5 tyres; type 20 with R22.5 – R20 tyres – 3. Knorr SB6 axle disc brake, ∅ 377 mm, braking surface: 301 cm^2 per wheel – 4. ABS electropneumatic valve – 5. Self-limited, Knorr DX65 7.6 bar brake control Duplex distributor (**) – 6. Back-pressure valve – 7. Parking brake safety valve (optional) – 8. Parking brake control hand distributor (optional) – 9. 6.5 bar low pressure indicator switch – 10. Trailer brake control servodistributor, Knorr AC597 (**) WABCO 937 009 (**) pred. 0.2 bar – 11. Combined brake cylinder (type 14/7300 with R 19.5 tyres; type 16/7900 with R22.5 – R20 tyres – 12. Rear axle drum brake - ∅ 360 mm, width: 170 mm, braking surface: 988 cm^2 per wheel, full angle of jaw control wedge: 12° – 13. ISO trailer semicoupling – 14. Single-control servodistributor – 15. Pressure control takeoff – 16. Trailer pressure reductor, 8.5 bar – 17. Services safety valve (optional) – 18. Low pressure indicator switch, 6.5 bar (optional) – 19. Trailer + springs air tank (15 l) – 20. Axle air tank (20 l) – 21. Rear axle air tank (20 l) – 22. Manual condensate drain valve – 23. A.P.U. (Drier with 11 bar regulator – Four-way 7.5/6.5 bar protection valve) Knorr ZB45 (**) LA81 (**) AE46 (**) – 24. Single-cylinder compressor, 225/359 cm^3 compressor revs/engine ratio – 25. Pressure control takeoff – 26. Knorr anti-lock electronic control unit (types 0 486 104 or B 486 104 072) – 27. Trailer services low pressure luminous indicator (optional) – 28. Electric pressure gauge – 29. Low pressure indicator switch pneumatic pressure switch, 6.5 bar – 30. Stop lights – 31. Parking brake luminous indicator – A. To the pneumatic suspension system – B. Services.

(**) The numeric characters that come after the code refer to features not essential under braking directives.

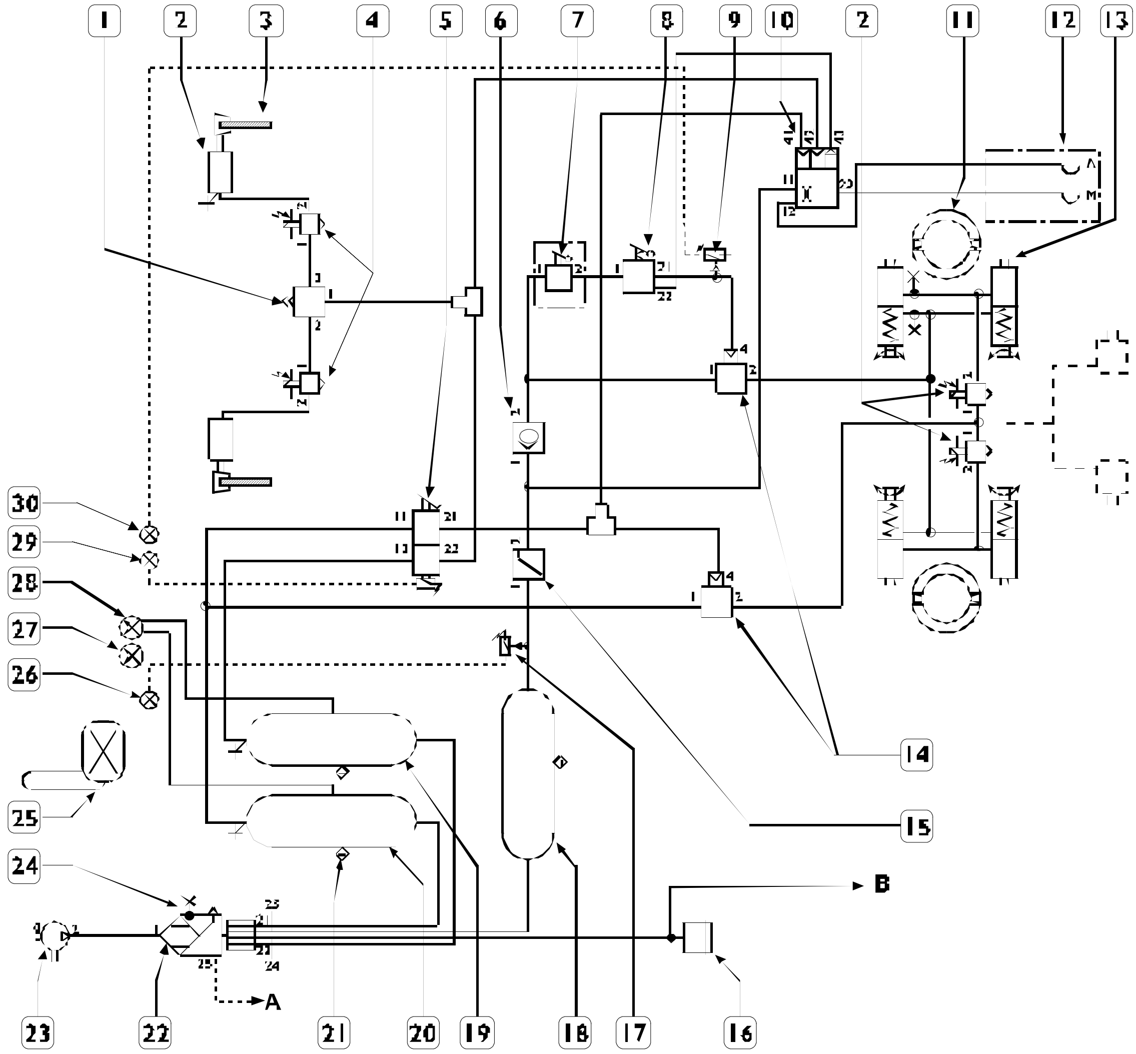
Figure 2.22 MODELS: 180/E/EP option 4667 isolated



1. Quick-discharge valve or proportional reduction valve 1:1,5 (optional) – 2. Axle membrane brake cylinder (type 22) – 3. Knorr SB6 axle disc brake, ∅ 436 mm, braking surface: 392 ÷ 408 cm^2 per wheel – 4. ABS electropneumatic valve – 5. Self-limited, Knorr DX65 7.6 bar brake control Duplex distributor (**) – 6. Parking brake safety valve (optional) – 7. Self-limited, 7.5 bar parking brake control hand distributor – 8. 6.5 bar low pressure indicator switch – 9. Single-control servodistributor – 10. Rear axle drum brake - ∅ 381 mm, width: 178 mm, braking surface: 1,400 cm^2 per wheel, full angle of jaw control wedge: 12° – 11. Rear axle combined brake cylinder, type 12/720 – 12. Services safety valve (optional) – 13. Axle air tank (20 l) – 14. Rear axle air tank (20 l) – 15. Manual condensate drain valve – 16. A.P.U. (Drier with 11 bar regulator – Four-way 7.5/6.5 bar protection valve) Knorr ZB45 (**) LA81 (**) AE46 (**) – 17. Single-cylinder compressor, 225/359 cm^3 compressor revs/engine ratio – 18. Pressure control takeoff – 19. Knorr anti-lock electronic control unit (types 0 486 104 or B 486 104 072 – 20. Electric pressure gauge – 21. Low pressure indicator switch pneumatic pressure switch, 6.5 bar – 22. Stop lights – 23. Parking brake luminous indicator – A. To the pneumatic suspension system – B. Services.

(**) The numeric characters that come after the code refer to features not essential under braking directives.

Figure 2.23 MODELS: 180/EP/EFP option 4667 trailing

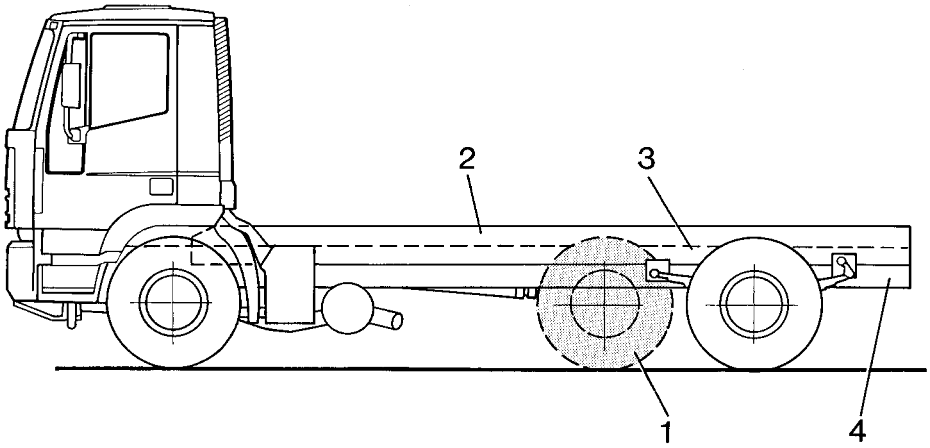


1. Quick-discharge valve or proportional reduction valve 1:1,5 (optional) – 2. Axle membrane brake cylinder, type 22 – 3. Knorr SB6 axle disc brake, ∅ 436 mm, braking surface: 392 ÷ 408 cm^2 per wheel; Bendix axle disc brake, ∅ 430 mm, braking surface: 384 cm^2 per wheel – 4. ABS electropneumatic valve – 5. Self-limited, Knorr DX65 7.6 bar brake control Duplex distributor (**) – 6. Back-pressure valve – 7. Parking brake safety valve (optional) – 8. Parking brake control hand distributor (limit. 8.5 bar) – 9. 6.5 bar low pressure indicator switch – 10. Trailer brake control servodistributor, Knorr AC597 (**) WABCO 937 009 (**) pred. 0.5 bar – 11. Rear axle drum brake - ∅ 381 mm, width: 178 mm, braking surface: 1,400 cm^2 per wheel, full angle of jaw control wedge: 12° – 12. ISO trailer semicoupling – 13. Rear axle combined brake cylinder, type 12/20 – 14. Single-control servodistributor – 15. Trailer pressure reductor, 8.5 bar – 16. Services safety valve (optional) – 17. Low pressure indicator switch, 6.5 bar (optional) – 18. Trailer + springs air tank (15 l) – 19. Axle air tank (20 l) – 20. Rear axle air tank (20 l) – 21. Manual condensate drain valve – 22. A.P.U. (Drier with 11 bar regulator – Four-way 7.5/6.5 bar protection valve) Knorr ZB45 (**) LA81 (**) AE46 (**) – 23. Single-cylinder compressor, 225/359 cm^3 compressor revs/engine ratio – 24. Pressure control takeoff – 25. Knorr anti-lock electronic control unit (types 0 486 104 or B 486 104 072) – 26. Trailer services low pressure luminous indicator (optional) – 27. Electric pressure gauge – 28. Low pressure indicator switch pneumatic pressure switch, 6.5 bar – 29. Stop lights – 30. Parking brake luminous indicator – A. To the pneumatic suspension system – B. Services.
(**) The numeric characters that come after the code refer to features not essential under braking directives.

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 2.4.1.) in order to obtain the proper distribution of the weights (see Fig. 2.24).

Figure 2.24



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

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 axles will be fitted with a device controlled from the driver's seat which is able to render them rigid 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.

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.

The use of a compensating suspension, in particular off-road vehicles whether constant total or partial, is to be preferred because of its ability to maintain the load distribution on the two rear axles. Thus ensuring that both axles are able to react to both static and dynamic loads in the manner contemplated by the builders and in compliance with the regulations in force where applicable (e.g. axle misalignment).

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.

Stabilisers

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

Similar devices must be adopted with mixed suspension on supplementary axle installations to ensure stability when tipper bodies are fitted and it is important that the specifications detailed in section 3.4. are adopted.

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.

Braking System

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.

Whenever possible the auxiliary axle should 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 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.

These circuits also determine the dimensions of the tubing to be used and the required capacity of the air cylinders. When the additional axle is equipped with independent suspension, a good solution is to design an independent circuit with adequate load apportioning valve, to be protected by a system pressure valve and controlled by the brake circuits of the front and rear axle through a relay valve. It should be borne in mind that the solution must not alter the balance of response times and pressures in the original circuits.

Arrangements are also permitted whereby the direct connection is achieved between the braking sections of the added axle and that of the live axle. It should be ascertained that the capacity of the air reservoir is adequate to the size of the additional brake cylinders. If necessary an additional air reservoir should be installed.

Current government regulations regarding emergency and parking brakes must be respected. We recommend that the parking brake be constructed to act on the added axle as well.

Warning

For general instructions concerning both the braking system and the anti-lock brake system (ABS) for those vehicles equipped with such systems, refer to point 2.14.

For the electrical system, follow the instructions given at point 2.15.

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 set down on the specific authorization.

Some national regulations permit the use of the raise device at normal speeds provided that the homologated maximum load established for the drive axle is not exceeded.

In such cases the indications given in point 1.2.2 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 will 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.

2.7 Work on the Suspension

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

As a general rule no modification of the parabolic springs is permitted. On vehicles equipped with these springs, installation of elastic rubber components may be authorised for special versions or 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.

In vehicles equipped with load apportioning valve (LAV) for the braking system, modification of the rear suspension requires adjustment of the compensator (see point 2.14.5).

2.7.1 Changing a Mechanical Suspension into a Pneumatic or Mixed Suspension

Modifications of this kind are generally authorised for the rear axle only. Modification proposals presented by bodybuilders to the Company may be examined upon submission.

The responsibility for the dimensions of the air actuated springs and their installation, for the counteracting bars, the effectiveness of the suspension and their effect on the behaviour of the vehicle and the pneumatic supply system rests solely with the firm that has carried out the modification. Suspension and anchoring components are very important to vehicle safety so that the firm carrying out the modification must undertake the necessary design and testing.

On vehicles which are equipped with a load apportioning valve , this must be replaced with a pneumatically controlled LAV actuated by the pressure of the air in the springs. It must be calibrated in order to create the same braking performance in relation to the load on the axle, as that on the original vehicle. The bodybuilder must ensure that the respective values are indicated on the plate made for that purpose.

The auxiliary air tank for the suspension must be connected to the circuit of the vehicle in compliance with the specifications given in point 2.14.4.

2.8 Modification of the Engine Air Intake and Exhaust Systems

Modification which would alter the characteristics of the air intake and exhaust systems may not be carried out without prior authorisation.

Any work done must not alter the existing vacuum values of the intake or the exhaust back pressure.

The routing of the tubing must be as even as possible. Bends must not have an angle of over 90° and the radii should not be lower 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.

Sufficient clearance should be maintained (min. 150 mm) between the exhaust pipe and the electrical system, plastic hoses, the spare wheel 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.

Any work done on the exhaust system of the vehicle requires that the vehicle be homologated again with regard to noise and smoke wherever government regulations require it.

The air intake must be positioned to avoid the intake of hot air from the engine and/or of dusty air or snow and rain. The apertures for the intake of air which may have to be made in the bodies of vans, must have a working surface of not less than two and a half times that of the master hose located upstream of the filter. These apertures (e.g. openings in the grill) must be of such a dimension that they do not become obstructed .

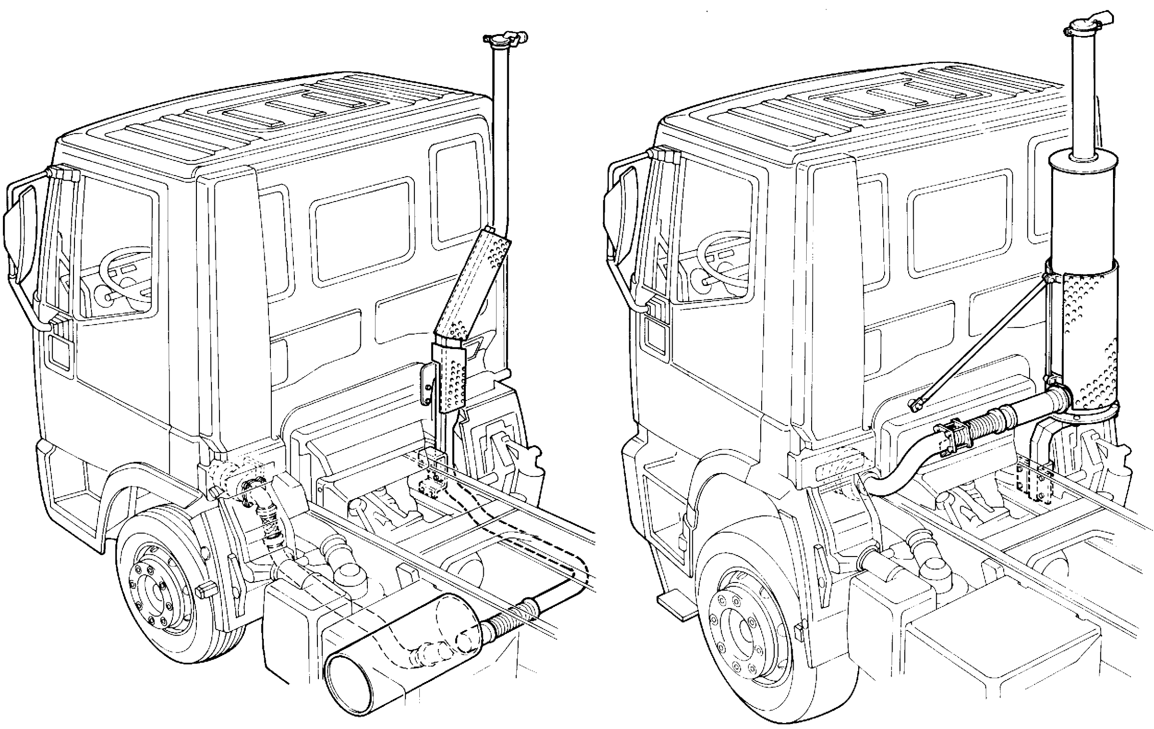
It is not permissible to modify or substitute the original air filter or exhaust system without prior consent from IVECO. Modifications to the equipment (fuel injection pump, regulator, injectors etc.) are not permissible as this may alter the correct functioning of the engine and adversely affect the emissions of gases from the exhaust.

2.8.1 Vertical Exhaust

Apart from the general matters discussed in the above point, ensure that:

- The exhaust is far enough away from the inlet area.
- A suitable supporting structure duly braced and fixed to the vehicle chassis, is made for the vertical section of the pipe.
- A section of flexible hose is fitted to free the silencer elastically from the rest of the added pipe.
- Arrangements are made to prevent the direct entry of water into the end part of the pipe.
- Fig. 2.25 shows two examples of possible systems: one with a silencer in the area of the chassis frame and the other with a silencer in a vertical position behind the cab.

Figure 2.25



On vehicles fitted with a vertical silencer (typically used on four axle vehicles) the silencer support bracket should be bolted to the chassis using the nuts provided on the bracket. On models with 12.00R24 tyres the spacing between the fixings on the bracket is greater and both fixings must be used. Where the sidemember is less than 190mm in depth the upper connection must be made using a bracket bolted to the subframe.

2.9 Modifications of the Engine Cooling System

As a general rule, the proper functioning of the cooling system designed by IVECO, 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 which entail work on the cooling system (e.g. modification to the driver's 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 as this affects the original design.
- 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 of 8 to 10litres/min. 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 siphonings and providing appropriate bleeding points) that could hinder the circulation of water. Check therefore, that the priming of the water must not pump, when the engine is first started and subsequently running at the lowest speed, is instantaneous even when the circuit is not pressurised. Accelerate briefly if necessary. In addition to this check that the delivery pressure of the water pump, when the engine is running under no load and at maximum RPM, is not lower than 1 bar.

2.10 Installation of a Supplementary Heating System

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

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

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

Furthermore:

- Ensure correct operation of the vehicle components and equipment (i.e. cooling system).
- Check the electrical system to ensure that the battery capacity and alternator output is sufficient for the higher current requirements (see point 2.15). 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 2.9), it is advisable to follow the instructions listed below to ensure reliability of the heating system and safe operation of the original system:
  - specify in detail the connecting points of the newly added system to the original one. Agreements with the company may be obtained if necessary;
  - determin 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 contamination) 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.

2.11 Installing an Air-Conditioning System

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

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

- The installation must not interfere with the correct operation of the vehicle components and of equipment which may be connected with the installation.
- Check the electrical system to ensure that the battery capacity and alternator output is sufficient for the higher current requirements (see point 2.15). Provide the new circuitry with a protection fuse.
- With the agreement of IVECO, establish a method for installing the compressor, if fitted on the engine (see point 4.5).
- 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 features (reduction in the radiating area of the engine radiator).
- The best arrangement is for the condenser not to be combined with the engine radiator but in a separate compartment, suitably ventilated.
- The arrangement of the evaporator-blower unit in the cab (if not anticipated by IVECO) should be designed to make sure that the accessibility control and operating equipment is not impaired.

b) Equipment fitted on the cab roof

- When the equipment (condenser, evaporator, blower) is fitted on the cab roof, make sure that its mass is not higher than that permitted for roof installation. Furthermore, the bodybuilder should provide for proper reinforcement to the roof frame if necessary, in relation to the mass of the unit and the extent of the modification introduced (see point 2.12.).

2.12 Cab Modifications

2.12.1 General Specifications

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

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

The variations in the weight of the cab as well as its different depth must be considered when positioning the payload, in order to ensure correct distribution of the permitted weights on the axles (see point 1.2).

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 rationally, 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 2.1.3.).

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

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

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

2.12.2 Roof Panel Modifications

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

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

The cabs are provided with anchorage points along the roof sides (8 points for normal cabs, 10 points for crew cabs) having threaded holes M8X1 protected by appropriate plastic plugs.

Should it be necessary to make an opening to form a roof compartment, ensure that:

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

2.12.3 Installation of a Spoiler or a Top-sleeper

Upon request, the various versions designed by IVECO can be delivered with relevant instructions for installation. It is recommended that these versions are used as they are specifically checked.

The installation of other versions will be carried out in the same way as prescribed for the original ones by using the anchorage points placed on the roof sides resting on devices of adequate dimensions. Moreover, the instructions of the manufactures of the add-on assemblies are also to be met.

Their positioning must not impair the correct operation of the engine air intake system when this is placed behind the cab.

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

2.12.4 Crew Cabs

When making crew cabs, cabs for special vehicles, for municipal use, fire fighting etc. check whether the cab's suspension requires uprating due to the increase in weight, also taking into account any extra seating arrangements made. Before work of this type can be started on tilting cabs, IVECO's approval is required to confirm whether the original suspension, tilting and locking devices are suitable.

As a rule, solutions equivalent to those designed by IVECO for similar versions may be adopted.

In order to help preserve the integrity and rigidity of the cab, we recommend that, as far as possible, the rear structures are kept intact. The cut may be made at the side, taking care that the door opening remains intact.

The bodybuilder must make the necessary connections to the load- bearing structure, comprising the longitudinal runners and uprights and connect the new floor to the existing structure. Provide inspection panels if necessary.

Take particular care when preparing the surface of the elements to be welded by applying a zinc primer, taking the necessary precautions to ensure that the primed surface is properly prepared for subsequent painting (see point 2.1.3).

Whenever the cab has to remain of the tilting type, the following points will be taken into consideration depending on the increase in cab weight:

- Modify the hydraulic tilting devices.
- Restore the cab locking devices.
- Decrease the tilting angle.
- Adapt the suspension.

For the cab tilting system, a cylinder of greater capacity with relevant resting devices can be installed or a supplementary one fitted taking care to maintain the required clearance from the adjacent components.

The area affected by the thrust of the hydraulic devices must be such to avoid an excessive concentration of stress. For this purpose ensure that:

- The lifting points are positioned as far back as possible.
- There are suitable anchorage points both on the cab floor and vehicle chassis.

If the tilting cab exceeds the upper point of equilibrium, ensure that the added hydraulic device enables the cab to be held in the end-of travel, if it does not, fit a safety cable.

Adopt the necessary measures to ensure that the cab locks properly on lowering.

The original cab safety lock and warning light arrangement must remain unaltered.

The cab suspension system must be adjusted to suit the added weight and new dimensions. This must be done rationally without affecting the normal movements of the cab.

When working out a suitable cab suspension system, the following points must be observed:

- The cab's attitude, designed for the standard vehicle, must not be altered.
- The added part with its weight must not affect the original portion of the cab with its suspension.
- Ensure normal oscillation of the cab along the vertical, longitudinal and transverse plane.

If the cab has to be converted to a fixed cab, use similar suspension systems as those used on tilting cabs. Take care to provide a removable cowling, hatches and panels to enable inspection and maintenance work on the parts underneath.

To ease workshop operations we recommend that a rear anchorage point be provided for lifting, or that it should be possible to fit a safety bar.

A cab modification may affect components such as the air inlet and filter. Using standard parts fitted to other models such as sleeper cab variants may offer a good solution and enable legal requirements to be met.

Precautions

Modifications of this type influence the operation and safety of the vehicle (suspension, tilting operations) which means that they must be carried out carefully and undertaking all the necessary steps to ensure safety.

2.13 Changing the Size of the Tyres

IVECO's approval must be sought prior to replacing the tyres with others of a different size of load capacity from those which were approved at the time the vehicle was homologated.

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

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

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

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.

In the case of heavy vehicles, care must be taken to remain within the limits set for overall width by the various government regulations.

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

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

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

2.14 Modifications to the Braking System

2.14.1 General Specifications

The braking system and its components are very important to traffic safety and vehicle dependability.

Modification to equipment such as governor, brake and control valves, brake cylinders, load apportioning valve etc. are not permitted as these parts are held to be safety elements.

Any modification to the braking system (modifying pipes, adjusting or replacing the load apportioning valve, fitting additional operating cylinders etc.) requires our authorisation. This does not apply to the installation of an air drier carried out by 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.

EuroCargo TECTOR vehicles

Repositioning the Brake Fluid Reservoir is permitted provided it is not moved more than 200mm from its original position and also its vertical position on the sidemember remains the same.

2.14.2 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.

Pipes must never be welded.

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

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

Metal Pipes

For the hydraulic system pipes and those between the air compressor and adjustment units, any additions and replacements must be as follows:

- Brake pipes (material, size, connectors) : according to ISO 4038 Standard
- Compressor pipes (material, size, connectors) : according to DIN 3901
- Curvature radii (referred to pipe centreline) : minimum 2 x outer dia.
- Tightening torque
  brake pipe dia. 6x4 (connectors M 12x1) : 20 Nm
  Compressor pipes dia. 19x15 (connectors M26x1.5) : 90 Nm

Plastic Pipes

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

- in areas where the temperature inside/outside the pipe could exceed 80°C (e.g. closer than 100 mm to 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:

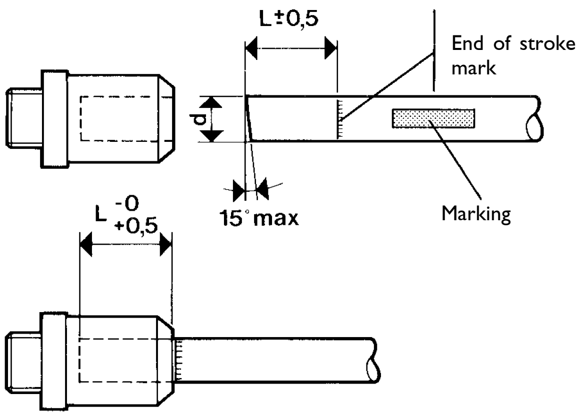
- Material and dimensions : Standard DIN 74324 (Iveco Standard 18-0400, 18-2715) (max. operating pressure 11 bars)
- Radii of curvature : min. 6 x outer dia. (referred to the pipe centreline)

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 Fig. 2.26) 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.

Figure 2.26



d mm	L mm
6	19,8
8	20,5
10	24
12	25
16	27,1

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.

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.

Precautions

Should piping be replaced, use new connectors. After opening, connectors must not be reused.

Installation

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 elements 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.

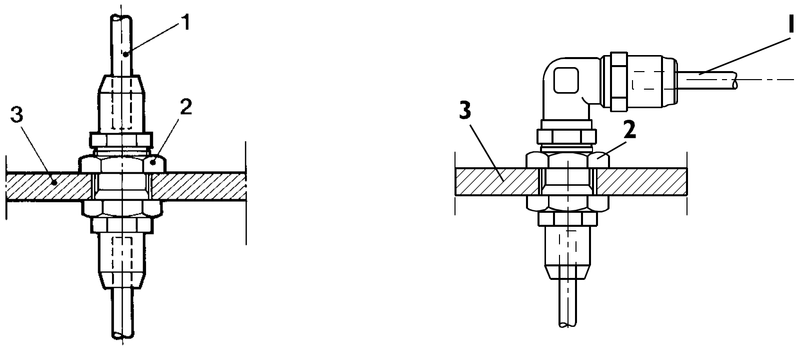
For plastic pipes, in order to prevent distortion and tension on the connectors when fitting them, take the necessary precautions when working out on the run and fitting the fixing elements onto the chassis. Flawless fitting of the fixing element will ensure that the pipes do not rub against the fixed 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 such as a bulkhead connection for a straight or angled run is given in the diagram below.

Figure 2.27



1 Pipe
2 Bulkhead connector
3 Chassis

Important

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.

2.14.3 Vehicles with ABS Devices

When modifying the wheelbase on vehicles with systems fitted with ABS anti-locking devices (automatic adjustment of the braking force), the original position of the adjustment modulators in relation to the rear wheel axle must be maintained. The electrical wires between the sensors on the rear axle and the control unit and between the unit and modulators must be modified accordingly by using new wires or extensions with appropriate connectors should there be insufficient length in the originals. Brake pipes upstream of the modulators must be similarly modified. In systems where the adjustment devices act only on the live axle, keep the original position of the control assembly (sensor, unit, modulator), in relation to the rear wheel axle, unchanged.

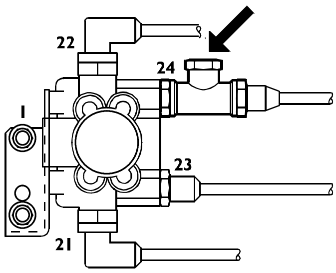
When fitting an additional axle on vehicles with a Category 1 ABS system (adjustment on all wheels), the braking force on the added axle must be suitably adjusted. Given the various types of axles available on the market, featuring different solutions for the suspension, braking systems etc., it is not possible to provide the necessary general information. The solution to be adopted therefore, must be assessed for each individual case by consulting IVECO and the supplier of the ABS system.

2.14.4 Taking Air from the System

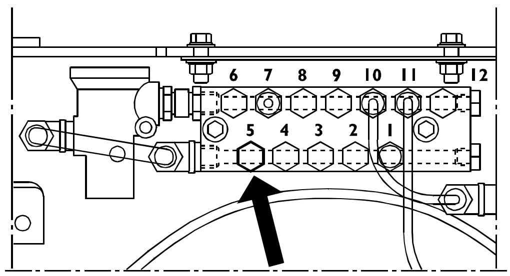
Small quantities of air may be removed from the service tank to actuate auxiliary devices (such as a power take-off) in vehicles that are equipped with a pneumatic or pneumatic-hydraulic brake systems, provided that a control pressure value of 8.5 bar and limited return, which does not permit the drawing of air below that pressure, is inserted in the new take-off.
Take the air directly from of the 4-way safety valve on the service line (outlet 24) located by the air reservoirs.
For the EuroCargo range a T-union can be used (e.g. IVECO part no. 98420917) (see Fig. 2.28).
For the EuroTech/Star and Trakker ranges, the air can be taken directly from the distributor plate using connection no.5 (see Fig. 2.28), unless it is used otherwise.

Figure 2.28

EuroCargo



EuroTech/Star/Trakker



If larger quantities of air are required, a supplementary air tank must be fitted. However, in this case it will be necessary to verify that the standard air compressor is capable of filling the brake system tank in the specifically prescribed times.
A compressor of greater capacity may have to be installed if necessary.

2.14.5 Instructions for Adjusting the Load Apportioning Valve

If the setting of the braking load apportioning valve is erroneously altered by the bodybuilder when fitting the superstructure, it will have to be set correctly by an IVECO workshop according to the information given in the specific documentation (e.g. valve rating plate, workshop handbook).

a) Vehicles with standard equipment

The adjustment of the load apportioning valve is made directly at the assembly plant and pre-supposes the mounting of standard bodies (for instance regular box-type).
Adjustment and calibration data are given on the specific label. Adjustment of the load apportioning valve may be permitted provided in certain circumstances (eg wheelbase modifications) that deceleration values of national regulations are met. The firm carrying out such modifications is also responsible for changing data on the specific plate and for submitting the vehicle for testing by the competent authorities.

b) Vehicles with special bodies built by outside body builders

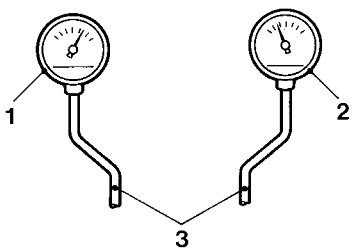
The use of special bodies (cranes, cement-mixers etc.) and modifications to the chassis (changing the wheelbase, moving assemblies) causes a different distribution of load on the axles - and, consequently, a new value for the unladen weight on the rear axle different from that original contemplated.
This being the case, it is desirable to have an authorised workshop check the functioning of the LAV. The calibration values are given on the tag. The new unladen weight value, which can be obtained by weighing, must be recorded on the tag if regulations require it.
In case of vehicles with interchangeable bodies, the unladen vehicle conditions is considered to be that with the chassis alone, the body is grouped with the payload (unless prescribed otherwise locally).

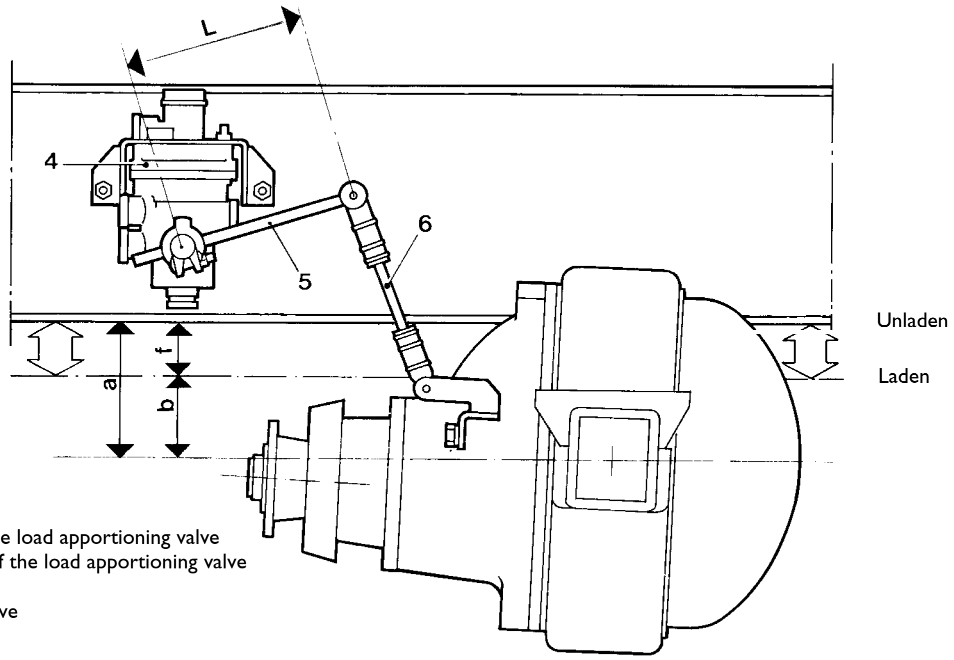
c) Modification of the rear suspension

If the rate of the rear springs are altered, e.g. by changing the number of leaves, the data for adjusting the LAV must be corrected accordingly. If the modification on the suspension result in a considerable variation of the maximum permissible axle loads, or of the GVM, it may be necessary to revise the braking forces so that the national legal requirements on the braking system can be complied with.

The relevant instructions will be contained in the authorisations released by IVECO. Where the change to the rate of the rear spring does not change the maximum allowable loads and the GVM, the LAV adjustment must be carried out by an authorized workshop.
In order to avoid jeopardizing the braking ability of the vehicle, the ratio between axle load/braking pressure (in various load conditions) specified on the LAV plate must be met.

Figure 2.29





1 Gauge upstream of the load apportioning valve
2 Gauge downstream of the load apportioning valve
3 Test connectors
4 Load apportioning valve
5 Lever
6 Connecting rod

The deflection of the modified spring under the two load conditions (see Figure 2.29) can be measured directly on the vehicle. The length of the load apportioning valve lever (or arm) that is to be attained may be calculated approximately on the basis of the following formula:

$$Ln = Ls \frac{fn}{fs}$$

Ln = New length of the lever
Ls = Length of the standard lever
fn = New deflection of the spring
fs = Camber of the standard spring

The adjustment should be made on the vehicle as follows (see Fig. 2.29):

1) With the vehicle unloaded, the rod is to be adjusted in such a manner that the braking pressure indicated by the gauge (2) corresponds to that which was calculated for the empty vehicle.
2) Setting the lever upward by a distance equal to the deflection of the leaf spring from empty to loaded, make certain that the pressure on the gauge corresponds to that of the load apportioning valve for the loaded version.
   Minor differences may be corrected by changing the length of the lever.

After adjustment a new tag containing the new calibration values must be attached.

2.14.6 Installing a Load Apportioning Valve on Vehicles not so Equipped

Most of our vehicles are equipped with a load apportioning valve on the rear axle.
For those vehicles not factory-equipped we recommend using units that are in use on similar vehicles.
Since this component is important to vehicle safety, it is advisable to turn to authorised workshops. The adjustment will be carried out as explained above.

The brake performance under all conditions must meet current legislation.

2.15 Electrical System: Modifications and Drawing-Off Power

2.15.1 General Information

The vehicles operate on a 24v electric system for normal requirements and the chassis is an earth return. This acts as a current return wire between relevant components, such as battery and alternator. All component negative terminals are connected through the chassis in the absence of an insulated return wire.
Installation of auxiliary equipment or circuits added by the to bodybuilder must take into account the instructions given below. Depending on the complexity of the modification, suitable documentation (e.g. electrical diagram) must be provided for inclusion with that relating to the vehicle.
Using colours/codes for wires and connectors equal to those used on the original vehicle makes the installation more consistent and facilitates repair work.

Remarks

More detailed information regarding the electrical system of the vehicle can be found in the relevant workshop manuals:

Models	Diagrams	Components
EuroCargo	603.42.823	603.42.303
EuroCargo Tector (NEF)	603.43.693	-
EuroTech (Cursor)	603.43.263	603.43.263
EuroTech	603.42.603	603.42.623
EuroStar/Trakker	603.42.683	603.42.623

These manuals can be obtained from the IVECO After Sales Network or from the relative departments of the IVECO Sales Management.

⚠ **Precautions**

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

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

It is strictly forbidden to make modifications or connections to the electronic control unit wiring harnesses; in particular, the signal line between control units (CAN line) must not be tampered with for any reason. Any diagnosis and maintenance operations can be made only by authorized personnel using equipment approved by IVECO.

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

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

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

During work on the chassis frame, to safeguard the electrical system, disconnect the relevant components and the earth connections, follow the guides given in points 2.1.2 and 2.2.4.

To safeguard the electrical components on the vehicle the following precautions should be taken:

Never disconnect the connectors from the control units when the engine is running or when the control units are powered.

Never power components interlocked by electronic modules with the rated voltage of the vehicle through wander cables.

Control units equipped with metal sheathes have to be earthed through a screw or bolt unless otherwise specified.

When fitting additional equipment, where necessary, diodes must be fitted to provide protection against any induction current peaks.

The earth signal originating from analogue sensors must only be wired to a specific receiver. Additional earth connections could result in false output signals being emitted from these sensors.

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

Additional equipment should be connected to the system earth with the utmost care (see point 2.1.2.). The relative wiring must not be fitted alongside the existing electronic circuits in order to avoid electromagnetic interference.

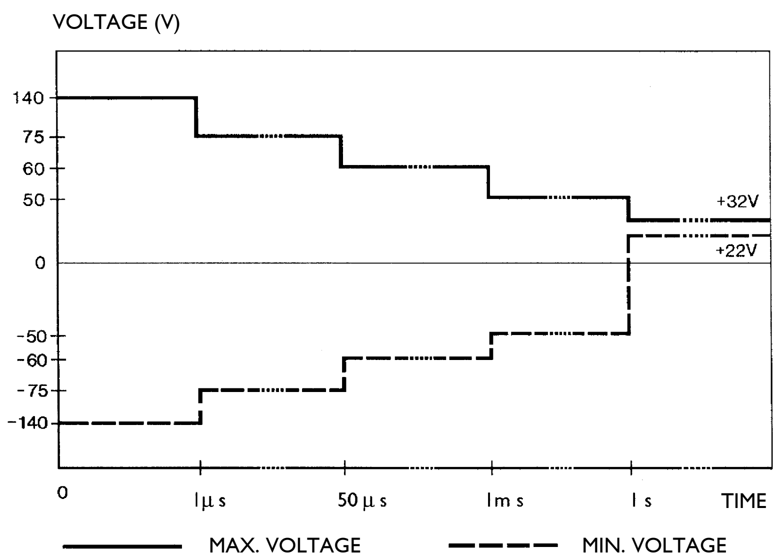
The wiring of the electronic systems (length, conductor type, arrangement, clamping, connecting shield braids etc.) must follow the original IVECO standards. Carefully reset the original system after carrying out any work.

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

- Electromagnetic immunity level required for the electronic systems:
  Secondary systems 50 V/m for frequencies variable between 20 MHz and 1 GHz
  Main systems 100 V/m for frequencies variable between 20 MHz and 1 GHz

- Required electromagnetic emission levels for electrical/electro-mechanical/electronic systems:

a) Maximum range of transient voltage for 24V systems.



b) Max. levels of radiated and conducted emissions.

Type of disturbance	Type of band	Type of detector	Acceptable disturbance limits in dBμV (normal unit of measurement at CISPR for measurement of emissions)				
			150 KHz 300 KHz	530 KHz 2 MHz	5.9 MHz 6.2 MHz	30 MHz 54 MHz	70-108 MHz, 144-172 MHz 420-512 MHz, 820-960 MHz
Radiated	Broadband	Quasi-peak	63	54	35	35	24
Radiated	Broadband	Peak	76	67	48	48	37
Radiated	Narrowband	Peak	41	34	34	34	24
Conducted	Broadband	Quasi-peak	80	66	52	52	36
Conducted	Broadband	Peak	90	76	62	62	46
Conducted	Narrowband	Peak	70	50	45	40	30

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

These levels are granted only if the system comes from "IVECO Spare Parts" or it has been certified as per ISO, CISPR, VDE international regulations. In case of systems which use the primary or secondary civil electric network (220V AC) as a supply source, the relevant characteristics have to comply with the IEC regulations.

Transceiver System (C.B., 2 metres and cellular telephone).

The installation of C.B. apparatus (27 MHz), 2 m (144 MHz) and cellular telephones must use the power supply system already fitted to the vehicle, connecting directly to terminal 30 with an additional fuse. This apparatus must be homologated to conform to legal requirements and be of the fixed type (not portable). Install the transmitting part in a separate area from the electronic components of the vehicle. The antenna must be installed externally where possible on a wide metallic base, observing the assembly instructions and manufactures warnings from. The connections and positioning of the cables pertaining to the installations must be made ensuring that:

- a good quality antenna is used particularly with regard to the visible covering of the protective shield.
- Fit the cable so that an adequate distance (min. 50 mm) is left between it and the existing wiring and ensure the minimum distance from the metallic structure of the cab, avoiding bends or restrictions in the cable itself. It should be fitted to the right or left side of the vehicle where possible.
- Ensure that both the base of the antenna and the containers holding the apparatus are correctly earthed to the structure of the vehicle to ensure the highest levels of power transfer.

The power supply for the apparatus, where this requires a voltage which differs from that of the existing equipment, must be obtained using an adequate 24-12V DC/DC transformer, if not already fitted. The power supply cables must be as short as possible avoiding the presence of coils (no twisting) and maintaining the minimum distance from the reference plane.

The use of non-homologated transceivers or the application of supplementary amplifiers could seriously compromise the correct operation of the electronic/electrical devices normally fitted to the vehicle and negatively affect the safety of the vehicle and/or its driver .

Warnings

When fitting devices such as:

- Retarder
- Auxiliary heaters
- Power take -offs
- Air conditioning systems
- Automatic gearboxes
- Fleet management
- Speed limiting devices
- Anti theft devices
- Cellular phones etc

which could interact with the other electrical systems already fitted to the vehicle (e.g. ABS, EDC etc.), contact IVECO in order to optimise the installation.

Remarks

For the operations which might cause interference with the basic system, it is necessary to carry out diagnostic checks in order to make sure that the system has been properly fitted .

These checks can be carried out using the self-diagnosis system of the on-board control units (blink-code) or at the IVECO Service Network.

The company reserves the right to decline its own warranty cover on the vehicle should any work be carried out which does not comply with the regulations of the Company.

2.15.2 Additional equipment

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

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

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

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

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

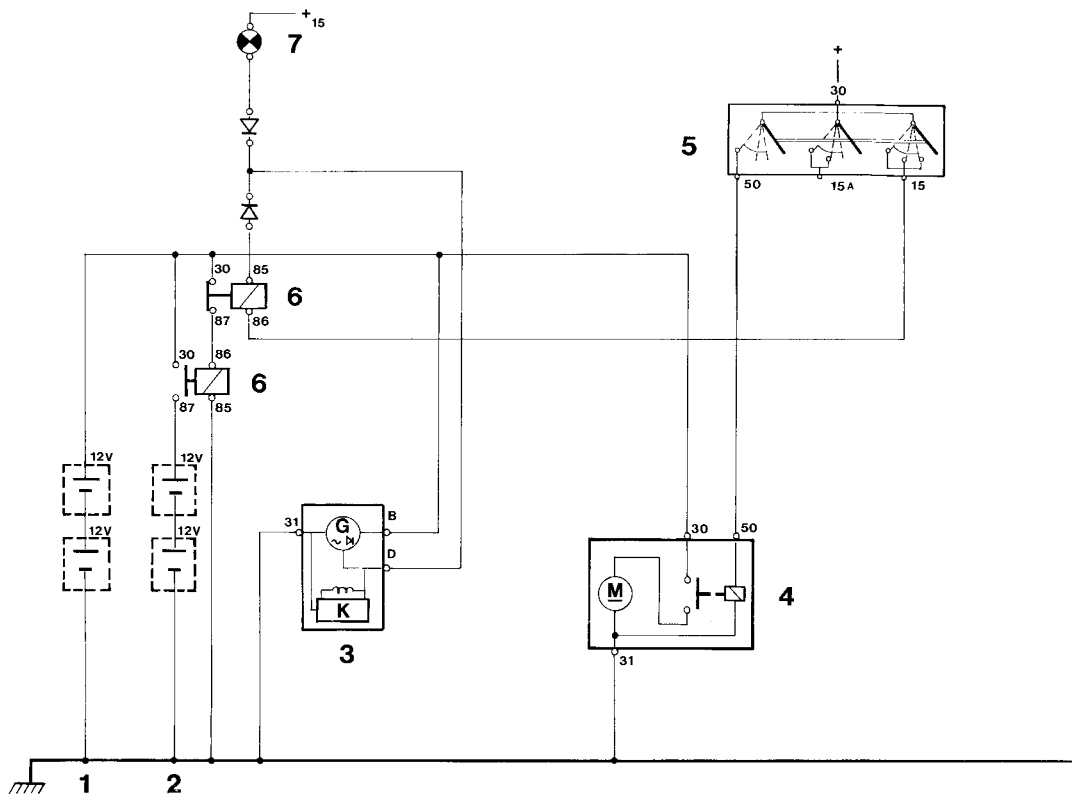
Additional Batteries and Alternators

Installing high power-consumption electric equipment (e.g. electric motors used frequently or for a long time without using the vehicle's engine, as, for example, with the tail lifts in urban applications) or a great deal of additional electrical equipment, may require power which the vehicle's standard system is unable to deliver. In such cases additional batteries of the appropriate capacity must be used.

Their insertion into the vehicle's circuits must include a separate recharging system (see Fig. 2.30) integrated with that of the vehicle. In this case it is advisable to provide supplementary batteries with the same capacity as the batteries originally installed in order to ensure correct recharging of all batteries.

Figure 2.30

Installing additional batteries



1 Standard batteries
2 Supplementary batteries
3 Alternator with built-in regulator
4 Starter motor
5 Starter key
6 Relays
7 Battery charging condition tell-tale

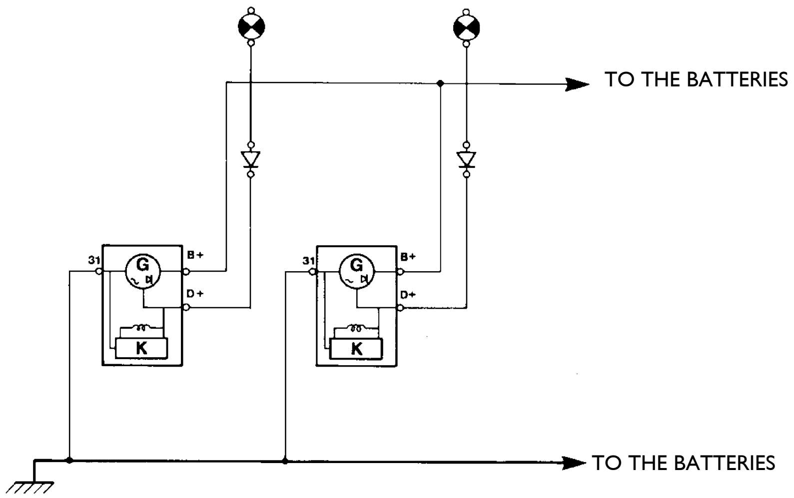
Installing additional batteries involves checking that the alternator is of a sufficient capacity to recharge. If necessary, an alternator with larger power or an additional one must be used. In this case connect up as shown in Fig. 2.31.

When using electric motors which are activated only while the vehicle engine is running, instead of supplementary batteries, it could be sufficient to use a larger power alternator or a supplementary one.

Such alternators have to be equipped with Zener diode rectifiers in order to avoid damaging the electrical/electronic systems already fitted which might arise from accidental disconnection of the batteries.

Figure 2.31

Installing an additional alternator



Auxiliary Electric Systems

Special care has to be taken when fitting refrigeration units that are driven by a second engine driven alternator.

These generators, according to their RPM, generate a voltage between 270 to 540v in the wires that are routed to the cooling unit on the vehicle.

The danger caused by possible electromagnetic interferences between close wires from the above mentioned alternator and those already on the vehicle, can easily occur.

Such cases require highly insulated wires routed separately, yet not close to the standard wires of the vehicle.

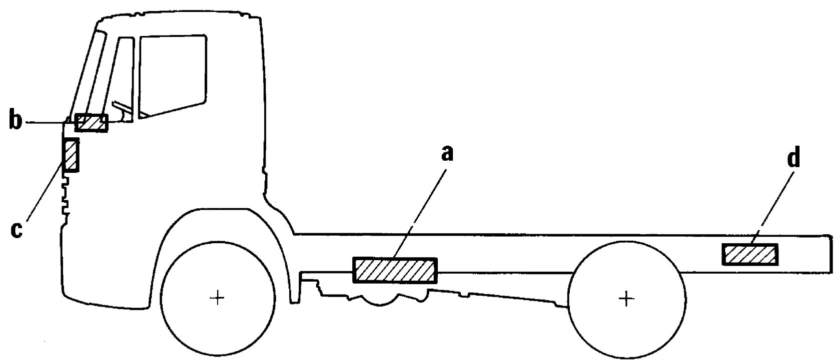
The electromagnetic output levels previously mentioned have to be complied with for these units.

2.15.3 Power Draw-off (and electrical signals)

2.15.3.1 EuroCargo Range
EuroTech, Star, Trakker Range (Production until June 98)

The information about the points from which power draw-off is possible, the available current and the precautions to be observed are as follows:

Figure 2.32



a. From the batteries - b. From the control unit - c. From the front bulkhead connectors - d. From the rear junction box

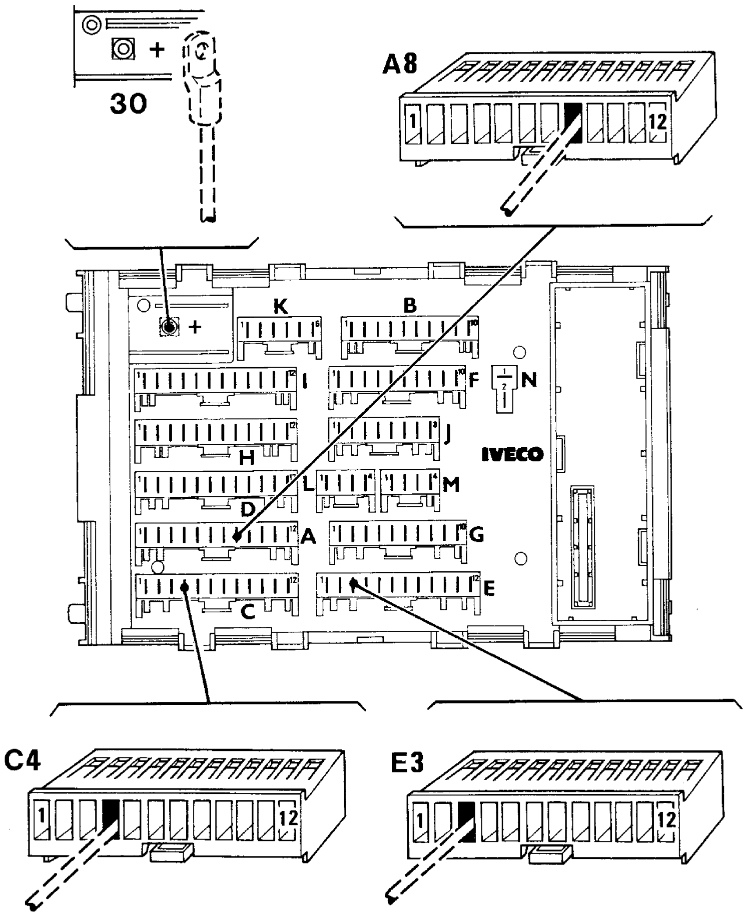
a) From the batteries

After inserting a suitable fuse, the following power draw-off can be made:

With engine off:	10A	duration 60 mins
	20A	duration 30 mins

While the engine is running another 5 to 20A may be further drawn-off depending on the engine's speed. For greater power draw-off, ask for the optional high output alternators and optional uprated batteries.

Figure 2.33



b) From the control unit

A total of 10A can be taken from each of the following terminals:

- A8 key-operated
- C4 directly from the battery
- E3 key-operated (disengaged during the starting phase) .

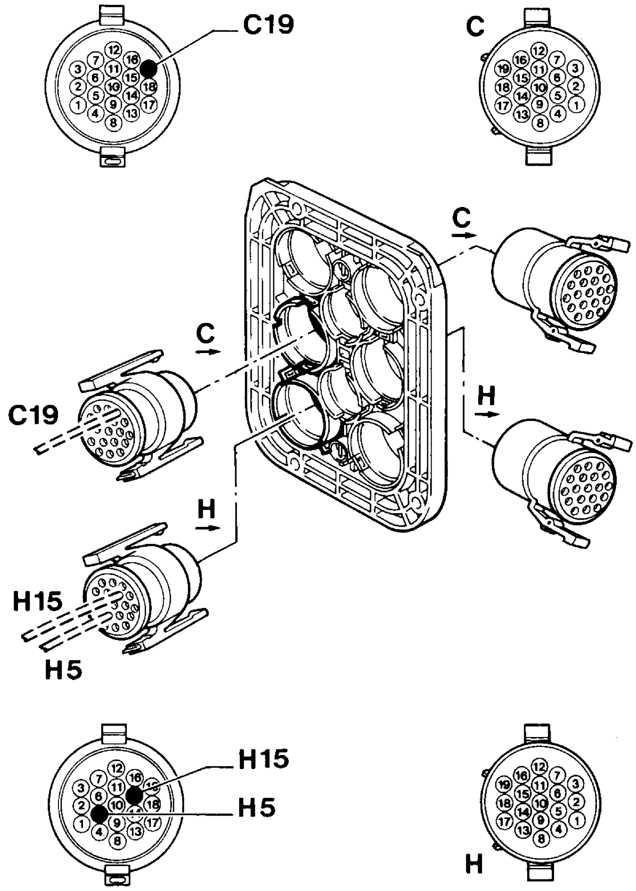
Inserting a fuse as close as possible to the control unit.

Greater quantities can be taken using a remote relay directly connected to the batteries.

Check the outputs available at the bulkhead junction block. Care must be taken when removing and refitting the junction block (s) so as not to damage the cable terminals.

Care mast be taken to prevent ingress of water at all times.

Figure 2.34



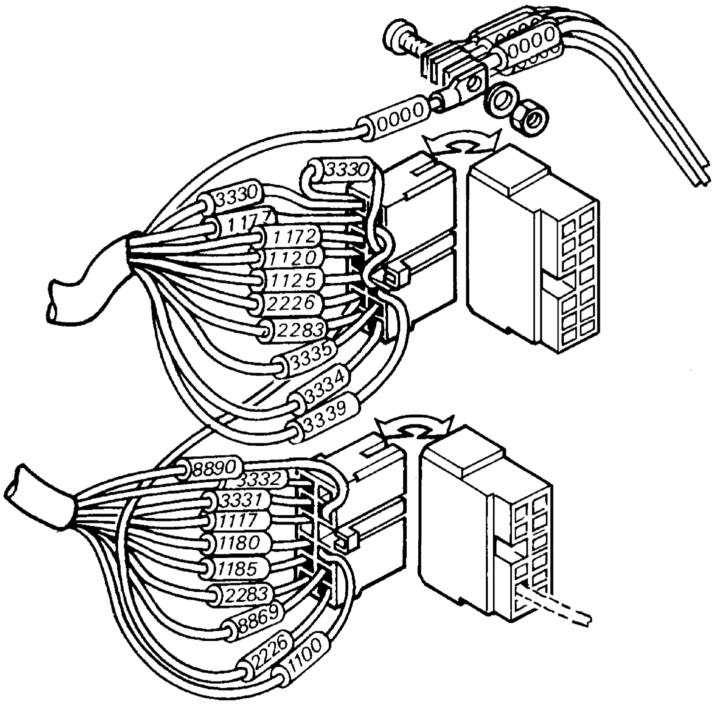
c) From the front bulkhead junction box

After removing the plugs and inserting the terminals with relevant grommets - obtainable from the IVECO Dealer Parts Depts, the following current draw is possible:

- C19	For additional headlights	: max 7.5A (the fuse is not necessary)
- H5	Supplementary lighting	: max 6A (the fuse is not necessary)
- H15	Draw off with starter switch "on"	: max 10A (the fuse must be inserted)

If not already used for the standard equipment.

Figure 2.35



d) From the Rear Junction box

For vehicles of the EuroCargo Range (suitable for towing) it is possible to take 2A on cable No. 8869 (the fuse is not necessary). On models not suitable for towing it is possible to take 2A on front bulkhead B17 pin (the fuse is not necessary).

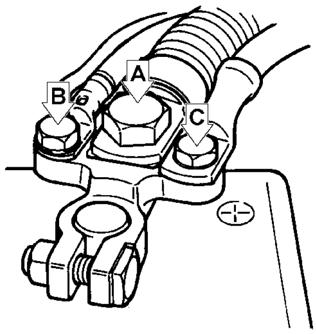
For vehicles of the EuroTech/EuroStar/EuroTrakker Range, it is possible to take 2A by using Control unit J8 connection; pass with added cable from a free pin to front bulkhead (the fuse is not necessary).

2.15.3.2 EuroCargo Tector range

Power can be taken at the points listed below, specifically provided for bodybuilders:

a) From batteries

Figura 2.36



A : Starting motor

B : Terminal reserved for iveco users

C : Terminal reserved for bodybilders.

Taking power through the specific terminal 'c' specially provided for bodybuilders.

With engine stopped:	Up to 10% of the battery rating.
With engine running:	A further 20% of the battery rating can be drawn, according to the alternator power and the engine revs

When greater power is needed, uprated batteries and alternator should be fitted for frequent use with high loads (E.G. tail lifts) higher capacity batteries (minimum 110A) with an alternator of not less than 90A should be fitted.

Precautions

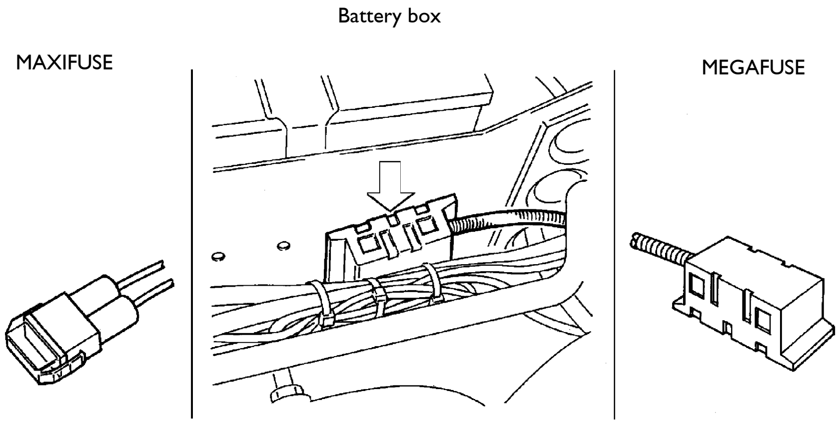
For the separation and protection of the additional circuit from the original one, use proper fuses located next to the supply point.
Protect the additional cables by means of special sheaths or corrugated covers, and install them in compliance with the instruction of 2.15.4.

Maxifuse and Megafuse fuses

A set of five fuse holder kits is available from any IVECO Parts Dept., to protect high power supplies.

These fuses should be positioned as close as possible to the supply terminal on the battery according to the space available on the vehicle.

Figure 2.37



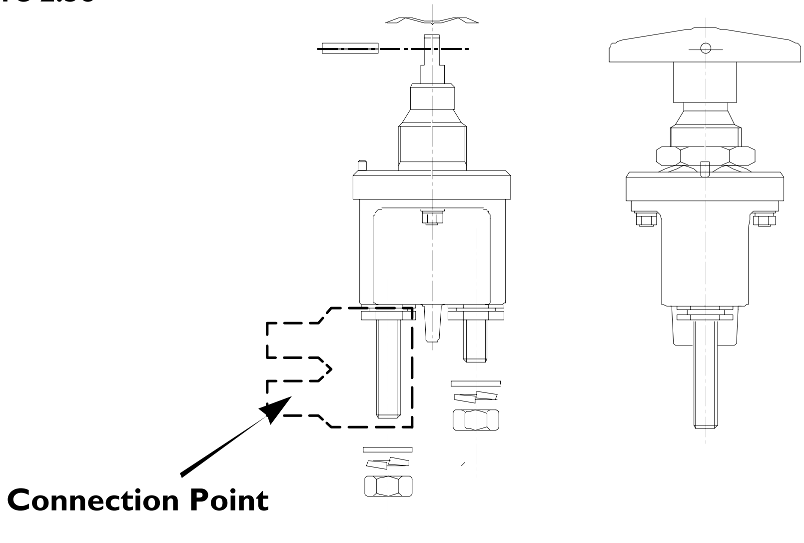
Capacity	IVECO Ref. No.	Cable section
Kit 40A	4104 0110 KZ	10mm^2
Kit 60A	4104 0111 KZ	10mm^2

Capacity	IVECO Ref. No.	Cable section
Kit 100A	4104 0112 KZ	25mm^2
Kit 125A	4104 0113 KZ	35mm^2
Kit 150A	4104 0114 KZ	50mm^2

b) taking power from the battery cut-off switch (same as shown at "A" from batteries) is permitted

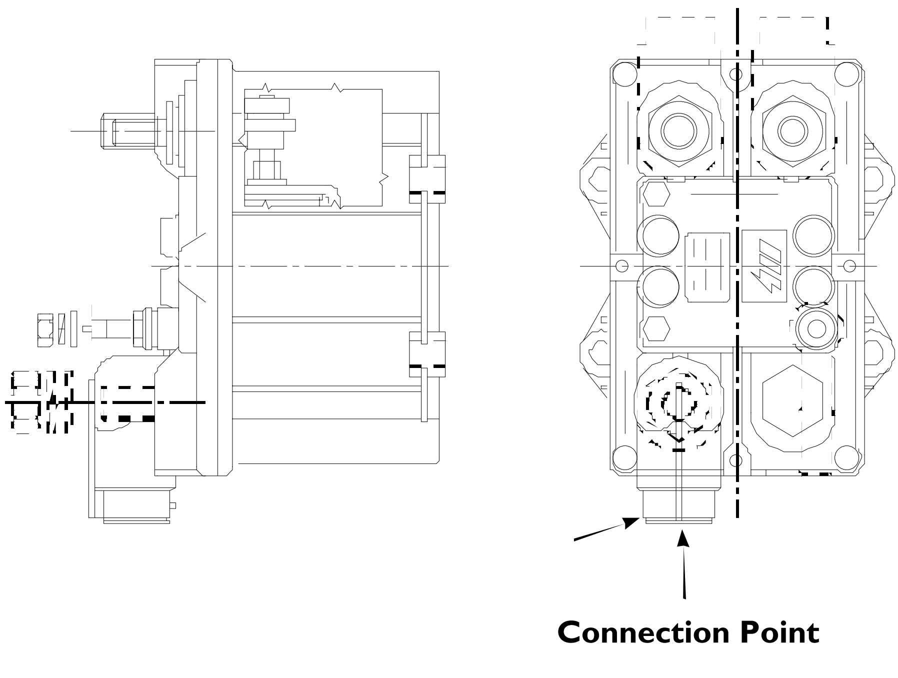
On vehicles with option 541 (mechanical battery cut-off switch) power can be taken from under the terminal cover as shown in figure 2.38

Figure 2.38



On vehicles with Option 2532 (elettrical battery cut-off switch) power can be taken from under the terminal cover as shown in figure 2.39

Figure 2.39

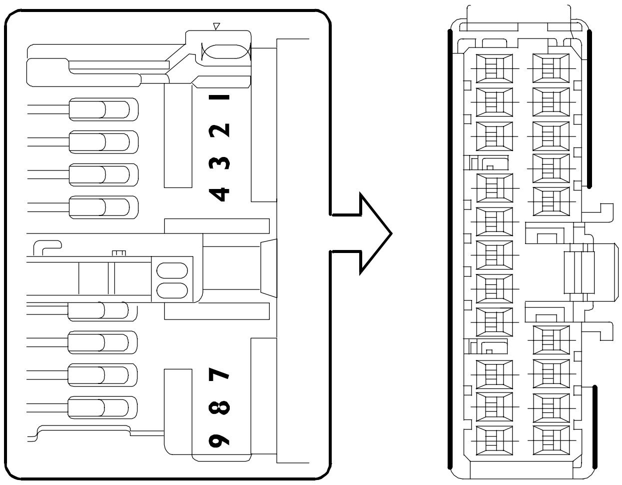


PTO MODE ∅ software 3.3.1

c) From inside the cab (vehicles built <u>before</u> chassis numbers 384102, four cylinder engines, and 385416 six cylinder engines).

It is possible to take power from pins 3, 5 and 6 in the blue 20-pin connector located in the electronic control unit compartment (next to the ABS control unit) behind the panel in front of the passenger feet.

Figure 2.40



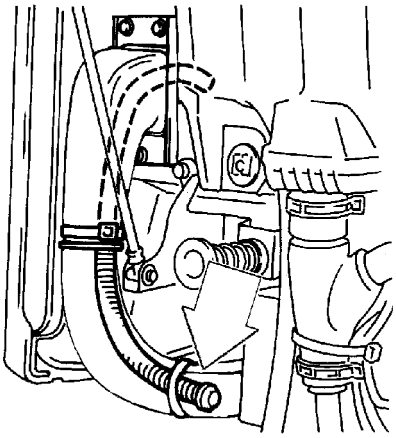
Pin	Cable no.	∅ mm	Maximum load	Description
1	5509	0.5	1 mA	Signal with vehicle stationary, signal D8 (8V) of standard tachograph
2	7778	0.5	100 mA	Engine running, alternator L 24V when engine is running
3	**4442**	**1**	**5A**	**Light ON:** **Ignition key in OFF position: 24V only when the parking light is in ON position** **Ignition key in ON position: 24V when the parking and low-beam headlights are in ON position** [1]
4	6662	0.5	200 mA	Handbrake signal, earthed when the spring brake is applied [1] [2]
5	**8879**	**1**	**5A**	**Key 15**
6	**7772**	**1**	**10A**	**Key 30**
7	***	*	***	Not connected
8	***	*	***	Not connected
9	0000	0.5	5A	Earth
10	7156	0.5	10 mA	Power supply for Cruise Control switches
11	8154	0.5	~ 10mA	CC OFF: operated by opening connection to PIN 10 [3]
12	8155	0.5	~ 10mA	CC RESUME: to operate, connect to PIN 10
13	8156	0.5	~ 10mA	CC SET +: to operate connect to PIN 10
14	8157	0.5	~ 10mA	CC SET -: to operate connect to PIN 10
15	***	*	***	Not connected
16	***	*	***	Not connected
17	***	*	***	Not connected
18	***	*	***	Not connected
19	***	*	***	Not connected
20	0000	1	10A	Earth

1) Steady signal even when the MOUDLE TEST key is pressed
2) The signal is earthed when the pressure on springs is lower than 5.5 bar
3) Must be included between Pins 10 and 11.

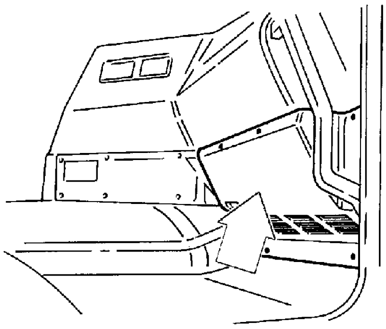
To enable bodybuilders to take cables in and out of the cab, without drilling holes, there is a dedicated corrugated tube located under the front hood on the passenger side of the cab (see figure 2.41).
The bottom end of the tube is protected by a plug to prevent smoke and dust getting into the cab and must be sealed again after inserting cables through it.

Figura 2.41

Corrugated pipe



Passenger's side cab interior.
The arrow shows the panel behind which the other end of the corrugated pipe is found.



d) From the connectors placed on the chassis (approximately on the chassis centre line)

Figure 2.42

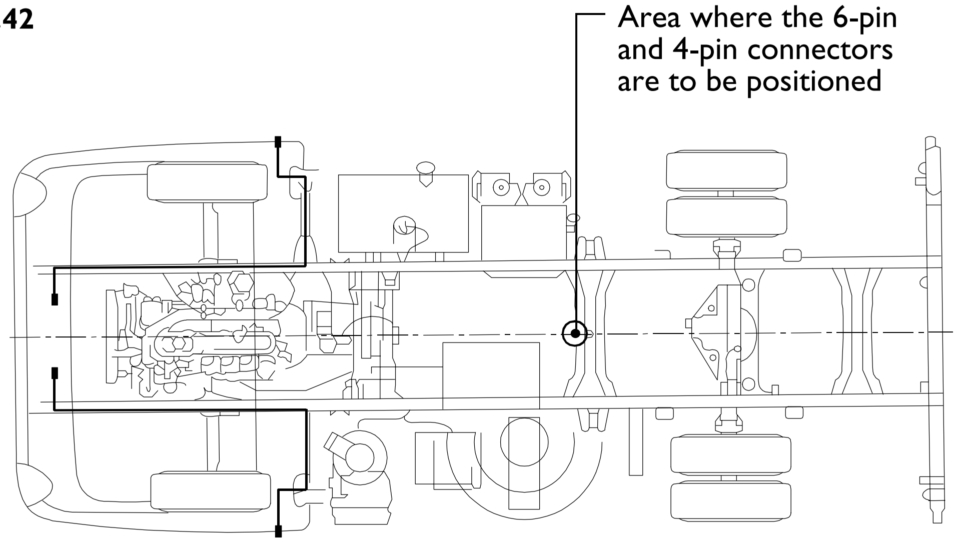
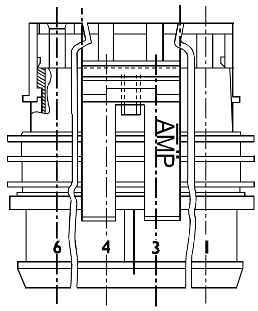


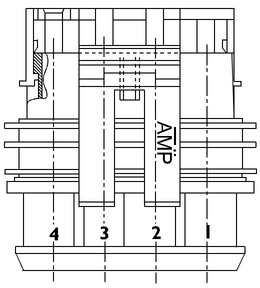
Figure 2.43



6-pin connector interface

Pin	Cable No.	∅ mm	Maximum load	Description
1	0150	0.5	~ 10mA	Junction W2 earth
2	7151	0.5	~ 10mA	Junction V2 (24V)
3	5502	0.5	~ 10mA	2nd speed limiter; to activate, connect PIN 2
4	2226	0.5	1A	Gearshift in reverse, 24V in reverse
5	9906	0.5	1A	Engine stop; to activate, connect PIN 1
6	8050	0.5	1A	Gearshift in neutral, 0V in neutral

Figure 2.44



4-pin connector interface (currently not available)

Pin	Cable No.	Load	Description
1	0158	~ 10mA	PTO earth
2	0166	~ 10mA	Mode 1 PTO; to activate, connect PIN 1
3	0167	~ 10mA	Mode 2 PTO; to activate, connect PIN 1
4	0168	~ 10mA	Mode 3 PTO; to activate, connect PIN 1

NOTE:

A SPECIAL KIT IS AVAILABLE IN THE SPARE PARTS CATALOGUE (PART NUMBER: 2992273), WHICH INCLUDES:

– 20, 6 AND 4 PIN MALE CONNECTORS

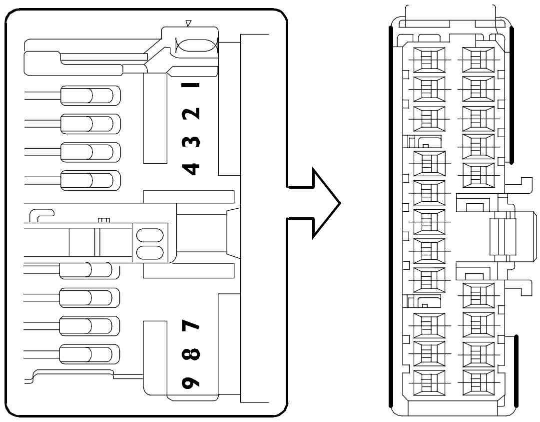
– PINS FOR CABLES WITH SECTIONS OF 1 mm^2 AND 0.5 mm^2

- RUBBER GROMMETS FOR PINS (BOTH USED AND UNUSED)

e) From inside the cab PTO 1, 2, 3 software 4.1.2 (vehicles built from chassis numbers 384102, four cylinder engines, and 385416 six cylinder engines).

It is possible to take power from pins 3, 5 and 6 in the blue 20-pin connector located in the electronic control unit compartment (next to the ABS control unit) behind the panel in front of the passenger feet.

Figura 2.45



Pin	Cable No.	∅ mm	Maximum load	Description
1	5509	0.5	1 mA	Signal with vehicle stationary, signal D8 (8V) of standard tachograph
2	7778	0.5	100 mA	Engine running, alternator L 24V when engine is running
3	**4442**	**1**	**5A**	**Light ON; Ignition key in OFF position: 24V only when the parking light is in ON position Ignition key in ON position: 24V when the parking and low-beam headlights are in ON position** [1]
4	6662	0.5	200 mA	Handbrake signal, earthed when the spring brake is applied [1] [2]
5	**8879**	**1**	**5A**	**Key 15**
6	**7772**	**1**	**10A**	**Key 30**
7	8050	0.5	10 Ma	Engine start – Activated by connection to pin 15 [4]
8	9906	0.5	10 mA	Engine stop – Activated by connection to pin 15
9	0000	0.5	10A	Earth
10	7156	0.5	10 mA	Power supply for Cruise Control switches
11	8154	0.5	~ 10mA	CC OFF: operated by opening connection to PIN 10 [3]
12	8155	0.5	~ 10mA	CC RESUME: to operate connect to PIN 10
13	8157	0.5	~ 10mA	CC SET -: to operate connect to PIN 10
14	8156	0.5	~ 10mA	CC SET +: to operate connect to PIN 10
15	0150	0.5	~ 10mA	Junction W2
16	0158	0.5	~ 10mA	PTO earth
17	0166	0.5	~ 10mA	PTO1 – Active by connection to pin 16
18	0167	0.5	~ 10mA	PTO2 – Active by connection to pin 16
19	0168	0.5	~ 10mA	PTO3 – Active by connection to pin 16
20				Not connected

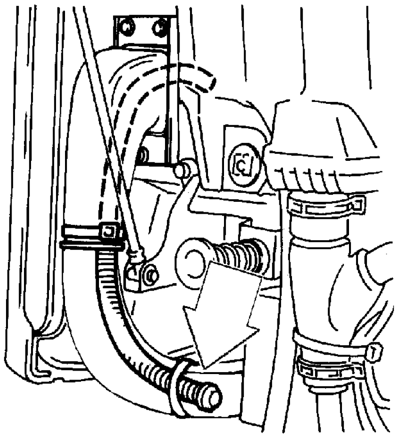
1) Steady signal even when the MOUDLE TEST key is pressed
2) The signal is earthed when the pressure on springs is lower than 5.5 bar
3) Must be included between Pins 10 and 11, in case of vehicles without Cruise Control for functions CC RESUME, CC SET -, CC SET + and PER PTO 1,2,3

4) ⚠ WARNING: The use of the engine start/stop signal requires previous installation of devices to ensure that the operation occurs under safe conditions – and in compliance with the regulations in force – for the operator, the persons and/or the objects situated in the vicinity. The bodybuilder is responsible for locating and properly fitting these devices (e.g. parking brake ON, neutral gearshift, etc.), by means of arrangements that ensure the requested function and the use of reliable components.

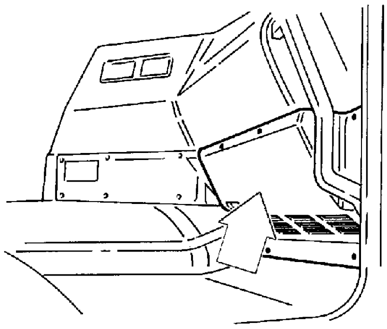
To enable bodybuilders to take cables in and out of the cab, without drilling holes, there is a dedicated corrugated tube located under the front hood on the passenger side of the cab (see figure 2.46).
The bottom end of the tube is protected by a plug to prevent smoke and dust getting into the cab and must be sealed again after inserting cables through it.

Figura 2.46

Corrugated pipe



Passenger's side cab interior.
The arrow shows the panel behind which the other end of the corrugated pipe is found.



f) From the connectors placed on the chassis (approximately on the chassis centre line; area of chassis no. 2367351)

Figure 2.47

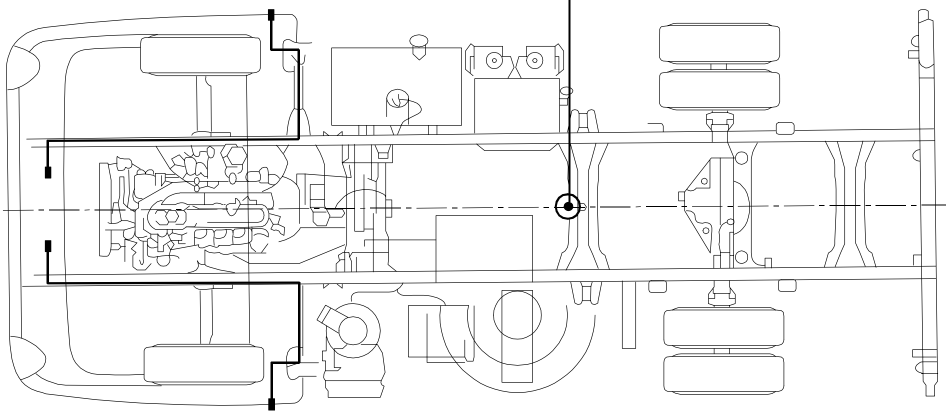
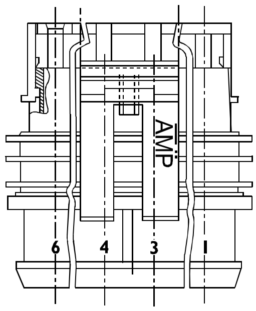


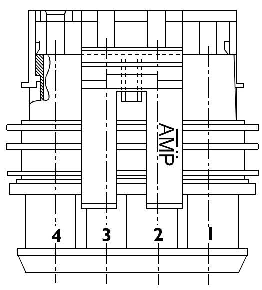
Figure 2.48



6-pin connector interface

Pin	Cable No.	∅ mm	Maximum load	Description
1	-	-	↰	Not connected
2	7151	0.5	~ 10mA	Junction V2 (24V)
3	5502	0.5	~ 10mA	2nd speed limiter; to activate, connect to PIN 2
4	2226	0.5	10 mA	Gearshift in reverse, 24V in reverse
5	5519	0.5	10 mA	Engine revs signals
6	8050	0.5	10 mA	Gearbox in neutral, 0V in neutral

Figure 2.49



4-pin connector interface (only with ALLISON automatic transmission).
Positioned in the 20 pin connector area (in the cab).

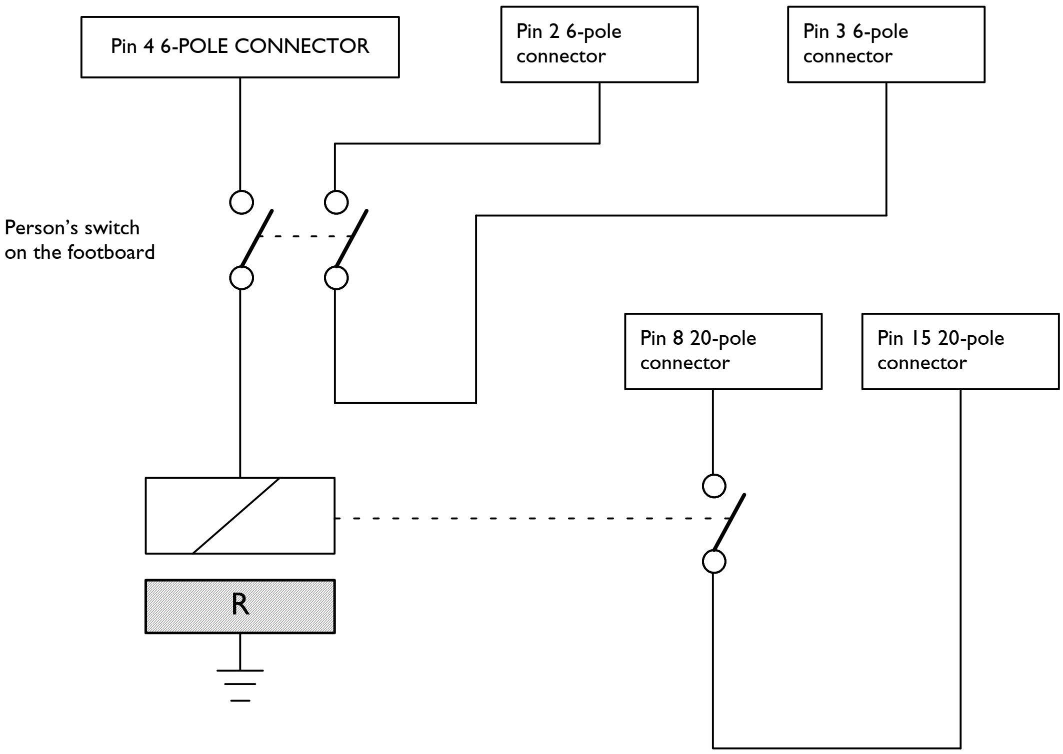
Pin	Cable No.	Load	Ø mm	Description
1	312MO	~ 10mA	1	PTO actuation
2	0166	~ 10mA	1	Gearshift in neutral, 24V in neutral
3	0167	10mA		Gearshift in outer neutral
4	-	↰	-	Not connected

NOTE:
A SPECIAL KIT IS AVAILABLE IN THE SPARE PARTS CATALOGUE (PART NUMBER: 504033457), WHICH INCLUDES:
- 20, 6 AND 4 PIN MALE CONNECTORS
- PINS FOR CABLES WITH SECTIONS OF 1 mm² AND 0.5 mm²
- RUBBER GROMMETS FOR PINS (BOTH USED AND UNUSED)

2.15.3.2.1 Connection for engine switching off when a person is standing on the footboard and the reverse gear is engaged

Make a connection to the 6-pole connector for outfitters on the chassis, and to the 20-pole connector per outfitters in the cabin. The person's switch on the footboard is closed when the person is present. A relay is to be added, as shown in the diagram.

The section that leads to the 6-pole connector is to be added if you want the vehicle's speed to be limited to 30 km/h when a person is standing on the footboard; in this case, the switch must consist of a double-contact switch.

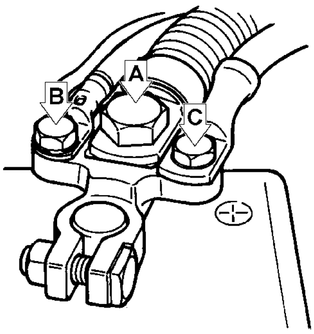


2.15.3.3 EuroTech MH and Euro Trakker Range with Cursor engine, EuroTech, EuroStar, EuroTrakker Range (Production as of July 98)

Power can be taken at the points shown below, specially provided for bodybuilders:

a) From the batteries

Figure 2.50



A : Starter motor

B : Terminal reserved for IVECO users

C : Terminal reserved for bodybuilders

Taking power through the specific terminal C specially provided for bodybuilders.

With engine stopped:	Up to 10% of rated battery capacity.
With engine running:	It is possible to draw off an additional 20% of the rated battery capacity, depending on the alternator power and engine speed.

For higher powers it is necessary to have uprated batteries and alternator. Supplying high loads (e.g. tail lifts), with frequent use, requires using batteries of sufficient capacity (at least 143 Ah) and alternators of sufficient power (no less than 90 A).

⚠ **Precautions**

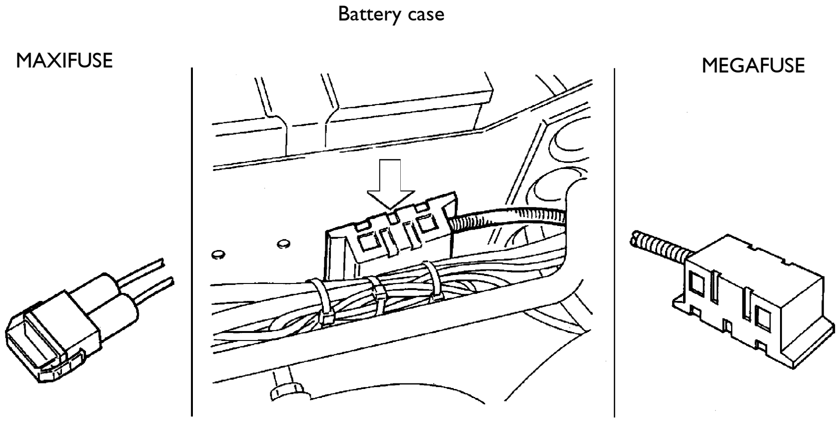
To separate and protect the additional circuit from the original one, use appropriate fuses positioned close to the supply. Protect the additional cables in special sheaths or corrugated ducts, installing them in compliance with the instructions of point 2.15.4.

Maxifuses and Megafuses

Your IVECO Parts Dept. has a set of five fuse-holder kits to protect high power supplies.

The bodybuilder should position them as close as possible to the supply terminal on the batteries according to the space available on the vehicle.

Figure 2.51



Capacity	IVECO Ref. No.	Cable cross-section
Kit 40A	4104 0110 KZ	$10mm^2$
Kit 60A	4104 0111 KZ	$10mm^2$

Capacity	IVECO Ref. No.	Cable cross-section
Kit 100A	4104 0112 KZ	$25mm^2$
Kit 125A	4104 0113 KZ	$30mm^2$
Kit 150A	4104 0114 KZ	$50mm^2$

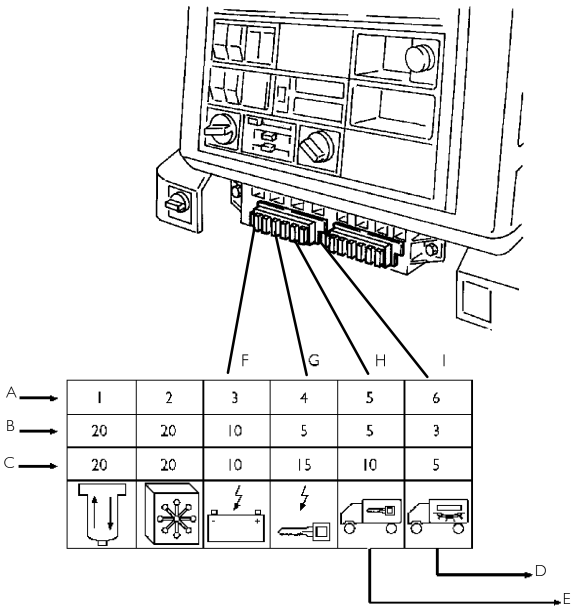
b) From inside the cab

Under the central fascia panel it is possible to take power through the terminals of the following fuses:

Fuse No. 3 from the batteries : up to 10A

Fuse No. 4 key positive : up to 15A EuroTech MH Cursor Range;
EuroTrakker Cursor
(5A EuroTech, Star, Trakker Range)

Figure 2.52 "MP" cab central facia



A	1	2	3	4	5	6
B	20	20	10	5	5	3
C	20	20	10	15	10	5

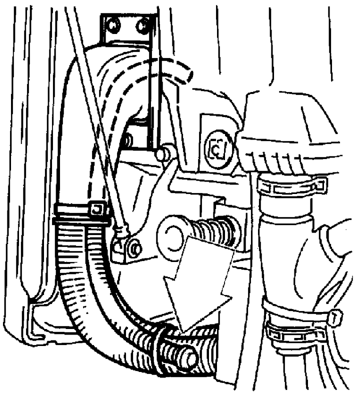
A = Fuse number
B = Values in Amps EuroTech/Star/Trakker Ranges
C = Values in Amps EuroTech "Cursor" and EuroTrakker "Cursor" Ranges
D = External lights (ST81 connector)
E = Key positive (ST81 connector)

Fuses 5 and 6 are for the bipolar cable, which is provided for taking power at the junction box outside the vehicle. On truck models the junction box is mounted on the rear overhang, and on tractors (for semitrailers) behind the cab.

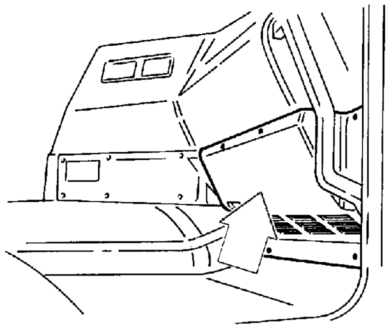
To enable bodybuilders to take cables in and out of the cab, without drilling holes, there is a dedicated corrugated tube located under the front hood on the passenger side of the cab (see Fig. 2.53).
The bottom end of the tube is protected by a plug to prevent smoke and dust getting into the cab and must be sealed again after inserting cables through it.

Figure 2.53

Corrugated tube



Inside cab on passenger side. The arrow shows the panel behind which is the other end of the corrugated tube.

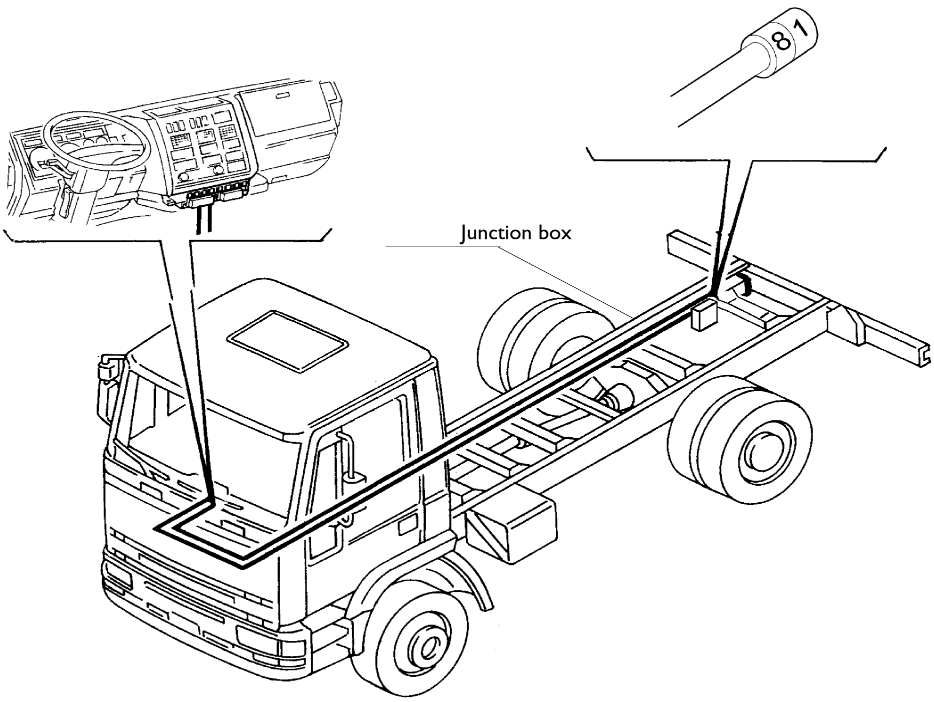


c) From the bipolar cable on the chassis

Through the ST81 connector of the bipolar cable, specially provided for bodybuilders, on the rear overhang for the truck models (see Fig. 2.54) or behind the cab on tractors for semitrailers, the following power consumption is possible:

- Terminal 15 (key positive):	10A for the EuroTech MH Cursor Range; EuroTrakker Cursor 5A for the EuroTech, Star, Trakker Ranges (fuse no. 5 in the cab, see paragraph b).
- Terminal 58 (external lights):	5A for the EuroTech MH Cursor Range; EuroTrakker Cursor 3A for the EuroTech, Star, Trakker Ranges (fuse no. 6 in the cab, see paragraph b).

Figure 2.54



Note: EuroTech MH and EuroTrakker Ranges with Cursor engine: Interface with the electrical/electronic systems on the vehicle.

Point 5.7 gives the information for interfacing with the vehicle's electrical/electronic system for the equipment installed by bodybuilders.

2.15.4 Additional Circuits

These must be separated and protected by a fuse from the vehicle's main circuit.
The wires used must be of a size to suit their functions and be properly insulated. They must be suitably protected in sheathing (not PVC) or ducted in corrugated pipes in the case of several functions (we suggest type 6 polyamide material for the corrugated pipes) and be correctly fitted, **shielded from impact and heat sources**. Their passage through the components of the structure (cross members, runners etc.) must be via grommets or protective conduits. They must be fixed separately by insulating (e.g. nylon) wire clips at the appropriate intervals (approx. 350 mm apart). Where possible it is recommended that different runs are used between wires (looms) with high intensity absorption signals (e.g. electric motors, solenoid valves) and those with low intensity absorption signals (e.g. sensors) to avoid any interference between them. All should be kept as close as possible to the metal structure of the vehicle.

Depending on the power drawn, use cables and fuses with the following specifications:

Max. continuous current 1) (A)	Fuse capacity (A)	Cable cross-section (mm^2)
0 - 4.9	5	0.5
5 - 9.9	10	1
10 - 18	20	2.5
19 - 28	30	4
29 - 35	40	6
36 - 48	50	10
49 - 69	70	16
70 - 98	100	25
99 - 123	125	35
124 - 148	150	50

1) For uses longer than 30 seconds

Precautions

New wires must not run alongside wires that transmit signals (e.g. ABS). These latter wires have been allocated a special run to satisfy electromagnetic requirements (EMI)
When grouping several wires together, remember that there will be a reduction in their intensity as compared to the rated value of a single cable due to reduced heat dissipation.

•

2.15.5 Harness Modifications due to Changes to Wheelbase or Overhang

Should it be necessary to lengthen the wires on the chassis owing to the new dimensions of wheelbase and overhang, a watertight junction box must be used which has the same characteristics as those used on the standard vehicle. The components used such as wires, connectors, terminal blocks, conduits etc. must be of the same type as those used originally and be correctly fitted.

As regards the ABS system, follow the instructions given at point 2.14.3.

2.15.6 Power Draw-off at a Voltage Different from that of the System

On vehicles with a 24V system, should the trailer (or other equipment) require a 12V system, a potential divider must be used which draws power from the standard circuit. Power must not be drawn from one battery only due to the detrimental effects this would have on the batteries during recharging.

2.15.7 Battery Main Switch (optional equipment)

This is generally located on the battery box and is manually operated. It is a single-pole switch which disconnects the battery from the chassis leaving only the tachograph in operation due to legal requirements.

An electric battery disconnector is available on request, fitted in the same position as for the hand-operated disconnector. Switching on can be performed by either operating a key switch, warning light switch, external light switch, auxiliary heater thermostat, air conditioning system.

For special outfits (e.g. fuel transport, dangerous goods, etc.), a specific system conforming to the A.D.R. standard is provided.

2.15.8 Installing Side Marker Lamps

In some countries, regulations (domestic or EC) require the vehicle to be equipped with side marker lamps, depending on its overall length.

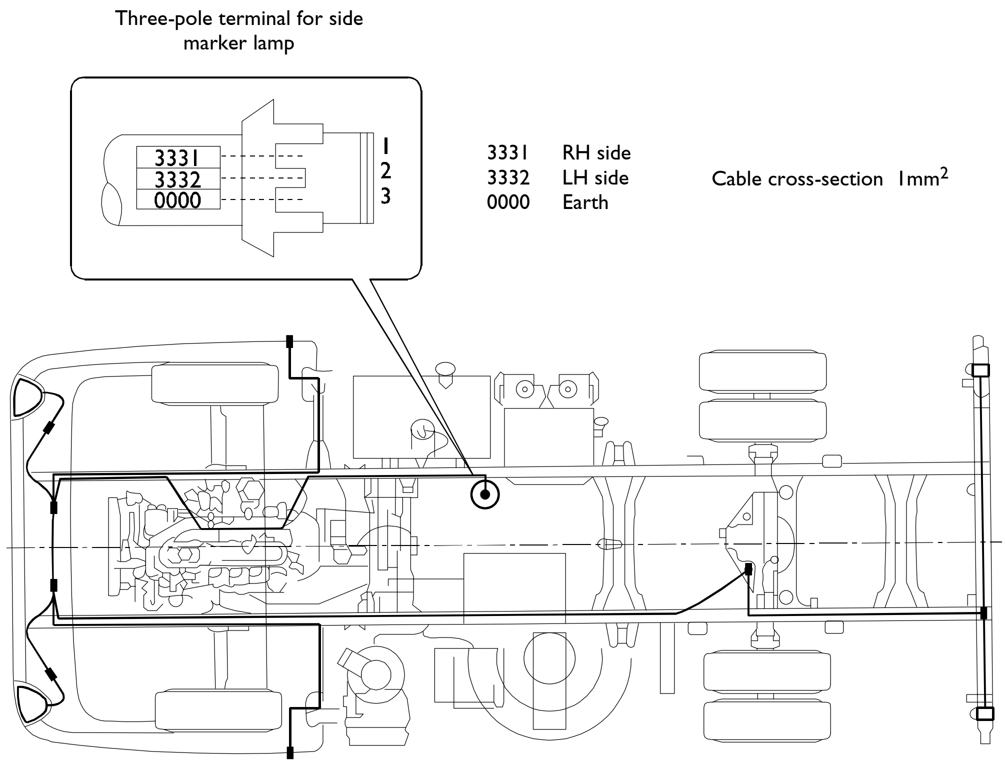
The vehicles in the IVECO Range are equipped with specific terminals for side marker light connection.

Bodybuilders must fit the lights on the relevant structures and connect to the dedicated terminals.

The positions of these terminals for the specific Ranges are shown below.

a) EuroCargo Range

Figura 2.55



Models " 60E.. - 180E.. "

Connector on the vehicle		Interface to use		
9843 5344	Female connector	9843 5331	Male connector	n° 1
		9844 7231	Half bearing	n° 1
		9843 5370	Cable terminal	n° 3
		486 1936	Seal	n° 3

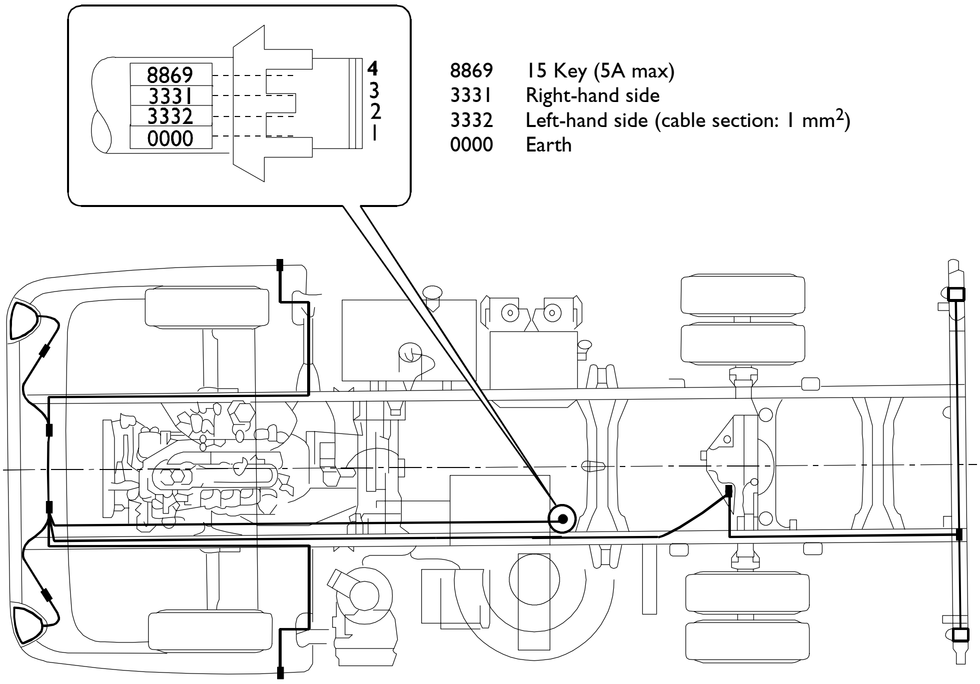
Note:

Vehicles are supplied with a kit containing:

- Information for locating the terminal on a standard vehicle.
- The components needed to make the connection.

b) Eurocargo TECTOR range

Figure 2.56



Models " 65E.. - 180E.. "

Connector on vehicle		Interface to be used		
9843 5341	Female connector	9843 5377	Male connector	n° 1
		9844 7232	Half shell	n° 1
		9843 5370	Cable terminal	n° 4
		486 1936	Gasket	n° 4

Note:

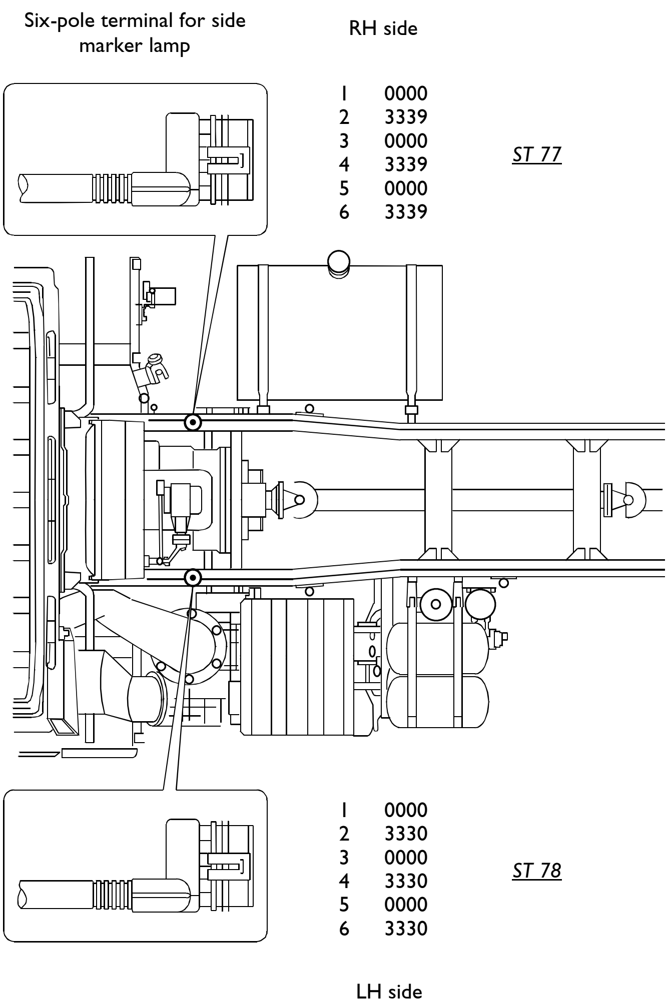
Vehicles are supplied with a kit containing:

– Information for the terminal on a standard vehicle.

– The components needed to make the connection.

c) EuroTech MH and EuroTrakker Ranges with Cursor engine

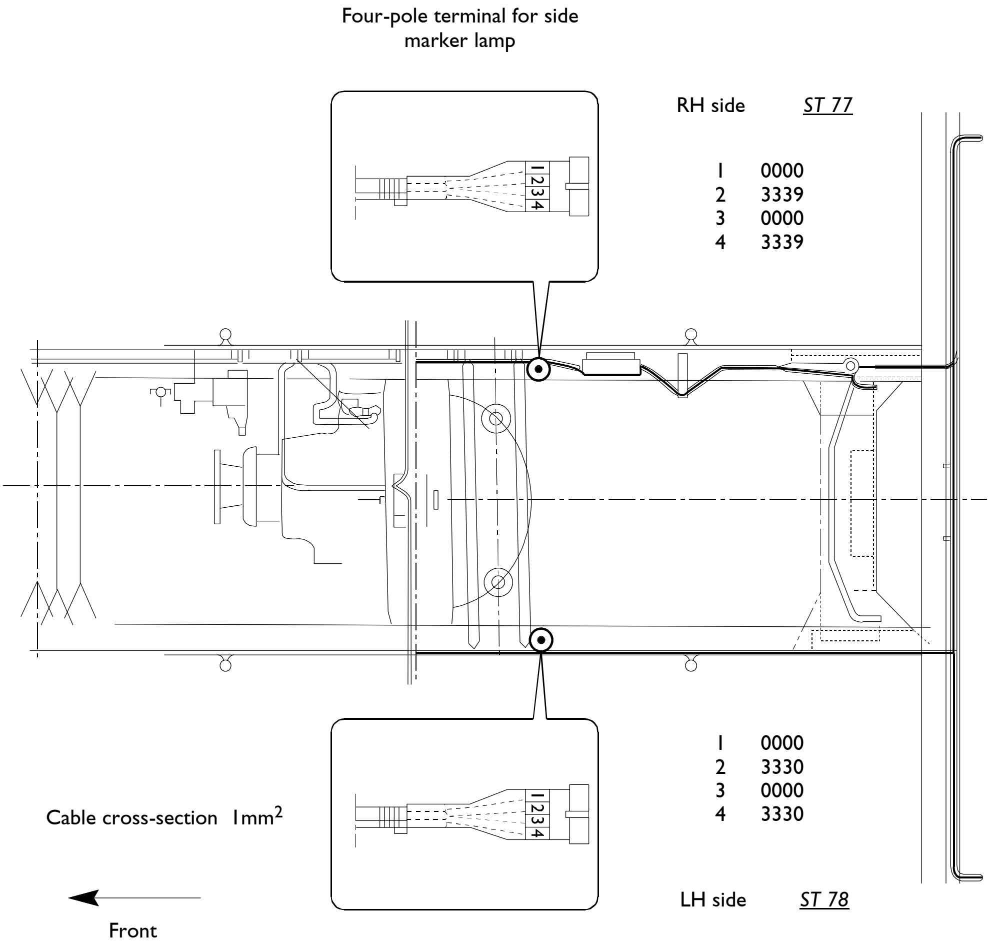
Figure 2.57



Connector on the vehicle		Interface to use		
9843 5343	Female connector	9843 5339	Male connector	n° 1
		9844 7233	Half bearing	n° 1
		9843 5370	Cable terminal	n° 6
		486 1936	Seal	n° 6

d) EuroTech, Star, Trakker Range

Figure 2.58



Connector on the vehicle		Interface to use		
9843 5341	Female connector	9843 5337	Male connector	n° 1
		9844 7232	Half bearing	n° 1
		9843 5370	Cable terminal	n° 4
		486 1936	Seal	n° 4

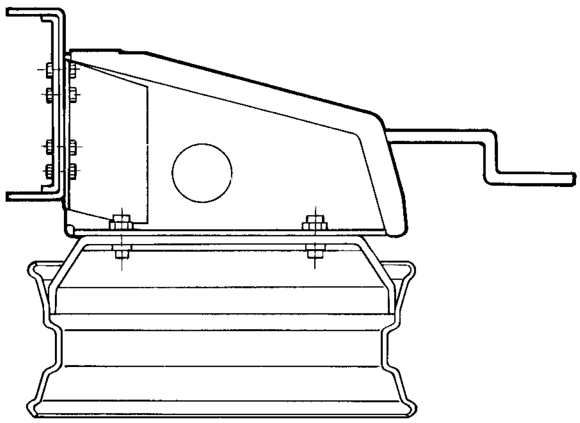
2.16 Repositioning Parts and Mounting Auxiliary Assemblies and Equipment

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 Fig.2.59).

Figure 2.59



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.

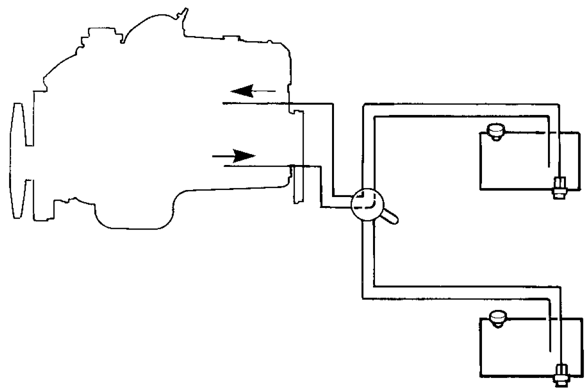
A similar procedure should be adopted when fitting additional units such as tanks, compressors etc. When positioning them, due consideration must be given to the distribution of the weights (see point 1.2). In any event, an adequate distance of their height from the ground must be ensured with due consideration given to the use of the vehicle.

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 2.2.1. 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).

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 Fig. 2.60).

Figure 2.60



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.

2.17 Transporting Dangerous Goods

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.

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 EU 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 EU Directives.
Anti-lock braking system (ABS) and retarder compulsory in the cases required by the law.

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

4) Exhaust system.
Those parts of the exhaust system which reach temperatures of more than 200°C and cannot be moved in front of the protective wall, must be adequately insulated.
If the exit of the exhaust cannot be turned outwards, in the case of tranporting explosives, it must be equipped with a spark arresting device.
(If any modifications of the exhaust pipes are necessary, they must be carried out in accordance with point 2.8).

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 EU Directives and set to 85 km/h.

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

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

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

2.18 Retarder installation

An extra retarder (e.g. eddy current drag brake or hydraulic brake) may be positioned behind the gearbox (assembly installation) or on the transmission (separate installation) and it is subject to our authorisation.

Installation on some vehicles can be carried out at our plants (as optional extra). Later installation on these vehicles must match the original solution (as for brake manufacturer co-operation).

In the remaining cases, the brake manufacturing firm workshops must carry out the installation in compliance with points 2.2.1 and 2.3.2 and 2.15 of these instructions. The firm authorised to carry out the installation is responsible for correct operation, anchoring part size, good quality of work. Extra gearbox reinforcements may be needed or existing ones may have to be strengthened when the retarder is installed as one assembly with the gearbox.

The technical documentation needed for the installation can be requested from IVECO. The information on the electrical system of each model is given in the Workshop Manuals and can be obtained from the IVECO Service Network (see point 2.15.1). When it is necessary to fit heatproof shields, their position and material specifications must comply with current standards (e.g. ISO 3795) ensuring their effectiveness.

To cool hydraulic retarders, their connection with the engine cooling system is allowed provided that this does not entail exceeding the maximum temperature allowances for the original system coolant. Otherwise, a separate cooling circuit must be fitted.

If it is necessary to install additional heat exchangers, their dimensions must be defined by the retarder manufacturer. Their positioning must not alter the functioning of the original cooling system of the vehicle.

In the presence of electronic system installed on the vehicle (e.g. ABS, EDC etc.) which interact with the retarder, contact IVECO in order to optimise the application.

2.19 Modifications to the Rear Underrun

Our vehicles are fitted with a rear underrun bar in accordance with EEC Directive 70/221 and 81/333.

The maximum permitted distance from the bar to the rearmost part of the body is 400mm, deducting the distortion of approx. 20 to 40 mm found during approval tests. For further information see the official information issued by IVECO.

Whenever the 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 vehicles or installing special equipment (e.g. tail lifts) it may be necessary to modify the structure of the underrun bar. Such modifications must not change 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.

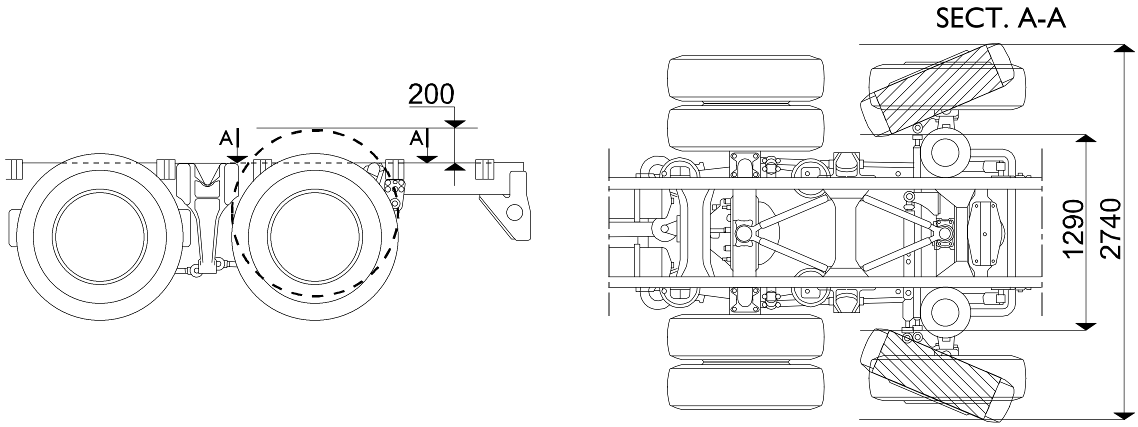
Whenever different underrun bar must be used, check relevant current regulations. Documentation or quality control certificates must be presented upon request from the competent authority.

2.20 Rear Mudguards and Wheel Boxes

When vehicles are supplied without mudguards, the bodybuilder must fit them using similar installations 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 Fig 2.61. 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 2.61

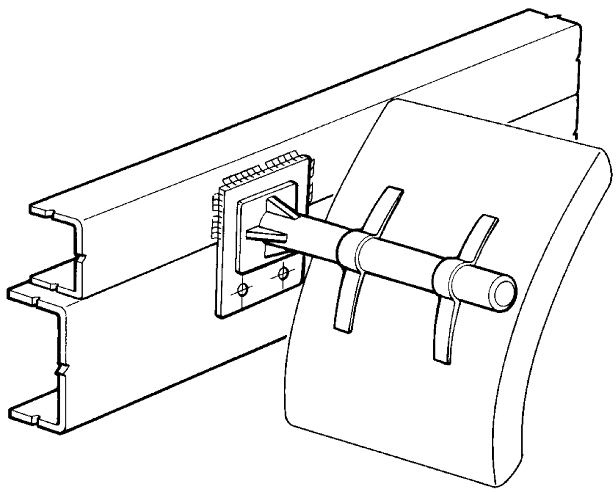


When fitting mudguards or making wheel boxes the following points should be considered:

- The supporting structure should be sufficiently strong enough, avoiding any sudden variation in section.
- If the support are fixed to the web of the sidemembers they must be bolted, the sidemembers must not be welded (see Figure 2.62).

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

Figure 2.62



2.21 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.

2.22 Side Guards

In some countries local or EEC 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 2.2.1.

According to the EEC 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

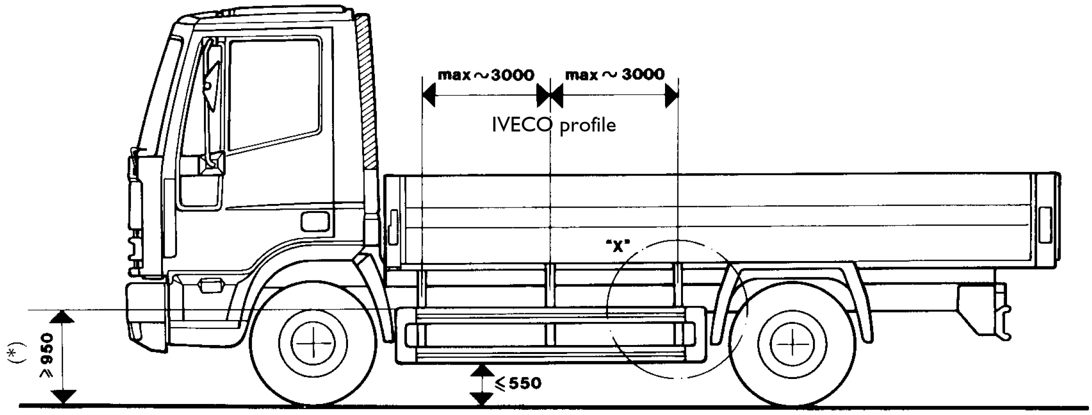
The guards must be made of the appropriate materials (e.g. FeE420).

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.

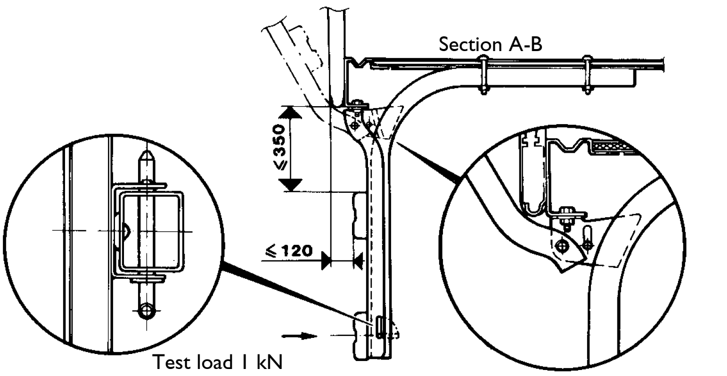
Figure 2.63 shows a type of side guard designed in compliance with the relevant EC Directive to be fitted to fixed bodies (available on request). The illustration also shows a specimen of a support designed for the combined fastening on the side guard and the rear wheel mudguard which can be fitted to mobile auxiliary subframes.

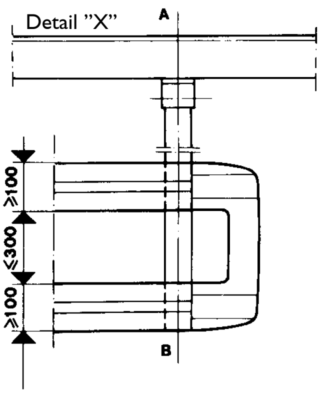
The Bodybuilder will take care of the preparation and the arrangement of the side guard depending on the type of auxiliary subframe concerned, as it is not possible to provide instructions of a general character applying to all equipment versions.

Figure 2.63

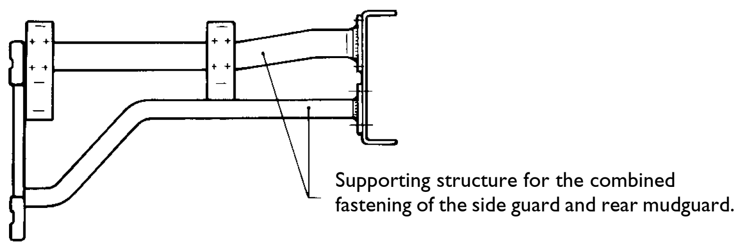


(*) Either the bottom part of the auxiliary frame is over 1,300 mm from the ground or the width of the auxiliary subframe is less than the external space occupied by the tyres.





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



2.23 Chocks

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

3. BUILDING AND MOUNTING THE STRUCTURES

Index

The following detailed instructions assume compliance with the more general specifications given above.

3.1 Subframes and Bodies

3.1.1 Construction of the Subframe

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

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

Material

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

Tensile strength $R \geq$	370 N/mm^2	
Yield point $R_{0.2} \geq$	240 N/mm^2	e.g. Fe360C (BS 4360 Grade 40B)
Stretching $A_5 \geq$	25%	

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 characteristics of some materials considered in some applications below explained are as follows:

Material	Fe510D (Qst 52-3; BS 4360 Grade 50C)	FeE320G (BS 1449 HS 43/35)
Tensile strength $R \geq$	520 N/mm^2	430 N/mm^2
Yield point $R_{0.2} \geq$	360 N/mm^2	320 N/mm^2
Stretching $A_5 \geq$	21%	17%

Aluminium Subframe

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

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

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

Please note that when defining the minimum size of reinforcement sections, reference must be made not only to the limit of permissible stress for aluminium, but also to the different Coefficient of Elasticity compared to steel (approximately 7,000 instead of 21,000 kg/mm^2) which requires greater dimensions of the sections themselves.

Similarly, if the connection between the frame and subframe allows the transmission of shearing stresses (plate connection), then when checking the stress of both ends of the single section, the relevant new neutral axis has to be estabilished according to the different elastic modulus of both materials.

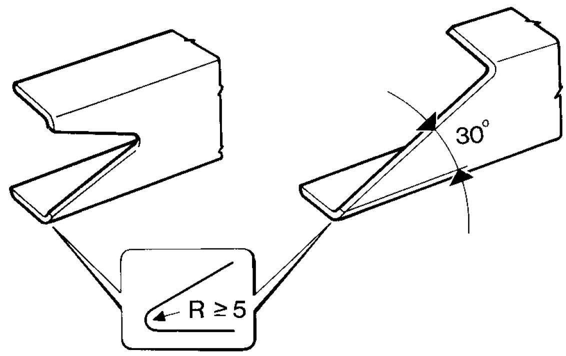
In the final analysis, if the subframe has to contribute to the frame's strength/stiffness, higher sectional dimensions for the runners will have to be used if aluminium is to be considered instead of steel.

Longitudinal Runner Profiles

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

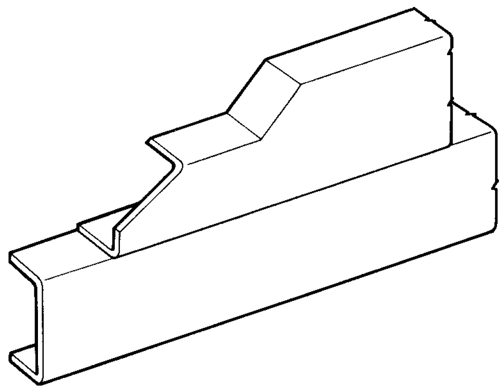
In order to achieve a gradual reduction in the resistant section, the front ends of the longitudinal runner must be tapered upwards at an angle of no more than 30°, or tapered in some other equivalent way (see fig. 3.1) ensuring that the front end in contact with the chassis is suitably connected, min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

Figure 3.1



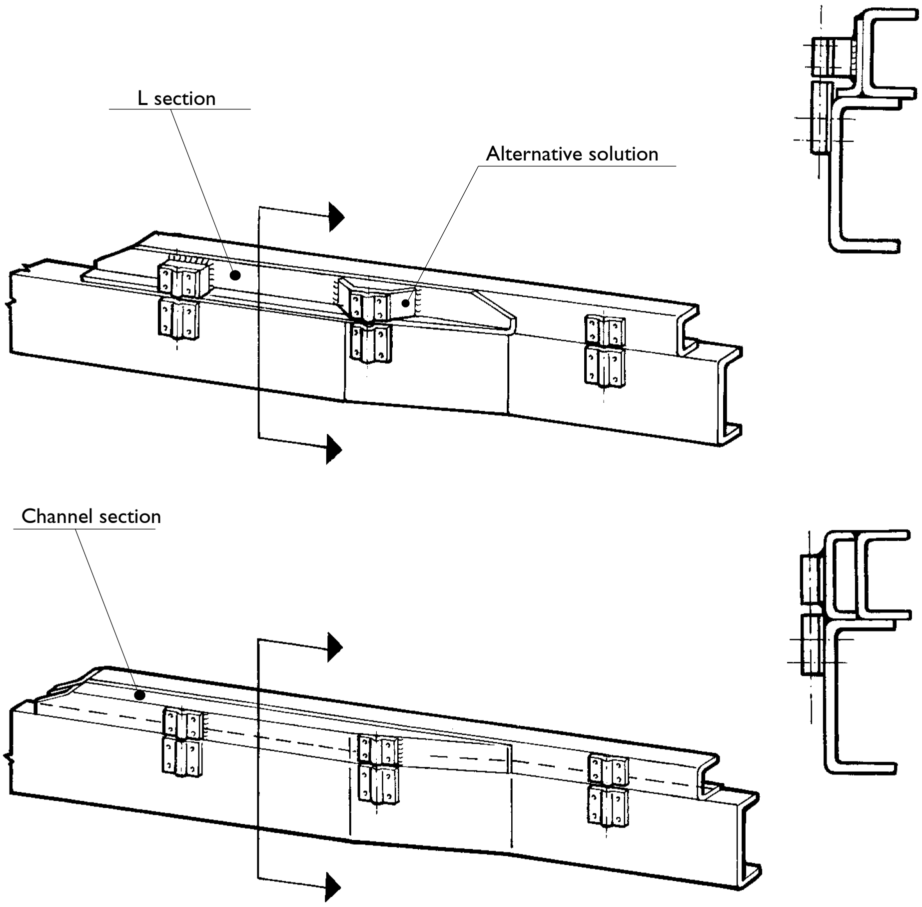
If the cab's rear suspension components do not allow the entire runner to pass through, the latter may be shaped as shown in figure 3.2. This could require the assessment of the minimum resisting section if high flexural moment occurs at the front (e.g. with crane mounted behind cab if operating towards the vehicle's front).

Figure 3.2



On vehicles where chassis side members are not parallel to each other, the auxiliary frame runner profiles must follow the shape of the main side members. 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. Should the front part of the auxiliary frame be narrower than the chassis, either a number of suitably shaped U-sections or of angle L-sections with the appropriate ribbing can be installed on the outside of the auxiliary frame (fig. 3.3).

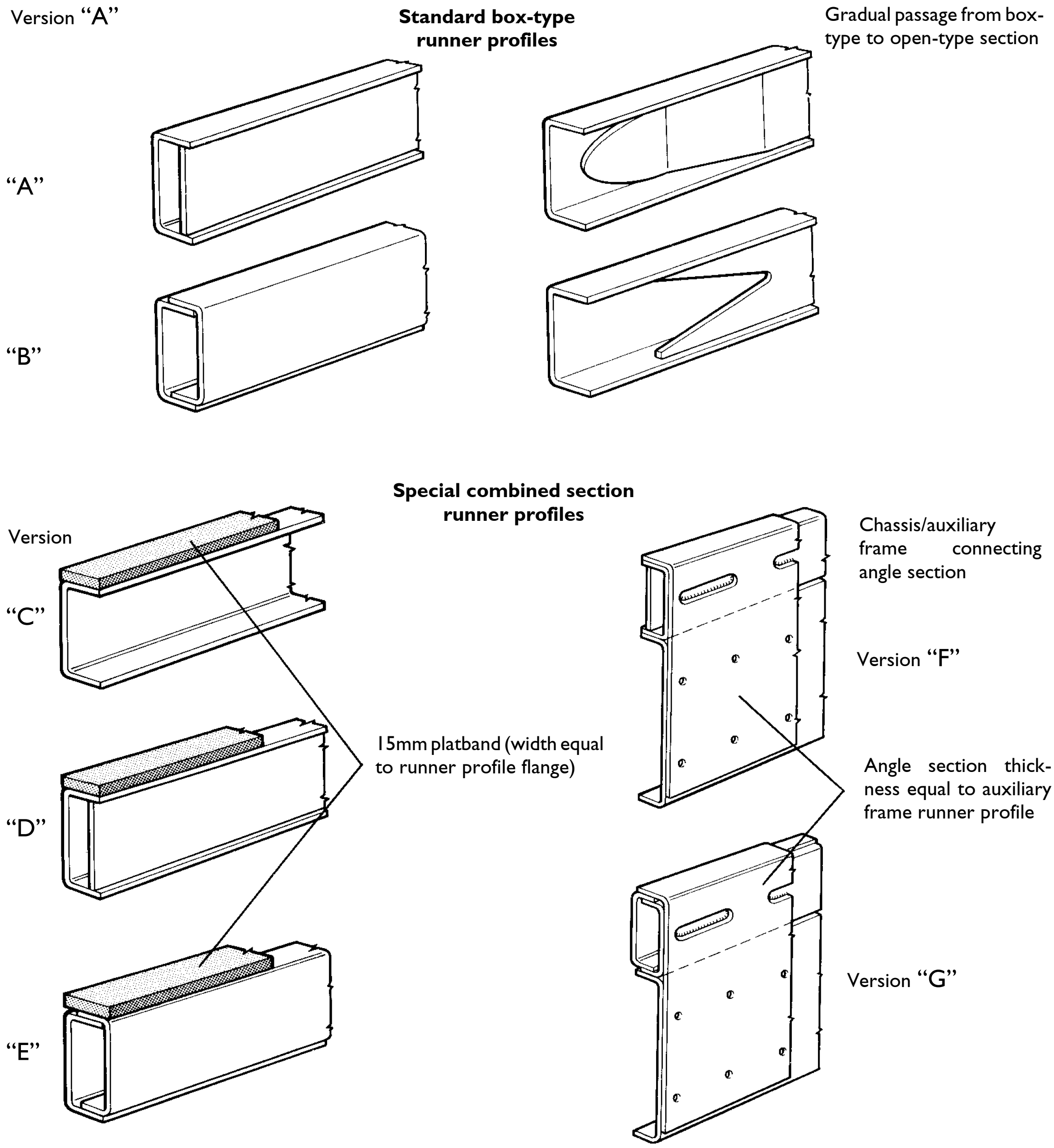
Figure 3.3



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

Proper care must be taken to ensure a gradual passing from the box- type section to the open kind. Some examples on how to achieve this are shown in fig. 3.4.

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).

Such dimensions can be obtained from the technical literature supplied by the manufacturer of the runner profiles. It should be borne in mind that the moment of inertia, apart from being an important factor for the calculation of the share of bending moment to be applied, also represents the most adequate response to the degree of torsional stress required for the specific type of connecting section in use. Therefore, the moment of resistance is a determining factor as regards the stress exerted on the material.

Cross Members

An adequate number of cross members, which should be positioned if possible adjacent to the fastenings, are required to brace the two runners of the subframe.
The cross members may be of the open type (e.g. C-type) or, if greater rigidity is desired, of the closed type.

Suitable gusset plates must be employed at the points of the connection to confer sufficient strength to the connection (see fig. 3.5). In those cases, when greater rigidity is required for the connection, the work procedure may be carried out as illustrated in fig. 3.6

Figure 3.5

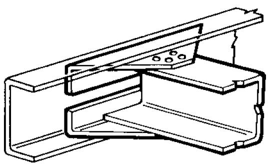
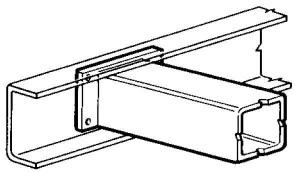


Figure 3.6



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 fig. 3.7).
- Box-frame construction, crossties (see fig. 3.8)
- By applying in addition to the box-frame construction a longitudinal torsion-resistant bar (see fig. 3.9).

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

Figure 3.7

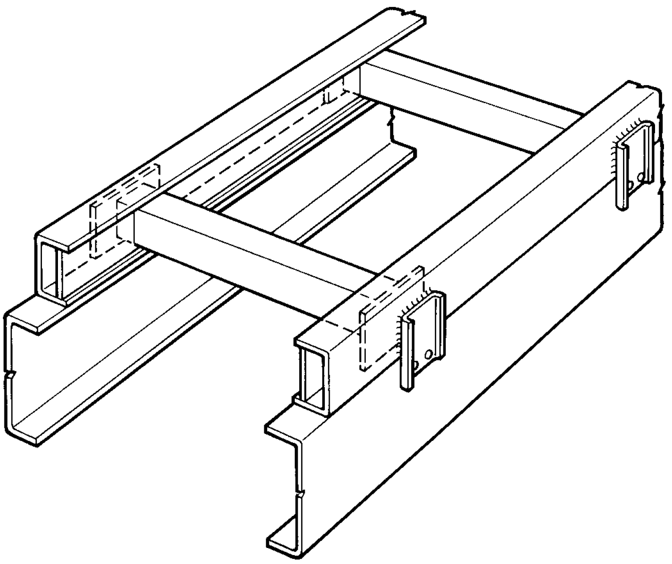
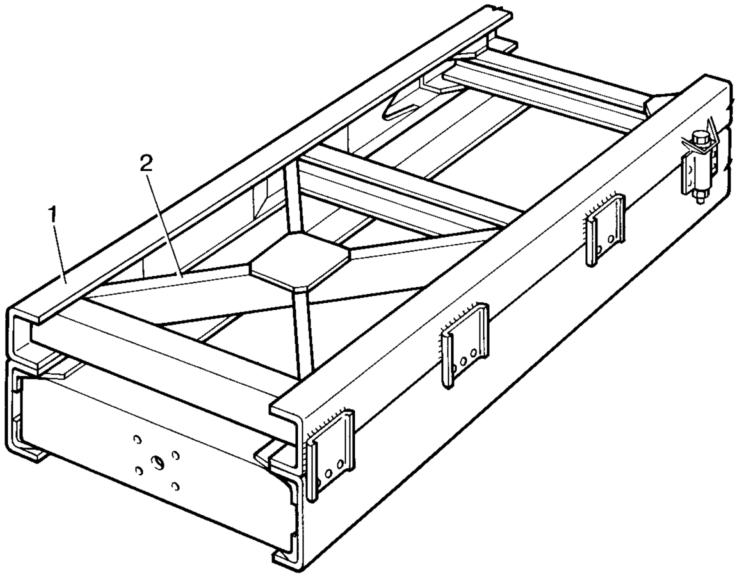
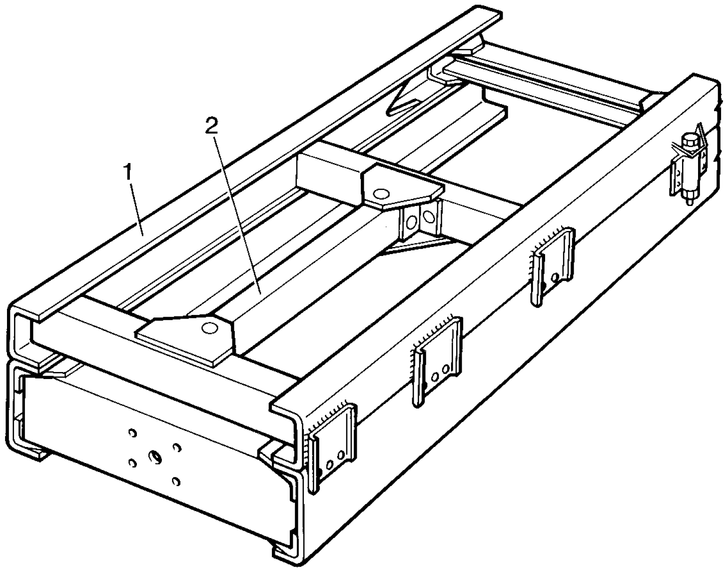


Figure 3.8



1 Subframe
2 Crossties

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 subframe.

3.1.2 Connections

Choosing the Type of Body Mounting

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

The subframe connection may be flexible (brackets or clamps) or it may be rigid, resistant to shearing stress (longitudinal or transverse plates); the choice must be made based on the type of body that is to be mounted (see points 3.2 to 3.13) analysing the stress forces which the additional equipment that is added transmits to the chassis both under static and dynamic conditions. The number, size and type of securing devices properly subdivided over the length of the subframe, must be such as to ensure a good connection between the chassis of the vehicle and the subframe.

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

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

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

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

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

In order to improve the longitudinal or transverse securing of the connection, it is permissible to have holes on the flanges of the side members, but only at the rear end of the members, over a length of not more than 150 mm, provided that the anchorage of any cross members that may be present is not weakened (see fig 3.13). The mountings shown in fig 3.14 may be used, applying the screws which connect the rear cross member or underrun brackets to the chassis.

In all other cases, holes on the frame flanges must not be drilled.

Body Mounting Characteristics

Flexible joints (see figs 3.10, 3.11 and 3.12) 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 fig. 3.14) between subframe and chassis, a single strong section is obtained, provided that the number and position of the joints are adequate to support the resulting shearing stresses.

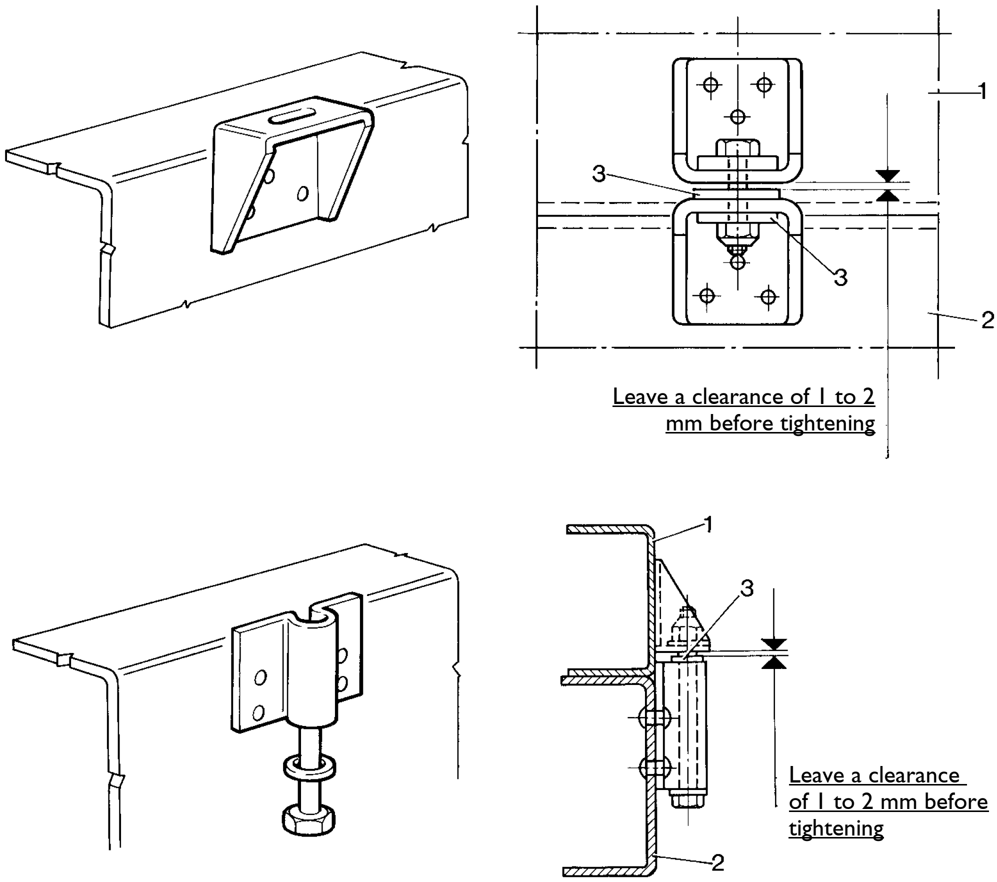
When using sheer resisting plates to secure the subframe to the sidemembers, a single strong section is formed which has a higher strength capacity when compared with the connections made using brakets or clamps. This has the following advantages:

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

3.1.2.1 Connection with Brackets

A few examples of this type of connection (flexibility mounting), are shown in fig. 3.10 and 3.11.

Figure 3.10



1 Subframe
2 Frame
3 Shims

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

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

In order to guide and better contain the loads transversally, a slight protrusion of the brackets above the chassis is recommended. When the brackets are fitted flush with the upper flange of the side member, the lateral movement of the body structure must be secured by other means (e.g. using guide plates the chassis connected - see fig. 3.12). When the front connection is of the elastic type (fig. 3.11), lengthwise securing must be ensured even in the conditions of maximum twisting of the chassis (e.g. off-road).

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

Connection with Greater Elasticity

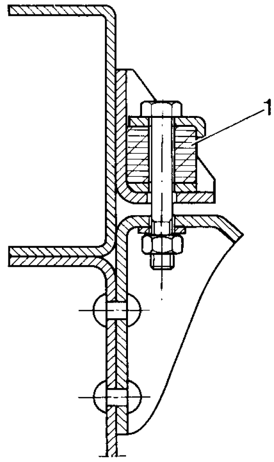
Since there is no clear definition for a torsionally rigid body or indeed the arduousness of a vehicle mission, such flexibility is required for all body types except for special applications (e.g. crane mounting). A helical spring (IVECO part number 92940105) is available from Iveco Parts Departments and should be used at the first and second body mounting points each side on Day cab vehicles <u>and</u> ML65E and ML75E Sleeper cab vehicles. For all other Sleeper cab vehicles the springs are only fitted at the first body-mounting brackets.

The detail of the body mounting and installation is as follows:

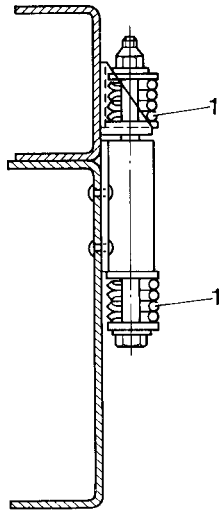
Spring stiffness	= 424 N/mm
Free length	= 44 mm
Installed length	= 41 mm (first position, each side)
	= 39 mm (second position each side)

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

Figure 3.11



1 Elastic element



1 Elastic elements

3.1.2.2 Connection with U-bolts (clamps)

The most important mounting of this type is illustrated in fig. 3.12.

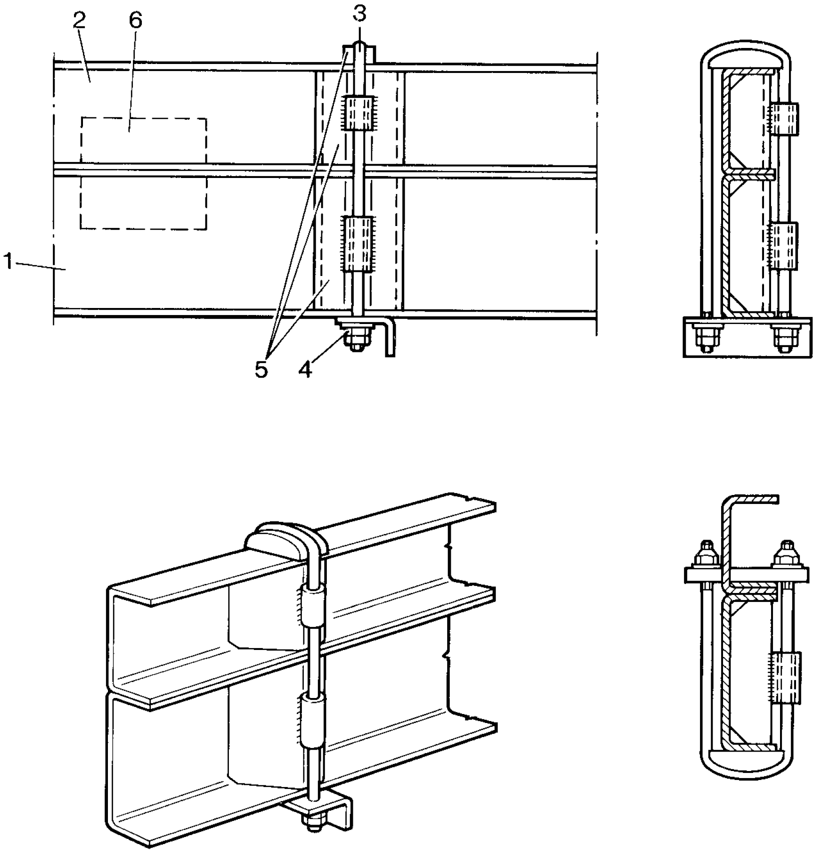
In this type of construction the bodybuilder must place a spacing piece, preferably made of metal, between the flanges of the two side members at the point where the U-bolts are located, in order to prevent the bending of the frames when the U-bolts are tightened.

In order to guide and to better contain transversally the structure that is attached to the vehicle's chassis, this type of joint must be complemented by the addition of plates that are attached to the subframe and chassis as shown in fig. 3.12.

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

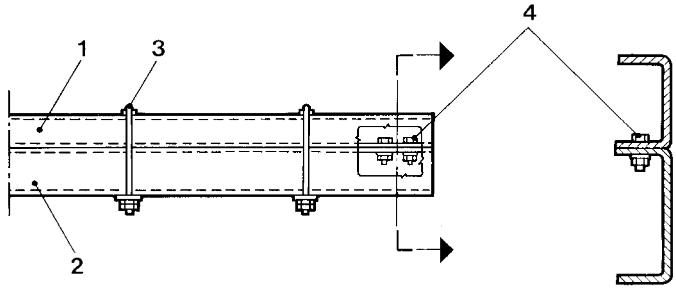
For this purpose it is also possible to use bolt-type connections at the rear end of the chassis as illustrated in fig. 3.13.

Figure 3.12



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

Figure 3.13



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

3.1.2.3 Connection made with Plates for Longitudinal and Transversal Securing Anchorage (Rigid type joint)

This type of anchorage shown in fig. 3.14 is achieved by means of a plate that is welded to the auxiliary frame and is secured to the chassis by means of 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 3.2, 3.4 and 3.5 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).

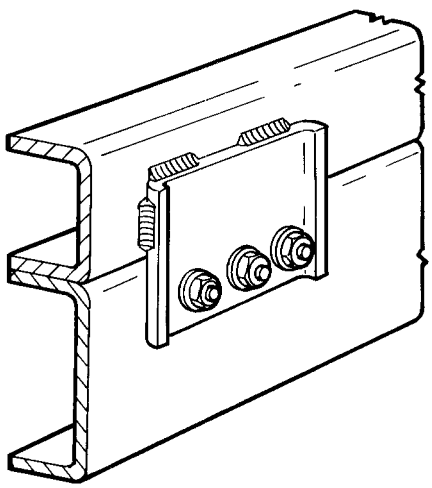
- When the bodies cause high bending moments on the frame and the relevant strength has to be increased by means of shear resistant connection between frame and subframe, or the subframe height has to be limited as far as possible (e.g. towing of central axle trailers, crane on rear overhang, tail lifts),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

Frame/subframe section height ratio	Max. distance between the centreline of the shearing resistant plates 1)	Models	Min. characteristics of the plates	
			Thickness (mm)	Fixing hardware dimensions (at least 3 screws each plate) 2)
> 1,0	700	60 ÷ 100	5	M 12
		120 ÷ 150	6	
≤ 1,0	500	≥ 170	8	M 14

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 3.14



3.1.2.4 Mixed Connection

On the basis of instructions given for the construction of the subframe (point 3.1.1.) and considerations included in the general section of point 3.1.2., 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 flexible connections (brackets, clamps) and rigid connections (plates for longitudinal and transversal anchorage).

As a guideline it is advisable to have elastic 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 (e.g. tippers, cement mixers, crane on vehicle rear overhang etc.).

3.2 Fitting Box-bodies

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 3.1.

Table 3.1 (for models of class MP 190 up to MP 330 and 380, the data given below apply to loads on front axle up to 8000 kg).

MODELS	Wheelbase (mm) (referring to the driving axle, on vehicles with 3 axles with third rear axle)	Minimum reinforcing runner	
		Section modulus Wx (cm^3)	Dimensions (mm)
ML 60; 65; 75; 80	up 3690	21	80x60x5
ML 60; 65; 75; 80 ML 100	above 3690 up 3690	26	100X50X5
ML 100	above 3690	36	100x60x6
ML 120; 120EL[7]; 130; 150	up 3690	31	100x60x5
ML 120; 120EL[7] 130; 150	above 3690	36	100x60x6
ML 170	-	46	120x60x6
MH 190; MP 180/190[2)4)] MP 240; MH 260	up 6300[2)]	89[3)] (46)[1)]	160x70x7[3)] (120X60X6)
MP 260 (6x4) fino 330 H MP 380 H	up 4800/1380 up 4200/1380	46	120x60x6
MP 340 H	4200/1380 up 5020/1380 up 5800/1380	46 119 (57)[5)6)] 245 (150)[5)6)]	120x60x6 200x80x6 (140x60x6)[5)6)] 250x100x8 (200x80x8)[5)6)]

1) Possible alternative, for models MT 190, MP 180 and MP 190, using cleat plates for the entire length of the chassis and connection with brackets in the front area.
2) For MH and MP models with a wheelbase of up to 5700 mm and rear overhang up to 2300 mm. A longitudinal runner 120x60x6mm (Wx 46cm3 minimum) is sufficient for all models with 2 or 3 axles up to a maximum front axle load of 7500 kg.
3) For models with pneumatic suspension (190P; FP) with wheelbase up to 6300 mm and rear overhang over 2300 mm. When the maximum permitted rear load is used, the longitudinal runner must use materials with a yield of over 320 Nm/mm2 and be connected to the chassis by shear resistant plates (cleat plates). The plates should start approximately 1000 mm before the centre line of the drive axle and continue to the end of the chassis.
4) For models 240P; 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) Longitudinal runners must have a yield of over 360 N/mm2.
6) With front axles loads up to 2 x 7500 kg.
7) On the MLL version, use a runner with Wmin no less than 57cm3.

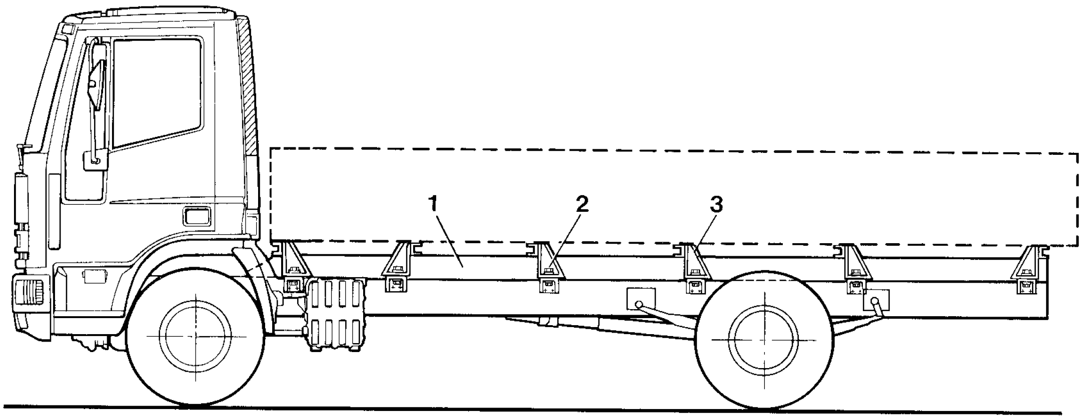
The attachment is carried out using the brackets arranged on the vertical web of the side members. If such brackets have not been provided by the Manufacturer, they must be installed according to the specifications given in point 3.1.2. In order to provide an adequate lengthwise securing when the brackets or clamps are used, it is good common practice to arrange a rigid joint (one on each side) on the rear overhang, using plates or bolts on the upper flange of the side member (see figs. 3.13 and 3.14).

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 lengthwise thrusts, as shown in fig. 3.15

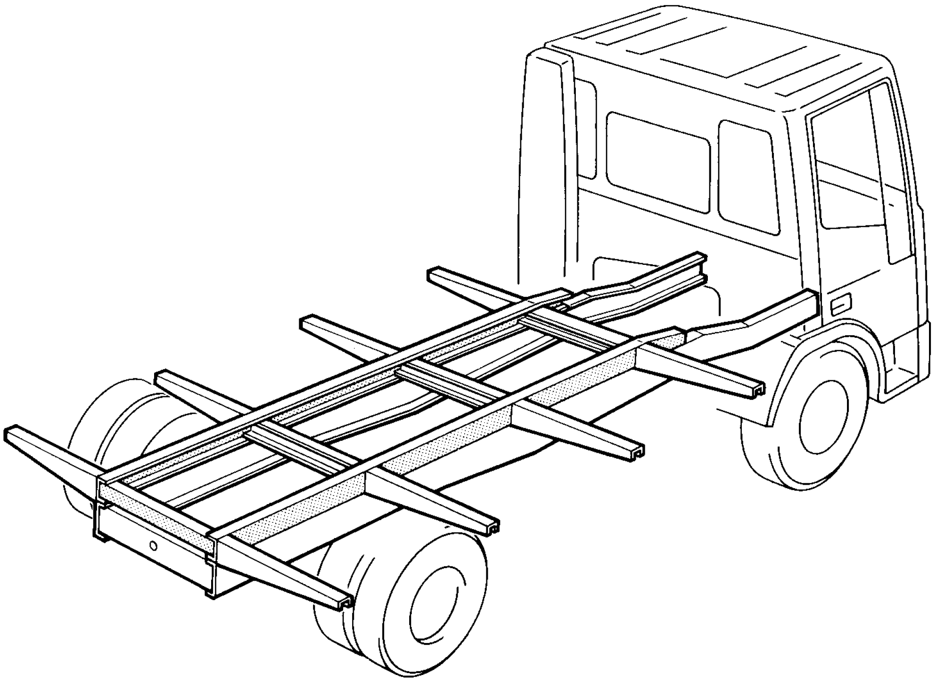
For special builds (e.g. specific vehicles to transport liquids) when a reinforcing runner of limited height is needed, the subframe structure may be integrated with the body anchoring brackets matching the height of the whole longitudinal reinforcement runner (see fig. 3.16). In this case, rear wheel boxes may be fitted at the base of the fixture.

Figure 3.15



1 Subframe
2 Brackets
3 Securing anchorages

Figure 3.16



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 mounting of the box-type bodies and of structures with high torsional rigidity in general requires - particularly when the vehicle is used off-road -the employment of elastic joints towards the front end of the structure to avoid limiting the torsional capacity of the main frame excessively.

3.2.1 Demountable Bodies

The construction of interchangeable equipment that is meant to be lifted off when replacement is necessary (e.g. through lifting devices or the vehicle's air suspension itself) and then to be positioned on four supporting posts, generally requires the adoption of a subframe featuring side runner profile dimensions as specified in table 3.1 or of adequate structures comprising coupling and hoisting devices.
Adequate reinforcements must be fitted whenever concentrated loads imposed by lifting apparatus determine high stress on vehicle chassis.

To ensure good operation, all vehicle stability conditions must be checked out in accordance with the suspension specifications. Models that are equipped with a pneumatic suspension on the rear axle or full pneumatic suspension are particularly well suited for this type of use.

The lifting devices acting vertically may be fitted not only on the subframe but, in special cases, also be mounted on plates of adequate dimensions connecting the chassis frame to the subframe.

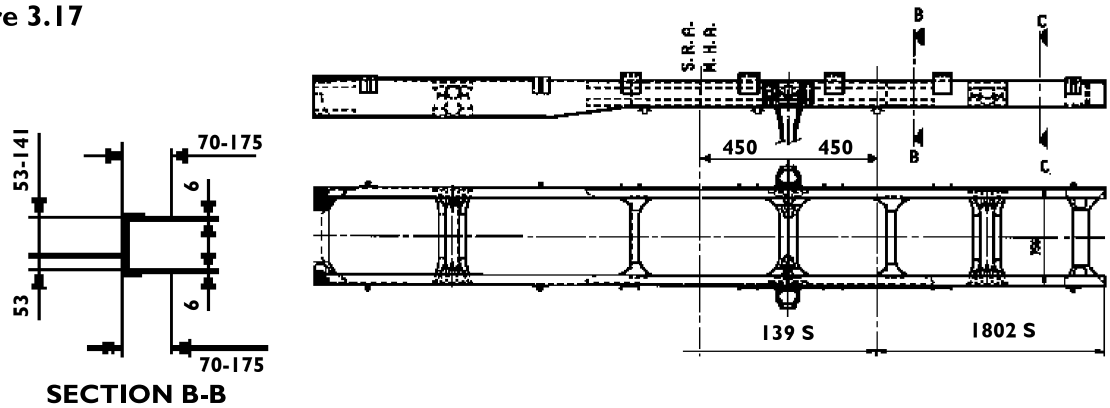
Regarding the connecting of bodies, especially when quick locking systems are used, it is necessary to provide adequate supports to counteract the longitudinal and transversal thrusts under dynamic conditions.

The possibility of doing without a subframe or a specific substructure may be submitted to the Manufacturer for approval provided that:

- The interchangeable body must rest along its entire length on the vehicle chassis or at least cover most of the area where suspension attachments are.
- An adequate number of coupling devices must be fitted along the side member vertical web.
- Lifting apparatus anchoring must be such that its loads upon the chassis are limited.

3.2.2 Car transport

Figure 3.17



3.3 Building Vans

To mount the body onto the vehicle chassis, a structure made up of longitudinal runners and cross members may be built (see fig. 3.16). The dimensions of the longitudinal runners should be of the order of those shown in Table 3.1.

Longitudinal runners may be dispensed with provided the cross members used for the floor structures are placed no more than 700 mm from one another, forming a sufficiently rigid (self-bearing) structure.
In order to provide the required stability and to avoid the front end of the chassis being too rigid, the suggestions given in point 3.2 should be followed.

3.4 Tipping Bodies

The use of tipping bodies, whether end or three way, subjects the chassis to notable stress. For this reason it is most important to select the right vehicle from among those intended for this use. Therefore we list here the specifications that must be adhered to for this type of construction subdivided according to light or heavy duty. Tables 3.2 and 3.3. 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 abided by.

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

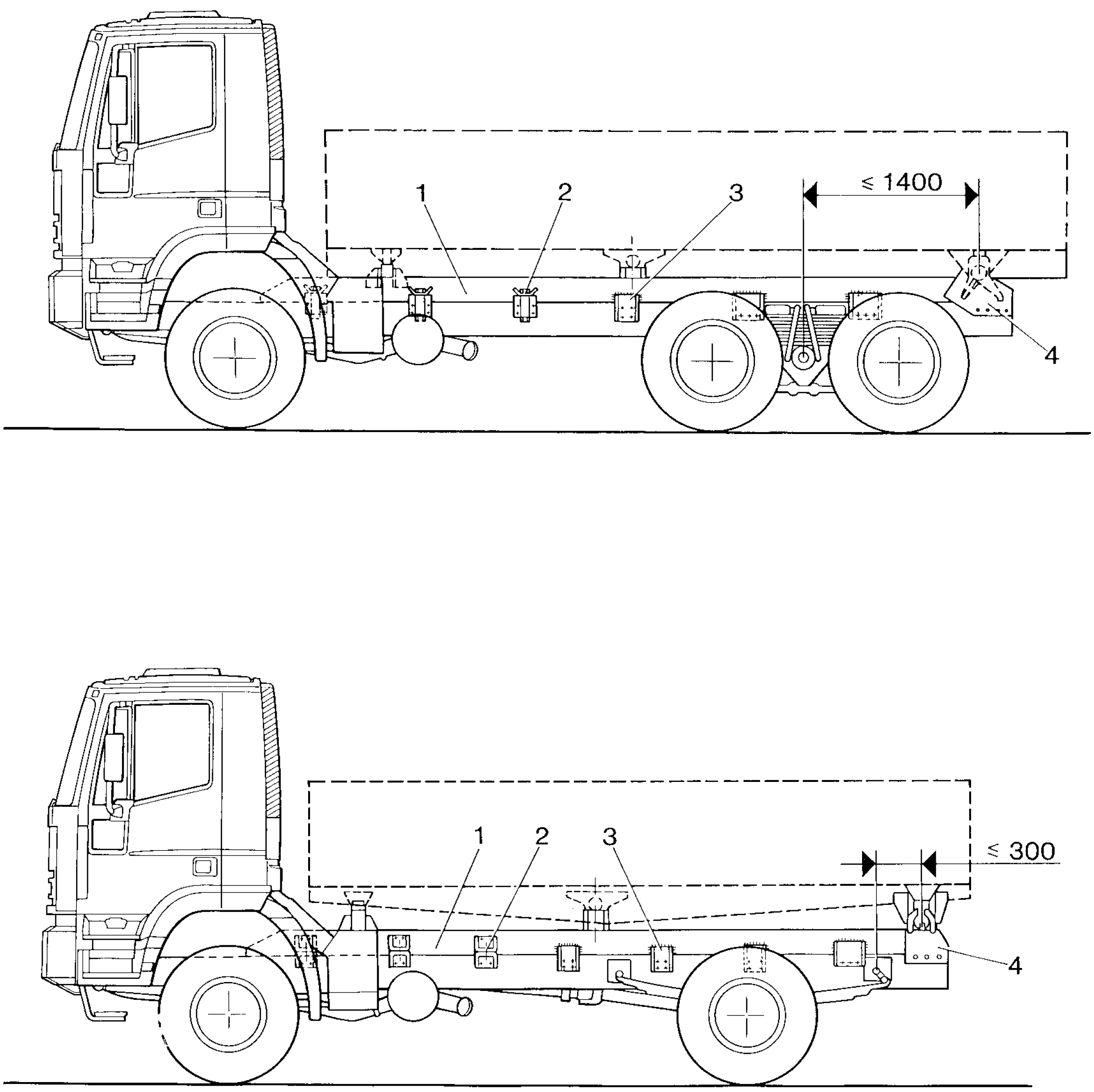
After fitting the body, the bodybuilders must ensure that the vehicle remains stable during tipping.

The following points must be kept in mind:

- The subframe must be (see figs. 3.8 and 3.9) suitable for the vehicle type and for the specific operating conditions. It must have adequately dimensioned side and cross members and be stiffened at the rear by box-type construction and crossbraces. Anchoring the subframe to the chassis, flexible joints brackets or shelves must be placed at the front end, whereas the rear section requires rigid-type joints (plates, see fig. 3.14) to allow the added structure to contribute more to the rigidity of the whole. The "omega" brackets can be adopted on vehicles which are already equipped with them.
- The rear tipping hinge must be mounted on the subframe as near as possible to the rear support of the rear suspension. In order not to impair the stability of the vehicle during tilting operations and not to increase excessively the stress on the chassis, it is recommended that the distances between the tipping hinge and the rear spring support or tandem centreline be observed (see fig. 3.18). If for technical reasons this cannot be achieved, small increases may be permitted provided a higher strength subframe is used, in order to increase the rigidity of the rear end. In the case of large volume transports requiring long bodies , it is advisable (in those cases where it is permissible) to lengthen the wheelbase of the vehicle.
- Great care must be given to the positioning of the lifting device both in terms of providing supports of adequate strength and in order to position the mountings precisely and conveniently. It is advisable in any case to place the device to the front of the centre of gravity of the body plus payload so as to reduce the extent of the localised load.

- For both under floor and front end tipping gear installations it is recommended that appropriate stabiliser acting as a guide for the stroke of the tipping body, are fitted.
- The hinge of the lifting unit must be mounted on the subframe.
  The useful volume on the body must conform - with the consideration of the maximum permissible mass on the axles - to the density of the material that is to be transported (a density mass of approx. 1600 kg/m^3 is to be used for excavated material). When freight having a low density is transported, the useful volume may be increased within the limits established for the maximum height of the centre of gravity of the payload plus the fixtures.
- The bodybuilders must see to it that the functioning and safety of all parts of the vehicle (for instance, the positioning of lights, tow hook etc.) is safeguarded, in full compliance with the current safety regulations.

Figure 3.18



1 Subframe
2 Brackets
3 Plates
4 Butt strap

3.4.1 Heavy-duty Service

In table 3.2 are listed the vehicles that are suitable for heavy-duty operations along with the minimum dimensions for the main subframe runners.

Particular attention must be paid to the strict adherence to the general specifications given to ensure the vehicles have adequate stability in the rear tipping phases.

When mounting tipping bodies on chassis provided with pedestal brackets or other types suitable for different types of bodies, the latter shall be replaced by shear/thrust resistant plates (cleat plates) from the rear spring/bogie front hanger bracket to the rear chassis or additional plates shall be fitted.

The rear frame overhang may have to be shortened, so that the maximum distance to the position of the tipping hinge comply with fig. 3.18.

For the models with two rear axles, the following will be complied with:

- The box-type construction of the reinforcing longitudinal sectional member (see fig. 3.4) will include the section that is included between the rear edge and 1300 mm in front of the centreline of the two axles.
- The cross-braces will include the area between the centreline of the twin axle and the rear end of the chassis.
- The tipping support may not be positioned more than 1400 mm from the centreline of the twin axle.

Table 3.2

For MP models the subframe longitudinal runners should be boxed in and cleat plated to the chassis (as fig. 3.4; 3.8 and 3.17), from the rear end of the longitudinal to a point 1000 mm in front of the centre line of the rear axle(s).

MODELS	**Wheelbase (mm)**	**Section modulus Wx (cm^3) based on the yield point of the material**		**Dimensions (mm) depending on the yield point of the material**	
		Fe360=240	**Fe510=360**		
		240	360	240	360
ML 60K; 65K ML 75K; 80K	- -	39		120x60x5	
ML 65H	-	39		120x60x5	
ML 85H	-	39		120x60x5	
ML 95W	-	46		120x60x6	
ML 100K	-	46		120x60x6	
ML 120K		65	26	140x70x6	100x50x5
ML 120H	-	65		140x70x6	
ML 130K		74	36	140x70x7	100x60x6
ML 135W	-	46		120x60x6	
ML 150K	-	117	74	160x70x7[1)]	140x70x7
ML 150H	3105 3690	57		140x60x6	
ML 170K	3690 4185	74 89		140x70x7 160x70x7	
ML 260KE	3830 4180	105 135		180x70x7 200x80x8	
MP 190H; W	3800/4200		65[1)] 113[2)] 150[3)]		140x70x6[1)] 180x70x8[2)] 200x80x8[3]

Table 3.2 (continued)

MODELS	Wheelbase (mm)	Section modulus Wx (cm^3) based on the yield point of the material		Dimensions (mm) depending on the yield point of the material	
		Fe360=240	Fe510=360		
		240	360	240	360
MP 260H; W	up to 3820/1380		89 1) 113 2) 150 3)		160x70x7 1) 180x70x8 2) 200x80x8 3)
MP 330H; W	up to 3820/1380		113 1) 130 2) 150 3)		180x70x8 1) 180x80x8 2) 200x80x8 3)
MP 380H; W	up to 3820/1380	-	89 1) 113 2) 150 3)	-	160x70x7 1) 180x70x8 2) 200x80x8 3)
MP 340H	4200/1380 5020/1380	-	133 4) 190 4)	-	180x70x7 4) 200x80x8 4)
MP 410H	up to 5020/1380	-	162 2)4) 190 3)4)	-	180x80x8 2) 200x80x8 3)

1) For max. load on the front axle of 7500 kg
2) For max. load on the front axle of 8000 kg
3) For max.load on the front axle of 8500 kg. Use a section with min. dimensions of 220 x 80 x 8 mm for versions 8460 (340 and 380 HP)
4) Boxed section for entire length.

3.4.2 Light-duty Service

For these operations we recommend using vehicles with short wheelbases. In table 3.3 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 body suitable for the vehicle and its intended operation.
- The rear end of the auxiliary frame must be stiffened using e.g. box-type sections, crossbraces, cleat plates etc.
- The rear tipping hinge must be placed as near as possible to the rear support 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 not exceed 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, 4x2 and 6x2 versions, 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 3.3

MODELS (Wheelbase mm)	Section modulus Wx (cm^3) based on the yield point of the material		Dimensions (mm) depending on the yield point of the material	
	Fe360=240 240	Fe510=360 360	240	360
ML 60; 65 ML 75; 80	26		100x50x5	
ML 100	39		120x60x5	
ML 120EL	57		140x60x6	
ML 120	31		100x60x5	
ML 130	36		100x60x6	
ML 150	57	36	140x60x6	100x60x6
ML 170 MT 180 MT 190	46		120x60x6	
MP 180; MH 190 MP 190	46 89 2)		120x60x6 160x70x7 2)	
MP 240/TN; MH 260/TN MP 260(6x4)	89/110 1)		160x70x7 1)	
MP 240/FT; /PT; MH 260/FT; /PT MP 260/P; /FP(6x4)	150/190 1)	89/110 1)	200x80x8 1)	160x70x7 1)
MP 240/P; /FP; /PS; /FS; MH 260/P; /FP; /PS; /FS	173/222 1)	89/110 1)	220x80x8 1)	160x70x7 1)
MP 340H	89/110 1)		160x70x7 1)	

1) Necessity for a boxed section with connections resistant to shearing, starting from approx. 1000 mm in front of the centreline of the drive axle(s) up to the rear end of the chassis.
2) For 8000 kg on front axle.

3.4.3 Removable Containers

Not all vehicles lend themselves equally well to be used for removable type containers (i.e. the containers which can be shifted to the ground by laying or slipping down). Heavy duty vehicles are certainly better suited to this use but it is best to consult the Manufacturer concerning the suitability of the various models in relation to the use of the vehicle.

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

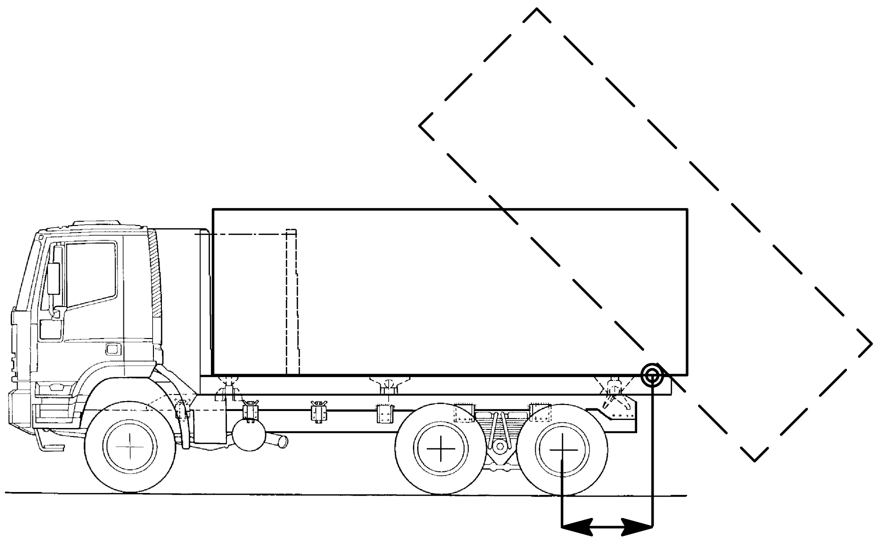
For this reason, the auxiliary frame to be used (see point 3.1) should be of the same dimensions as that for light tippers. Where vehicles with long wheelbases or rear overhangs are used, it may be necessary to use runners of larger dimensions for the subframe.

The lifting devices must be anchored to the subframe as indicated in point 3.4.

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 work procedures, particularly when the laying containers are used. This supports are also recommended in case rear axles with air or mixed suspension are used. As an alternative, refer to the explanations in chapter 3.4.2. concerning the air bleed 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 1.2.3.); when the containers for rather high payloads are used, a rear stabilising bar as well as stiffer rear suspension must be used, whenever the Manufacturer requires it.

Figure 3.19



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

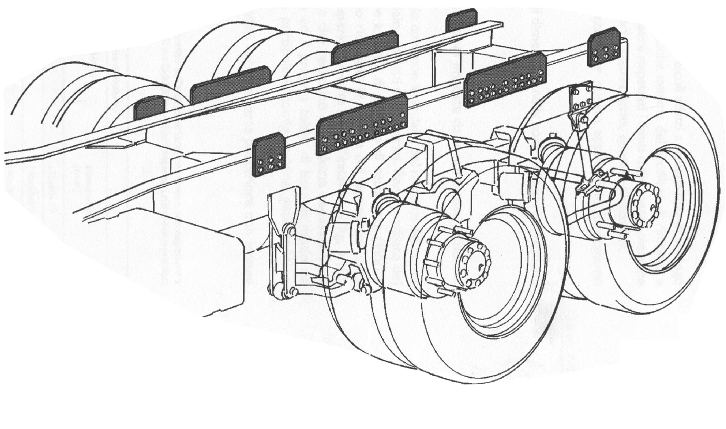
3.5 Installation of Concrete Mixers

Concrete mixers may be installed only on vehicles that are suitable for this purpose as indicated in table 3.4, where also the minimum requirements for the reinforcing sections and the capacity drums are given. It is clear that the maximum permissible mass for the vehicles must be respected. Stabilising bars must be used for these applications whenever they are available.

HB models, specially designed for these applications, mainly feature:

- Specific frame rear overhangs.
- Large frame subframe connecting plates in the central portion of the bogie.

Figure 3.20



- Suitably sized stabilizer bars.
- Vertical engine exhaust.
- No rear underrun bar.

In addition to observing all the possible government regulations relating to the installation of concrete mixers, the following points must be kept in mind:

- The concrete mixer must be fitted with its own continuous steel subframe in observance of point 3.1, so as to distribute the concentrated weight as much as possible over the chassis. For the runners of the subframe, sections with a moment of resistance (Wx) and a moment of inertia (Jx) not lower that those for the sections on table 3.4 may be used, which permit substantial reductions in the height of the added structure's centre of gravity (i.e. boxed-type structures or sections with the upper flange turned toward the outside see fig. 3.21).
- Suitable cross members must be provided to ensure adequate rigidity in the mounting between the cement mixing apparatus and its basic frame, so as to free the vehicle's chassis from the forces that result from the particular geometry and functional configuration of the concrete mixer.
  The subframe must be suitably stiffened towards the rear with appropriate crosspieces or crossbraces.

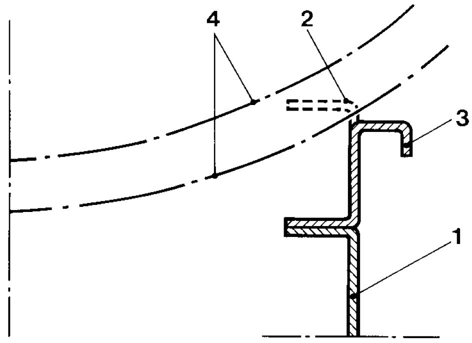
Table 3.4

(The dimensions of the sections refer to the maximum permitted load on the front axle, not exceding 7500 kg except for model MP 410 H for which the section indicated is valid up to 2 x 8500 kg - higher values require sections of greater size to be defined upon request).

MODELS	**Useful drum capacity (m^3)**	**Minimum strengthening**	
		Section modulus Wx (cm^3)	**Dimensions (mm)**
ML 150K	3 ÷ 3,5	66	120x80x7 1)
ML 170K	4 ÷ 5	81	140x80x7 1)
ML 260 KE	6 ÷ 7	108	140x80x8 1)
MP 190H; W	4 ÷ 5	66	120x80x7 1)
MP 260H; HB; W	6 ÷ 7	66	120x80x7 1)
MP 330H; W	8 ÷ 9	81	140x80x7 1)
MP 380H; W	10	81	140x80x7 1)
MP 340H; HB 2)	7 ÷ 9	81	140x80x7 1)
MP 410H; HB	10	108	140x80x8 1) 3)

1) Other runner section permitted (see fig. 3.18)
2) Up to wheelbase 5020/1380 mm
3) Boxed section

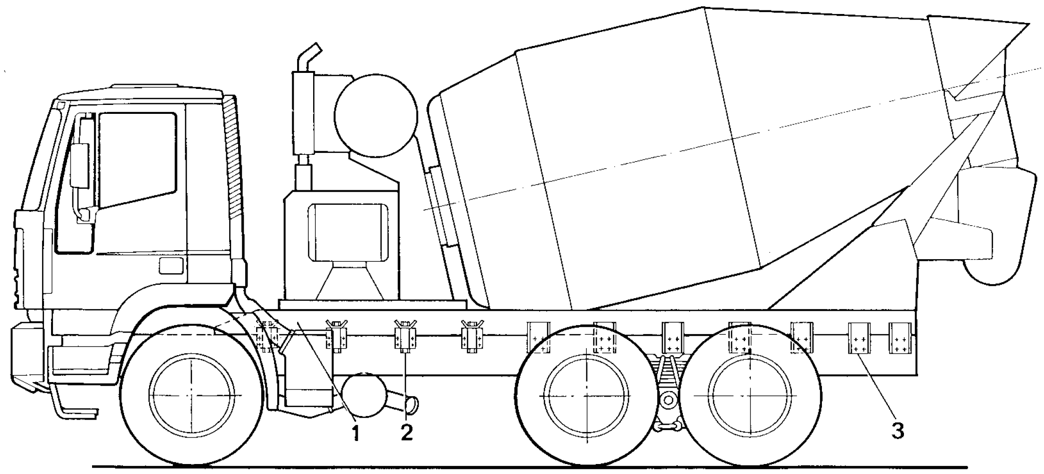
Figure 3.21



1 Main frame
2 Regular channel profile
3 Runner with upper flange turned over
4 Position of drum

- The mounting (see point 3.1.2) must affect only the two frames and must be constructed in such a manner as to provide a secure anchorage. For those vehicles which are not yet equipped with them, we recommend the use of cleat plates to avoid slippage in length or to the side, restricting the use of flexible joints to the front end of the subframe (see figs. 3.14 and 3.22).

Figure 3.22



1 Subframe
2 Brackets
3 Cleat plates

- When installing the cement mixer assembly, care must be taken to position the centre of gravity as close to the front axle as possible, obviously with due consideration to the maximum permissible weight on the axle itself.
  To obtain the necessary stability of the vehicle and its safety while in operation, particularly when cornering or on rough terrain with transverse and/or longitudinal slope, the swing effect of the payload inside the drum must be taken into consideration since it results in a shift of the dynamic centre of gravity of the payload and consequently it adversely affects the vehicle's behaviour.
- Specific PTO solutions are available on request that are independent of the clutch and suitable for concrete mixer applications (see point 4.5.2). The auxiliary motor to control the drum must be mounted on an appropriate elastic suspension.
- Due to rotation of the drum the centre of gravity of the load moves and therefore the differences in the trasverse load must be kept within acceptable limits.

3.6 Tractors for Semitrailers

For this use the vehicles provided by the Manufacturer 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.

3.6.1 Position of the Fifth Wheel

The position of the fifth wheel may be selected from among the positions established by the Manufacturer in relation to the tare of the tractor in its standard version. If, as a result of subsequent additions and/or modifications, the empty mass should be changed, reference must be made to the actual mass 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 1.2.1).

To ensure a perfect 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 3.6.3.).

3.6.2 The Fifth Wheel

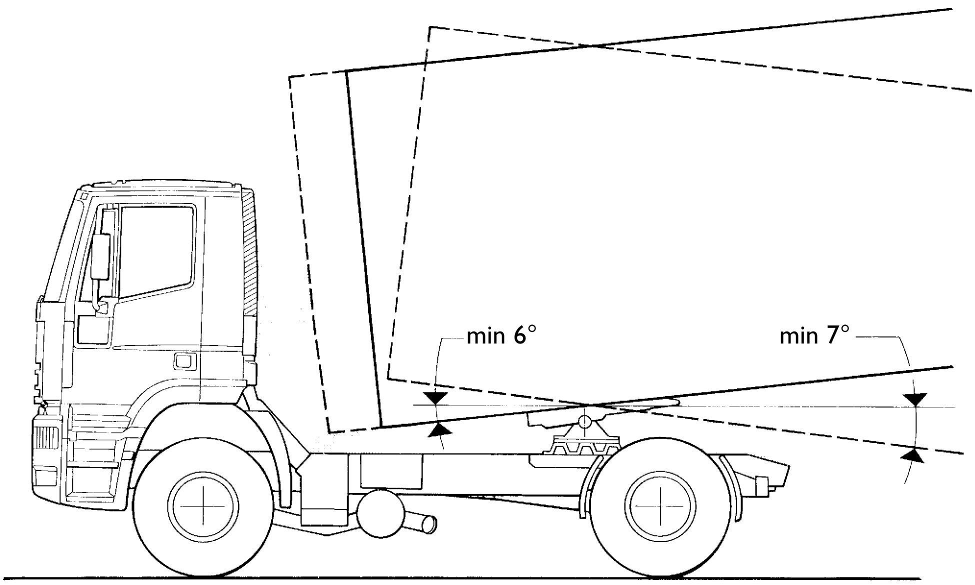
All the fifth wheels having load characteristics, dimensions and performance that have been declared suitable for a specific use by their manufacturer, may be used on our vehicles. The type of fifth wheel to be selected depends on the vehicle and on the type of transport to be carried out. For instance,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

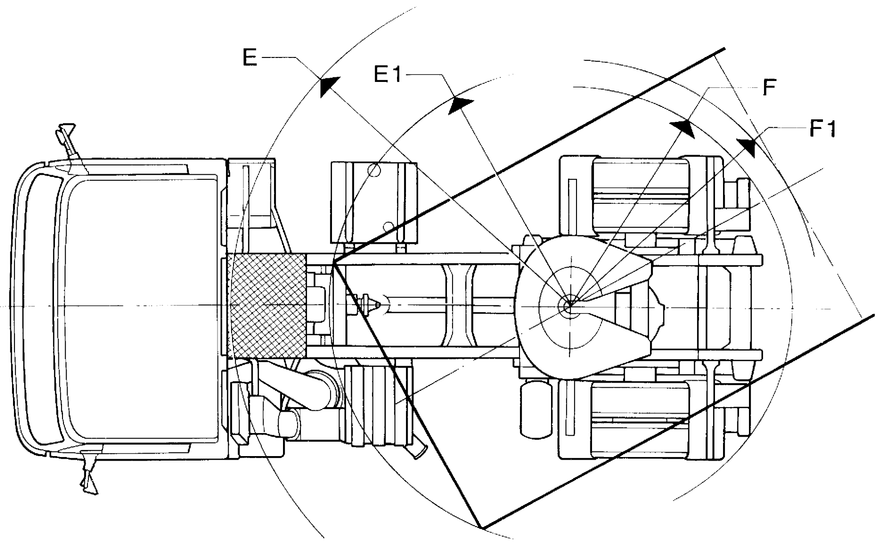
Where government regulations require it, fifth wheels must meet all requirements or be homologated. Regarding their anchorage, number of bolts, dimensions, materials and positioning of longitudinal and transverse stops, see instructions of the manufacture of fifth wheels.
As the fifth wheel is very important to vehicle safety, it must not be modified in any way.

3.6.3 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 (e.g. ISO R 1726) for road use (see fig. 3.23).

Figure 3.23





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

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

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

3.6.4 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 to 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.
- 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.
- The component parts of the mounting, in those cases when it consists of several parts, must be joined to one another by welding and/or rivets so as to form a single unit.
- The anchoring of the mounting to the tractor (see figs. 3.24 and 3.25) must be made on the angle bars, if provided or as otherwise specified.

For the joining, class 8.8 min. bolts (in number and diameter at least equal to that required to secure the fifth wheel) must be used together with a device to preclude their becoming loose.

As for attaching the longitudinal stops, welding is not permitted nor are holes made directly into the flange of the side member.

It is permissible to attach slide rails to the chassis, on building and fitting them remember:

- 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.

3.6.4.1 Installation of Simple Plate-type Mounting

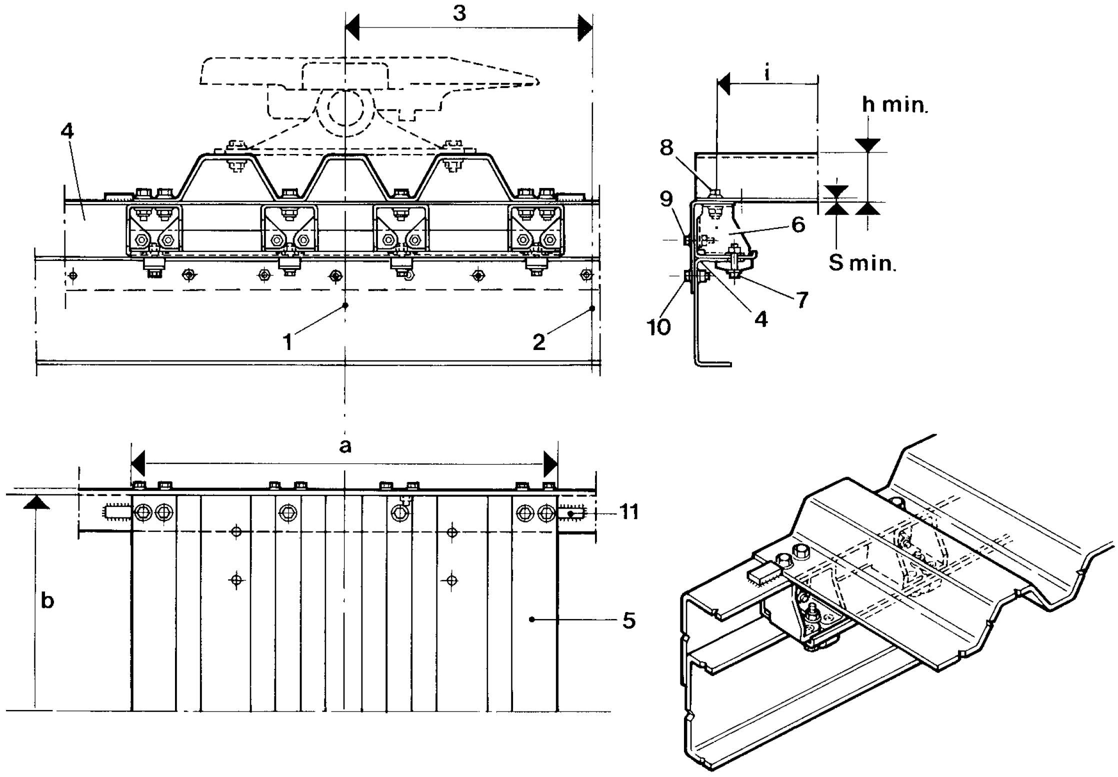
As a general rule, for tractors that are intended for normal road use, and if not otherwise specified by the Manufacturer, the mounting plate for the fifth wheel must be fret-shaped (see fig. 3.24), connected to the chassis by means of longitudinal runners and appropriate brackets.

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 together with the vehicle and provisionally fastened to it. The final fastening operation 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 implemented.

Fitting instructions for Models ML 180E..T; T/P (EuroCargo)

Figure 3.24



1 Fifth wheel centreline
2 Rear wheel centreline
3 Fifth wheel forward displacement
4 Longitudinal runners
5 Fret-shaped plate (bed plate)
6 Bracket assembly
7 Lower mount of bracket
8 Mount of fret-shaped plate (class 8.8)
9 Lateral mount of bracket
10 Lateral mount of longitudinal runners
11 Longitudinal stops

Drilling

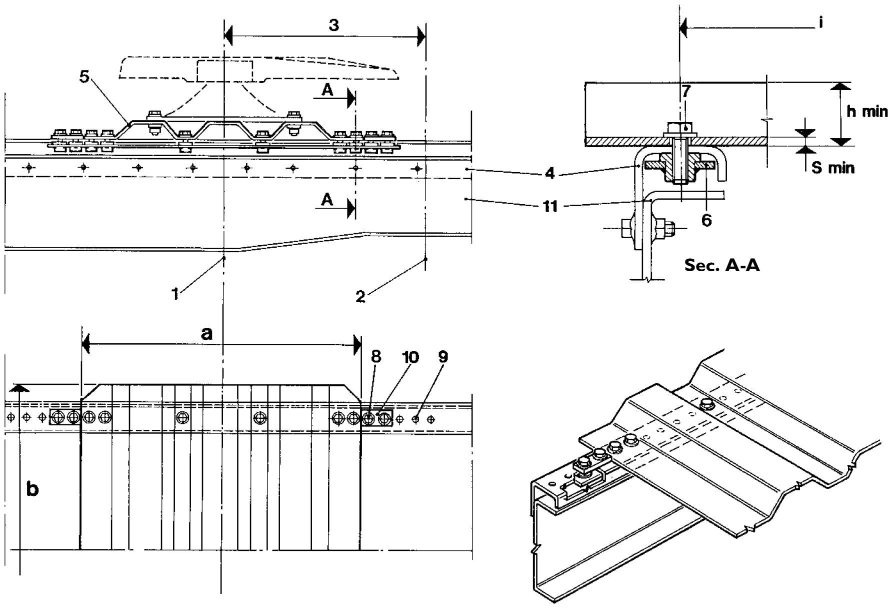
After assessing the fifth wheel position, the holes, dia. 13.5 (on the web) and 17 mm (on the flange) are to be drilled on the longitudinal runner (see fig. 3.24) using the bracket assembly 6 and plate 5 as a drilling jig.

Mounting of brackets and fifth wheel bed plate (fig. 3.24)

- Ensure the bracket assembly 6 rests on the chassis, tighten the screws 7 (M12 - tightening torque 80 Nm).
- Plate 5 is to mount to the longitudinal runner by means of screws 8 (M16 - tightening torque 180 Nm).
- Tighten screws 9 and 10 (M12 - tightening torque 80 Nm).
- Weld the longitudinal stops flush with the plate.

Fitting instructions for Models ML 260; ML 280E; 280E; 320E.. T; T/P (EuroCargo)

Figure 3.25



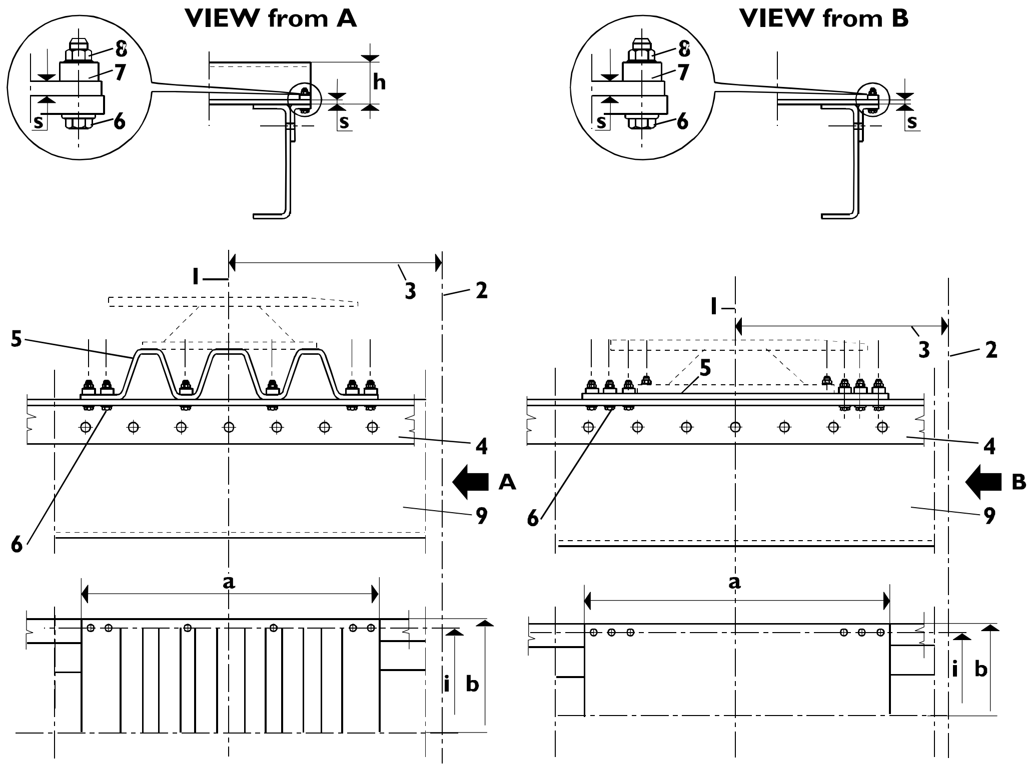
1 Fifth wheel centreline
2 Rear wheel centreline
3 Fifth wheel displacement
4 Longitudinal runners
5 Fret-shaped plate (bed plate)
6 Bracket assembly
7 Mount of fret-shaped plate (screws class 10.9)
8 Mount of Longitudinal stops
9 Drilling for fifth weel position
10 Longitudinal stops
11 Chassis side-member

Bed Plate Fixing (see Fig. 3.25)

- Having determined the 5th wheel position (modular position every 45 mm) secure the bed plate to the longitudinal runner with screws 7 and relevant brackets 6.
- Secure the longitudinal stops with screws 8.
- Tighten M16 screws 7 and 8 (tightening torque 260 Nm to 300 Nm).

Fitting instructions for 4x2 Models
MH / MP / 440 E..T ; T/P ; T/FP (EuroTech / EuroStar)
MP 400 E..HT (EuroTrakker)
(Solution for vehicles with chassis no. from 172608)

Figure 3.26



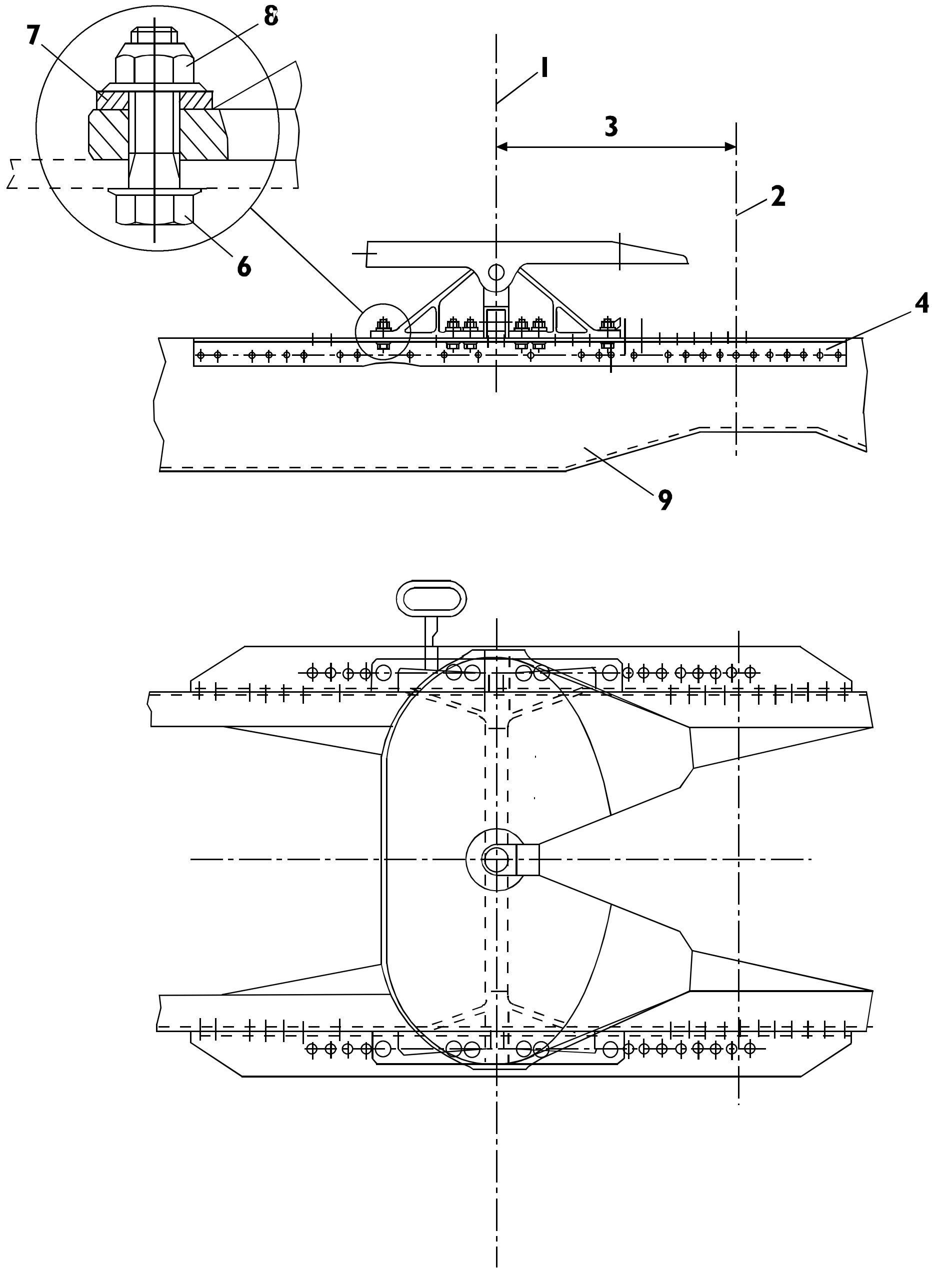
1 Fifth wheel centreline
2 Rear wheel centreline
3 Fifth wheel forward displacement
4 Longitudinal runners
5 Fifth wheel bed plate
6 Class 10.9 M16x1.5 screws
7 Fixing spacers (h=15mm)
8 Self-locking flanged-head nuts
9 Chassis side members

Bed Plate Fixing (fig. 3.26)

- 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).

Assembling instructions for models 4x2: MH/MP/LD 440 E…T; T/P; T/FP (Eurotech, Eurostar) (JOST JSK 37 ER fifth wheel) With crosspiece (Option 7727 – 7728)

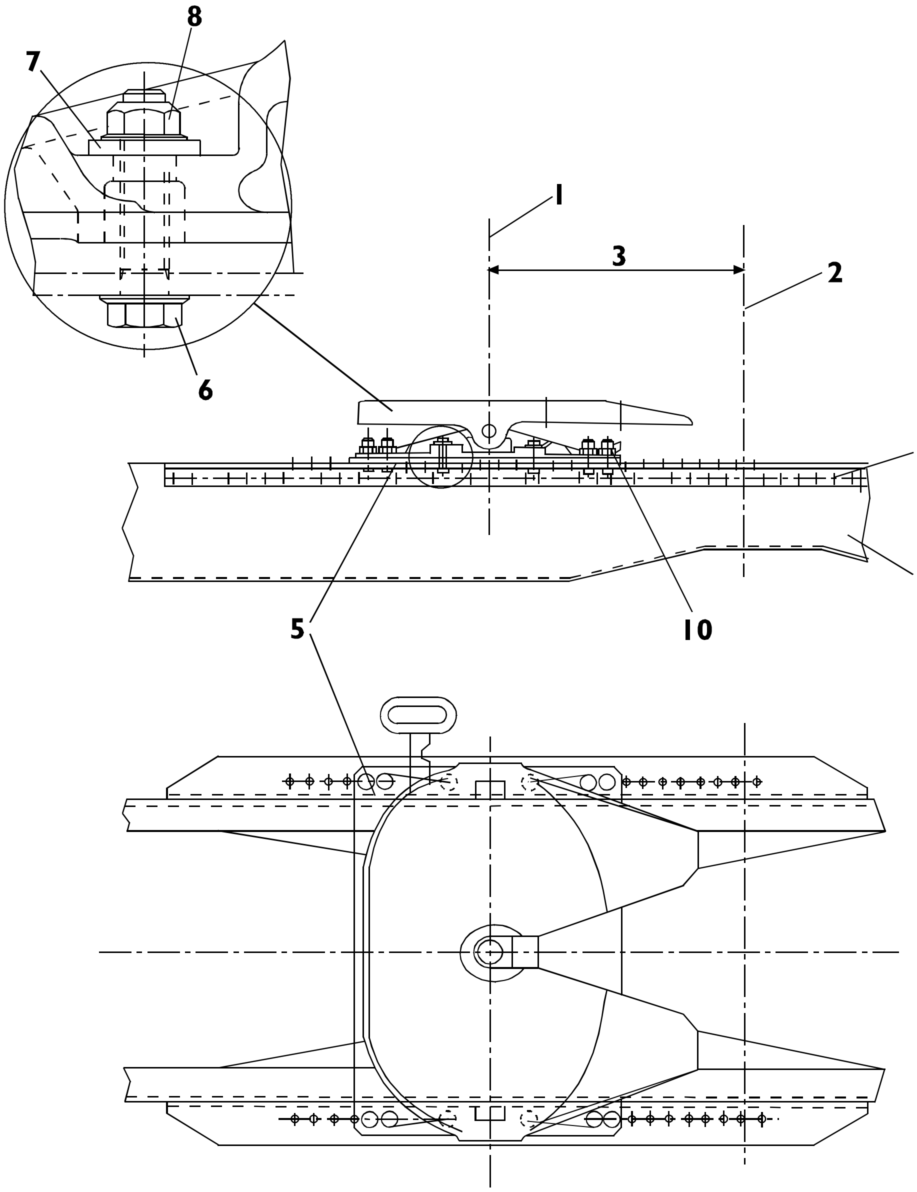
Figure 3.27



1 Fifth wheel axis
2 Rear wheel axis
3 Fifth wheel position
4 Longitudinal sections
5 -
6 Flanged screws M16x1.5-10.9
7 Washer (h = 6 mm)
8 Flanged-head self-locking nuts
9 Chassis longitudinal frame members

Assembling instructions for models 4x2: MH/MP/LD 440 E…T; T/P; T/FP (Eurotech, Eurostar) (JOST JSK 37 ER fifth wheel) Without crosspiece (Option 7830)

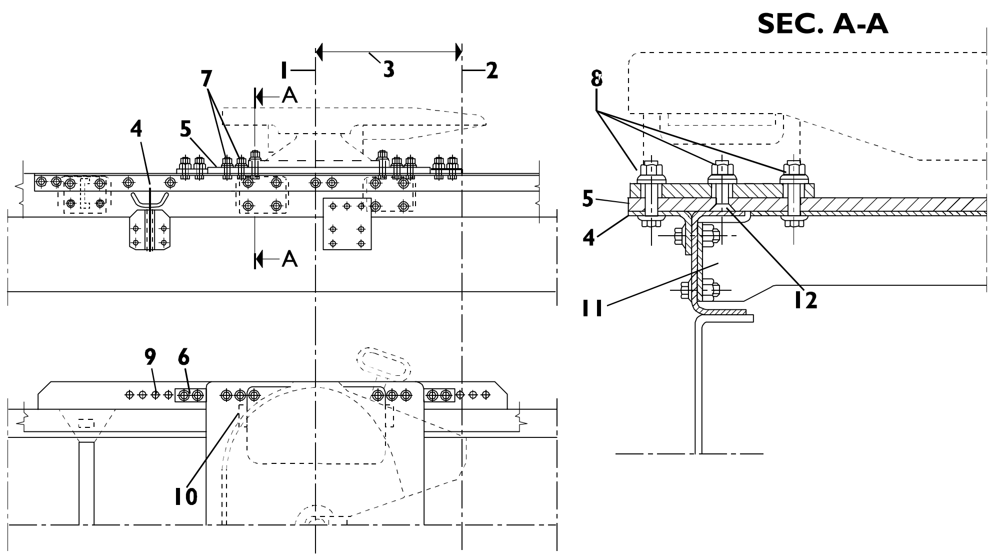
Figure 3.28



1 Fifth wheel axis
2 Rear wheel axis
3 Fifth wheel position
4 Longitudinal sections
5 Plate
6 Flanged screws M16x1.5-10.9
7 Washer (h = 6 mm)
8 Flanged-head self-locking nuts
9 Chassis longitudinal frame members
10 Fastening spacers (h = 15 mm)

Fitting instructions for 6x4 and 6x6 Models MP720E.. HT/ WT (EuroTrakker) with IVECO fifth wheel support structure

Figure 3.29



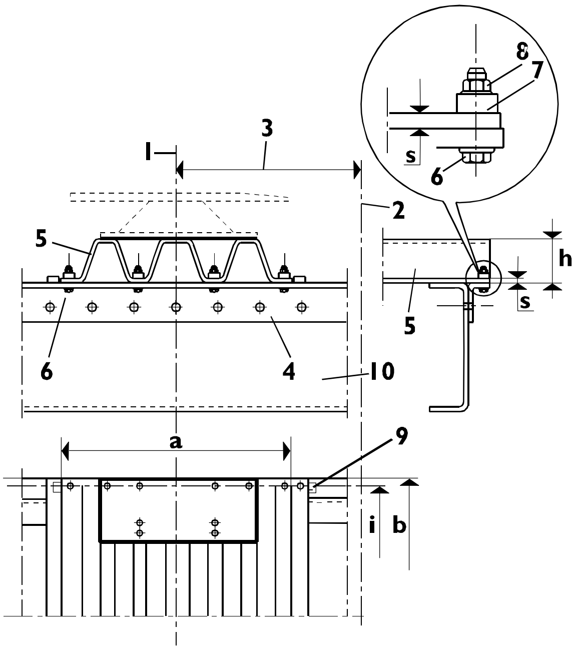
1 Fifth wheel centreline
2 Rear wheel centreline
3 Fifth wheel forward displacement (modular positions every 45 mm)
4 Fixing angle sections
5 Fifth wheel holder plate
6 Longitudinal stops for plate
7 Class 10.9 M16x1.5 screws, nuts fixing fifth wheel plate
8 Class 10.9 M16x1.5 screws and nuts fixing fifth wheel
9 Holes for fixing fifth wheel plate
10 Longitudinal stops for fifth wheel
11 Cross member
12 Countersunk head screws (M16x1.5 - 10.9)

Bed Plate Fixing (see Fig. 3.29)

- Having determined the fifth wheel forward displacement (modular positions every 45 mm), position the cross members (11) and connect them to the subframe longitudinal runners with 8+8 screws, together with the assembly formed by the fifth wheel and the plate, joined together with the 4 countersunk head screws (12).
- Fit the longitudinal stops (6) with the screws on the top flange of the subframe and the ones on the fifth wheel plate (10) to be secured by welding.
- Connect the fifth wheel plate with the fixing angle sections with 8 screws (7), tightening torque for M16x1.5 screws: 260 to 300 Nm.

Fitting instructions for 6x2 and 6x4 Models:
MP/400 E..TX/P ; TX/FP (EuroTech/EuroStar 6x2)
MP/440 E..TY/P ; TY/FP
MP/440 E..TY/PS ; TY/FS
MP/440 E..TY/PT ; TY/FT
MP/440 E..TY/TN
MP/440 E..TZ ; TZ/P ; TZ/FP (EuroTech/EuroStar 6x4)
(Solution for vehicles with chassis no. from 172608)
MP/440 E..HT (EuroTrakker 6x4)

Figure 3.30



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

Bed Plate Fixing (see Fig. 3.30)

- 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).
- Weld the longitudinal stops in contact with the plate.

Bed Plate Dimensions

Table 3.5 gives the minimum dimensions for the fifth wheel bearing plate for the various models: height "h" must be respected to ensure adequate safety margins in the movement between tractor and semitrailer (see Fig. 3.23).

Table 3.5

MODELS			Minimum dimensions (mm)					Bed plate fixing screws		Longitudinal stops
			h	s	a	b	i	No.	∅ mm	
ML 180		EuroCargo	90	6	800	840	770	12[1)]	16[1)]	x
ML 260/280/320		EuroCargo	50	8	810	970	776	12[2)]	16[2)]	x
MH/MP 400E..T T/P T/FP	4x2	EuroTech/EuroStar	50[3)4)] -	8 12[3)]	810 710	970 960	860	12[5)] 12[5) 7)]	16x1,5[2)]	-
MP 440E..T T/P T/FP	4x2	EuroTech/EuroStar	50[3)4)] 100[3)4)]	8 8 12[3)]	810 810 710	970 970 960	860	12[5)] 12[5)] 12[5) 7)]	16x1,5[2)]	-
MP 400E..TX/P TX/FP	6x2C	EuroTech/EuroStar	100[3)4)]	8[6)]	710	970	860	8[5)]	16x1,5[2)]	x
MP 440E..TY/P TY/FP TY/PS TY/PT TY/FS TY/FT MP 440E..TY/TN	6x2P	EuroTech/EuroStar	100[3)4)]	8[6)]	710	970	860	8[5)]	16x1,5[2)]	x
MP 440E..TZ TZ/P TZ/FP	6x4	EuroTech/EuroStar	100[3)4)]	8[6)]	710	970	860	8[5)]	16x1,5[2)]	x
MP 400E..HT	4x2	EuroTrak-ker	100[3)4)]	8	810	970	862	12[5)]	16x1,5[2)]	-
MP 440E..HT	6x4	EuroTrak-ker	100[3)4)]	8[6)]	810	970	862	8[5)]	16x1,5[2)]	x

1) Use flanged head screws and nuts.
2) Use screws class 10.9 and self-locking nuts.
3) The height of the plate depends on: forward displacement of the fifth wheel, tyre dimension, type of suspension, fifth wheel height. For this reason it must be calculated each time so that the safety margins for tractor/semitrailer movement are ensured (see fig. 3.20).
4) When load values on the front axle are higher than those given in the table below (e.g. owing to the forward displacement of the fifth wheel position) or when a vehicle is assigned to heavy-duty tasks, it will be necessary to install an auxiliary fr ame of the type described at point 3.6.4.2 (the case of additional equipment being installed on the front section of the vehicle resulting in additional weight resting on the front axle is excluded.
5) Use class 10.9 Screws with self-locking nuts and 15 mm long spacers.
6) With plates 4 mm thick on the top and bottom.
7) Use countersunk head screws at the vehicle side member.

MODELS	Wheelbase (mm)	Max. load on front axle (kg)
MP 400/440 T; T/P; T/FP	≤ 3800	7500[8)]
MP 400 TX/P; TX/FP	2440/1360	7500
MP 440 TY/P; TY/FP; TY/PS; TY/PT; TY/FS; TY/FT	3200/1395	7500[8)]
MP 440 TY/TN	3200/1380 3500/1380	7500[8)] 7500[8)]
MP 440 TZ; TZ/P TZ/FP	2800/1395	7500[8)]
MP 400 HT	3500	7500
MP 440 HT	2800/1380 3200/1380	7500

8) Possible 8000 kg on vehicles with mechanical front suspension, LD cab and 8280 engine (520 HP)

3.6.4.2 Preparation and installations of a Structure Working together with Chassis

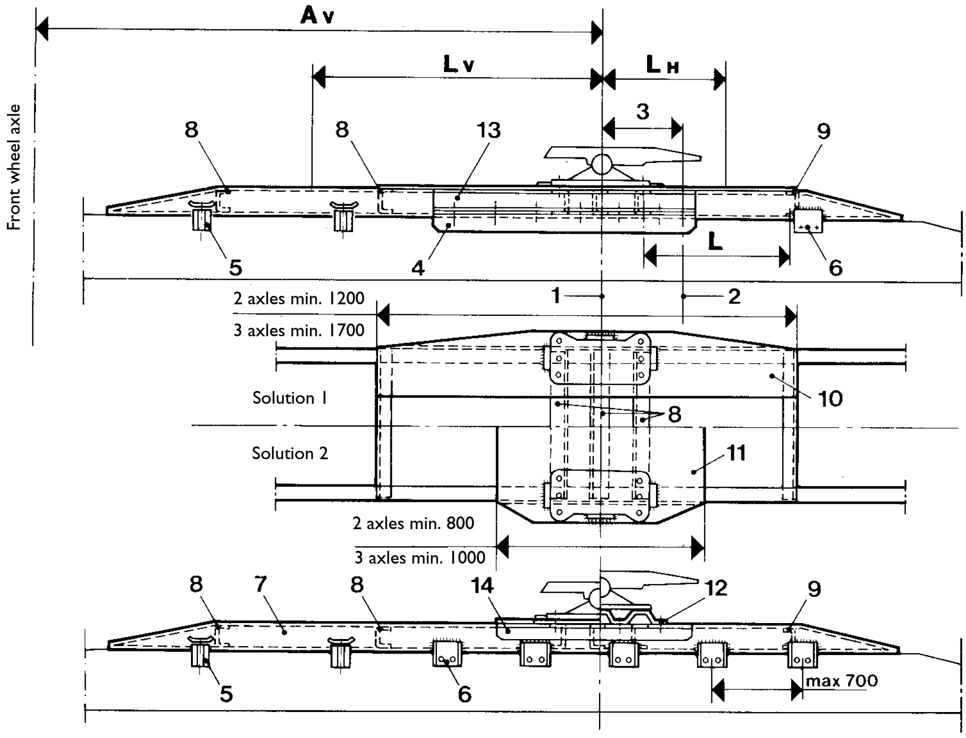
The purpose of installing a suitable mounting similar in construction to the subframe (see Fig. 3.31) in addition to distributing the weight that bears on the fifth wheel is to give the vehicle's chassis added torsional and flexional strength. It is required for extreme heavy- duty operations on certain markets and for the models indicated on table 3.6 which also gives the minimum dimensions for the longitudinal runners for the side members.

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 plane surface bearing the fifth wheel may be constructed in one of the following ways:

- by means of a plane 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 fifth wheels can supply (height 30 or 40 mm) where there are no problems concerning the height of the fifth wheel plane.

The plates on which the fifth wheel bears must be joined rigidly to the framework of the base (side and cross members).
The supports already provided by the Manufacturer (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 fig. 3.31). In addition to the other general type specifications given in point 3.6.4, the specific requirements stipulated for certain models on their respective diagrams which are available on request, must also be adhered to.

Figure 3.31



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 3.6)

A_V =Distance between front axle and fifth wheel centreline
L_V = } Minimum required reinforcement lenght when a
L_H = } special runner profile (see Fig. 3.4) is used.

8 Stiffening crossties
9. Rear cross members (for L> 400 mm)
10. Half-plate (min thickness = 8 mm)
11. Plate (min. thickness = 10 mm)
12. Fret-shaped plate
13. Channel profile
14. Fixing angle piece

Table 3.6

MODELS	Wheelbase (mm)	Minimum reinforcement profile: Section modulus Wx (cm3) based on the yield point of the material (N/mm^2) (Fe360=240; Fe510=360) 240	360	Dimensions (mm) depending on the yield point of the material (N/mm2) 240	360
ML 60; 65[1]	≤ 2700	31		100x60x5	
ML 75; 80[1]	≤ 3105	39		120x60x5	
ML 100[1]	≤ 3690	46		120x60x6	
ML 120EL	≤ 3690	89	57	160x70x7	140x60x6
ML 120[1]	≤ 3690	65	21	140x70x6	80x60x5
ML 130[1]	≤ 3690	89	31	160x70x7	100x60x5
ML 150[1]	≤ 3690	117	57	200x80x7	140x60x6
ML 170	≤ 3690	150	74	200x80x8	140x70x7
MP 180; 190; MH 190[1] MP 400 T; T/P: T/FP MP 440 T; T/P: T/FP; MH 440T; TP	3200 ≤ 3500 ≤ 3800	90[2,3] 150[2,3] 208[2,3]	57[2,5] 57[2,4] 90[2,4]	140x80x8[2,3] 200x80x8[2,3] 250x80x8[2,3]	100x80x8[2,5] 100x80x8[2,4] 140x80x8[2,4]
MP 400 TX/P; TX/FP	2440/1360	-	150[2,5]	-	200x80x8[2,5]
MP 240/TN; MH 260/TN[1] MP 440 TY/TN	3200/1380	173[6] 208[2,3]	42[6] 150[2,5]	220x80x8[6] 250x80x8[2,3]	80x80x8[6] 200x80x8[2,5]
	3500/1380	208[6] 208[2,3]	57[6] 208[2,5]	250x80x8[6] 250x80x8[2,3]	100x80x8[6] 250x80x8[2,5]
MP 240/P; /FP; /FS; /PS /FT; /PT; MH 260/P; /PS; /FP; /FS; /FT; /PT[1] MP 440 TY/P; TY/FP; TY/PS;TY/PT; TY/FS; TY/FT	3200/1395	208[6] -	73[6] 208[2,5]	250x80x8[6] -	120x80x8[6] 250x80x8[2,5]
MP 260[1] MP 440 TZ	2800/1380	135[6] 208[2,5]	36[6] 89[2,5]	200x80x7[6] 250x80x8[2,5]	100x60x6[6] 160x70x7[2,5]
MP 260/P; /FP[1] MP 440 TZ/P; TZ/FP	2800/1395	208[6] -	57[6] 208[2,5]	250x80x8[6] -	100x80x8[6] 250x80x8[2,5]
MP 400/HT; (4x2) MP 190/H; /HW	3200/3500 3800	72	52	140x70x7	120x70x6
MP 440/HT; (6x4) MP 260/H; /HW	2800/3200 2800/3500	72	60	140x70x7	120x70x7
MP 330/H; /HW MP 560/HT	2800/3200 3500	-	72	-	140x70x7[8]
MP 380/H; /HW MP 720/HT	2800/3200 3500	-	72	-	140x70x7[8]

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) or with load values on the front axle exceeding those given in Table 3.5
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).
7) Should it be necessary to reduce the height of the runner profile using shear resistant connections between the chassis and the subframe (see fig. 3.31) instead of the channel profile specified in 3.6. it is possible to make use of combined section runner profiles (see table below) provided that 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.
8) With FeE420 material (HS 46/40).

Solutions adopting combined section reinforcement profiles (see Fig. 3.4)

	A	B	C o D	E	F	G
Material yield point (N/mm^2)	≤ 320	≤ 320	≤ 240	≤ 240	≤ 360	≤ 360
Max. runner profile height reduction (mm)	40	60	100	120	100	120
Combined reinforcements length Lv: LH: (see Fig. 3.22)	$0,3A_V$ $0,2A_V$	$0,4A_V$V $0,22A_V$V	$0,5A_V$ $0,25A_V$	$0,55A_V$ $0,25A_V$	$0,5A_V$ $0,25A_V$	$0,55A_V$ $0,25A_V$V
Example: Combined section as an alternative to the channel section (mm):	⟦210x80x8	[] 190x80x8	[opp. ⟦ 150x80x8 + straight section 15x80	[] 130x80x8 + straight section 15x80	⟦ 150x80x8 +⌈ angle section	[] 130x80x8 +⌈ angle section
Actual height reduction (mm)	40	52	85	97	92	104

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

3.6.4.3 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, will be defined in each case.

For class MP 190 H vehicles up to MP 380 H it is necessary to replace the crossmember No. 4 of the chassis (side-member rear offsetting at about 2000 m from front wheel axle) with that specific to the tractor version (solution with long gusset plates). For use on roads in good conditions and up to 7500 kg on front axle, the use of subframe for fifth wheel mounting is not required.
In the case of 8000 kg on the front axle, for on and off-road use, a subframe with longitudinal profile 140x70x7 mm, must be used.

3.7 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 thrusts that may arise when braking, requires that the choice of vehicle to be used be cleared with the Manufacturer beforehand.

The structure that bears the weight on the tractor must be of the type that uses a subframe (see point 3.6.4.2.): the other conditions that must be met to engage in this type of transport will be specified each time in our authorisations.

3.8 Installation of Tanks and Containers for Bulk Materials

As a general rule, the installation of tanks and containers on our vehicles requires the use of an appropriate auxiliary frame.

Table 3.7. contains the guidelines for the dimensions of the longitudinal runners to be used for the auxiliary frame.

Table 3.7

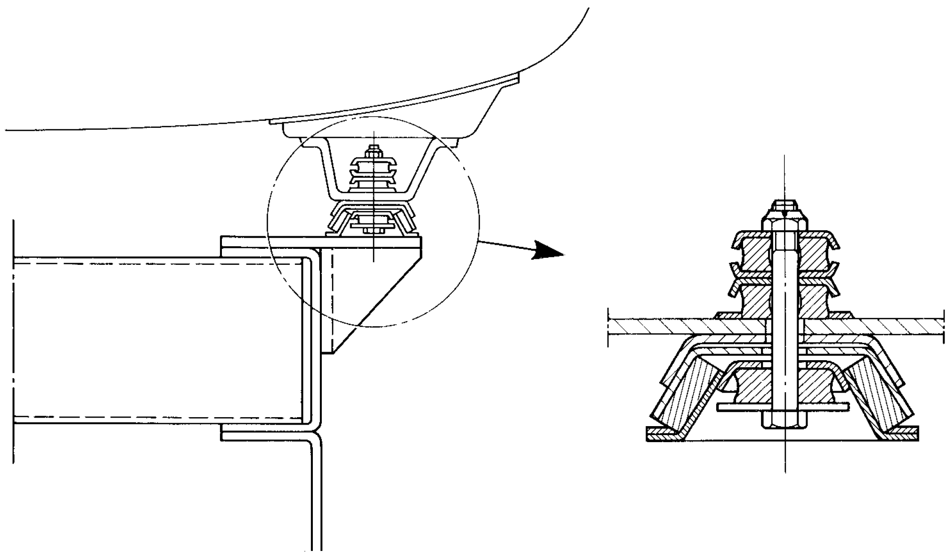
MODELS	Minimum reinforcement profile	
	Section Modulus Wx (cm^3)	Dimensions (mm)
ML 60; 65; 75; 80	26	100 x 50 x 5
ML 100; 120;120EL[4]; 130; 150	36	100 x 60 x 6
ML 170	46	120 x 60 x 6
MP 180; 190; MH 190	46 89[1]	120 x 60 x 6 120 x 70 x 7 [1]
MP 240; 260; MH 260	59[2] 89[1] [2]	120 x 70 x 7 [2] 160 x 70 x 7 [1] [2]
MP 340H	59[2] [3]	120 x 70 x 7 [2] [3]

1) For 8000 kg on front axle with engines 8460 (340/380 HP) and 8210 (420/480 HP) with MP cab.
2) Stiffen the counterframe in the area on which the tanks and containers rest.
3) 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.
4) On the MLL version, use a section with Wmin no less than 57cm3.

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 fig. 3.32) between the body of the tank and the auxiliary frame in front and rigid supports that are capable of withstanding longitudinal and transverse forces in the rear.

Figure 3.32



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

When faced with a different situation, a possible solution could be that of reinforcing the structure by means of longitudinal runner profiles of larger dimensions in comparison with those given in table 3.7.
Other type of body connections can be permitted upon request.

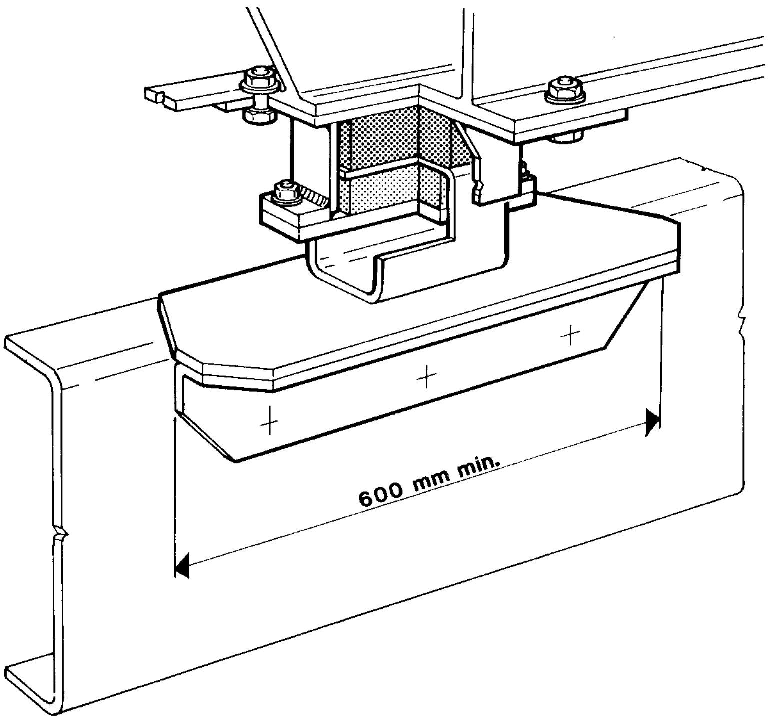
In order to define the elastic connection, the rigidity characteristics of the vehicle chassis as well as the area where the connections are to be installed and the type of use for which it is intended must be taken into account.

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.

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

- The distance between saddles must be determined depending on the load to be discharged. In any case it 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 will thus be authorised by the Manufacturer.
- Self-bearing tanks may be positioned directly on the chassis by means of suitable mountings located right behind the cab and in the rear axle(s) area. Their amount and distribution depend on the number of axles and the wheelbase; they 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 fig. 3.33). The anchoring devices 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 anchorings should be employed where possible.
  Other solutions are possible depending on the type of construction.

Figure 3.33



The installation of two or more separate containers or tanks on the vehicle requires the use of an auxiliary frame 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 mass of the front axle and fully loaded vehicle mass (see point 1.2.1 and 1.2.3).

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 so as to ensure good handling (see point 1.2.2); we recommend the use of vehicles with stabilising 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 of the coupling devices.

Concerning the installation of containers for fuel or flammable liquids, all current government safety regulations must be abided by (see point 2.17).

3.9 Installation of Cranes

The selection of the crane must be made with due consideration to its characteristics (mass, 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.

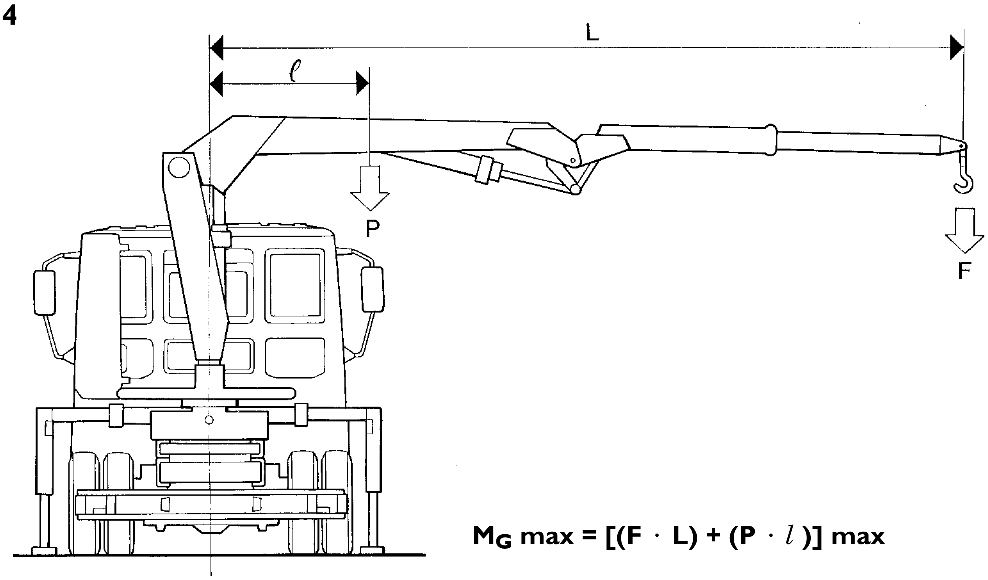
While the crane is operating, the stabilisers (hydraulic if possible) must be used and be in contact with the ground. As a general rule, the installation of a crane requires the use of a suitable subframe, whose construction must taken into account all general specifications relating to it (point 3.1). Concerning the dimensions of the runners for the subframe, refer to tables 3.8, 3.9 and 3.10.

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 section members must be in length 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 (e.g. tipper) requires the use of its own subframe, it may also be used for the crane provided that its dimensions are adequate.

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

Figure 3.34



$$M_G \max = [(F \cdot L) + (P \cdot l)] \max$$

The dimensions of the subframe refer to the total maximum static moment of the crane (Mg max.) which is calculated on the basis of the equation given in fig. 3.34.

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.

3.9.1 Crane Behind the Driver's Cab

The mounting of the subframe onto the chassis frame will as a rule, be performed by using the standard brackets (see fig. 3.35) to which are added, if necessary, other flexible anchorages (brackets or clamps) so that the flexibility and torsional characteristics of the chassis frame remain unchanged.

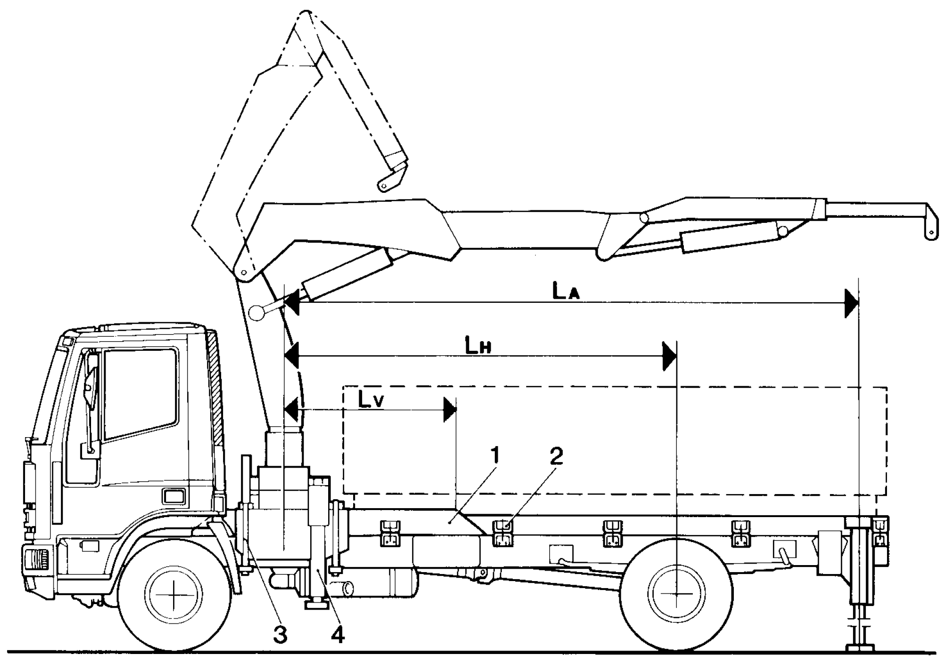
The dimensions and the subframe to be used for this type of installation are specified in table 3.8.

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 fig. 3.36). For these applications, the minimum dimensions of the reinforcing runner are specified in Table 3.9.

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 3.8. and 3.9.

The subframe for the crane may be integrated with the body longitudinal runner as shown in fig. 3.35. Length "Lv" must not be less than 35% of the wheelbase for vehicles with forward-control cab when the body runner has a smaller cross-section.

Figure 3.35



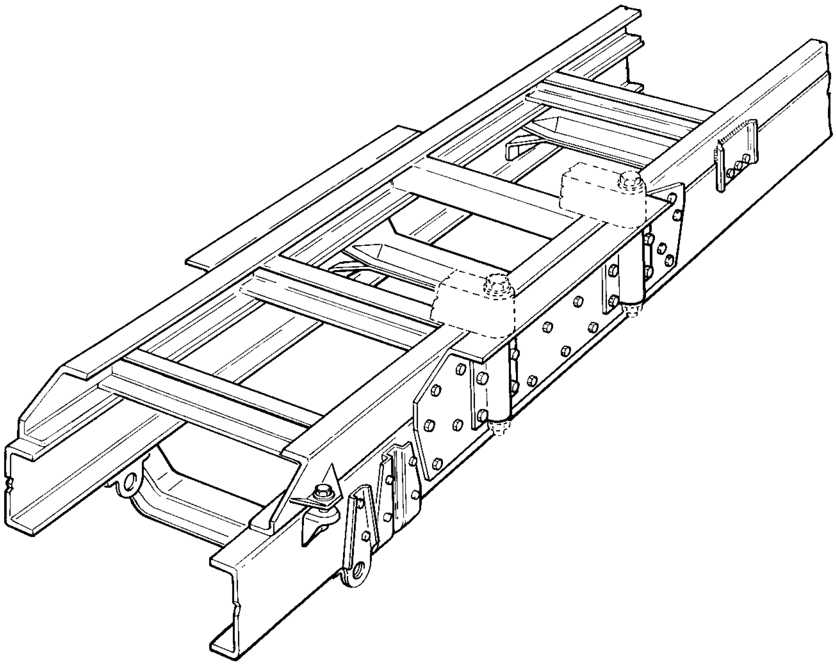
1 Subframe
2 Connections
3 Crane joints
4 Stabilisers

Table 3.8
Cranes mounted behind the driver's cab
(subframe mounted with brackets or clamps)

MODELS	Wheelbase (mm)		Crane capacity MG max (kNm)																		
(Chassis frame section in mm)		Yield point of subframe material (N/mm^2)	-20	20-30	30-40	40-50	50-60	60-70	70-80	80-90	90-100	100-120	120-140	140-160	160-180	180-200	200-220	220-240	240-260	260-280	280-300
			Minimum value of subframe Section Modulus Wx (cm^3)[1]																		
ML 60; 65 ML 75 (180,5x65x4)	up to 4455 up to 4455	240 (Fe360)	A	A	31	89	135	173	E												
		360 (Fe510)	A	A	31	57	89	105	E												
ML 60; 65; 75 ML 65H (182,5X65X5)	4815	240	A	A	19[1]	46	119	150	E												
		360	A	A	19[1]	46	57	89	E												
ML 80 ML 85H ML 100 (203x65x4)	up to 3690 up to 3105 up to 3690	240	A	A	19[1]	46	105	150	208	E											
		360	A	A	19[1]	46	89	89	119	E											
ML 80 ML 85H ML 100 ML 120EL[4] (205x65x5)	4185-4815 3690-4455 4185-4815 3105-3690	240	A	A	A	26[1]	46	135	173	208	E										
		360	A	A	A	26[1]	46	89	89	119	E										
ML 120EL[4] (207x65x6)	4185-4815	240	A	A	A	A	21[1]	57	89	119	150	208	E								
		360	A	A	A	A	19[1]	46[1]	89	89	119	150	E								
ML 95W ML 120 ML 120H ML 130 ML 150 (250x70x5)	3240-3690 up to 5175 3105-3690 up to 4185 up to 3690	240	A	A	A	A	A	36	57	89	150	245	E								
		360	A	A	A	A	A	36	57	89	105	150	E								
ML 120 ML 120H ML 130 ML 135W ML 150 (252x70x6)	5670 4185-4815 4455-4815 3240÷3915 4185/4815	240	A	A	A	A	A	A	31[1]	57	89	245	317	E							
		360	A	A	A	A	A	A	31[1]	57	89	119	173	E							
ML 120 ML 130 ML 150 (253,4x70x6,7)	6570 5175-6570 5175-5670	240	A	A	A	A	A	A	A	36[1]	57	208	286	374	E						
		360	A	A	A	A	A	A	A	36[1]	57	105	150	208	E						
ML 150 (255,4x70x7,7)	6570	240	A	A	A	A	A	A	A	A	36[1]	105	173	245	317	E					
		360	A	A	A	A	A	A	A	A	36[1]	89	119	160	208	245	E				
ML 150H ML 170; 180E (274,5x80x6)	3105-3690 3690	240	A	A	A	A	A	A	A	A	36[1]	89	245	343	439	E					
		360	A	A	A	A	A	A	A	A	36[1]	89	135	173	245	286	E				
ML 150H ML 170; 180E (275,9x80x6,7)	4185 4185 4725-5310 up to 4185	240	A	A	A	A	A	A	A	A	A	57[1]	208	317	406	E					
		360	A	A	A	A	A	A	A	A	A	57[1]	105	150	208	245	E				
ML 150 ML 150H ML 170; 180E (277,9x80x7,7)	6570 4590-4815 4590-6570	240	A	A	A	A	A	A	A	A	A	A	89	245	374	474	E				
		360	A	A	A	A	A	A	A	A	A	A	89	119	173	208	286	374	E		
ML 260KE (275,9x80x6,7)	3830/1372 4190/1372	360	A	A	A	A	A	A	A	A	A	57[1]	105	150	208	245	286	317	374	E	
		420	A	A	A	A	A	A	A	A	A	57[1]	105	150	208	208	286	286	343	E	
MH 190;MP 180;190 MP 240/P; /FP; /FS MP 240/FT; /PS; /PT MP 240/TN MH 260/P; PS MH 260/PT MH 260/TN MP 260 (6x4) MP 260/P (6x4) (302,4x80x6,7)	up to 6300 up to 5100/1395 up to 5100/1395 up to 5700/1380 up to 5100/1395 up to 5100/1395 up to 5700/1380 up to 4800/1380 up to 4800/1395	240	A	A	A	A	A	A	A	A	A	A	21[1]	89	343	439	E	E	E	E	E
		360	A	A	A	A	A	A	A	A	A	A	21[1]	89	119	150	245	374	439	E	E
		420	A	A	A	A	A	A	A	A	A		21[1]	89	119	150	185	208	245	343	406
MP 190HM MP 190H; W MH 260/PT MP 260HM(6x4) MP 260H; W MP 330H; W MP 340H (304,4x80x7,7)	up to 6300 up to 5700 up to 5700/1395 up to 4500/1380 up to 4800/1380 up to 4200/1380 up to 5820/1380	240	A	A	A	A	A	A	A	A	A	A	A	21[1]	89	406	E	E	E	E	E
		360	A	A	A	A	A	A	A	A	A	A	A	21[1]	89	119	150	245	374	474	E
		420	A	A	A	A	A	A	A	A	A	A	A	21[1]	89	119	150	185	208	245	343
MP 380H; W MP 410H (309x80x10)	up to 4200/1380 up to 5020/1380	240	A	A	A	A	A	A	A	A	A	A	A	A	A	A	57[1]	474	E	E	E
		360	A	A	A	A	A	A	A	A	A	A	A	A	A	A	57[1]	105	150	286	439
		420	A	A	A	A	A	A	A	A	A	A	A	A	A	A	57[1]	105	150	173	208

Notes: See page 3-53

Figure 3.36



When installing cranes on large-cab (crew 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.

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 fig. 3.11) so as not to excessively constrain the chassis torsional movement. Since in such cases the crane will be virtually connected to the subframe only, the size of the longitudinal runners must be adequate to resist the crane operation-generated movements.

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

Normally, when the crane is placed behind the cab, it is necessary to move the platform body or equipment to 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 (see point 3.4).

Table 3.9
Cranes mounted behind the driver's cab
(subframe mounting with shear resistant plates)

MODELS	Wheelbase (mm)	Crane capacity MG max (kNm)																		
		Yield point of subframe material	-20	20-30	30-40	40-50	50-60	60-70	70-80	80-90	90-100	100-120	120-140	140-160	160-180	180-200	200-220	220-240	240-260	260-280	280-300
(sezione telaio in mm)		(N/mm[2])	Minimum value of subframe Section Modulus Wx (cm³)[1)]																		
ML 60; 65 ML 75 ML 80 (180.5x65x4)	up to 4455 up to 4455 up to 4185	240 (Fe360)	A	A	31	46	57	89	105[2)]	E											
		360 (Fe510)	A	A	A	31	46	57	89[2)]	105[2)]	119[2)]	E									
ML 60; 65; 75 ML 65H ML 80 (182.5x65x5)	4815	240	A	A	A	31	46	89	89[2)]	119[2)]	E										
		360	A	A	A	A	31	46	57[2)]	57[2)]	89[2)]	E									
ML 80 ML 85H ML 100 (203x65x4)	up to 3690 3105 3690	240	A	A	A	31[1)]	46	89	89	105[2)]	E										
		360	A	A	A	A	31[1)]	46	57	89[2)]	105[2)]	E									
ML 80 ML 85H ML 100 ML 120EL [4)] (205x65x5)	4185-4815 3690-4455 3690-4815 3105-3690	240	A	A	A	31[1)]	46	57	89	89	119[2)]	E									
		360	A	A	A	A	A	31[1)]	46	57	89[2)]	105[2)]	E								
ML 120EL [4)] (207x65x6)	4185-4815	240	A	A	A	31[1)]	46[1)]	57	89	119)	135)	E									
		360	A	A	A	A	19[1)]	36	46	57	89[2)]	E									
ML 95W ML 120 ML 120H ML 130 ML 150 (250x70x5)	3240-3690 up to 5175 3105-3690 up to 4185 up to 3690	240	A	A	A	A	A	21[1)]	36	57	89	105	E								
		360	A	A	A	A	A	A	A	21[1)]	36	89	105	E							
ML 120 ML 120H ML 130 ML 135W ML 150 (252x70x6)	4455-5670 4185-4815 4455-5175 3240-3915 4185/4815	240	A	A	A	A	A	A	31[1)]	46	89	89	E								
		360	A	A	A	A	A	A	A	A	31[1)]	57	89	E							
ML 120 ML 130 ML 150 (253.4x70x6.7)	5175-6570 4185-5670 5175-5670	240	A	A	A	A	A	A	21[1)]	36	57	89	E								
		360	A	A	A	A	A	A	A	A	21[1)]	46	89	105	E						
ML 120 ML 130 ML 150 (255.4x70x7.7)	6570	240	A	A	A	A	A	A	A	31	46	57	105	173	208	E					
		360	A	A	A	A	A	A	A	A	21[1)]	36	46	89	119	135	E				
ML 150H ML 170 - 180 (274.5x80x6)	3105-3690 3690	240	A	A	A	A	A	A	21[1)]	31[1)]	36)	89	105	150	208	245	E				
		360	A	A	A	A	A	A	A	A	21)	31[1)]	57	89	105	135	173	208	245	E	
ML 150H ML 170 (275.9x80x6.7)	4185 4185	240	A	A	A	A	A	A	A	21[1)]	36[1)]	89	105	135	173	208	E				
		360	A	A	A	A	A	A	A	A	A	21[1)]	46	89	89	135	150	173	208	245	E
ML 150 ML 150H ML 170 - 180 (277.9x80x7.7)	6570 4590-4815 4590-6570	240	A	A	A	A	A	A	A	A	21[1)]	57	89	135	150	208	245	E			
		360	A	A	A	A	A	A	A	A	A	21[1)]	36[1)]	89	89	135	150	173	208	245	E
ML 260KE (275.9x80x6.7)	3830/1372 4190/1372	360	A	A	A	A	A	A	A	A	A	21[1)]	46	89	119	135	150	173	208	286	E
		420	A	A	A	A	A	A	A	A	A	21[1)]	46	57	89	119	119	135	173	185	245
MH 190;MP 180;190 MP 240/P; /FP; /FS MP 240/FT; /PS; /PT MP 240/TN MH 260/P; PS MH 260/PT MH 260/TN MP 260 (6x4) MP 260/P (6x4) (302.4x80x6.7)	up to 6300 up to 5100/1395 up to 5100/1395 up to 5700/1380 up to 5100/1395 up to 5100/1395 up to 5700/1380 up to 4800/1380 up to 4800/1395	240	A	A	A	A	A	A	A	A	31[1)]	46	89	105	150	173	245	E			
		360	A	A	A	A	A	A	A	A	A	A	31[1)]	46	89	89	135	150	173	208	245
		420	A	A	A	A	A	A	A	A	A	A	A	31[1)]	36[1)]	89	89	105	135	150	173
MP 190HM MP190H; W MH 260/PT MP 260HM(6x4) MP 260H; W MP 330H; W MP 340H (304.4x80x7.7)	up to 6300 up to 5700 5700/1395 up to 4500/1380 up to 4800/1380 up to 4200/1380 up to 5820/1380	240	A	A	A	A	A	A	A	A	A	31[1)]	36[1)]	89	89	135	150	208	245	E	
		360	A	A	A	A	A	A	A	A	A	A	A	31[1)]	36[1)]	89	89	105	135	150	173
		420	A	A	A	A	A	A	A	A	A	A	A	A	A	31[1)]	46	89	89	105	135
MP 380H; W MP 410H (309x80x10)	4200/1380 5020/1380	240	A	A	A	A	A	A	A	A	A	A	36[1)]	89	105	135	173	208	245	E	
		360	A	A	A	A	A	A	A	A	A	A	A	31[1)]	36[1)]	89	89	105	135	150	173
		420	A	A	A	A	A	A	A	A	A	A	A	A	A	31[1)]	36[1)]	89	89	105	135
Section Modulus Wx (cm³) required for the chassis + subframe aggregate section relative to the subframe and for each side of the vehicle		240	63	94	125	157	188	219	250	282	313	375	438	500	563	625	688	750	813	875	938
		360	48	72	96	120	143	167	191	215	238	286	334	381	329	477	524	572	619	667	715
		420 } *	40	60	80	100	120	140	160	180	200	240	280	320	360	400	440	480	520	560	600
		490 } *	34	50	67	84	100	117	134	150	167	200	234	267	300	334	367	400	434	467	500

Notes: See page 3-53.
* Also valid for chassis runner profile (lower flange of the aggregate section).

Table for selection of runner profiles (see Tables 3.8 and 3.9)

Section Modulus for each section Wx (cm^3)	Recommended section (or other with equal inertia and resistance moment) (mm) (channel profile)	Section Modulus for each section Wx (cm^3)	Recommended section (or other with equal inertia and resistance moment
19	80x50x5	173	220x80x8
21	80x60x5	185	250x80x7
26	100x50x5	208	250x80x8
31	100x60x5	245	250x100x8
36	100x60x6	286	280x100x8
46	120x60x6	317	300x100x8
57	140x60x6	343	320x100x8
89	160x70x7	374	340x100x8
105	180x70x7	406	360x100x8
119	200x80x6	439	380x100x8
135	200x80x7	474	400x100x8
150	200x80x8		

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 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 3.9.) it is possible to make use of combined section runner profiles (see table below) provided that the flange width and thickness values are no less than the tabulated ones. These are instructions of a general nature appl ying to materials covered by this manual. Material with higher mechanical specifications call for the measurement of the overall chassis and subframe bending moment (see last part of table 3.9). 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, 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 only.

4) On the MLL version, use a runner with Wmin no less than $57cm^3$.

Solutions with combined section runner profiles (see fig. 3.4)

	A	B	C or D	E	F	G
Material yield point (N/mm^2):	≤ 320	≤ 320	≤ 240	≤ 240	≤ 360	≤ 360
Max. runner profile height reduction (mm):	40	60	100	120	100	120
Combined reinforcements length (see Fig. 3.26) L_V=	$0.25L_h$ or	L_A $0.35L_h$ or	L_A $0.4L_h$ or	L_A $0.45L_h$ or	L_A $0.55L_h$ or	L_A $0.6L_h$ or
Example: Combined section as an alternative to the channel section (mm): C250x80x8 mm:	⟦210x80x8	][190x80x8	[opp. ⟦ 150x80x8 + straight section 15x80	][130x80x8 + straight section 15x80	⟦ 150x80x8 +⌈ angle section	][130x80x8 +⌈ angle section
Actual height reduction (mm)	40	52	85	97	92	104

The above data cannot be used when the subframe is connected to the vehicle chassis by means of brackets (see table 3.8). In this case, moments of resistance and stress data must be calculated for each chassis and subframe section.

3.9.2 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 rear support of the front spring. The dimensions of the runners to be used are given in table 3.10.

In consideration of the particular distribution of the mass on the vehicle, wherein the load is concentrated on the rear overhang, and 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 construction sections (see point 3.1.1.) and brackets are to be employed in the area corresponding to the rear suspension and the rear overhang (Length Lv as per fig. 3.37). Care must also be taken to ensure that the transition from box-type to open section be well blended as illustrated in fig. 3.4.

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 joints (i.e. an adequate number of plates spaced at most 700 mm from each other), whereas elastic anchorages are to be used in the front part. Due care must be taken to ensure that under any load conditions, the ratio of the mass on the front axle to the rear axle or axles, respects the limits set for the vehicle (see point 1.2.3).

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

The rear overhang of the crane (length Lu, see fig 3.37) 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 an added 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 1.2.3). If the minimum prescribed value is not reached, the vehicle must be allowed to drive only with the axle in the lowered position.

Table 3.10
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^2)**	**-20**	**20-30**	**30-40**	**40-50**	**50-60**	**60-70**	**70-80**	**80-90**	**90-100**	**100-120**	**120-140**	**140-160**	**160-180**	**180-200**	**200-220**	**220-240**	**240-260**	**260-280**	**280-300**
			Minimum value of subframe Section Modulus Wx (cm^3)[1]																		
ML 60; 65	up to 4455	240 (Fe360)	A	A	A	23[1]	42	57	110	110	135	E									
ML 75	up to 4455	360 (Fe510)	A	A	A	23[1]	32	57	110	110	135	E									
(180,5x65x4)																					
ML 60		240	A	A	A	23[1]	32	42	71	110	110	E									
ML 65H		360	A	A	A	A	23[1]	32	57	71	110	E									
ML 65	4815																				
ML 75																					
(182,5x65x5)																					
ML 80	up to 3690	240	A	A	A	A	32[1]	42	71	110	110	E									
ML 85H	3105	360	A	A	A	A	23[1]	42	71	110	110	E									
ML 100	up to 3690																				
(203x65x4)																					
ML 80	4185-4815	240	A	A	A	A	23[1]	42	42	71	110	135	E								
ML 85H	3690-4455	360	A	A	A	A	A	23[1]	32[1]	57	71	110	E								
ML 100	4185-4815																				
ML120EL[3]	3105-3690																				
(205x65x5)																					
ML 120EL[3]	4185-4815	240	A	A	A	A	32[1]	57	71	110	110	173	E								
(207x65x6)		360	A	A	A	A	A	32[1]	42	57	71	110	135	E							
ML 95W	3240-3690	240	A	A	A	A	A	A	23[1]	42	42	71	110	E							
ML 120	up to 5175	360	A	A	A	A	A	A	A	A	23[1]	71	110	E							
ML 120H	3105-3690																				
ML 130	up to 4185																				
ML 150	up to 3690																				
(250x70x5)																					
ML 120	5670	240	A	A	A	A	A	A	A	32[1]	42	71	110	135	E						
ML 120H	4185-4815	360	A	A	A	A	A	A	A	A	23[1]	42	71	110	135	E					
ML 130	4455-4815																				
ML 135W	3240-3915																				
ML 150	4185/4815																				
(252x70x6)																					
ML 120	6570	240	A	A	A	A	A	A	A	23[1]	42	57	110	135	E						
ML 130	4185-6570	360	A	A	A	A	A	A	A	A	23[1]	32[1]	57	71	110	135	E				
ML 150	5175-5670																				
(253,4x70x6,7)																					
ML 150	6570	240	A	A	A	A	A	A	A	23[1]	42	71	110	135	173	E	E				
(255,4x70x7,7)		360	A	A	A	A	A	A	A	A	23[1]	32[1]	57	57	110	135	173	E			
ML 150H	3105-4185	240	A	A	A	A	A	A	23[1]	42[1]	42[1]	110	110	173	222	222	E				
ML 170; 180E	up to 4185	360	A	A	A	A	A	A	23[1]	23[1]	23[1]	42[1]	71	110	173	222	246	246	E		
(229,5x80x6)																					
ML 150H	4590-4815	240	A	A	A	A	A	A	A	32[1]	42[1]	71	110	135	222	222	E				
ML 170; 180E	4590-5175	360	A	A	A	A	A	A	A	23[1]	23[1]	42[1]	57	110	135	173	222	246	E		
(230,9x80x6,7)																					
ML 150	6570	240	A	A	A	A	A	A	A	A	42[1]	71	110	135	173	222	246	E			
ML 150H	4590-4815	360									23[1]	32[1]	42[1]	71	110	135	173	222	222	246	E
ML 170; 180E	5670																				
(232,9x80x7,7)																					
ML 260KE	3830/1372	360	A	A	A	A	A	A	A	A	A	23[1]	32	42	110	135	173	222	246	E	
(275,9x80x6,7)	4190/1372	420	A	A	A	A	A	A	A	A	A	23[1]	32	42	71	110	135	173	222	222	E
MH 190;MP 180;MP 190	up to 6300	240	A	A	A	A	A	23[1]	32[1]	42[1]	57	110	135	173	222	246	E				
MP 240/P; /FP; /FS	up to 5100/1395	360	A	A	A	A	A	A	A	23[1]	32[1]	42[1]	71	110	135	173	222	222	246	E	
MP 240/FT; /PS; /PT	up to 5100/1395	420	A	A	A	A	A	A	A	23[1]	23[1]	32[1]	42[1]	71	110	135	173	173	222	246	E
MH 260/P; /PS	up to 5100/1395																				
MH 260/PT	up to 5100/1395																				
(212,4x80x6,7)																					
MP 190HM	up to 6300	240	A	A	A	A	A	A	23	32	42	71	71	135	173	222	283	E			
(214,4x80x7,7)		360	A	A	A	A	A	A	A	A	23	32	42	71	71	135	173	173	222	E	
		420	A	A	A	A	A	A	A	A	A	23	32	42	71	110	135	135	173	283	E
MH 260/PT	5700/1395	240	A	A	A	A	A	A	A	A	A	A	42	71	110	135	173	222	222	E	
MH 260/TN	up to 5700/1380	360	A	A	A	A	A	A	A	A	A	A	23	32	42	57	110	110	135	135	173
MP 240/TN	up to 5700/1380	420	A	A	A	A	A	A	A	A	A	A	23	23	23	42	57	71	110	135	173
MP 260 (6x4)	up to 4800/1380																				
MP 260/P (6x4)	up to 4800/1395																				
(302,4x80x6,7)																					
MP 190H; W	up to 5700	240	A	A	A	A	A	A	A	A	A	A	A	42[1]	57	110	135	173	222	222	E
MP 260HM(6x4)	up to 4500/1380	360	A	A	A	A	A	A	A	A	A	A	A	A	A	57	71	110	110	135	173
MP 260H; W	up to 4800/1380	420	A	A	A	A	A	A	A	A	A	A	A	A	A	32[1]	42[1]	57	71	110	110
MP 330H; W	up to 4200/1380																				
MP 340H	up to 5820/1380																				
(304,4x80x7,7)																					
MP 380H; W	up to 4200/1380	240	A	A	A	A	A	A	A	A	A	A	23[1]	42[1]	57	110	110	135	173	222	222
MP 410H	up to 5020/1380	360	A	A	A	A	A	A	A	A	A	A	A	A	23[1]	32[1]	42[1]	57	110	110	135
(309x80x10)		420	A	A	A	A	A	A	A	A	A	A	A	A	A	A	23[1]	42[1]	42[1]	57	71
Section Modulus Wx (cm^3) required		240	63	94	125	157	188	219	250	282	313	375	438	500	563	625	688	750	813	875	938
for the chassis + subframe aggregate		360	48	72	96	120	143	167	191	215	238	286	334	381	329	477	524	572	619	667	715
section relative to the subframe and		420 } *	40	60	80	100	120	140	160	180	200	240	280	320	360	400	440	480	520	560	600
for each side of the vehicle		490	34	50	67	84	100	117	134	150	167	200	234	267	300	334	367	400	434	467	500

Notes: See page 3-56.
* Also valid for chassis runner profile (lower flange of the aggregate section).

Table for selection of runner profiles (see Table 3.10)

Section Modulus for each section Wx (cm³)	Recommended section (or other with equal inertia and resistance moment) (mm) (channel profile)	Section Modulus for each section Wx (cm³)	Recommended section (or other with equal inertia and resistance moment) (mm) (channel profile)
23	80x50x5	110	160x70x7
32	100x50x5	135	180x70x7
42	100x60x6	173	200x80x7
57	120x60x6	222	220x80x8
71	140x60x6	246	250x80x7

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 established 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 3.10) 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 3.10). 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.

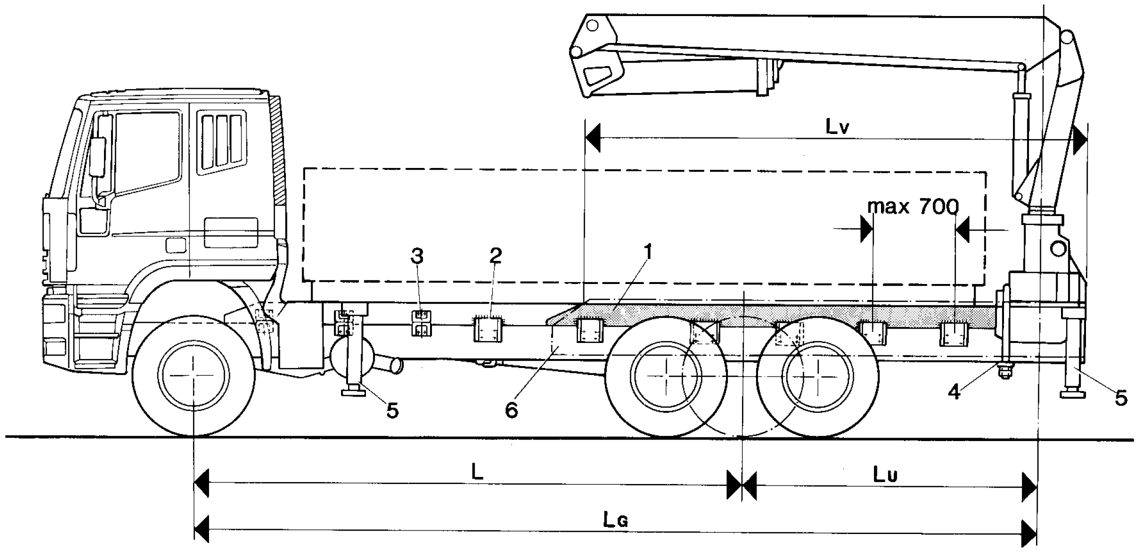
3 = On the MLL version, use a runner with Wmin no less than 57cm³.

Solutions with combined section runner profiles (see fig. 3.4)

	B	D	E	F	G
Material yield point (N/mm²)	≤ 320	≤ 240	≤ 240	≤ 360	≤ 360
Max. runner profile height reduction (mm):	20	60	80	60	80
Combined reinforcements length (see Fig. 3.28) L_V =	—	0.45 L_G	0.5 L_G	0.60 L_G	0.65 L_G
Example: Combined section as an alternative to the channel section (mm) : 220x80x8 mm	[] 200x80x8	[[160x80x8 + straight section 15x80	[] 140x80x8 + straight section 15x80	[[160x80x8 + angle section	[] 140x80x8 + angle section
Actual height reduction (mm)	12	45	57	52	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 fig. 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.

Figure 3.37



1 Subframe
2 Plates
3 Brackets
4 Crane joints
5 Stabilisers
6 Connecting angle bar (alternative solution)

3.9.3 Removable Cranes

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

In consideration of the fact that the vehicle may be used with or without the crane, we recommend recording 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.

3.10 Installation of Tail Lifts

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

- By means of Table 3.11, 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. of aluminium), the flexural moments induced on the chassis frame can be assessed by means of fig. 3.38, whereas the characteristics of the reinforcing runners can be defined with the relevant Table 3.12.

The bodybuilder or the Manufacturer of the tail lift will take care to ascertain safety and operational stability, in particular when applying Table 3.12.

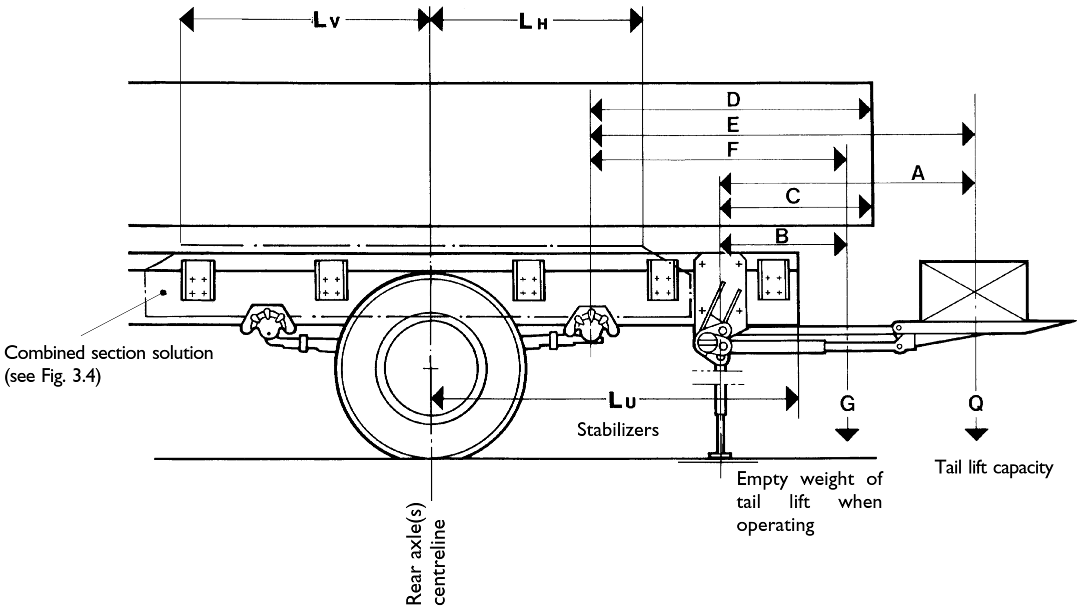
In any event, particularly in those specific uses where there is not suitable auxiliary frame (as in the case with bodies for vans or box- type bodies built by means of cross members), the anchoring for the loading platform must be provided by a structure that enables the stress to be distributed over the chassis of the vehicle.

Shear resisting plates

To provide the necessary strength and rigidity, the connection between the chassis and the auxiliary frame must involve (especially in overhangs of over 1500 mm) the use of shear resisting plates positioned 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 3.38. For the vehicles with weight range from 65E to 150E having bodywork longitudinal runners with thickness smaller than the value required in these insructions, the cleat plates shall be further fitted beyond the wheelbase centreline.

Figure 3.38

Method to assess the bending moment on the chassis frame while a tail lift is operating



Determining the bending moment "M" on the chassis

a. Tail lift stabiliser M = (Q·A)+ (G·B)
b. Tail lift without stabiliser M = (Q·E)+ (G·F)
E = (D - C) + A
F = (D - C) + B

N.B.

"A, B, G and Q": According to the data given by the Manufacturer of the tail lift.
"C" : Must be defined by the Bodybuilder taking into account the dimensions of the type of subframe and tail lift used
"D" : Depending on the type of subframe used.

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 3.11 and 3.12.

The runner profile dimensions given in table 3.11 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 3.12).

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 1.2.3); 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 2.15).

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

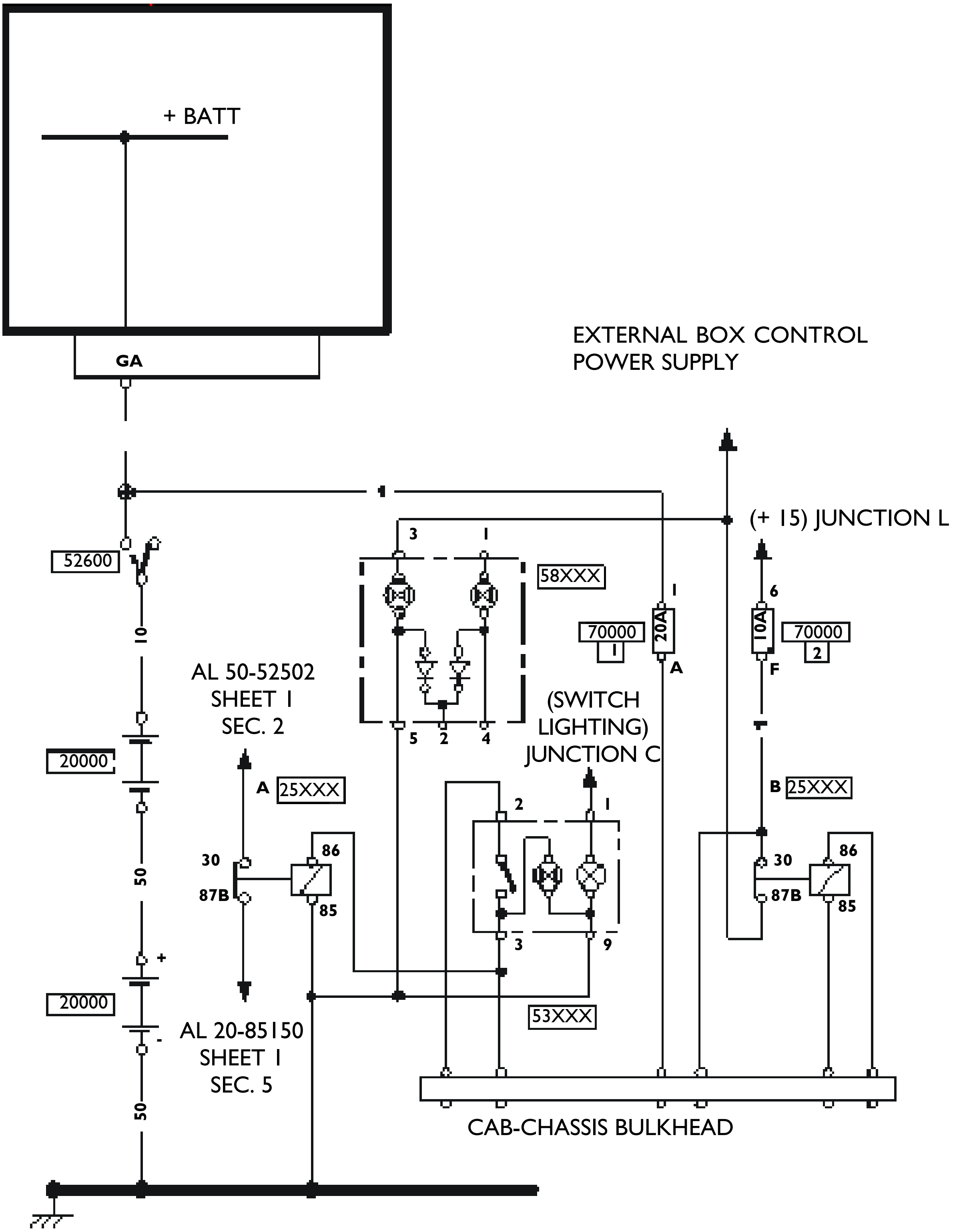
The bodybuilder will be responsible for any modification to the rear underrun guard or for installing a different type (see point 2.19) for preserving the visibility of the rear lights, for the overhang angles, and for the positioning of the tow hook as provided by the respective national ordinances.

For Eurocargo Tector

Tail lift arrangement

The Tector range offers Option 4113 (tail lift preparation pack), the general diagram of which is given below. (For more detailed information, refer to Workshop Manual 603.43.693).

Figure 3.39



2nd ECAS control + tail lift

Vehicles built with Option 4115 (second ECAS remote control at the rear) must have Option 4113 (tail lift preparation pack). The general diagram for which is shown below. For more detailed information, refer to the Workshop Manual 603.43.691).

Figure 3.40

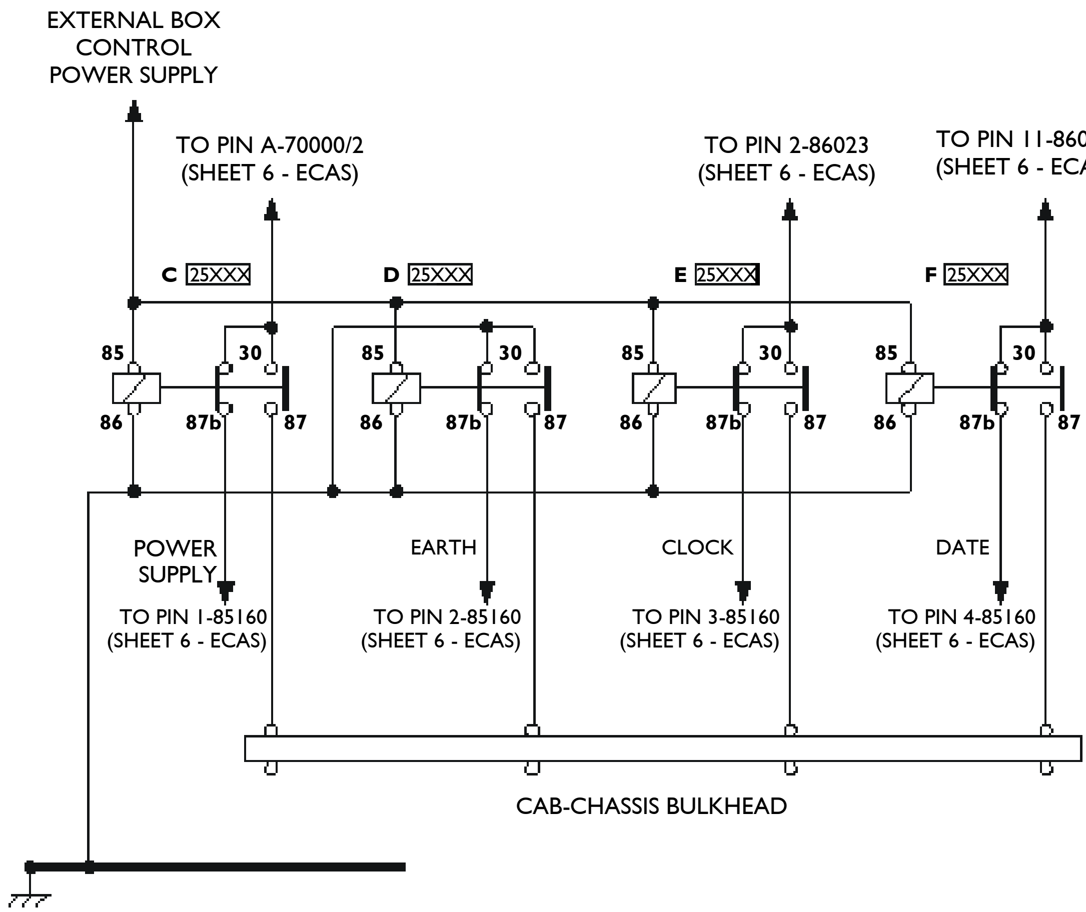


Table 3.11
Installation of tail lifts

MODELS				Tail lift capacity kN (kg)															
	Wheel-base (mm)	Cab	Max. body overhang (mm)	7.5 (750)		10 (1000)		12.5 (1250)		15 (1500)		17.5 (1750)		20 (2000)		25 (2500)		30 (3000)	
				Minimum value of subframe Section Modulus Wx (cm^3) as a function of the yield point of the material (N/mm^2)															
				240	360	240	360	240	360	240	360	240	360	240	360	240	360	240	360
ML 60 ML 65	2700		1740	A	A	A	A	A	A	A+S		E							
	3105		1765	A	A	A	A	A	A	A+S		E							
	3330		2280	A	A	16[1)]	16[1)]	21[1)]	16[1)]	A+S		E							
	3690		2280	A	A	16[1)]	16[1)]	21[1)]	16[1)]	A+S		E							
	4185		2595	A	A	21[1)]	16[1)]	21[1)]	16[1)]	A+S		E							
	4455		2280	A	A	21[1)]	16[1)]	36[1)]	21[1)]	A+S		E							
	4815		2955	A	A	21[1)]	16[1)]	36[1)]	21[1)]	A+S		E							
ML 60/P ML 65/P	3690		2280	16[1)]	16[1)]	21[1)]	16[1)]	36	21[1)]	A+S		E							
	4185		2595	21[1)]	16[1)]	31	21[1)]	46	31	A+S		E							
	4555		2730	21[1)]	16[1)]	36	21[1)]	46	31	A+S		E							
	4815		2955	21[1)]	16[1)]	36	21[1)]	46	31	A+S		E							
ML 75	3105		1765	A	A	A	A	A	A	A+S		E							
	3330		2100	A	A	A	A	21[1)]	16[1)]	A+S		E							
	3690		2280	A	A	A	A	21[1)]	16[1)]	A+S		E							
	4185		2595	A	A	16[1)]	16[1)]	21[1)]	16[1)]	A+S		E							
	4455		2730	A	A	21[1)]	16[1)]	36	21[1)]	A+S		E							
	4815		2955	A	A	21[1)]	16[1)]	36	21[1)]	A+S		E							
ML 75/P	3690		2280	16[1)]	16[1)]	21[1)]	16[1)]	36	21[1)]	A+S		E							
	4185		2595	21[1)]	16[1)]	31	21[1)]	46	31	A+S		E							
	4455		2730	21[1)]	16[1)]	36	21[1)]	46	31	A+S		E							
	4815		2955	21[1)]	16[1)]	36	21[1)]	46	31	A+S		E							
ML 80	3105		1765	A	A	A	A	A	A	A	A	A+S		16[1)]+S		E			
	3330		2100	A	A	A	A	16[1)]	16[1)]	21[1)]	16[1)]	A+S		16[1)]+S		E			
	3690		2280	A	A	A	A	16[1)]	16[1)]	21[1)]	16[1)]	A+S		16[1)]+S		E			
	4185		2595	A	A	A	A	21[1)]	16[1)]	21[1)]	16[1)]	A+S		16[1)]+S		E			
	4455		2730	A	A	16[1)]	16[1)]	21[1)]	16[1)]	21[1)]	21[1)]	A+S		16[1)]+S		E			
	4815		2955	A	A	A	A	21[1)]	16[1)]	36	21[1)]	A+S		16[1)]+S		E			
ML 80/P; /FP	3690		2280	A	A	16[1)]	16[1)]	21[1)]	16[1)]	36	21[1)]	A+S		16[1)]+S		E			
	4185		2595	16[1)]	16[1)]	21[1)]	16[1)]	36	21[1)]	46	31	A+S		16[1)]+S		E			
	4455		2730	16[1)]	16[1)]	21[1)]	16[1)]	36	21[1)]	57	31	A+S		16[1)]+S		E			
	4815		2955	A	A	21[1)]	16[1)]	36	21[1)]	57	31	A+S		16[1)]+S		E			
ML 100	3105		1765	A	A	A	A	A	A	A	A	A+S		16[1)]+S		E			
	3330		1830	A	A	A	A	A	A	A	A	A+S				E			
	3690		2280	A	A	A	A	21[1)]	16[1)]	21[1)]	16[1)]	A+S		A+S		E			
	4185		2595	A	A	A	A	A	A	21[1)]	16[1)]	A+S		A+S		E			
	4455		2730	A	A	A	A	21[1)]	16[1)]	31[1)]	16[1)]	A+S		A+S		E			
	4815		2955	A	A	A	A	21[1)]	16[1)]	36	21[1)]	A+S		A+S		E			
ML 100/P	4185		2595	A	A	21[1)]	16[1)]	21[1)]	16[1)]	36	21[1)]	A+S		A+S		E			
	4455		2730	A	A	21[1)]	16[1)]	31[1)]	16[1)]	46	21[1)]	A+S		A+S		E			
	4815		2955	A	A	21[1)]	16[1)]	36	21[1)]	57	31[1)]	A+S		A+S		E			
ML120EL[3)]	3105		1765	A	A	A	A	A	A	A	A	A+S		16[1)]+S		E			
	3330		1830	A	A	A	A	A	A	A	A	A+S		A+S		E			
	3690		2280	A	A	A	A	A	A	A	A	A+S		A+S		E			
	4185		2595	A	A	A	A	A	A	21[1)]	16[1)]	A+S		A+S		E			
	4455		2730	A	A	A	A	21[1)]	16[1)]	31[1)]	16[1)]	A+S		A+S		E			
	4815		2955	A	A	A	A	21[1)]	16[1)]	36	21[1)]	A+S		A+S		E			
ML120EL /P[3)]	3690		2280	A	A	21[1)]	16[1)]	21[1)]	16[1)]	36	21[1)]	A+S		A+S		E			
	4185		2595	A	A	21[1)]	16[1)]	21[1)]	16[1)]	36	21[1)]	A+S		A+S		E			
	4455		2730	A	A	21[1)]	16[1)]	31[1)]	16[1)]	46	21[1)]	A+S		A+S		E			
	4815		2955	A	A	21[1)]	16[1)]	36	21[1)]	57	31[1)]	A+S		A+S		E			
ML 120	4185		2505	A	A	A	A	A	A	A	A	A	A	A	A	E			
	4455		2640	A	A	A	A	A	A	A	A	A	A	21[1)]	16[1)]	E			
	4815		2910	A	A	A	A	A	A	A	A	21[1)]	16[1)]	36	21[1)]	E			
	5175		3135	A	A	A	A	A	A	A	A	21[1)]	16[1)]	36	21[1)]	E			
	5670		3450	A	A	A	A	A	A	A	A	31[1)]	16[1)]	36	21[1)]	E			
	6570		3855	A	A	A	A	A	A	31[1)]	16[1)]	36	31[1)]	89	36	E			
ML 120/P; /FP	4185		2505	A	A	A	A	A	A	A	A	21[1)]	16[1)]	31[1)]	16[1)]	E			
	4455		2550	A	A	A	A	A	A	16[1)]	A	31[1)]	16[1)]	31[1)]	21[1)]	E			
	4815		2910	A	A	A	A	A	A	21[1)]	16[1)]	21[1)]	16[1)]	46	21[1)]	E			
	5175		3135	A	A	A	A	21[1)]	16[1)]	21[1)]	16[1)]	36	21[1)]	57	31[1)]	E			
	5670		3450	A	A	A	A	21[1)]	16[1)]	21[1)]	16[1)]	36	21[1)]	89	31[1)]	E			
	6570		3855	A	A	A	A	31[1)]	21[1)]	31[1)]	21[1)]	46	31[1)]	89	36	E			
ML 130	4185	C	2505	A	A	A	A	A	A	A	A	A	A	A	A	E			
	4455	L	2370	A	A	A	A	A	A	A	A	A	A	A	A	E			
	4455	C	2640	A	A	A	A	A	A	A	A	A	A	21[1)]	16[1)]	E			
	4815	C+L	2910	A	A	A	A	A	A	A	A	21[1)]	16[1)]	36	21[1)]	E			
	5175	C+L	3135	A	A	A	A	A	A	A	A	A	A	A	A	E			
	5670	C+L	3450	A	A	A	A	A	A	A	A	A	A	36	21[1)]	E			
	6570	C+L	3855	A	A	A	A	31[1)]	21[1)]	31[1)]	21[1)]	46	31[1)]	89	36	E			
ML 130/P; /FP	4185	L	2190	A	A	A	A	A	A	A	A	A	A	21[1)]	16[1)]	E			
	4185	C	2505	A	A	A	A	A	A	A	A	21[1)]	16[1)]	31[1)]	16[1)]	E			
	4455	C	2550	A	A	A	A	A	A	A	A	31[1)]	16[1)]	31[1)]	21[1)]	E			
	4455	L	2370	A	A	A	A	A	A	A	A	A	A	31[1)]	16[1)]	E			
	4815	C+L	2910	A	A	A	A	A	A	21[1)]	16[1)]	31[1)]	21[1)]	46	21[1)]	E			
	5175	C+L	3135	A	A	A	A	A	A	21[1)]	16[1)]	21[1)]	16[1)]	36	21[1)]	E			
	5670	C+L	3450	A	A	A	A	A	A	21[1)]	16[1)]	36	21[1)]	57	31[1)]	E			
	6570	C+L	3950	A	A	A	A	36	21[1)]	36	21[1)]	57	31[1)]	89	46	E			

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 3.1 for standard platform bodies).
Notes: see page 3-67.

Table 3.11 (continued)
Installation of tail lifts

MODELS				Tail lift capacity kN (kg)															
	Wheel-base (mm)	Cab	Max. body over-hang (mm)	7.5 (750)		10 (1000)		12.5 (1250)		15 (1500)		17.5 (1750)		20 (2000)		25 (2500)		30 (3000)	
				Minimum value of subframe Section Modulus Wx (cm^3) as a function of the yield point of the material (N/mm^2)															
				240	360	240	360	240	360	240	360	240	360	240	360	240	360	240	360
ML 150	≤5175		≤3135	A	A	A	A	A	A	A	A	A	A	A	A	E			
	5670		3450	A	A	A	A	A	A	A	A	A	A	36	21[1)]	E			
	6570		3850	A	A	A	A	A	A	A	A	A	A	36[1)]	21[1)]	E			
ML 150/P; /FP	4185	L	2190	A	A	A	A	A	A	A	A	A	A	21[1)]	16[1)]	E			
	4185	C	2505	A	A	A	A	A	A	A	A	A	A	21[1)]	16[1)]	E			
	4455	C	2145	A	A	A	A	A	A	A	A	A	A	A	A	E			
	4455	L	2275	A	A	A	A	A	A	A	A	A	A	A	A	E			
	4815	L	2480	A	A	A	A	A	A	A	A	A	A	A	A	E			
	4815	C	2910	A	A	A	A	A	A	21[1)]	16[1)]	21[1)]	16[1)]	36	21[1)]	E			
	5175	C+L	3135	A	A	A	A	A	A	21[1)]	16[1)]	21[1)]	16[1)]	36	21[1)]	E			
	5670	C+L	3450	A	A	A	A	A	A	21[1)]	16[1)]	36	21[1)]	57	21[1)]	E			
	6570	C+L	3850	A	A	A	A	A	A	A	A	36	21[1)]	57	21[1)]	E			
ML 170; 180 ML 170/P; 180/P	≤5670	C+L	≤2500	A	A	A	A	A	A	A	A	A	A	A	A	A	A	E	
ML 170; 180	≤6570	C+L	3220	A	A	A	A	A	A	A	A	A	A	A	A	89	31	105	57
ML 170/P; 180/P	≤6570	C+L	3220	A	A	A	A	A	A	A	A	A	A	A	A	89	21[1)]	105	57
MH 190	3800	-	2275	A	A	A	A	A	A	A	A	A	A	A	A	A	A	89	46
	4200	-	2500	A	A	A	A	A	A	A	A	A	A	57	A	89	46	105	57
	4500	-	2230	A	A	A	A	A	A	A	A	A	A	A	A	A	A	89	46
	4800	-	2905	A	A	A	A	A	A	A	A	89	46	89	57	105	89	135	105
(302,4/212,4x 80x6,7)	5100	-	2815	A	A	A	A	A	A	A	A	57	A	89	46	105	57	135	89
	5700	-	2635	A	A	A	A	A	A	A	A	A	A	57	A	89	46	105	57
	6300	-	3780																
MH 190/P	3800	-	2275	A	A	A	A	A	A	A	A	57	A	89	46	89	46	135	89
	4200	-	2500	A	A	A	A	A	A	57	A	89	46	105	57	135	89	150	89
	4500	-	2230	A	A	A	A	A	A	A	A	57	A	89	46	89	46	135	89
	4800	-	2905	A	A	57	A	89	57	89	57	105	89	135	89	150	105	175	119
(302,4/212,4x 80x6,7)	5100	-	2815	A	A	57	A	89	46	89	46	105	57	135	89	150	89	175	105
	5700	-	2635	A	A	A	A	57	A	89	46	89	46	105	57	135	89	150	89
	6300	-																	
MP 190/HM	4200	-	1645	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	4500	-	1735	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	"	-	2230	A	A	A	A	A	A	A	A	A	A	A	A	A	A	57	A
	5100	-	2005	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	"	-	2410	A	A	A	A	A	A	A	A	A	A	A	A	57	A	57	A
	"	-	2635	A	A	A	A	A	A	A	A	A	A	57	A	89	46	89	57
	"	-	2815	A	A	A	A	A	A	A	A	A	A	57	A	89	46	89	57
	5700	-	2410	A	A	A	A	A	A	A	A	A	A	A	A	57	A	57	A
	"	-	2635	A	A	A	A	A	A	A	A	A	A	57	A	89	A	89	57
(304,4/214,4x 80x7,7)	6300	-	2455	A	A	A	A	A	A	A	A	A	A	A	A	57	A	57	A
	"	-	2815	A	A	A	A	A	A	A	A	A	A	57	A	89	46	89	57
	"	-	3230	A	A	A	A	57	A	57	A	57	A	89	46	105	46	135	89
MH 260/P; /PS; /PT	3800	-	2207	89	46	89	46	89	46	135	89	135	89	135	89	150	119	208	135
	4200	-	2567	89	46	105	57	135	89	150	89	150	89	173	105	208	135	286	150
(302,4/212,4x 80x6,7)	4500	-	2522	89	46	105	57	135	89	150	89	150	89	173	105	208	135	286	150
	4800	-	2522	89	46	105	57	135	89	150	89	150	89	173	105	208	135	286	150
	5100	-	2252	89	46	89	46	89	46	135	89	135	89	135	89	150	119	208	135
MH 260/TN MH 260/PT (p. 5700/1380) (302,4x80x6,7)	up to 5700 up to 5100	-	3475	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A

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 3.1 for standard platform bodies).
Notes: see page 3-67.

Table 3.11 (continued)
Installation of tail lifts

MODELS					Tail lift capacity kN (kg)															
Chassis frame section (mm)	Wheelbase		Max. body overhang (mm)		7,5 (750)		10 (1000)		12,5 (1250)		15 (1500)		17,5 (1750)		20 (2000)		25 (2500)		30 (3000)	
					Minimum value of subframe Section Modulus Wx (cm^3) as a function of the yield point of the material (N/mm^2)															
	(m)	(mm)			240	360	240	360	240	360	240	360	240	360	240	360	240	360	240	360
	4,2	4223	1195	1645	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	4,5	4493	1285	1735	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	4,5	4493	1780	2230	A	A	A	A	A	A	A	A	A	A	A	A	A	A	89	46
	5,1	5123	1555	2005	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	5,1	5123	1960	2410	A	A	A	A	A	A	A	A	A	A	A	A	89	46	89	46
MP 180;	5,1	5123	2185	2635	A	A	A	A	A	A	A	A	A	A	57	A	89	46	105	57
MP 190	5,1	5123	2365	2815	A	A	A	A	A	A	A	A	57	A	89	46	105	57	135	89
	5,7	5708	1960	2410	A	A	A	A	A	A	A	A	A	A	A	A	89	46	89	46
	5,7	5708	2185	2635	A	A	A	A	A	A	A	A	A	A	57	A	89	46	105	57
(302,4/	6,3	6293	2005	2455	A	A	A	A	A	A	A	A	A	A	A	A	89	46[1]	89	46[1]
212,4X	6,3	6293	2365	2815	A	A	A	A	A	A	A	A	57[1]	A	89	46[1]	105	57[1]	135	89
80X6,7)	6,3	6293	2770	3220	A	A	A	A	89	46[1]	89	46[1]	89	46[1]	105	57[1]	135	57[1]	173	105
	4,5	4471	1307	1760	A	A	A	A	A	A	A	A	A	A	A	A	A	A	89	46
	4,5	4471	1802	2250	A	A	A	A	A	A	A	A	57	A	89	46	89	46	135	89
	5,1	5101	1577	2030	A	A	A	A	A	A	A	A	A	A	A	A	89	46	89	46
MP 180/P;	5,1	5101	1982	2430	A	A	A	A	A	A	57	A	89	46	89	46	105	57	135	89
FP	5,1	5101	2207	2660	A	A	A	A	57	A	89	46	89	46	89	46	135	89	150	89
MP 190/P;	5,1	5101	2387	2840	A	A	57	A	89	46	89	46	105	57	135	89	150	89	173	105
/FP	5,7	5686	1982	2430	A	A	A	A	A	A	57	A	89	46	89	46	105	57	135	89
	5,7	5686	2207	2660	A	A	A	A	57	A	89	46	89	46	105	57	135	89	150	89
(302,4/	6,3	6271	2027	2480	A	A	A	A	A	A	57[1]	A	89	46[1]	89	46[1]	135	89	150	89
212,4X	6,3	6271	2387	2840	A	A	57[1]	A	89	46[1]	89	46[1]	105	57[1]	135	89	150	89	208	105
80X6,7	6,3	6271	2792	3240	89	46[1]	89	46[1]	105	57[1]	135	89	135	89	150	89	208	135	245	150
	4,2	4201	1127	1580	A	A	A	A	A	A	46	A	89	46	89	46	105	57	135	89
	4,2	4201	1622	2070	57	A	89	46	89	46	89	46	105	89	135	89	150	89	208	135
MP 240/P;	4,5	4471	1217	1670	A	A	A	A	A	A	57	A	89	46	89	46	105	57	135	89
/FP; /FS;/PS	4,5	4471	1622	2070	57	A	89	46	89	46	89	46	105	89	135	89	150	89	208	135
	4,8	4786	1487	1940	A	A	57	A	89	46	89	46	89	46	105	89	150	89	173	105
(302,4/	4,8	4786	1712	2160	89	46	89	46	89	46	105	57	135	89	135	89	173	105	208	135
212,4X	4,8	4786	2072	2520	89	46	105	57	135	89	150	89	150	89	173	105	208	135	286	150
80X6,7)	5,1	5101	1802	2250	89	46	89	46	105	57	135	89	135	89	150	89	173	105	208	135
	4,2	4201	1127	1580	A	A	A	A	A	A	A	A	A	A	A	A	A	A	89	46
MP 240/FT;	4,2	4201	1622	2070	A	A	A	A	A	A	A	A	57	A	89	46	105	57	135	89
/PT	4,5	4471	1217	1670	A	A	A	A	A	A	A	A	A	A	A	A	57	A	89	46
	4,5	4471	1622	2070	A	A	A	A	A	A	A	A	57	A	89	46	105	57	135	89
	4,8	4786	1487	1940	A	A	A	A	A	A	A	A	A	A	57	A	89	46	105	57
(302,4/	4,8	4786	1712	2160	A	A	A	A	A	A	57	A	89	46	89	46	105	57	135	89
212,4X	4,8	4786	2072	2520	A	A	57	A	89	46	89	A	105	57	135	89	150	89	173	105
80X6,7)	5,1	5101	1802	2250	A	A	A	A	46	A	89	46	89	46	89	46	135	89	150	89
	3,2	3218	820	1270	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	4,2	4208	1135	1585	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
MP 240;	4,2	4208	1630	2080	A	A	A	A	A	A	A	A	A	A	A	A	A	A	89	A
MP240/TN	4,5	4478	1225	1675	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	4,5	4478	1630	2080	A	A	A	A	A	A	A	A	A	A	A	A	A	A	89	A
	4,8	4793	1495	1945	A	A	A	A	A	A	A	A	A	A	A	A	A	A	89	A
	4,8	4793	1720	2170	A	A	A	A	A	A	A	A	A	A	A	A	89	A	89	A
(302,4X80	4,8	4793	2080	2530	A	A	A	A	A	A	A	A	A	A	89	A	89	A	135	57
X6,7)	5,1	5108	1810	2260	A	A	A	A	A	A	A	A	A	A	A	A	89	A	89	46
	3,2	3218	820	1270	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	3,5	3533	1405	1865	A	A	A	A	A	A	A	A	A	A	A	A	A	A	57	A
	3,8	3803	1135	1585	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	3,8	3803	1495	1945	A	A	A	A	A	A	A	A	A	A	A	A	A	A	89	A
MP 260	4,2	4208	1135	1585	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	4,2	4208	1495	1945	A	A	A	A	A	A	A	A	A	A	A	A	A	A	89	A
	4,2	4208	1630	2080	A	A	A	A	A	A	A	A	A	A	A	A	57	A	89	A
	4,2	4208	1855	2305	A	A	A	A	A	A	A	A	A	A	A	A	89	A	89	46
	4,5	4478	1990	2440	A	A	A	A	A	A	A	A	A	A	89	A	89	46	135	57
	4,8	4793	1495	1945	A	A	A	A	A	A	A	A	A	A	A	A	A	A	89	A
	4,8	4793	1720	2170	A	A	A	A	A	A	A	A	A	A	A	A	89	A	89	46
(302,4X80	4,8	4793	2125	2575	A	A	A	A	A	A	A	A	89	A	89	A	105	46	135	89
X6,7)	4,8	4793	2440	2890	A	A	A	A	89	A	89	A	89	46[1]	89	46	135	89	150	89
	3,8	3796	1127	1580	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	3,8	3796	1487	1940	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
MP 260/P;	4,2	4201	1127	1580	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
/FP	4,2	4201	1487	1940	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	4,2	4201	1622	2070	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
(302,4X80	4,2	4201	1847	2300	A	A	A	A	A	A	A	A	A	A	A	A	46	A	89	A
X6,7)	4,5	4471	1982	2430	A	A	A	A	A	A	A	A	A	A	A	A	89	A	89	46

For modes MP 190 E../P with 2792 mm rear overhang and models MP 240 E../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 3.1 for standard bodies).
Notes: see page 3-67.

Table 3.12
Installation of tail lifts
Bending moment permitted for runner of chassis frame/subframe

MODELS			Section Modulus Wx (cm^3) of subframe runner[2)]										
Chassis frame section (mm)	Wheel-base (mm)	Subframe material yield point (N/mm^2)	16	19	21	26	31	36	46	57	89	105	119
			Static bending moment permitted or chassis frame/subframe runner (shear resistant connections) (kNm)										
ML 60	2700	240	35,7	39,4	44,2	43,5	46,8	52,60	56,4	(60,8)			
ML 65	3105	360	44,7	50,5	52,5	54,4	(58,3)	(60,1)	(67,1)	(74,8)			
ML 75	3330												
	3690												
	4185												
(180,5X65X4)	4455												
ML 60	4815	240	39,0	42,9	47,9	46,9	50,4	56,7	(60,5)	(65,0)			
ML 65		360	48,7	56,3	(59,8)	(58,7)	(63,0)	(70,8)	(75,7)	(81,3)			
ML 75													
(182,5X65X5)													
ML 80	2700												
	3105	240	41,3	45,5	50,9	49,9	53,5	60,2	64,0	(68,4)			
	3330	360	51,7	57,6	59,6	62,3	(65,6)	(67,6)	(74,6)	(82,4)			
	3690												
ML 100													
(203X65X4)													
ML80	4185	240	45,2	49,6	55,2	53,9	57,8	(64,8)	(68,7)	(73,2)			
ML100	4455	360	56,5	65,1	(69,1)	(67,4)	(72,2)	(81,0)	(85,9)	(91,5)			
	4815												
ML 120EL	3105												
(205X65X5)	3330												
	3690												
ML 120	4185	240	48,6	52,2	53,3	56,9	58,2	60	65,8	72,1			
(207X65X6)	4455	360	67,3	72,3	73,8	78,8	80,6	83,2	41,1	99,8			
	4825												
ML 120	up to 5175	240	60,1	65,4	72,6	70,3	75	83,9	87,8	92,3			
ML 130	up to 4185	360	75,1	85,8	90,7	87,9	93,8	(104)	(109,7)	(115,4)			
ML 150	up to 3690												
(250X70X5)													
ML 120	5670	240	65,3	70,9	78,2	75,5	80,4	89,6	93,4	98,0			
ML 130	4455-4815	360	81,7	93,0	97,7	94,4	(100,5)	(112)	(116,8)	(122,5)			
ML 150	4185/4815												
(252X70X6)													
ML 120	6570	240	68,9	74,6	81,9	79,0	84,0	93,4	97,1	(101,7)			
ML 130; 150	5175/5670	360	86,1	98,0	(102,4)	(98,8)	(105)	(116,7)	(121,4)	(127,1)			
(253,4X70X6,7)													
ML 150	6570	240	74,2	82,4	86,1	84,0	88,6	94,8	101,7	117,5			
(255,4X70X7,7)		360	102,8	114,0	119,2	116,2	123,0	131,3	140,8	162,8			
ML 170; 180	up to 4185	240	59,1	65,4	70,4	68,0	72,5	80,4	84,0	88,4	109,3	115,9	116,8
(229,5X80X6		360	77,6	85,8	92,4	89,2	95,2	105,5	110,3	116,1	(143,3)	(152,1)	(153,3)
rear)													
ML 170; 180	4725/5310	240	62,5	68,9	74,0	71,4	76,0	84,0	87,5	91,9	113,2	119,9	120,6
(230,9X80X6,7	up to 4185	360	82,1	90,5	97,2	93,6	99,7	110,2	114,9	120,9	(148,5)	(157,4)	(158,3)
rear)													
ML 170; 180	5805-6570	240	67,4	73,9	79,1	76,0	80,8	89,0	92,4	96,7	118,4	(125,2)	125,7
(232,9X80X7,7	4725-6570	360	88,4	97,0	103,8	99,8	106,0	116,8	121,3	(126,9)	(155,5)	(164,3)	(165,0)
rear)													

( ) The necessity of installing stabilisers and checking stability during operation is to be ascertained.
Notes: see page 3.67.

Table 3.12 (continued)
Installation of tail lifts
Bending moment permitted for runner of chassis frame/subframe

MODELS			**Section Modulus Wx (cm³) of subframe runner²⁾**										
		Subframe material yield point	**16**	**19**	**21**	**26**	**31**	**36**	**46**	**57**	**89**	**105**	**119**
Chassis frame section (mm)	**Wheelbase (mm)**	**(N/mm²)**	**Static bending moment permitted or chassis frame/subframe runner (shear resistant connections) (kNm)**										
MH 190; MP 180; 190	up to 6300	240	55,2	61,3	65,6	63,3	67,6	74,7	78,4	82,7	(102,6)	(109,2)	(110,7)
MP 240/P; /FP; /FS;	up to 5100/1385	360	72,5	80,5	86,1	83,1	88,7	(98,1)	(102,8)	(108,6)	(134,7)	(143,4)	(145,2)
MP 240/PT; /PS; /PT;													
MH 260/P ;/PS		420	86,3	(95,9)	(102,5)	(99,0)	(105,6)	(116,8)	(122,4)	(129,2)	(160,3)	(170,7)	(172,9)
(212,4X80X6,7 rear)													
MP 240/TN	up to 5100/1380	240	90,7	99,6	(105,7)	(101,4)	(107,5)	(117,8)	(121,5)	(125,9)	(151,7)	(158,0)	(157,8)
MP 260 (6x4)	up to 4800/1380	360	(119,0)	(130,7)	(138,7)	(133,1)	(141,0)	(154,6)	(159,4)	(163,3)	(199,1)	(208,2)	(207,1)
MH 260/TN	up to 5700/1380	420	(141,7)	(155,6)	(165,1)	(158,5)	(167,9)	(184,1)	(189,8)	(196,8)	(237,0)	(247,8)	(246,5)
(302,4X80X6,7)													

MODELS			**Section Modulus Wx (cm³) of subframe runner²⁾**											
		Subframe material yield point	**135**	**150**	**173**	**208**	**245**	**286**	**317**	**343**	**374**	**406**	**439**	**474**
Chassis frame section (mm)	**Wheelbase (mm)**	**(N/mm²)**	**Static bending moment permitted or chassis frame/subframe runner (shear resistant connections) (kNm)**											
MH 190; MP 180; 190	up to 6300	240	(122,8)	(134,1)	(143,1)	(157,7)	(173,0)	(189,7)	(201,6)	(213,9)	(226,8)	(240,1)	(253,9)	(268,1)
MP 240/P; /FP; /FS;	up to 5100/1395	360	(161,2)	(176,0)	(187,7)	(207,0)	(227,1)	(249,0)	(264,6)	(280,0)	(297,7)	(315,2)	(333,2)	(351,9)
MP 240/PT; /PS; /PT;		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)
(212,4X80X6,7 rear)														
MP 240/TN	up to 5100/1380	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)
MH 260/TN	up to 5700/1380	360	(228,8)	(249,2)	(261,6)	(281,6)	(306,2)	(328,9)	(345,0)	(361,8)	(379,3)	(397,5)	(416,4)	(435,9)
MP 260 (6x4)	up to 4800/1380	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)
(302,4X80X6,7)														

( ) The necessity of installing stabilisers and checking stability during operation is to be ascertained.
Notes: see page 3-67.

Table for selection of runner profiles (see tables 3.11 and 3.12)

Section Modulus for each section Wx (cm³)	**Recommended section (or other with equal inertia and resistance moment) (mm) (channel profile)**	**Section Modulus for each section Wx (cm³)**	**Recommended section (or other with equal inertia and resistance moment) (mm) (channel profile)**
16	80x50x4	150	200x80x8
19	80x50x5	173	220x80x8
21	80x60x5	208	250x80x8
31	100x60x5	245	250x100x8
36	100x60x6	286	280x100x8
46	120x60x6	317	300x100x8
57	140x60x6	343	320x100x8
89	160x60x7	374	340x100x8
105	180x70x7	406	360x100x8
119	200x80x6	439	380x100x8
135	200x80x7	474	400x100x8

A = The reinforcing runner required for the corresponding subframe is sufficient (e.g. table 3.1 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
1 = If the type of subframe requires it, use larger runner profiles (see table 3.1)
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 3.11) 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. 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).
3 = On the MLL version, use a runner with Wmin no less than 57 cm^3.

Solutions with combined section runner profiles (see fig. 3.4)

	A	**B**	**C or D**	**E**	**F**	**G**
Material yield point (N/mm^2)	≤ 320	≤ 320	≤ 240	≤ 240	≤ 360	≤ 360
Max. runner profile height reduction (mm):	40	60	100	120	100	120
Combined reinforcements length (see Fig. 3.28) L_V = L_H=	 $0.5.L_U$ $0.6.L_U$	 $0.6.L_U$ $0.65.L_U$	 $0.8.L_U$ $0.95.L_U$	 $0.85.L_U$ $1.0.L_U$	 $0.8.L_U$ $0.95.L_U$	 $0.85.L_U$ $1.0.L_U$
Example: Combined section as an alternative to the channel section (mm): 250x80x8	⟦210x80x8	[] 190x80x8	[opp. ⟦ 150x80x8 + straight section 15x80	[]30x80x8 + straight section 15x80	⟦ 150x80x8 +⌈ angle section	[]30x80x8 +⌈ 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 fig. 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.

3.11 Vehicles for Municipal, Fire-fighting and Special Services

Special purpose superstructures may be installed on vehicles that are intended for special uses.
The use of such vehicles for uses other than those for which they are intended is subject to approval by the manufacturer.

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

- Building a subframe which is particularly strong at the rear or elastic mountings at the front of the vehicle.
- Shortening the rear overhang of the chassis. When very short overhangs are required, the chassis may be shortened immediately behind the rear spring support (or after the anti-roll bar connection in the case of pneumatic suspension), keeping the cross member connection to the chassis intact.
- Placing the engine exhaust in a vertical position, behind the cab. In such cases adopt solutions similar to those adopted by the Manufacturer (see Point 2.8.1.).
- Modifying the rear suspension by using asymmetrical springs.
- Rearranging the rear lights.

Precautions

Do not use the reverse light switch fitted on IVECO gearboxes for functions requiring a high degree of reliability and safety (e.g. stopping engine when reversing, on vehicles fitted for household waste collection, with personnel standing on the rear boards).

3.12 Installation of Snow-removal Equipment on Front of Vehicle

The installation of snow removal equipment on the front of the vehicle, such as blades or plows, requires the use of suitable supporting structures and entails observance of the specifications contained in point 2.2.1 concerning the connection to the chassis.

Furthermore, all government requirements and regulations governing the application of this type of equipment must be observed.

Operation and possibility to use the original components located at vehicle front (e.g. towing hook, footboard to clean windscreen) must be safeguarded. Otherwise the company carrying out the modification must fit equivalent systems in compliance with the safety regulations and norms.

For most of our vehicles - if used for snow removal purposes at maximum speeds of 62 kph - an increase of the maximum permissible weight of the axle may be granted upon request.

The Manufacturer that carries out the installation must document and guarantee the observance of the requested new weight limit.

3.13 Winch Installation

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

- On frame front end (front installation)
- On vehicle frame, behind the cab
- Between vehicle frame side member, centred or displaced on one side.
- On the frame rear end.

The installation should be performed so as not to interfere with operation of units and components of the vehicle, with respect to max. load limits allowed on axles and following the company directions.

Fixing of the winch unit and the relevant drive components should conform to directions reported at point 2.2.1 ensuring that the reinforced areas are not locally limited to the mounting area (see point 2.16) taking into consideration also the rope operations and in particular, its transverse component when the pulling action is running obliquely.

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

The company has various winch installations available for some models. When specific requests are made for commercially available types of winch, we suggest choosing those equipped with hydraulic systems that can be operated through the hydraulic pumps already used for equipment previously installed on the vehicle (tiltable cargo body, crane etc.). Should mechanical winches be mounted, the drive transmission will conform to the indications given at points 4.1 and 4.2. For worm screw type winches, the power take-off system arrangement should take into account the low performance of such a drive system.

Electrical winches should be used for low power requirements and for short periods of use because of the limited capacities of battery and alternator. Follow strictly the safety rules, if any.

4. POWER TAKE-OFFS

Index

4.1 General Specifications

For the control of the auxiliary groups like tippers, cranes, cement pumps, cement mixers, compressors, municipal vehicles etc. various types of power take-off can be used to supply the necessary drive. Depending on the type of use and the performance level required, the application may be applied to:

- the gearbox (or torque distributor)
- transmission
- the front of the engine
- the rear of the engine

The characteristics and performances are given in the paragraphs which follow and in the relevant documentation which will be supplied upon request.

For the definition of the power necessary for the apparatus to be controlled, particularly when the values requested are high, the absorbed power should also be considered during the drive transmission phase (5 to 10% for the mechanical transmissions, belts and gears, and greater values for the hydraulic controls).

The choice of transmission ratio for the power take-off should be made so that the absorption of power occurs in a flexible engine operating range: low r.p.m. (below 1,000 r .p.m.) must be avoided to prevent irregular running .

The power taken in relation to the number of revolutions of the power take-off at the required torque =

$$P(CV) = \frac{M \times n}{7023} \qquad P(kW) = \frac{M \times n}{9550}$$

P	=	Useable power
M	=	Torque permitted for the power take-off (Nm)
n	=	power take-off r.p.m.

Type of use

Both occasional and continuous use should be considered.

For occasional use periods of under 30 minutes are considered.

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

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

To avoid overloading, in some cases (e.g. hydraulic pumps, compressors) it may be necessary to include the application of devices like clutches or safety valves.

Transmissions

The kinematic forces of the transmission from the power take-off to the relevant apparatus should be carefully considered (angles, r.p.m., moment) during the design phase and the dynamic behaviour during operation in compliance with the transmission Manufacturer's instructions should be respected. The dimensions should take into consideration the forces which might occur under maximum power and torque conditions.

To obtain a uniformity of kinetic forces angles of equal value, maximum of 7°, should be obtained at the extremities (Fig. 4.1) . Solution Z is preferred to solution W due to the lower loads on the bearings of the power take-off and the equipment being driven. When it is necessary to obtain different spatial inclinations (φ), the variations in r.p.m. should be compensated for with the arrangement of the forks shown in Fig. 4.2.

For transmissions employing multiple sections, the instructions given at point 2.3.2 should be followed.

Figure 4.1

Solution Z

Solution W

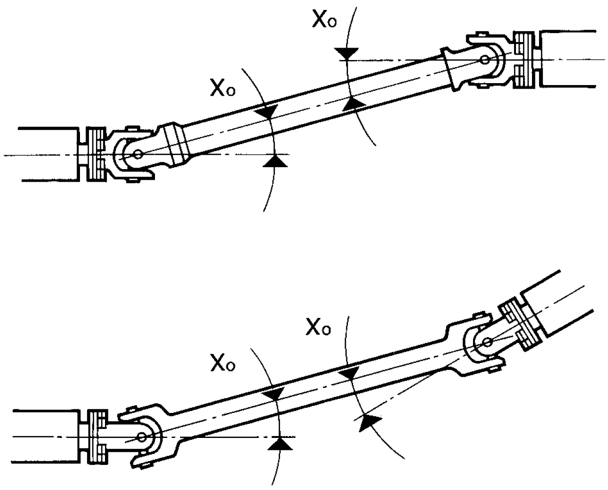
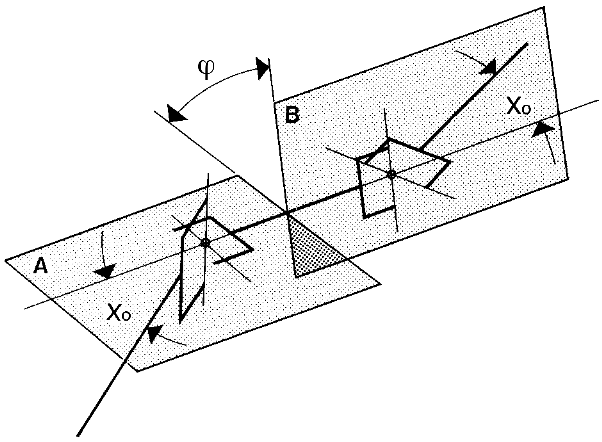


Figure 4.2



4.2 Power Take-off from Gearbox

Depending on the type of gearbox power can be taken from the layshaft through the flanges or splining located on the rear, side or lower part of the gearbox.

The technical characteristics necessary are given in the documentation supplied upon request for the various gearboxes.

The types of power take-off and the torque values obtained with the ratio between the number of output revolutions and engine r.p.m. are shown in Tables 4.1, 4.2 and 4.3.

The values refer to the conditions indicated in the table.

Higher values for occasional use must be agreed upon as each occasion arises depending on the type of use.

Check the vehicle to ascertain whether it is possible to fit a power take-off suitable to its size.

The power take-off applied to the gearbox must only be used when the vehicle is stationary and must be engaged and disengaged when the clutch is disengaged to avoid excessive stress on the synchronisers during gear change. For special situations when the power take-off is used and the vehicle is moving the gear must not be changed.

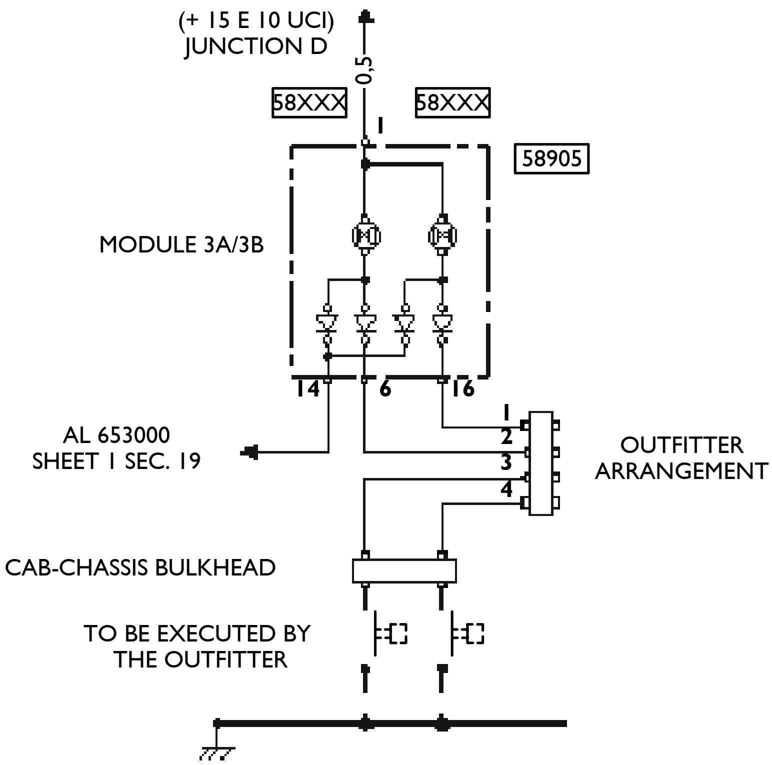
For gearboxes equipped with a torque converter, the same power take- offs used for normal gearboxes are, as a rule, used. It should be carefully noted that, when the engine r.p.m. is below 60% of the max. value the converter will be in the phase of hydraulic r.p.m.; in this phase, depending on the absorbed power, the r.p.m. of the power take-off is subject to oscillation despite the fact that the engine r.p.m. is constant.

For EuroCargo Tector

Power takeoff arrangement

The Tector range offers option 01483 (outfitter power takeoff arrangement), the general diagram of which is given below (for more detailed information, refer to Workshop Manual 603.43.693).

Figure 4.3



Direct Application of Pumps

When the application of pumps of other equipment (e.g. for the control of tipping apparatus or cranes) is carried out directly from the power take-off, without the use of intermediate shafts and after checking that the size of the pump permits margins of safety with chassis and engine unit (cross member, transmission shaft etc.), the static and dynamic torques exerted by the mass of the pump and by the power take-off should be checked for compatibility with the resistance of the walls of the gearbox.
By way of an example, the moment due to the additional masses must not adopt values of over 3% approx. of the maximum engine torque.

In cases where the gearbox is applied in a single unit with the engine, the value of the additional masses must be verified with regard to the inertial effects in order to avoid the induction of resonance conditions in the engine unit within the field of operational engine r.p.m.

Warning

- When employing power take-offs the torque values established in tables 4.1, 4.2. and 4.3 should be respected.
- For extended use the temperature of the gearbox oil should be checked. The oil temperature should not exceed 120°C and the temperature of the water should not exceed 100°C.
- Not all types of power take-off available on the market are suitable for continuous use. When in use the specifications (working periods, pauses etc.) specific to the power take-off in question should be respected.

Table 4.1
Gearbox power take-off data
IVECO gearbox

GEARBOX					POWER TAKE-OFF [2]			
Type	Drive take-off side [1]	Transmission ratio $i = \frac{\text{output rpm}}{\text{engine rpm}}$	ISO Flange type	Max. torque available Nm Continuous operation	Type	Transmission ratio $i = \frac{\text{output rpm}}{\text{engine rpm}}$	Max. torque available Nm[3] Continuous operation	Direction of rota-tion [4]
2838,5	D	0,447	7804-R	465	1600	0,82	255	C
					1700	1,12	185	M
	D	0,420	7804-R	530	1601	0,79	280	C
					1701	1,08	205	M
2845,5	P	0,420	7707-R	590[7]	1801	0,42	590	C
					1802	0,55	295	M
	S [5]	0,239	7804-R	580	-	-	-	-
	D	0,420	7804-R	540	1602	0,77	295	C
					1702	1,05	215	M
2845,6	P	0,420	7707-B	590[7]	1801	0,42	590	C
					1802	0,55	295	M
	S [5]	0,239	7804-R	580	-	-	-	-
	D	0,565	7804-R	540	1602	1,03	295	C
2855,6					1702	1,41	215	M
2855,5	P	0,565	7707-B	590[7]	1801	0,57	590	C
					1802	0,73	295	M
	S [5]	0,327	7804-R	520	-	-	-	-
	D	0,434	7804-R	640	1603	1,05	265	C
					1703	1,44	195	M
2865,6	P	0,434	7707-B	590[7]	1801	0,43	590	C
					1802	0,56	295	M
	S[5]	0,227	7804-R	580	-	-	-	-
	D	0,710	7804-R	470	1604	0,96	295	C
					1704	1,31	215	M
2870,9	P [6]	0,710	7707-B	385[7]	1802	0,92	295	M
	S[6]	0,507	7804-R	290	-	-	-	-
	I	0,767	7804-R	590	1705	1,03	295	M
					1706	1,42	215	M
	P [11]	0,767	7707-B	590[7]	1801[9]	0,77	590	C
2895,9					1802[9]	1,00	295	M
					1803[8)9)10)]	1,07	400	M
					1804[8)9)10)]	1,48	300	M
	I [5]	0,475	7804-R	440	-	-	-	-

1) Position of power take-off: S = left, D = right - P = rear, I = lower (with reference to direction of travel)
2) The types indicated are from IVECO by HYDROCAR. For the specific equipment the relative documentation should be requested.
3) The power take-off output values refer to continuous use (500 hours at 1,500 r.p.m.). For occasional use this is limited to rear take- offs, higher values must be evaluated r.p.m. and the the torque delivered.
4) Direction of rotation: M = engine; C = against engine.
5) On the reverse gear.
6) To install the necessary power take-off the connecting shaft with the relative bearing (part available form IVECO Spare Parts).
7) Value obtainable with direct power take-off. When using twin axle power take-offs, the take-off capacity on the gearbox depends, in addition to the spline shaft (value indicated in the table must not be exceeded) also on the capacity of the attachments on the rear wall of the gearbox for the power take-off; check therefore, on the basis of the internal ratio of the power take-off, the necessity of reducing the torque indicated in the table with the ratio:

$$\text{Max. tourque} = \frac{700\ \text{Nm}}{1 + \dfrac{\text{P.T.O. input rpm}}{\text{P.T.O. output rpm}}}$$

For the screws securing the power take-off to the gearbox, use torque 37-41 Nm.
The output torque from the power take-off depends on its internal r.p.m. ratio.
8) Possibility of installing in vertical and horizontal positions.
9) Necessary installation of a forced lubrication system originating from the gearbox (included in the kit).
10) In applications where torques are envisaged with peaks over three times the maximum value that can be taken from the gearbox, use power take-offs (1803, 1804 and 1816 Fire Fighting) equipped with a specific torque limiting device. In particular, it is recommended for the following uses:
- trucks to compress and transport refuse;
- high-pressure washing systems (bin-washers);
- cement pumps - water centrifuge pumps - rotating compressors;
- suction (drain clearing) vehicles.

11) To fit the p.t.o. on gearboxes manufactured after 10 / 08 / 98 connecting shaft, complete with bearings, part number 8868509 must be used and this is available from IVECO Spare Parts Division .

Simultaneous use of 2power take-offs
Where two power take-offs are used simultaneously, the take-off values on the gearbox must be reduced in order to avoid exceeding the sum of 100% of the maximum torque permitted for the single applications (e.g. for each power take-off 50% of the value indicated in the table or 70% for the first and 30% for the second).
More demanding uses must be subject to approval as each occasion arises by the competent Technical Office of our Sales Management Department.

Table 4.2
Gearbox power take-off data
ZF gearbox

GEARBOX						P.T.O.					
Type (aperture)	Drive take-off side [1]	Gear range [2]	Transmission ratio $i = \frac{\text{output rpm}}{\text{engine rpm}}$	Type of take-off [7]	Max. torque available (Nm)	Type	Gear range [2]	Transmission ratio [6] $i = \frac{\text{output rpm}}{\text{engine rpm}}$	Max. torque available (Nm)[3] Intermittent operation	Max. torque available (Nm)[3] Continuous operation	Direction of rotation [4]
ZF 9S-109 9S-109 IT (12,91-1,0)	P	-	0,72		800	N 71/b;c[5]	-	0,72	-	500	D
						N 71/2b;c[5]	-	0,95	300	-	S
						N 109/10b;c[5]	-	0,88 1,08 1,27 1,34[6] 1,42	- - - - -	400 340 300 290 270	S
ZF 16S-109 16S-109 IT (13,31-1,0)	P	L ---- V	0,79 ---------- 0,93		800	N 71/1b;c[5]	L V	0,79 0,93	-	500	D
						N 71/2b;c[5]	L V	1,04 1,23	300	-	S
						N 109/10b;c[5]	L V	0,96 1,14	-	400	S
							L V	1,18 1,40	-	340	S
							L V	1,39 1,64	-	300	S
							L V	1,46[6] 1,73[6]	-	290	S
							L V	1,55 1,83	-	270	S
ZF 16S-151 16S-221 (16,47-1,0) 16S-221 OD (13,8-0,84)	P	L ---- V	0,77 ------------ 0,92		1000	N 71/1b;c[5]	L V	0,77 0,92	-	1000	D
						N 71/2b;c[5]	L V	1,01 1,21	-	-	S
						N 221/10b;c[5]	L V	0,95 1,13	-	870	S
							L V	1,14 1,36	-	730	S
							L V	1,47 1,76	-	560	S
							L V	1,68 2,01	-	470	S
ZF 16S 151 16S 221 (16,47-1,0) 16S 221 OD (13,8-0,84)	P	L --- V	077 ----------- 0,92		1000	N 151/10 PL	L V	0,95 1,13	-	870	S
GEARBOXES WITH STEERING PUMP											
ZF 16S 151 IT 16S 221 IT (16,47-1,0) 16S-221 IT (13,8-0,84)	P	L --- V	077 ----------- 0,92		1000	N 71/1b;c[5]	L V	0,77 0,92	-	1000	D
						N 71/1b;c[5]	L V	1,01 1,21	300	-	S
						N 221/10b;c[5]	L V	0,95 1,13	-	870	S
							L V	1,14 1,36	-	730	S
							L V	1,47 1,76	-	560	S
							L V	1,68 2,01	-	470	S
GEARBOXES WITH INTARDER OR WITH INTARDER + STEERING PUMP											

1) Position of power take-off: S = left, R = right - P = rear, I = lower (with reference to direction of travel)
2) Gear range (pre-selector): L = normal; V = Fast.
3) Power take-off output values with an r.p.m. of 157 rad/se c (1,500 r.p.m.). The overall torque available depends on the engine r.p.m. and on the torque delivered. For other uses contact the Manufacturer supplying indications regarding the r.p.m., use, variations in torque (where applicable), overloading, inertia etc.
4) Direction of rotation: D = right; S = left (anticlockwise) seen from direction of travel.
5) Power take-off N. .../1 and N. .../2 used predominantly to command hydraulic pumps (e.g. dumpers, cranes, platforms, snowplows etc.). Power take-off N. .../10 used predominantly for continuous operation (command through transmission or direct application of pumps) of groups with high power requirements and r.p.m. (e.g. fire fighting vehicles, turntable ladders etc.) are available with different reduction gear ratios for the various applications. Where necessary the 352/1 b;c or N 352/2 b;c or N 353/2b;c power take-offs can be fitted.
Version "b": with flange (command through transmission shaft).
Version "c" for direct application of hydraulic pumps.
6) Not all gears are available as IVECO optionals.
7) Splined.

Table 4.3
Gearbox power take-off data
EATON gearbox

GEARBOX[1]					PTO side [2]						
Type (aperture)	Drive take-off side [3]	i = output rpm / engine rpm	Number of teeth in output	Max. torque available (Nm)	Drive take-off side1)	Type	i = output rpm / engine rpm	Max. torque available (Nm)[4] Intermittent operation Max. 30'	Max. 90' every 12h	Continuous operation	Direction of rotation [5]
EATON TS 13612 TS 16612 (14,88 ÷ 1,0)	D	0,513	78	400	-	-	-	-	-		-
	P		[6]	1500	P	1801.P 505+K504/S[8]	0,51	-	-	590	D
						1802.P 294+K504/S[7]	0,67	-	-	295	S
						1804.P 294+K504/S[7]	0,99	-	-	300	S
						1804.P 740+K504/S[8]	0,99	-	-	300	
						2401.P 801[7] [10] [14]	1,06	-	-	590	D
						2401.P 830[9] [10] [13]	1,06	-	-	590	
						2400.P 801[7] [10] [14]	1,46	-	-	550	D
						2400.P 830[9] [10] [13]	1,46	-	-	550	
						2403.P 830[9] [10] [13]	1,72	-	-	390	D
						2404.P 830[9] [10] [13]	1,92	-	-	380	
	I		78	750	I	1903.9 294[11] [12] [18]	0,98	-	-	380	D
EATON RT 11609 RT 14609 (12,65-1,0)	D	0,696[2]	45	750	-	-	-	-	-	-	-
	P		[6]	610	P[15]	P110F-100	0,221/0,334/0,45/ 0,612/0,824[16]	590	510	440	D
						P120P[17]	0,27/0,408/0,55/ 0,748/1,007[16]	412	300	150	S
						P120F-100	0,332/0,501/0,675/ 0,918/1,236[16]	440	380	237	S
	I		47	750	I	HY-1900	1,31	-	-	400	D
EATON RT 14609 (12,65-1,0)	D	0,696[2]	45	750	-	-	-	-	-	-	-
	P		[6]	610	P[15]	P210F-100	0,221/0,334/0,45/ 0,612/0,824[16]	590	510	440	D
						P220P[17]	0,27/0,408/0,55/ 0,748/1,007[16]	412	300	150	S
						P220F-100	0,332/0,501/0,675/ 0,918/1,236[16]	440	380	237	S
	I		47	750	I	HY-1900	1,31	-	-	400	D
EATON RT 11613 RT 14613 RT 14613B (14,24-1,0)	D	0,696[2]	45	750	-	-	-	-	-	-	-
	P		[6]	610	P[15]	P110F-100	0,262/0,396/0,533/ 0,591/0,976[16]	590	510	440	D
						P120P[17]	0,32/0,484/0,651/ 0,886/1,193[16]	412	300	150	S
						P120F-100	0,393/0,594/0,799/ 1,088/1,464[16]	440	380	237	S
	I		47	750	I	HY-1900	1,31	-	-	400	D

1) Data refers to the gearbox output. Check vehicle for possibility of installing power take-off.
2) The types indicated are from IVECO by Hydrocar.
3) Position of the power take-off: D = right; P = rear; I = lower (referred to direction of travel).
For the rear power take-offs the following solutions are possible (except for gearboxes: TS13612 and TS 16612):
   a) lower right-hand
   b) upper left-hand. An oil pump is necessary to supply the power take- off (excluding the power take-offs P110F-100 and P120F-100).
   c) lower right-hand and another in upper left-hand position. For that in the lower right-hand position a power take-off with built-in oil pump is necessary to lubricate the other power take-off (excluding the power take-offs P110F-100 and P210F-100 in upper left-hand position).
4) The output values of the power take-off refer to continuous use (500 hours at 1,500 r.p.m. of engine); the overall torque available depends on the engine r.p.m. and torque delivered. For other uses contact the Manufacturer supplying information regarding r.p.m., use, variations in torque (where applicable), overloading, inertia etc.
5) View from power take-off output.
6) Splined.
7) Output for pump attachment (4 holes ISO7653)
8) Output for cardan transmission (flange DIN00).
9) Output for cardan transmission (flange DIN10).
10) The power take-offs of the 2400,2401, 1403 and 2404 series: in the basic version this permits two drive take-offs: possibility of obtaining a different r.p.m. between the two outputs. For simultaneous use, the total torque obtained must not exceed the max. value indicated in the table.
11) Installation not possible simultaneous with the 2400 series power take-off.
12) Installations possible simultaneously between 1801/1804, 1903 and right-hand side. Max. value obtainable on gearbox 1500 Nm.
13) Output above centre of transmission.
14) Output below centre of transmission.
15) To install the power take-off the connecting shaft must be sufficiently long with suitable bearing. The engaging of the power take- off must activate the positioning device when the gearbox is in neutral.
16) The r.p.m. of the power take-off depends on the gear selected in the basic range.
17) The power take-offs P120P, P220P, P320P and P330P are used for the direct application of hydraulic pumps.
18) Its installation requires modification to the exhaust pipe and to the heat shield with 80 dB (A) equipment.

Table 4.4
Gearbox power take-off data
ZF - IVECO TEC "EuroTronic" Gearboxes

The following tables show the types of P.T.O. designed by ZF and Hydrocar, with their respective specifications, for TEC 1800/2200 "EuroTronic" gearboxes.

The application of power takeoffs fitted by bodybuilders or dealers (that is, after the vehicle has been manufactured) requires reprogramming of the transmission and engine electronic control unit, as well as other operations to be made on the electric and pneumatic systems.

Electronic Control Unit

This operation must be carried out following the instructions given in the IVECO manuals, only MODUS (available at IVECO Dealers and authorized IVECO Workshops), supply the relevant information to the P.T.O. used:

- Stationary use.
- Non-stationary use (the system however does not permit changing gear while the vehicle is moving).

After this operation, fix the adhesive plate, with the new data for the control unit, in the fuse compartment in the cab.

Using MODUS it is also possible to reprogram a new buzzer threshold for the engine speed, normally set at 1500 rpm.

Electrical System

Fit the P.T.O. control button in the cab with its relay close to the gear lever and connect to the electrical connector by the lever.
Install the relative warning light on the facia .

Under the cross member close to the gearbox there is an electric connection for the solenoid valve controlling the P.T.O.

Pneumatic System

Take the air from the protected service line to supply the solenoid valve (see paragraph 2.14.4).

a) ZF Power Take-off
Gearbox power take-off data
ZF - IVECO TEC "EuroTronic" Gearboxes

GEARBOX		ZF P.T.O.						
							ref. IVECO	
Type (aperture)	**Drive take-off position**	**Type**	**PTO position**	**i = output rpm / engine rpm**	**Max. torque available (Nm)**	**Direction of rotation (1)**	**connection pump "c" ISO 7653**	**flange connection "b" DIN 00/10**
	Rear	N 71/1[2]	central	0,71 (0,76)	1000	C	-	8866600EZ □
		N 71/2[2]	right/top right/bottom "b"	0,94 (1,0)	300 (3)	M	8866604EZ	8866603EZ □
							-	8866605EZ □
		N 71/4[2]	right/bottom	0,91 (0,97)	430 (3)	M	8866609EZ	8866608EZ □
12-1800 (14,88-1,0)		N 222/10	right/top	1,82 (1,94)	300	M	-	8866613EZ ○
				1,67 (1,79)	330		-	8866614EZ ○
				1,32 (1,41)	430		-	8866615EZ ○
		N 222/10 2 outputs	right/top "b" right/bottom "c"	1,82/1,12 (1,94/1,2)	300/630 (4)	M	8866616EZ ○	
				1,67/1,05 (1,79/1,12)	330/670 (4)		8866617EZ ○	
				1,32/0,97 (1,41/0,93)	430/690 (4)		8866618EZ ○	
		N 222/10	right/bottom	1,82 (1,94)	300	M	-	
(16-2200) (15,89-1,0)				1,67 (1,79)	330		-	
				1,32 (1,41)	430		-	
		N 222/10 2 outputs	right/top "c" right/bottom "b"	1,82/1,12 (1,94/1,2)	300/630 (4)	M	-	
				1,67/1,05 (1,79/1,12)	330/670 (4)		-	
				1,32/0,97 (1,41/0,93)	430/690 (4)		-	
		N 222 PL	top	1,85	5)	-	8866611EZ	-

Notes:

1) Direction of rotation:
   M = As engine
   C = Opposite to Engine
2) IVECO adapter kit (ZF):
   - With Intarder No. 8866622DB
   - Without Intarder No. 8866620EZ
3) Intermittent service (< 30 minutes)
4) Second output N10:
   The torques given correspond to the max. admissible value on the adapter shaft. If both outputs are used at the same time, the value given must be decreased correspondingly.
5) For supplementary power steering pump only.

Flanges: □ Ø 90 mm
○ Ø 100 mm

Output torques:

Depending on the use, check the torque peaks.
The torques given permit peaks up to 2 times the rated value. In the case of higher peaks (>2), it is necessary to make provision for protection against overloading.
To prevent vibration when using the power take off, avoid engine speeds lower than 1000 rpm.

b) Hydrocar Power Take-off
Gearbox power take-off data
ZF - IVECO TEC ”EuroTronic” Gearboxes

GEARBOX		HYDROCAR P.T.O.					
Type (aperture)	Drive take-off position	Type	PTO position	i = output rpm / engine rpm	Max. torque available (Nm)	Ref. IVECO: Pump connection	Ref. IVECO: Flange connection
12-1800 14,88-1,0	Rear	P.1801.P10.505 [1]	central	0,76	1000	-	8851460EZ[5] 8851463EZ[4,5]
		P.1802.P10.294 [2]	bottom	0,99	295	8851467EZ 8851470EZ[4]	8851466EZ[5] 8851469EZ[4,5]
		P.1865.P10.294 [3]	top	0,99	420	8851473EZ	8851472EZ[6]
		P..2420.P10.813	top	1 output 1,85	490	-	8851478EZ[6]
			bottom	2 outputs 1,20	640		
		P.2421.P10..813	top	1 output 1,79	425	-	8851479EZ[6]
			bottom	2 outputs 1,13	730		
		P.2422.P10.813	top	1 output 1,41	540	-	8851480EZ[6]
			bottom	2 outputs 0,94	890		
18-2200 15,89-1,0		P.1801.P10.505	central	0,71	1000	-	8851460EZ[5] 8851463EZ[4,5]
		P.1802.P10.294	bottom	0,93	295	8851467EZ 8851470EZ[4]	8851466EZ[5] 8851469EZ[4,5]
		P.1865.P10.294	top	0,93	420	8851473EZ	8851472EZ[6]
		P.2420.P10.813	top	1 output 1,82	390	-	8851478EZ[6]
			bottom	2 outputs 1,12	640		
		P.2421.P10.813	top	1 output 1,89	425	-	8851479EZ[6]
			bottom	2 outputs 1,05	730		
		P.2422.P10.813	top	1 output 1,32	540	-	8851480EZ[6]
			bottom	2 outputs 0,88	890		

Notes

1) Use 801.K510.S0 adapter. With Intarder, use 801.K521.S0 adapter.
2) Use 801.K521.S0 adapter.
3) Use 801.K522.S0 adapter.
4) With Intarder.
5) Flange DIN 00. ext. Æ 90 mm; i = 74.4 mm
6) Flange DIN 10. ext. Æ 100 mm; i = 84 mm

4.3 Power Take-off from Transfer Box

In vehicles with all wheel drive (4x4, 6x6) the application of power take- offs on the transfer box is possible. The r.p.m. for this use may be chosen on the basis of the most suitable gear.
Use is permitted only when the vehicle is stationary (transfer box in neutral). The specification regarding the correct use are given in the Owner's Manual supplied with the vehicle.

The available take-off values are given below:

Transfer box type	Power take-off	
	Max. capacity (Nm)	Output type
TC 700	500	flange ext. ∅ 90 mm 4 holes ∅ 8,1 mm
TC 1800[1)]	1180	flange ext. ∅ 120 mm 8 holes ∅ 10 mm; or direct pump connection

1) When the optional Power Take Off is required, detailed internal changes to the Transfer Box have to be made, therefore contact Sales Engineering for further information.

4.4 Power Take-off from Drive line

The authorisation for the application of a power take-off on the drive line downstream of the gearbox is issued after examination of the complete documentation presented to the Company.

The various power and torque values will be evaluated as each occasion arises on the basis of the conditions of use.

In general the following should be noted:
- The drive take-off may be operated only when the vehicle is stationary.
- The power take-off r.p.m. is dependent on the gear selected.
- The power take-off must be located immediately downstream of the gearbox. For vehicles with the drive line in two or more sections, the power take-off may also be fitted at the flexible support included between the first and second sections (respect the indications given in point 2.3.2).
- The angles of the drive line on the horizontal plane and vertical plane must be kept as close as possible to the original values.
- Masses and rigidity added to the drive line must not provoke a loss of balance or abnormal vibrations or damage the transmission drive line (from engine to axle) either during vehicle movement or during operation with the motor running.
- The power take-off must be fixed to the chassis with its own suspension.
- As the transmission is an important part for the safety of the vehicle, modification to it must only be carried out by specialist companies approved by the supplier of the transmission.

4.5 Power Take-off from Engine

In general the use of these power take-offs is planned for apparatus requiring a continuous power supply.

4.5.1 Front of engine

Crankshaft

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

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

- To the system comprising additional masses and relative rigidity which must be flexibly disengaged from the crankshaft with regard to the torsional and flexional effects.
- To the additional mass values and relative moments of inertia and to the distance from the centre of gravity of the masses from the centreline of the first main bearing which must be kept to a minimum.
- To avoiding a reduction in the radiator cooling capacity and dead water areas.
- To restoring the rigidity and resistance characteristics of the modified elements (cross member, bumper etc.).
- To avoid exceeding, during extended use, temperatures of the engine cooling fluid of over 100°C and engine oil temperature (measured on the main duct of the pressure switch area) of 110 to 120°C. A margin of approx. 10% should however be left. In other cases include supplementary heat exchangers.

Table 4.4. shows the values to be referred to for the take-off.

4.5.1.2

Figure 4.4

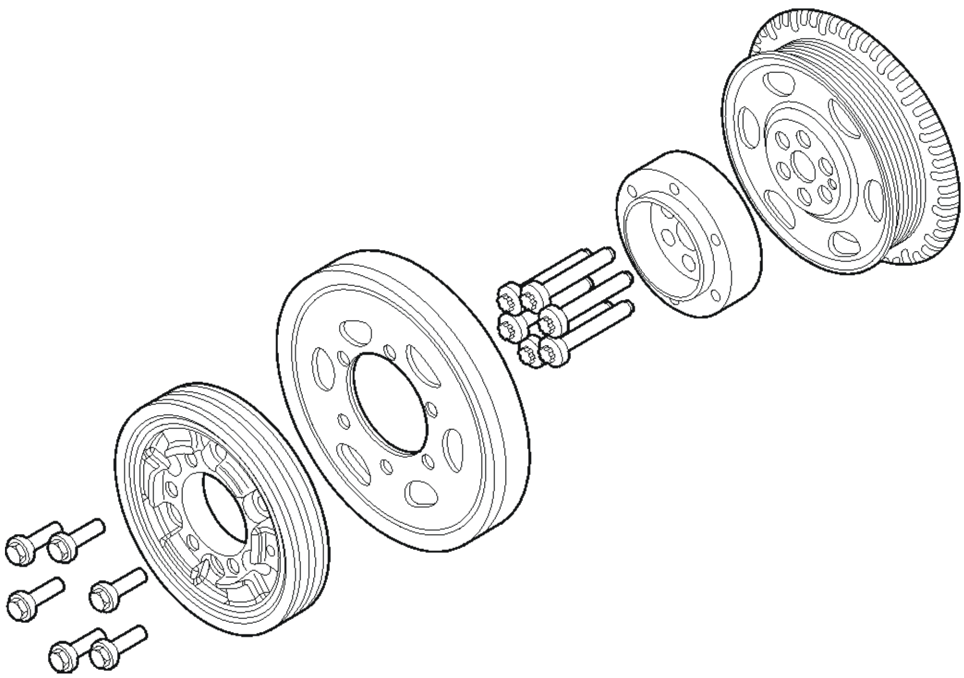


Figure 4.5

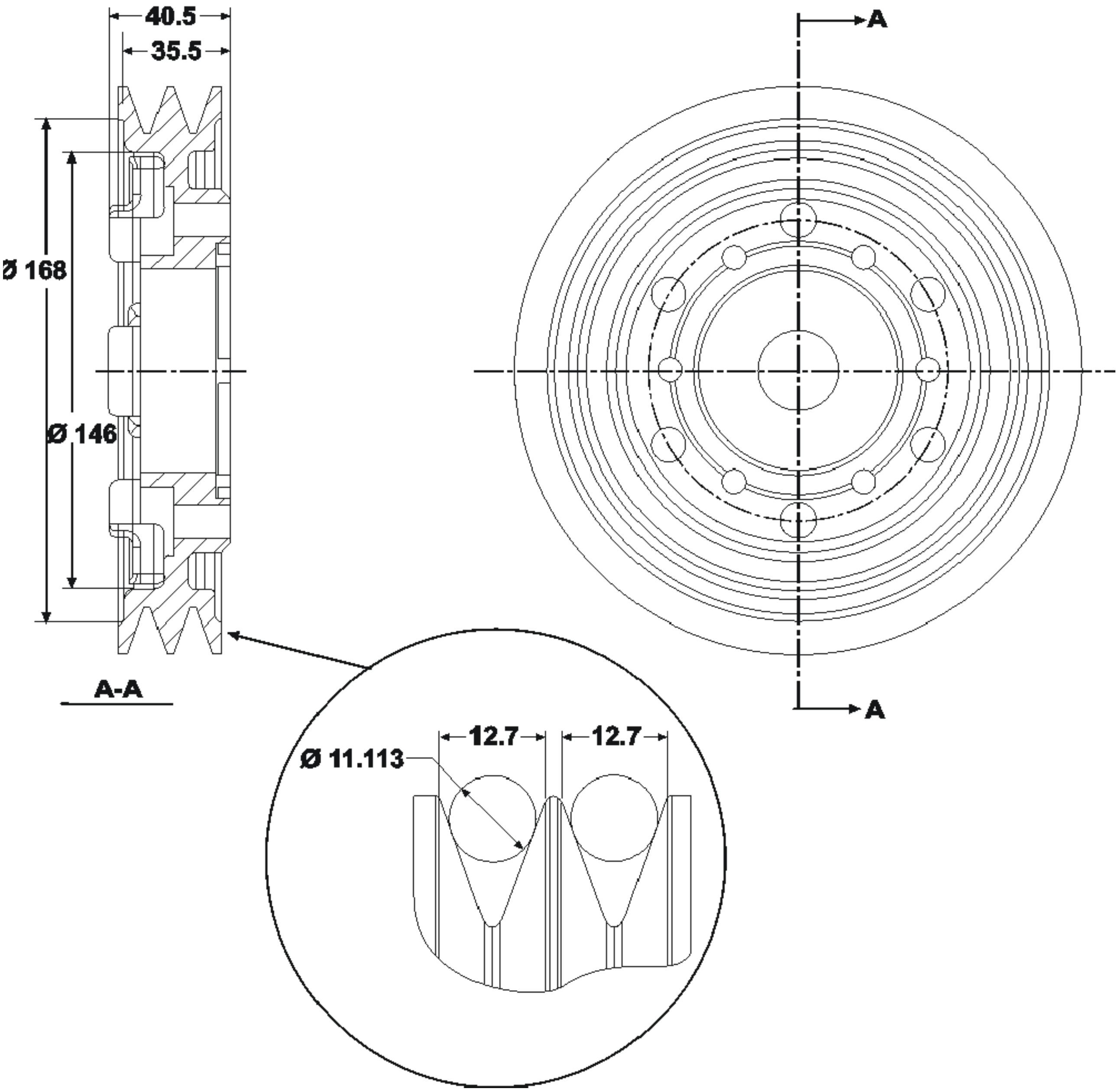


Table 4.4
Power take-off from front of engine

Engine type (power) (kW/Cv)	Rpm corresp. to full power rad/s	Rpm corresp. to full power (rpm)	Max. rpm admitted (start of red band) rad/s	Max. rpm admitted (start of red band) (rpm)	Max. take-off values: Max. torque available (Nm)	Max. moment of inertia (kgm^2)[1]	Max. bending moment (Nm)[2]	Moment multipl. factor (-)[3]	Multipl. factor ang. pos. (degrees)[4]
8040.45B (85/116)	282.69	2700	355.87	3400	100	0.015	80	1	0 - 45
8040.45 (100/136)	282.69	2700	355.87	3400	100	0.015	80	2	45 - 75
								3	75 - 105
								4	105 - 165
								3	165 - 195
								2	195 - 225
								1	225 - 360
8060.25R (105/143)	282.69	2700	355.87	3400	150	0.015	80	1	0 - 45
8060.45R (105/143)	282.69	2700	355.87	3400	150	0.015	80	2	45 - 75
8060.25V (130/177)	282.69	2700	355.87	3400	150	0.015	80	3	75 - 105
8060.45B (130/177)	282.69	2700	355.87	3400	150	0.015	80	4	105 - 165
8060.45 (152/207)	282.69	2700	355.87	3400	150	0.015	80	3	165 - 195
8060.45S (167/227)	282.69	2700	355.87	3400	150	0.015	80	2	195 - 225
								1	225 - 360
F4AE0481	282.69	2700	355.87	3400	150	0.015	100	1	225 - 15
F4AE0681	282.69	2700	355.87	3400	150	0.015	100	2	15 - 60
								3	60 - 105
								4	105 - 165
								3	165 - 210
								2	210 - 255
8360.46 (196/266)	230.34	2200	324	3100	200	0.025	100	2	0 - 30
								3	30 - 60
								4	60 - 120
								3	120 - 150
								2	150 - 180
								1	180 - 360
8460.41C (221/300.5)	230.34	2200	293.21	2800	400	0.050	120	2	0 - 30
8460.41K (254/345)	230.34	2200	293.21	2800	400	0.050	120	3	30 - 60
8460.41N (276/375)	219.8	2100	293.21	2800	400	0.050	120	4	60 - 120
								3	120 - 150
								2	150 - 180
								1	180 - 360
8210.22V (225/306)	209.4	2000	283	2700	400	0.050	150	2	0 - 30
8210.42K (272/370)	198.87	1900	272	2600	400	0.050	150	3	30 - 60
8210.42L (309/420)	198.87	1900	272	2600	400	0.050	150	4	60 - 120
8210.42M (346/470)	198.87	1900	272	2600	400	0.050	150	3	120 - 150
								2	150 - 180
								1	180 - 360
8280.42S (378/514)	198.87	1900	272	2600	500	0.100	250	1	0 - 45
								2	45 - 90
								3	90 - 135
								4	135 - 225
								3	225 - 270
								2	270 - 315
								1	315 - 360

Cursor 8 - F2B Series

E0681D (180/245)	251	2400	324	3100	400	0.050	120	1	0 - 180
E0681C (200/273)	251	2400	324	3100	400	0.050	120	2	180 - 210
E0681B (229/310)	251	2400	324	3100	400	0.050	120	3	210 - 240
E0681A (259/352)	251	2400	324	3100	400	0.050	120	4	240 - 300
								3	300 - 330
								2	330 - 360

Cursor 10 - F3A Series

E0681E (287/390)	220	2100	283	2700	500	0.050	150	1	0 - 180
E0681B (294/400)	220	2100	283	2700	500	0.050	150	2	180 - 210
E0681D (316/430)	220	2100	283	2700	500	0.050	150	3	210 - 240
								4	240 - 300
								3	300 - 330
								2	330 - 360

Cursor 13 - F3B Series

E0681G (279/380)	199	1900	262	2500	500	0.050	150	1	0 - 180
E0681C (324/440)	199	1900	262	2500	500	0.050	150	2	180 - 210
E0681E (353/480)	199	1900	262	2500	500	0.050	150	3	210 - 240
								4	240 - 300
								3	300 - 330
								2	330 - 360

1) Maximum moment of inertia of rigidly added masses.
2) Max. moment of flexure due to radial forces in relation to the first main support.
3) Amplification factor of the max. permitted flexural moment (depending on the angular position of the additional radial forces)
4) Direction of the additional radial forces. (zero: TDC cylinder axis; rotation: clockwise).

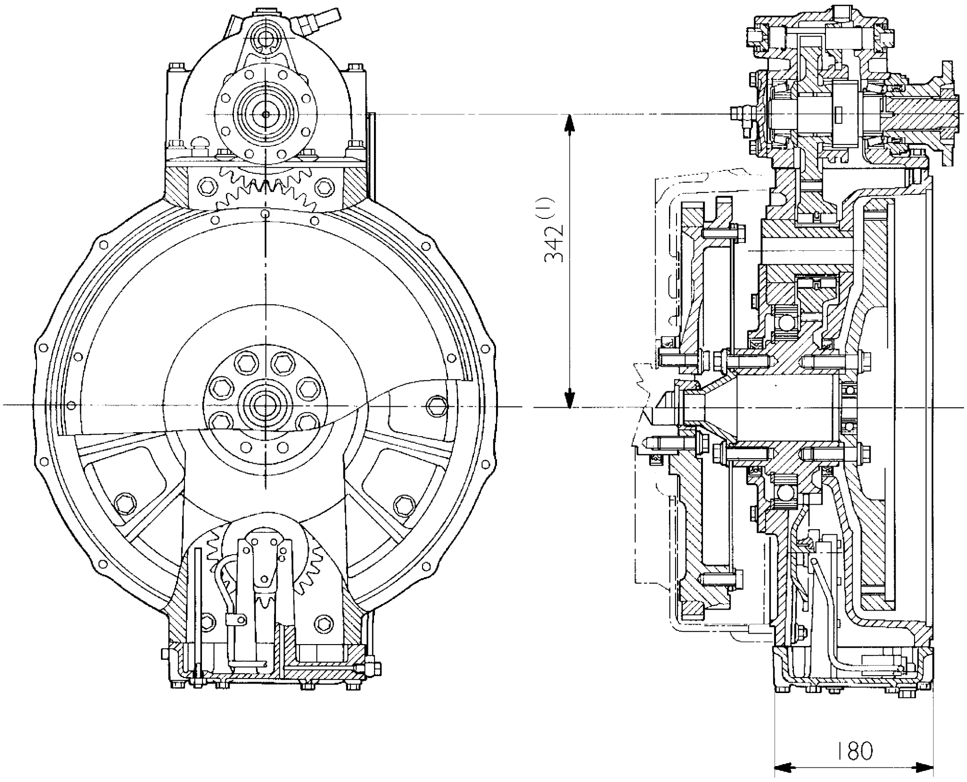
4.5.2 Rear of engine

a) Power takeoff from engine flywheel

On some models as an option, the IVECO Multipower power take-off is available. This is installed on the rear of the engine and is suitable for high power applications absorption when the vehicle is in gear and stationary (e.g. municipal vehicles, cement mixers e tc.) .

The power take-off occurs through the engine flywheel and is separate from the clutch control. The main dimensional characteristics are given in Fig. 4.6 while the technical characteristics are shown in table 4.5.

Figure 4.6



Note:
1) Available soon, a spacer to raise the output flange to 575 mm from 342 mm.
In the 4x4 and 6x6 versions, the solution which takes the Multipower installation rotated through 30° is possible.

Currently available is an option for a mechanical control with flanged output via coupling shaft. The engagement and disengagement must be carried out when the engine is stationary. A safety device prevents its use when the engine is running.

Table 4.5

Output rpm/engine rpm ratio	1.29
Max. torque available	900 Nm
Output flange	ISO 7646-120 X 8 X 10
Control	pneumatic
Direction of rotation	as engine
Installation on engines	series 8360; 8460; 8210

b) Power take-off from rear of engine

Models equipped with engines of the Cursor 8 and Cursor 13 series are supplied with friction clutch power takeoff which picks motion from the distribution gears, independently from the vehicle's clutch. The power takeoff is available in the direct pump mount version, or with a flange for Cardan shaft.

The installation of this power takeoff must be requested when ordering the vehicle; subsequent applications require the replacement of the whole engine.

Fig. 4.7 shows diagrams with dimensions and position of the PTO in relation to the engine and vehicle.
Tab. 4.6 gives the main data.

To take off a max. torque of 600 Nm (CURSOR 8) and 800 Nm (CURSOR 13) the moment of inertia of the rotating masses, movement after the power take-off (including the coupling shaft), must be no greater than: **0,03 Kgm^2**.

In no case must the max. available torque of 600 Nm (CURSOR 8) and 800 Nm (CURSOR 13) be exceeded.

Direct pump application

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

Connection with coupling shaft

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

Figure 4.7

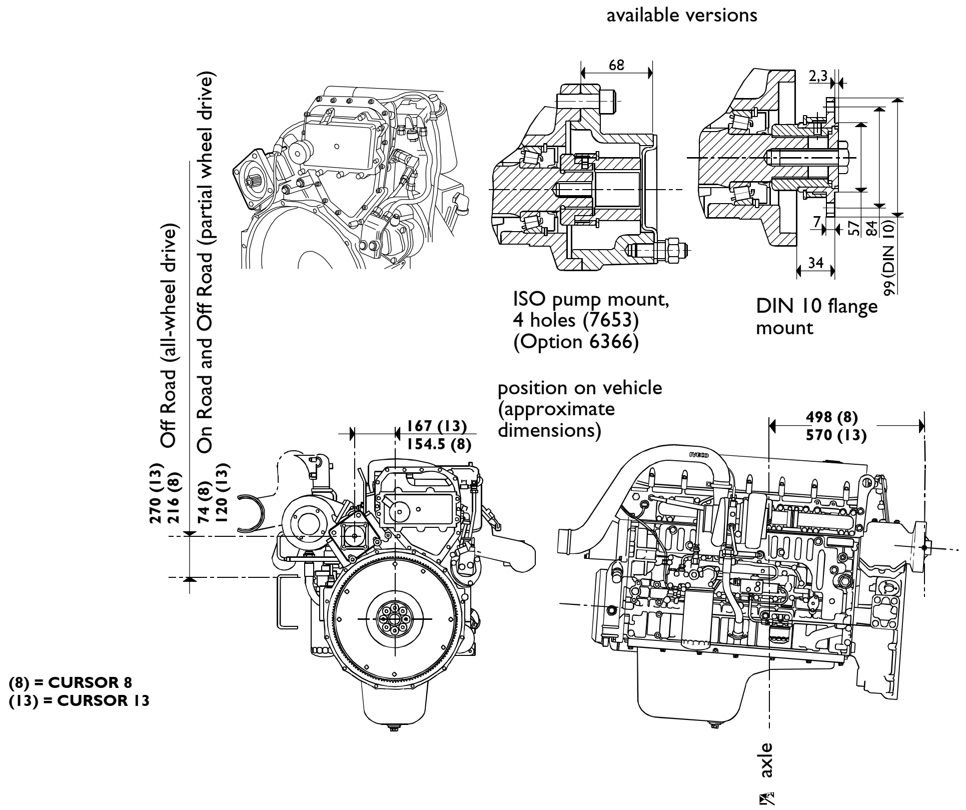


Table 4.6 Power takeoff distinctive features

Engine	Power take-off Drawing capacity (Nm)	Ratio $\frac{\text{output revs}}{\text{engine revs}}$	Type of output: Pump mount	Type of output: Flange mount	Direction of rotation
F2B E0681A/B/C/D	600	1.14	ISO, 4 holes(7653)	DIN 10	Opposite to engine
F3B	800	1.14	ISO, 4 holes(7653)	DIN 10	Opposite to engine

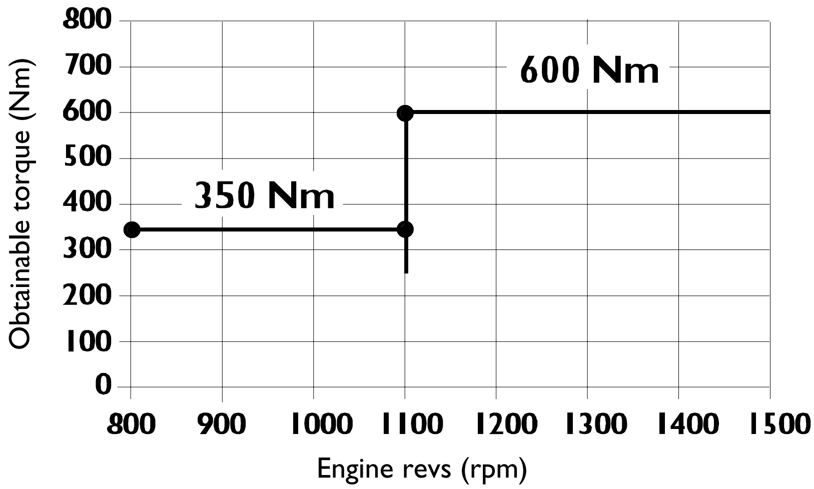
Note:

The power takeoff is manufactured by Hydrocar and is equipped with a pneumatic control with an oil-bath disc clutch.

Limits of the torque obtainable from the power takeoff according to engine revs

Torque drawing from the power takeoff is described in the following diagrams:

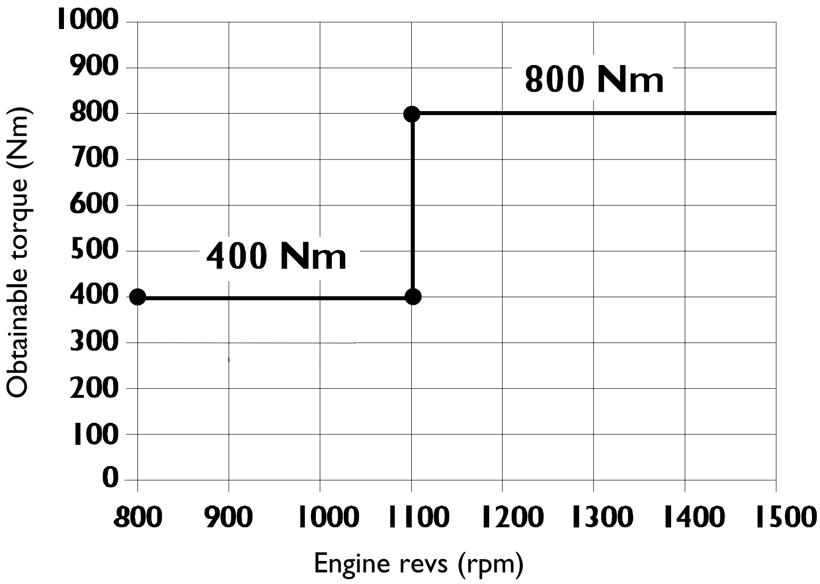
Figure 4.8 (CURSOR 8)



VEHICLE PROGRAMMING

- **Vehicle stopped - PTO mode ON**
  Torque drawing of 600 Nm is permitted over 1,100 r.p.m.
- **Vehicle running - PTO mode ON**
  . no limit to the torque obtainable from the power takeoff according to engine revs;
  . engine idle running set to 800 r.p.m.;
  . the power takeoff friction clutch air supply system pressure must be between 5.5 and 6.5 bar.

Figure 4.9 (CURSOR 13)



VEHICLE PROGRAMMING

- **Vehicle stopped - PTO mode ON**
  Torque drawing of 800 Nm is permitted over 1,000 r.p.m.
- **Vehicle running - PTO mode ON**
  . no limit to the torque obtainable from the power takeoff according to engine revs;
  . engine idle running set to 700 r.p.m.;
  . the power takeoff friction clutch air supply system pressure must not exceed 8 bar.

4.6 Engine speed sensing by means of EDC system (Eurotech Range …)

a) Control Unit M7

For engines which are equipped with this function the EDC system includes an electronic fuel injection regulation system, excluding the mechanical control between accelerator pedal and injection pump.

The engine receives the exact quantity of diesel required for its optimal operation at all times.

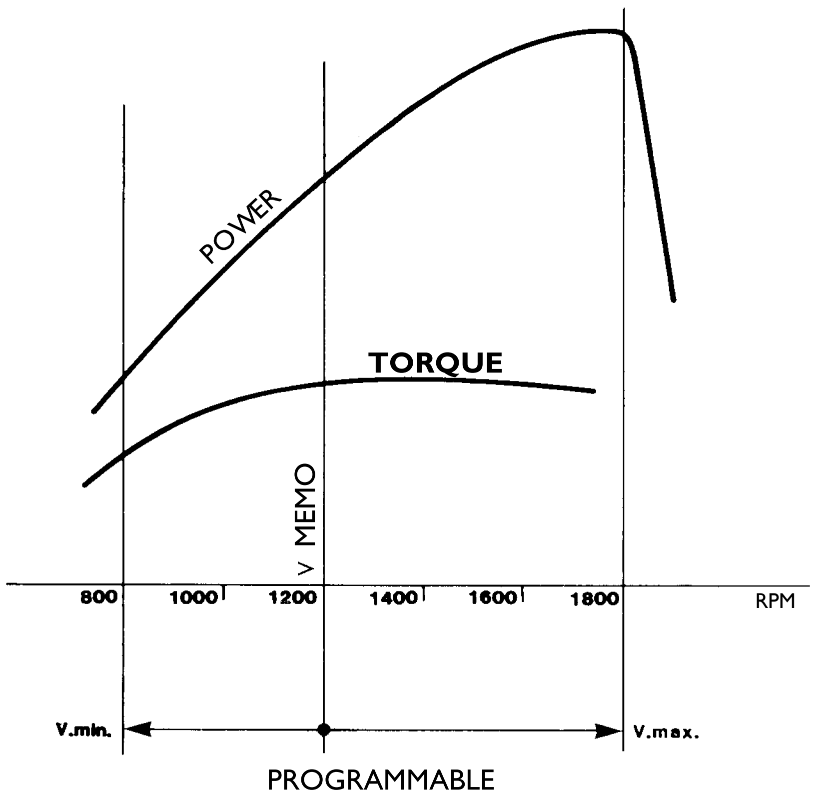
The instructions for the correct use are give in the Owner's manual supplied with the vehicle.

For power take-off applications, it is possible to adjust the engine r.p.m. during the power take-off phase. This occurs without a reduction in the engine r.p.m. during the take-off phase (isochronal regulation of the r.p.m.). The regulation is carried out via the "Cruise Control" switches as follows:

- Pressing the "MEMO" button when the vehicle is stationary automatically positions the engine r.p.m. at a value already memorised at V memo (approx. 1100 to 1200 r.p.m.).

- Through the commands "SET+ and SET-" it is possible to set the number of revolutions required (V min. 800 to 900 r.p.m.; V Max. 1600 to 1800 r.p.m.).

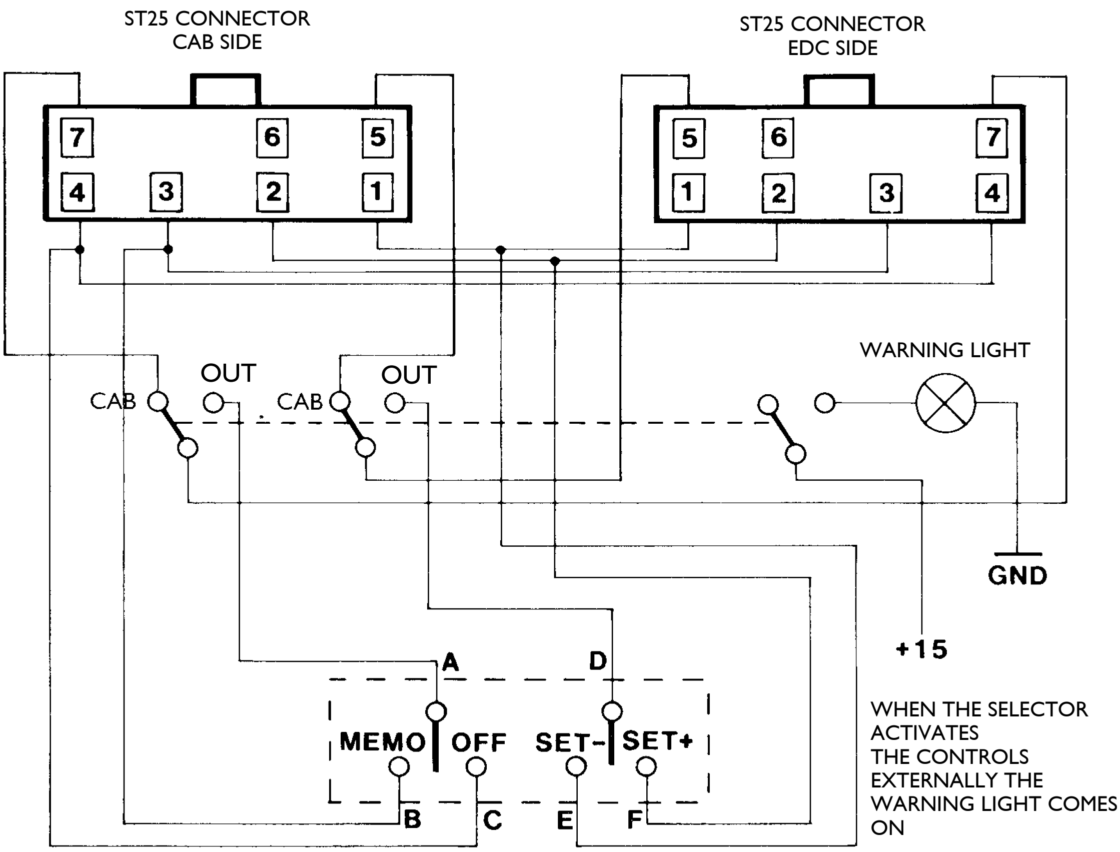
Figure 4.10



- Activating the "OFF" button or pressing the brake pedal, clutch pedal or engine brake, the control function of the engine is disengaged.

Should it be necessary to control the engine r.p.m. from outside the cab during the use of the power take-off (remote control), a "joystick" type control can be used in accordance with the chart given below. The precautions given at point 2.15 should be observed to guarantee a good level of insulation.

Figure 4.11



For power take-offs where it is necessary to set the values for V memo and V max. which are different from those already established (e.g. to avoid overrunning of the pump) the system permits the resetting of the control unit for the new values required.

The operation can be carried out by sending the control unit to the IVECO Service Network equipped with MODUS and supplying the following information:

- Type of vehicle; chassis N°
- Type of engine; Serial N°
- V memo (r.p.m.) required
- V max (r.p.m.) required.

The system permits the adjusting of V memo up to V max - 50 r.p.m.

b) Control unit MS 6.2 (CURSOR 8 - 10 - 13 Engines)

See the instructions in section 5, point 5.7.

4.7 Engine speed sensing by means of EDC system (EuroCargo TECTOR)

EDC 7 control unit

The EDC system performs electronic adjustment of fuel injection, without a mechanical link between the accelerator pedal and the injection pump.

The engine is continuously fed with the correct amount of diesel fuel required for optimum operation.

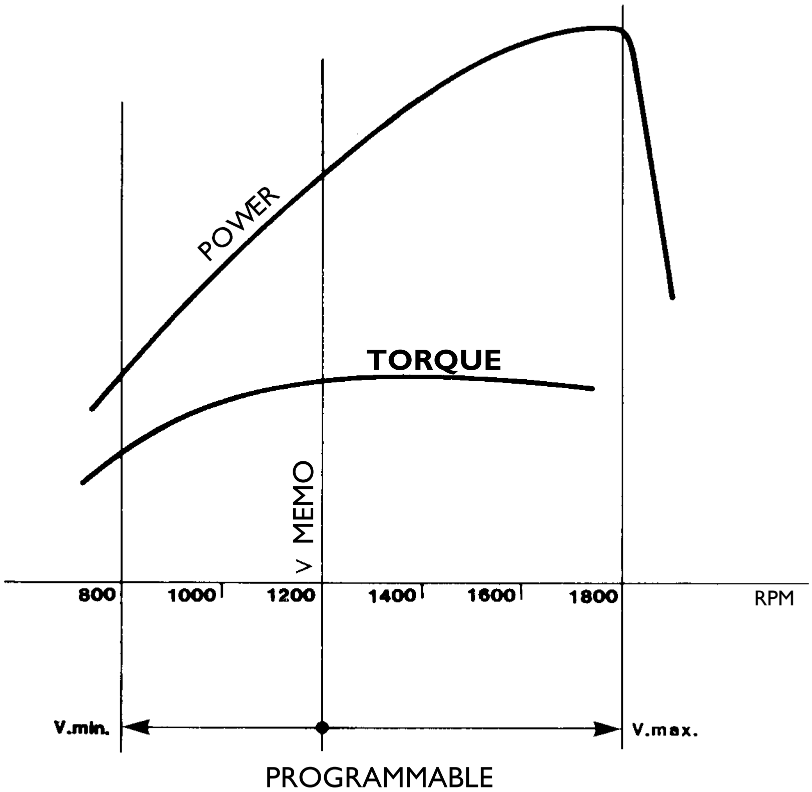
The instructions for correct use are shown in the owner handbook.

For power takeoff applications, it is possible to set the engine revs to the required value; this occurs without any reduction of engine speed during the power take off phase (isochronous revs adjustment). Adjustment is made through the Cruise Control switches as follows:

1 When the "MEMO" button is pressed, the engine speed is automatically set to the number of revs already stored in the memory, V memo (approximately 1,100 – 1,200 r.p.m.).

2 The required r.p.m. can be set by means of "SET+" and "SET-" controls.

Figure 4.12



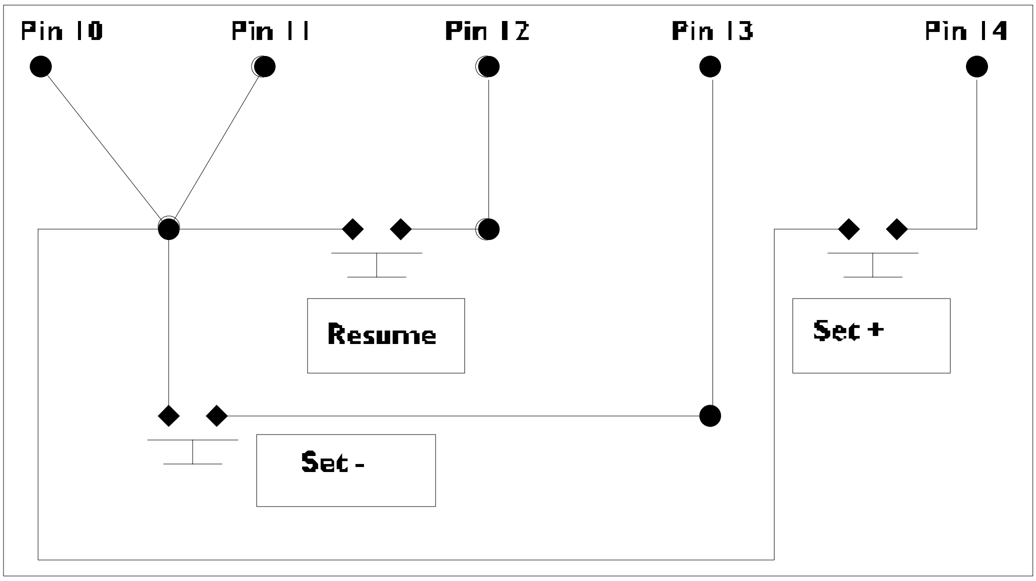
3 FOR VEHICLES WITHOUT CRUISE CONTROL LEVER:
A jumper connection with a n.c. button must be available between pins 10 and 11; when the button is pressed (and, therefore, contacts between pins 10 and 11 are open), the engine speed control is left out and idle speed is resumed. To perform the functions described in steps 1 and 2, the contact between pins 10 and 11 must be closed.

4 When the “OFF” button is actuated, or the brake, clutch or exhaust brake pedals are pressed, the engine control function is disabled

When using power takeoffs and the engine revs are to be controlled from inside the cab (remote Control), a device of the “JOYSTICK” type can be used, and the system must operate according to the diagram below. Observe the precautions described in paragraph 2.15, taking care to ensure proper insulation.

Figure 4.13

The contacts shown must be made using toggle switches instead of the normal type of switch.



For power take-offs where it is necessary to set the values for V memo and V max. which are different from those already established (e.g. to avoid overrunning of the pump) the system permits the resetting of the control unit for the new values required.

The operation can be carried out by sending the control unit to the IVECO Service Network equipped with MODUS and supplying the following information:

- Type of vehicle; chassis number
- Type of engine; serial number
- Desired V memo (r.p.m.)
- Desired V max (r.p.m.)
- Desired V min (r.p.m.)

The system permits the adjusting of V memo up to V max - 50 r.p.m.

For further indications, see Section 5, paragraph 5.8.

4.8 Engine r.p.m. Adjustment for Drive Take-off

For the application of the power take-offs depending on the additional group and the type of use, it may, in certain cases, be necessary to adopt injection pump governors equipped with specific characteristics.

In cases where the engine is equipped with a minimum and maximum governor, the regulation for power take-off r.p.m. is made on the basis of the power required (e.g in tippers) directly by the driver who, acting on the accelerator pedal, adjusts the flow of fuel.

When the additional group (e.g. crane, tailboard loader etc.) separate from the power requested requires the operation at certain engine r.p.m. values, the use of all speed governors must be included with the use of supplementary devices (hand-operated throttle).

In cases where the characteristics of the added group (e.g. pump, compressor etc.) make it necessary to remain below certain limits of r.p.m. (permitted r.p.m.), the all speed governors values must be equipped with a device which, activated mechanically or pneumatically with the engagement of the power take-off, limits the maximum r.p.m. during the take- off phase.

For some models the Company has made different governors available with the possibility of intermediate halting. Its adjustment may be made by the bodybuilder or by a workshop specialised in injection pumps, when the additional group is installed.

The change in the r.p.m. depends on the r.p.m. used by the engine and absorbed power.

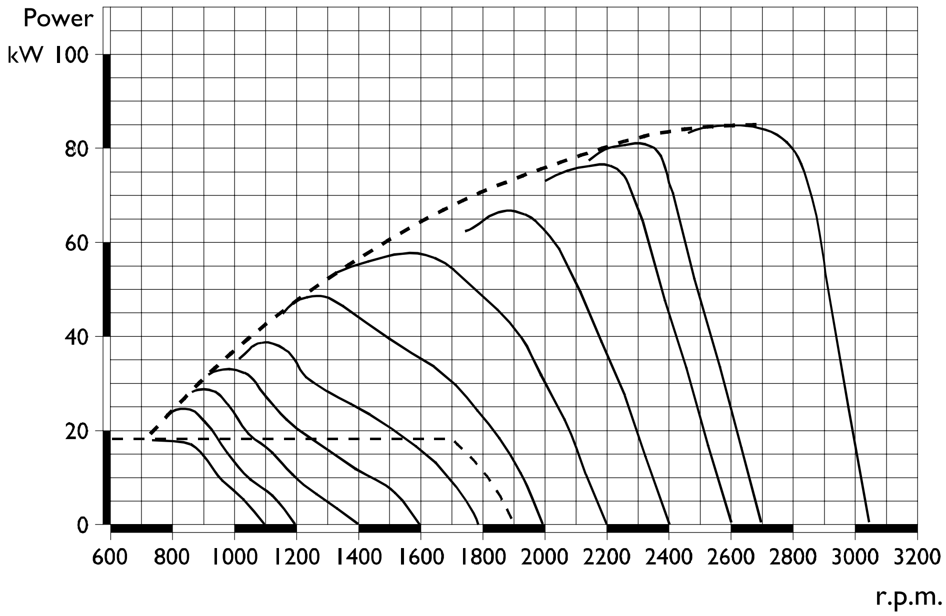
The governor diagrams given below show that the change decreases with the increase in the engine r.p.m. and increases proportionally with the power value taken off.

From the engine governor graphs below, depending on the power required, it is possible to establish the change in r.p.m. to be taken into consideration when taking-off with the desired r.p.m. The more vertical the curves, the less the absorbed power r.p.m. varies.

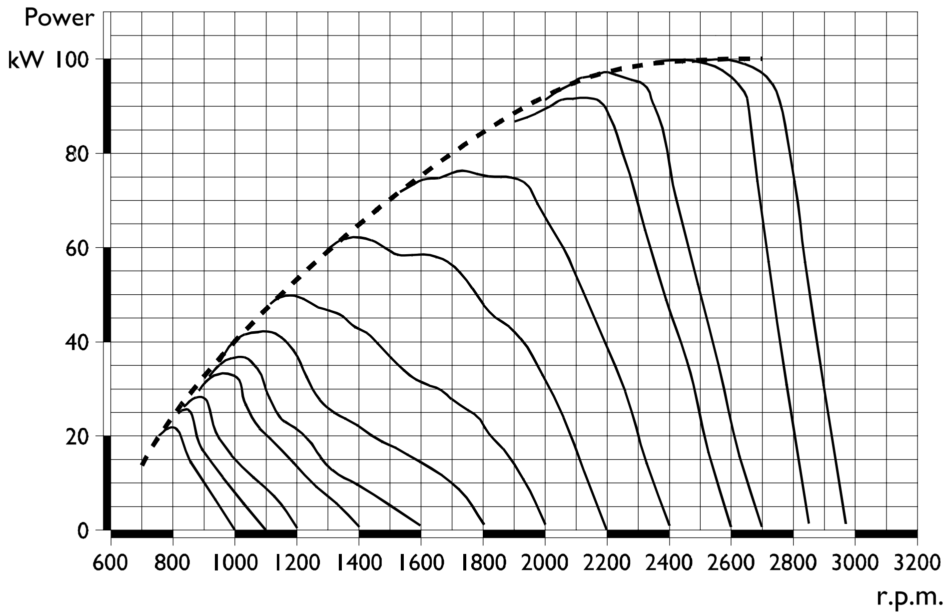
Example

Engine	8040.45 B
Power to be taken off	18 kW (25CV)
Requested r.p.m. (with power take-off)	1700 r.p.m.
Change	11.7%
r.p.m. to adjust (no load) to obtain 18 kW at 1700 r.p.m.	1900 r.p.m.

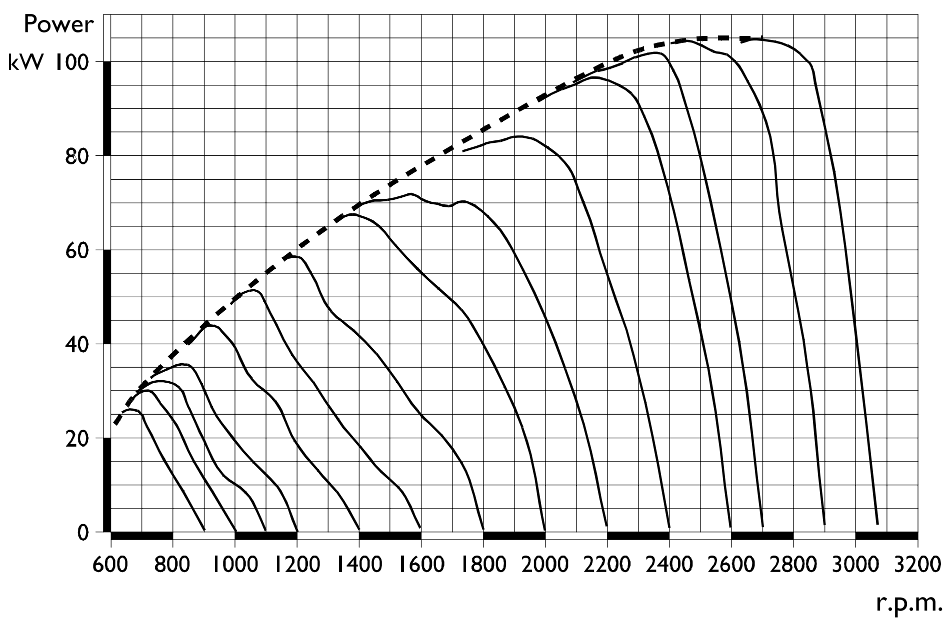
8040.45B 85 kW/116 Cv 2700 r.p.m.



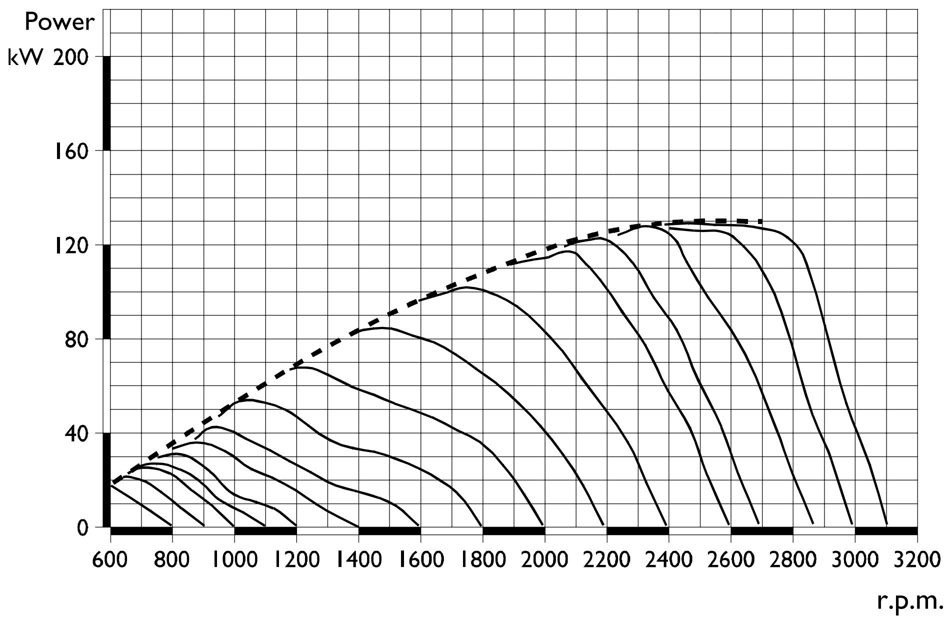
8040.45 100 kW/136 Cv 2700 r.p.m.



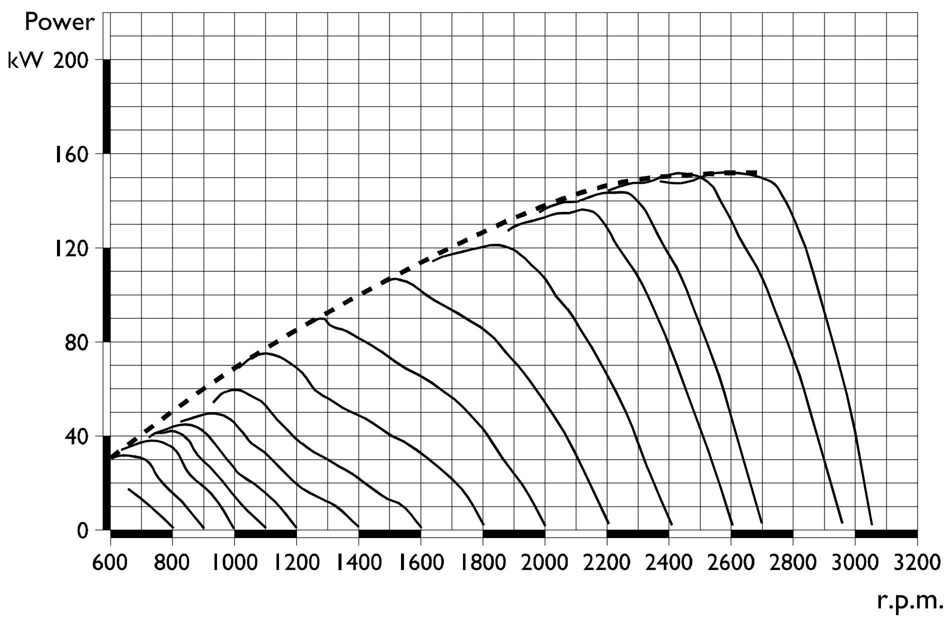
8040.45R 105 kW/143 Cv 2700 r.p.m.



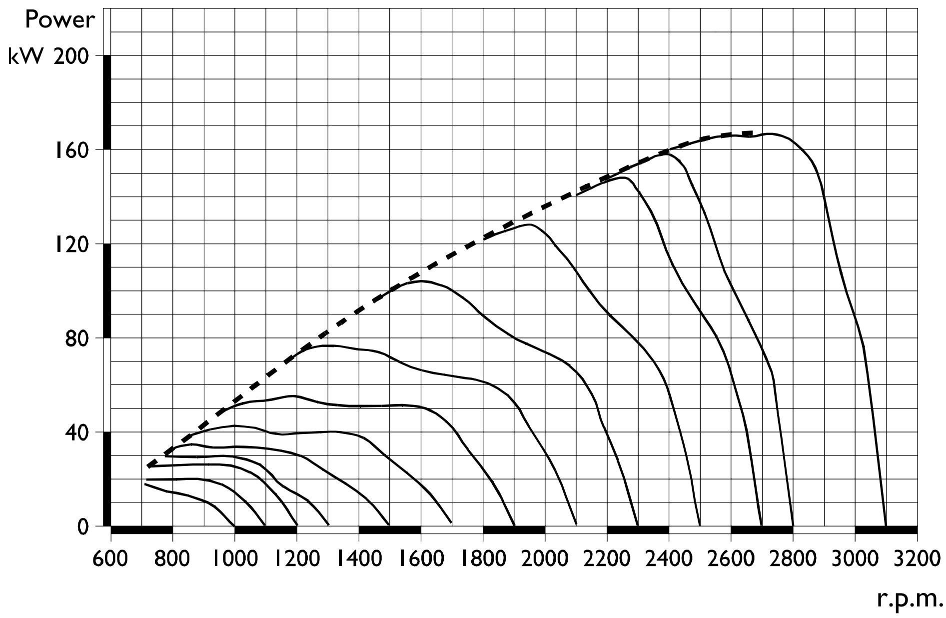
8060.45B 130 kW/177 Cv 2700 r.p.m.



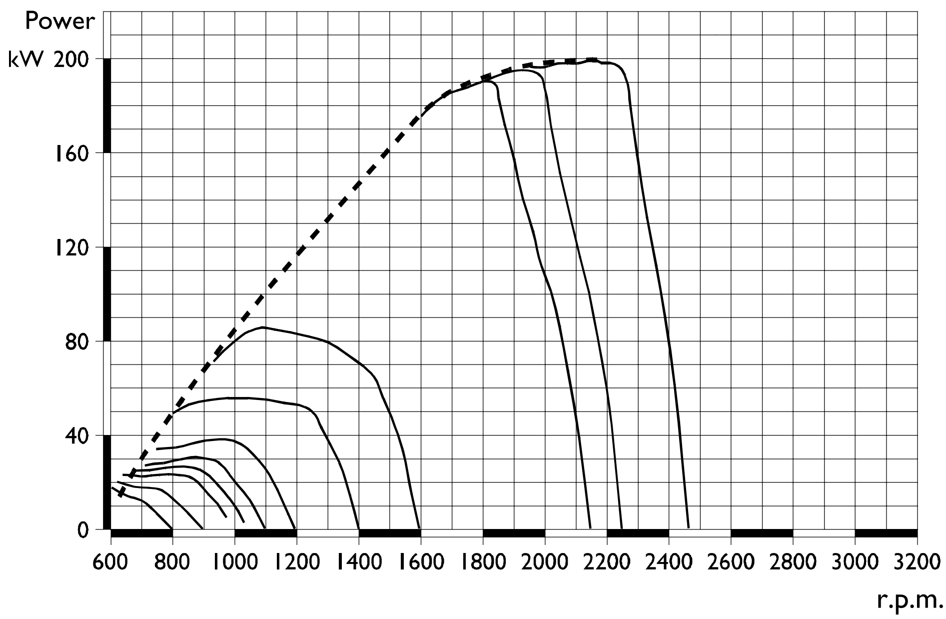
8060.45 152 kW/207 Cv 2700 r.p.m.



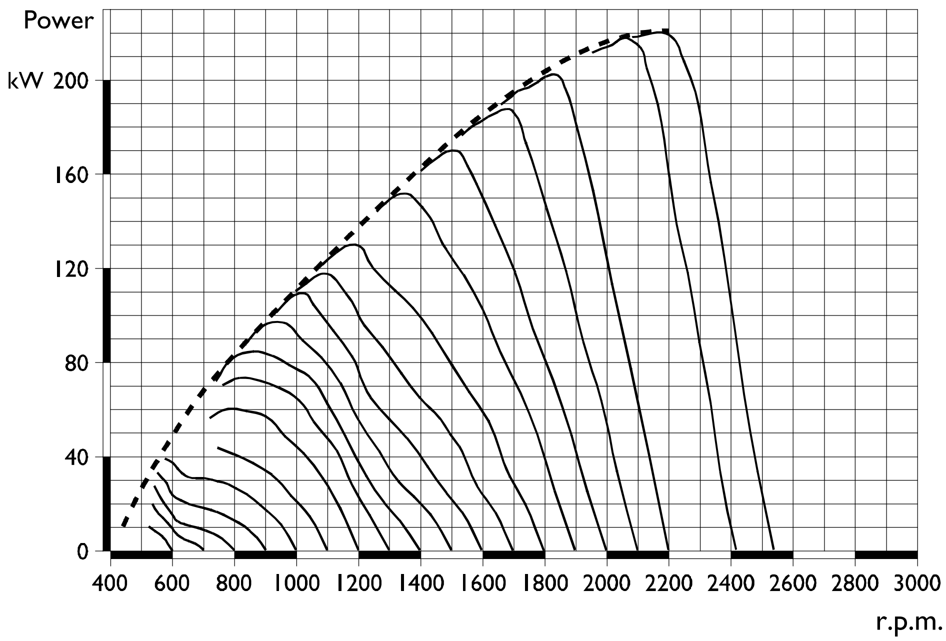
8060.45S 167 kW/227 Cv 2700 r.p.m.



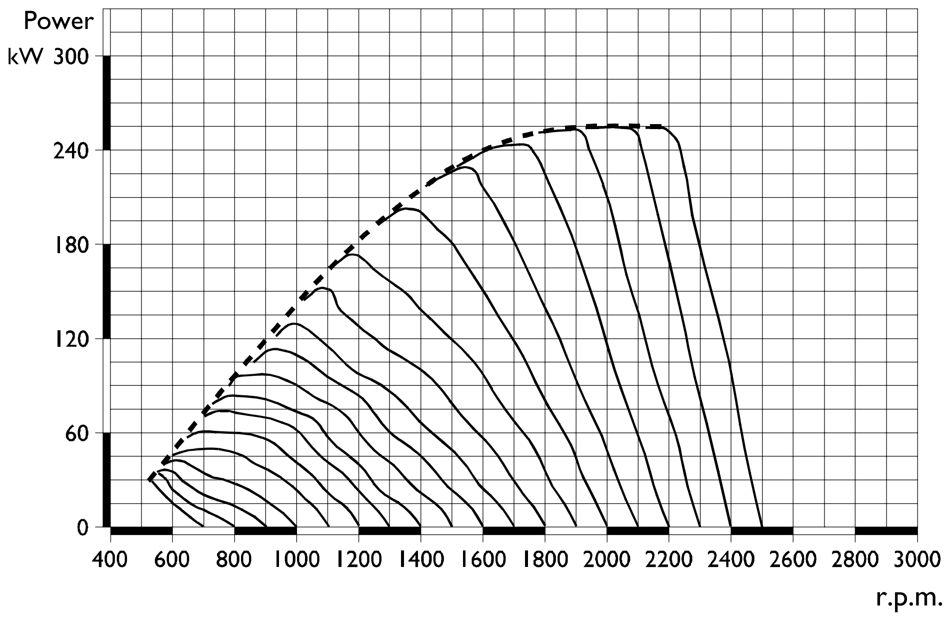
8360.46 196 kW/266.5 Cv 2700 r.p.m.



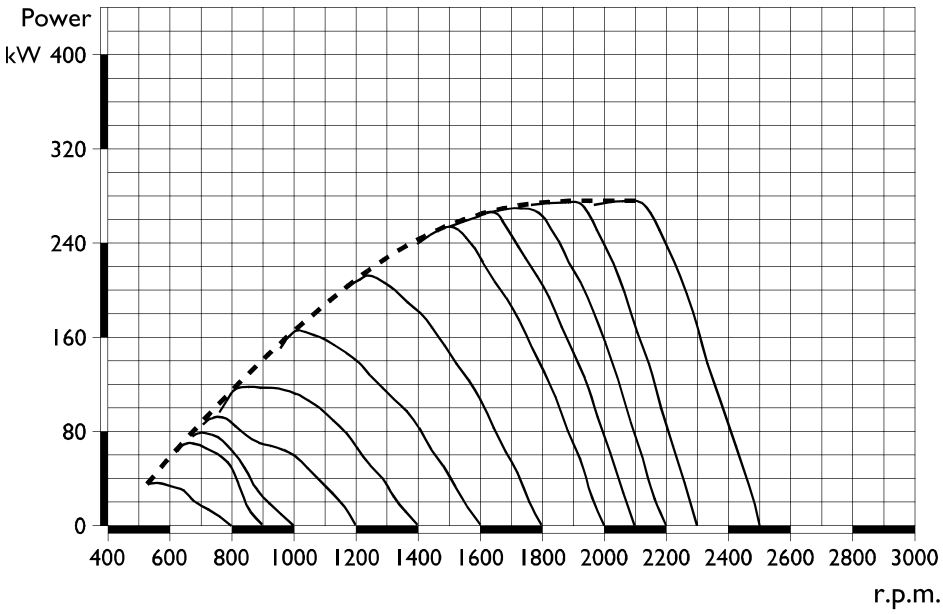
8460.41C 221 kW/300.5 Cv 2200 r.p.m.



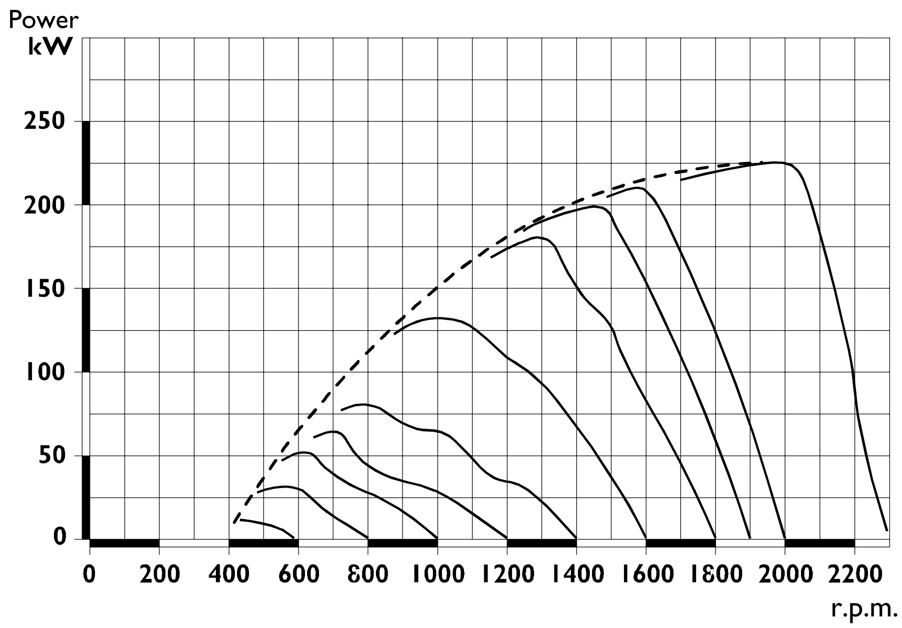
8460.41K 254 kW/345 Cv 2200 r.p.m.



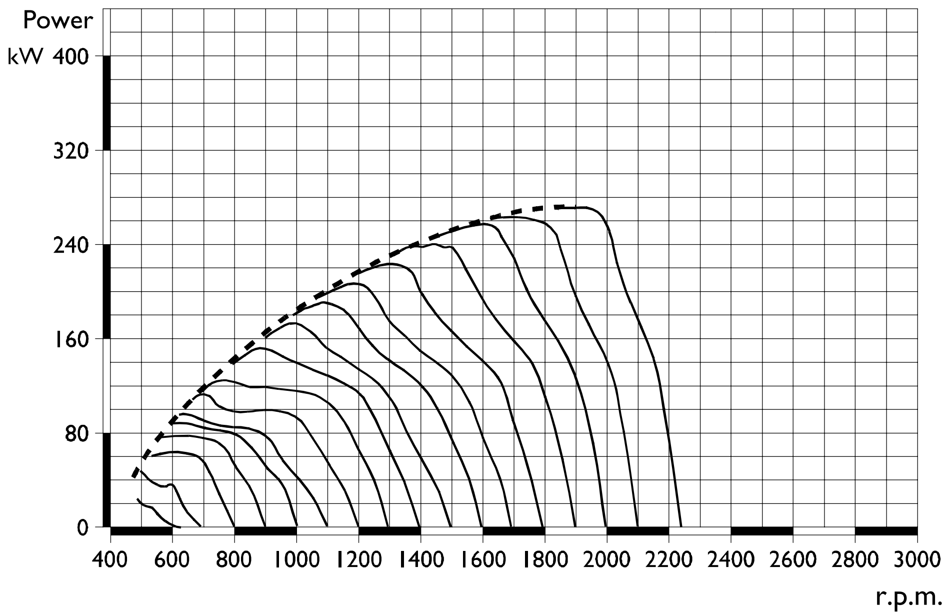
8460.41N 276 kW/375 Cv 2100 r.p.m.



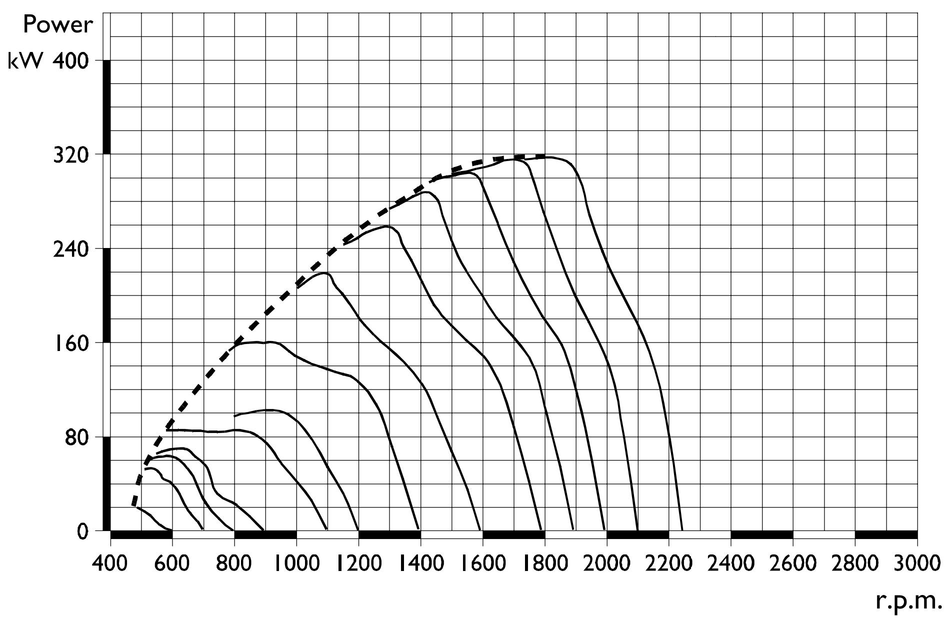
8210.22V 225 kW/306 Cv 2000 r.p.m.

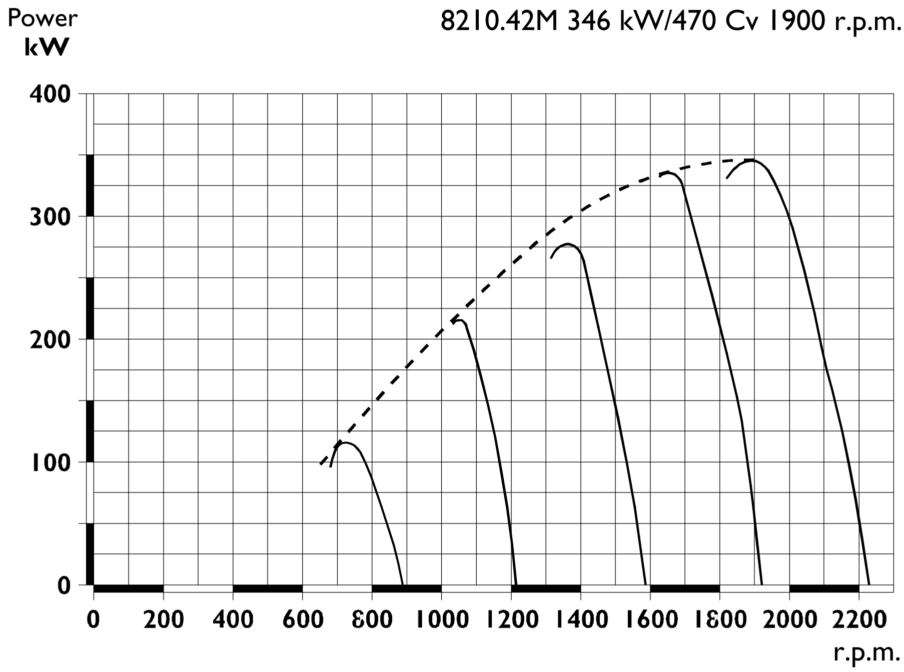


8210.42K 276 kW/370 Cv 1900 r.p.m.

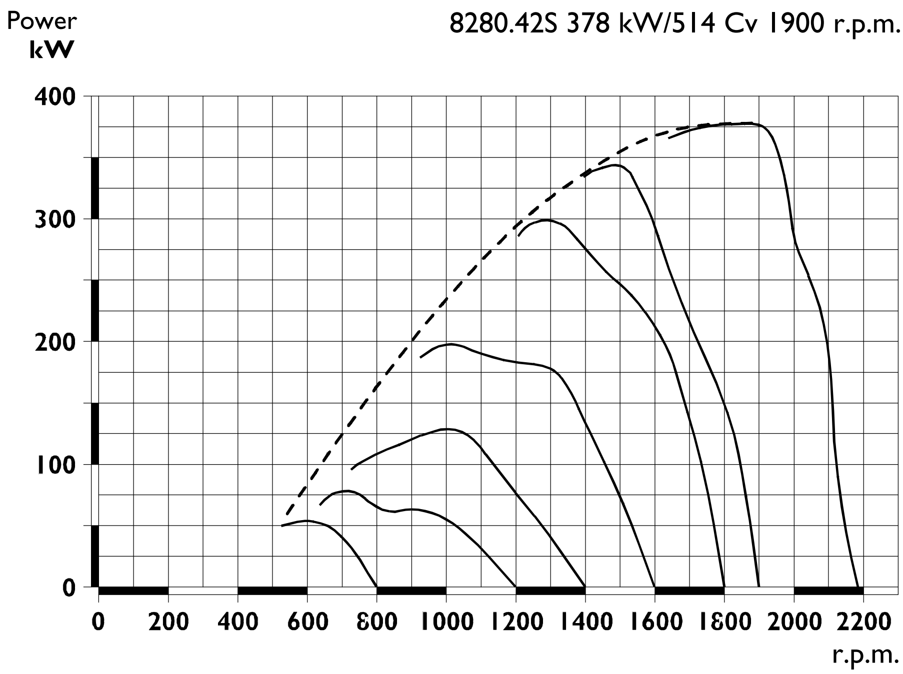


8210.42L 309 kW/420 Cv 1900 r.p.m.





Power
kW
8210.42M 346 kW/470 Cv 1900 r.p.m.
400
300
200
100
0
0 200 400 600 800 1000 1200 1400 1600 1800 2000 2200
r.p.m.



Power
kW
8280.42S 378 kW/514 Cv 1900 r.p.m.
400
300
200
100
0
0 200 400 600 800 1000 1200 1400 1600 1800 2000 2200
r.p.m.

5. SPECIFIC INFORMATION AND INSTRUCTIONS

Contents

5.1 General information

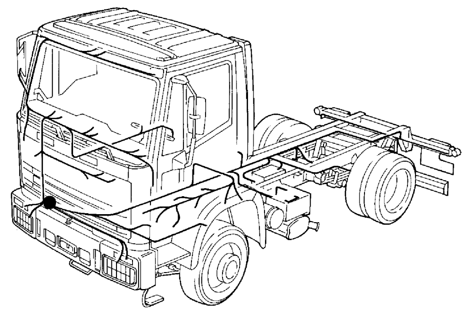
This section provides some instructions that are additional to and integrate those of a general nature given in the previous sections.

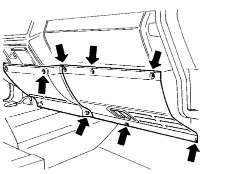
5.2 Position of electronic control units on vehicles

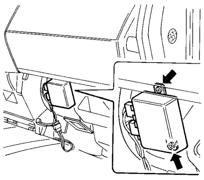
Note: Speculate position for right hand drive.

a) EuroCargo Range

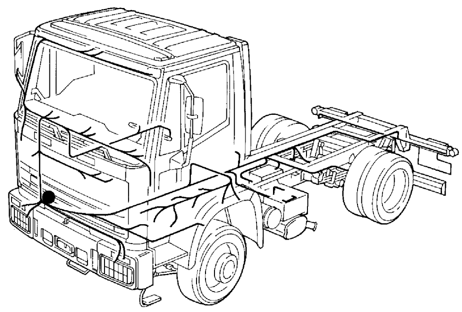
Pre-heating electronic control unit

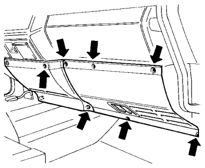


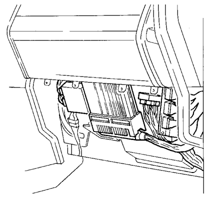




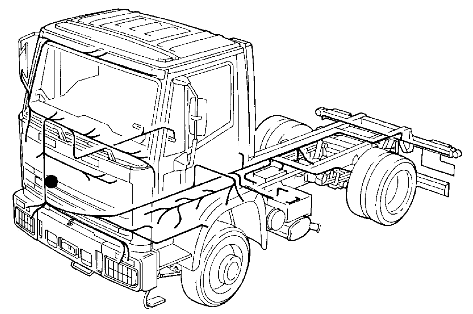
ABS electronic control unit

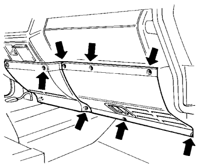


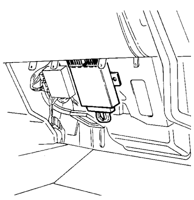




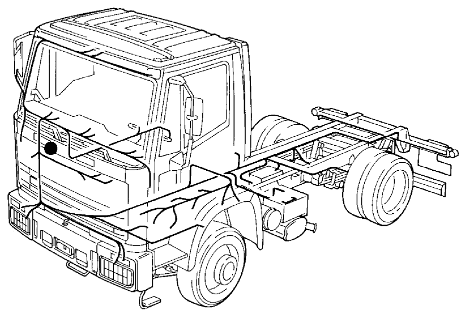
Speed limiter electronic control unit

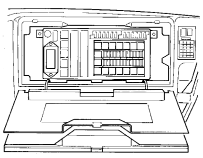


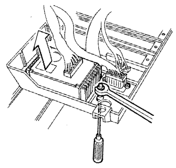




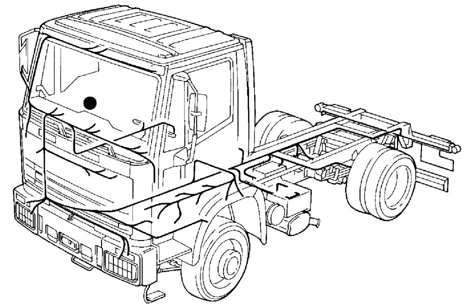
Indicator lights electronic control unit

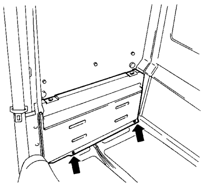


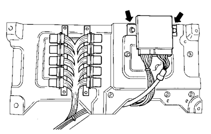




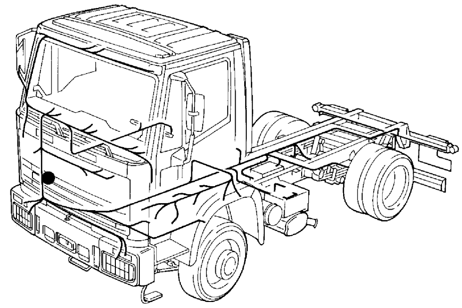
Supplementary heater electronic control unit

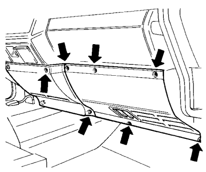


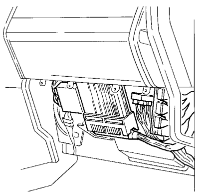




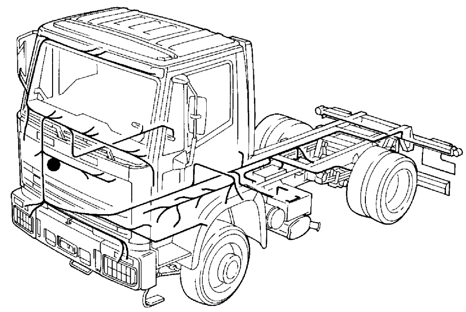
Iveco Control electronic control unit

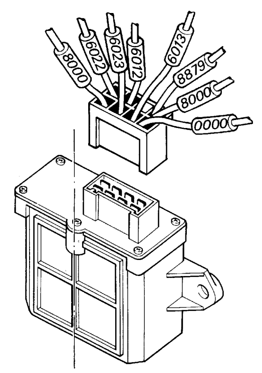






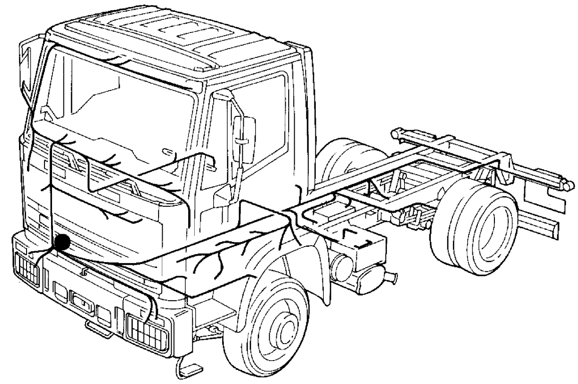
Brake shoe wear indicator electronic control unit

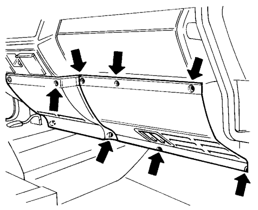


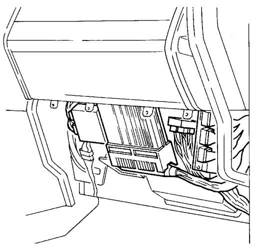


b) EuroCargo Range (TECTOR engine versions)

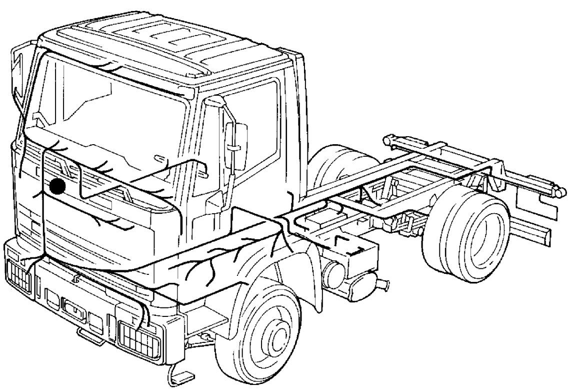
ABS electronic control unit

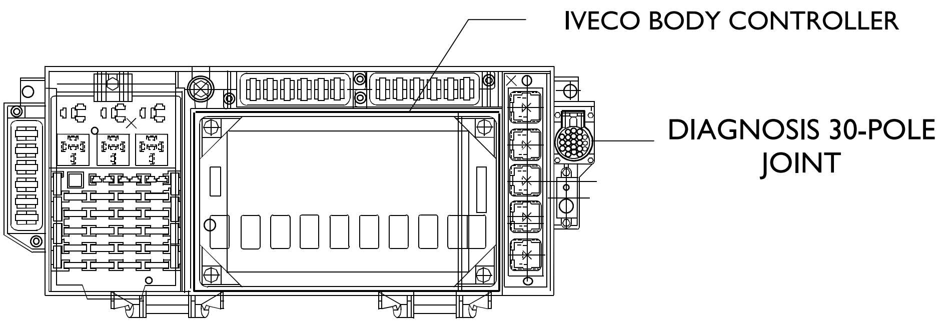




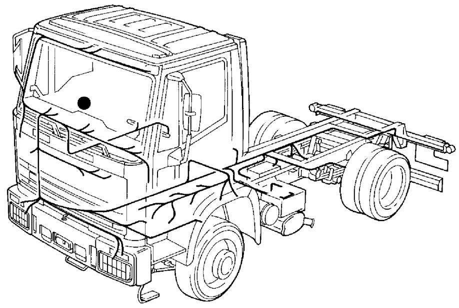


IVECO BODY CONTROLLER
control unit

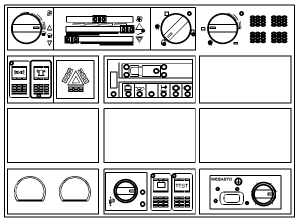




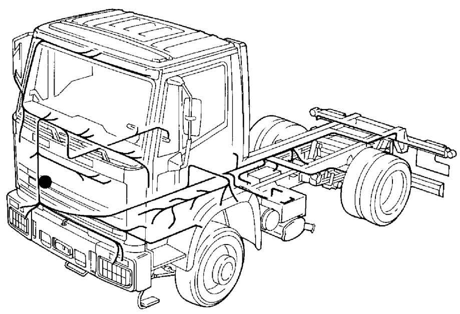
AIR TOP 2000 supplementary
heater electronic control unit

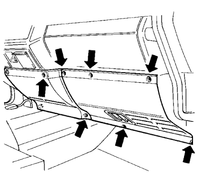


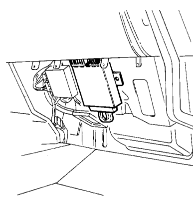
Timer Area for AIR TOP 2000



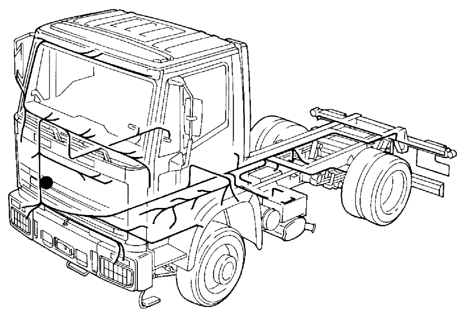
ECAS control unit

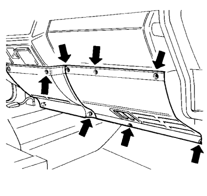


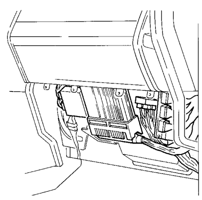




Iveco Control electronic
control unit

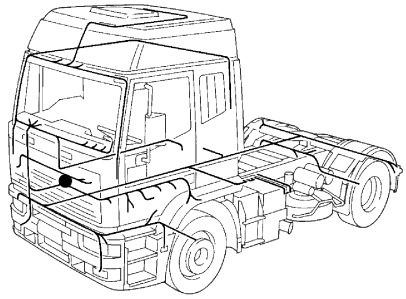


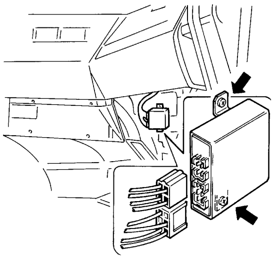




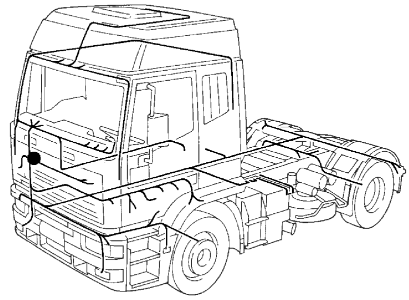
c) EuroTech - EuroStar - EuroTrakker Ranges

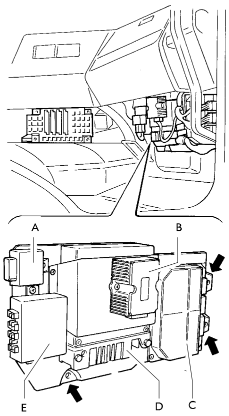
Pre-heating electronic
control unit

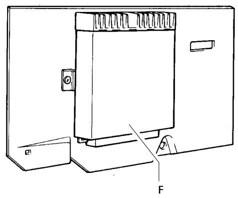




Electronic control unit:
ABS - Iveco Control - Tachometer
Signal amplifier - Speed limiter

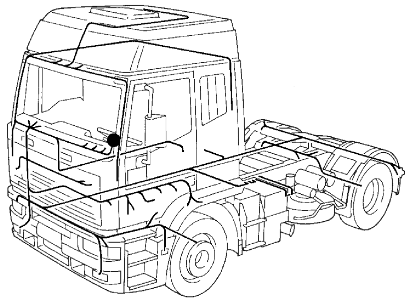




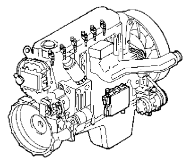


A = Signal amplifier
B = Tachometric electronic control unit
C = Iveco Control electronic control unit
D = ABS electronic control unit
E = Pre-heating electronic control unit
F = Speed limiter electronic control unit

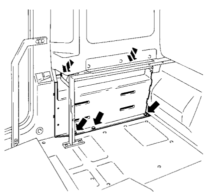
Electronic control unit:
EDC - Supplementary heater

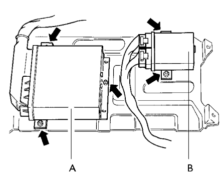


Cursor engine electronic control unit

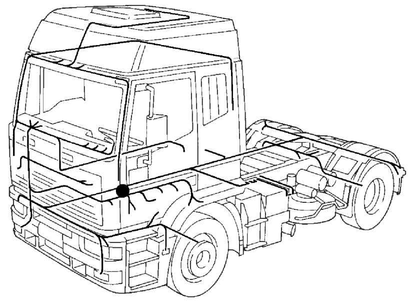


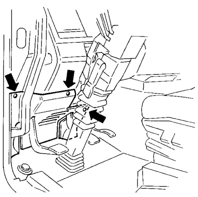
A = EDC electronic control unit
B = Supplementary heater
electronic control unit

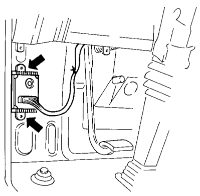




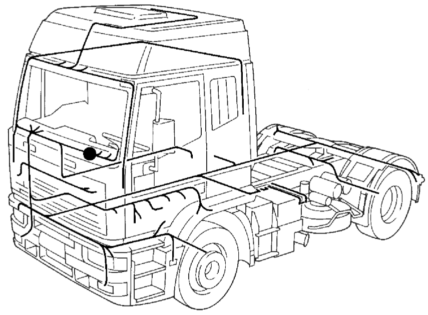
Indicator lights electronic
control unit

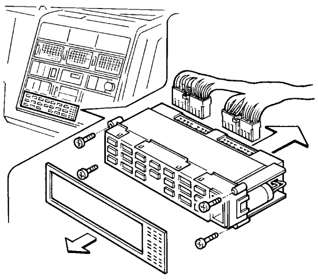




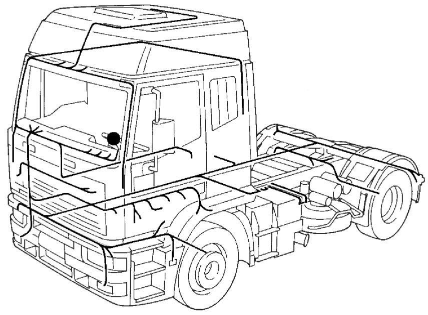


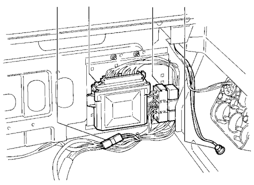
Automatic temperature control electronic control unit

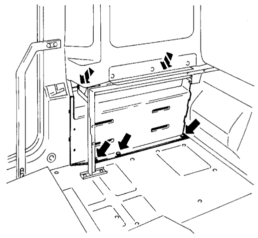




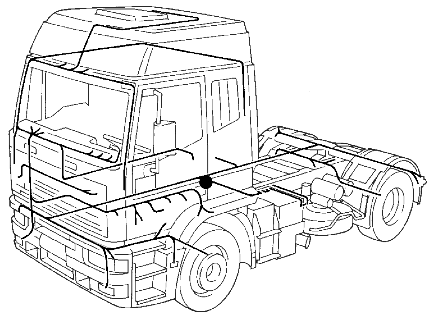
ECAS electronic control unit

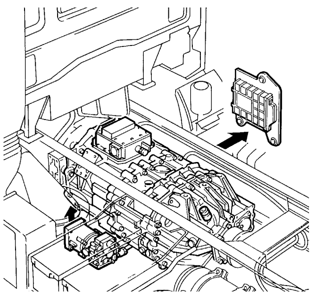




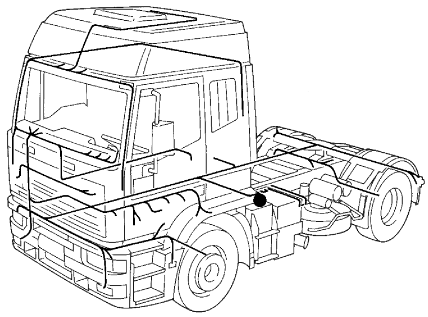


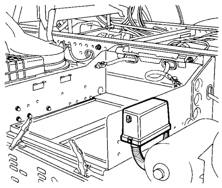
EuroTronic gearbox electronic control unit

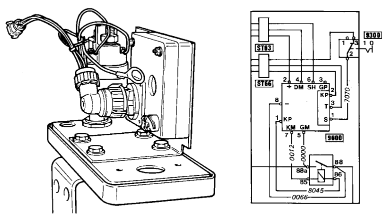




ADR electronic control unit







5.3 Installing anti-theft devices

When installing anti-theft devices you must observe the following precautions and instructions.

a. Type of anti-theft device:

IVECO recommends you use products that comply with the requirements requested and approved by recognized bodies such as ANIA, TÜV, UTAC, MIRRC (Thatcham), etc.
Likewise, follow the instructions given in the Specifications issued by specialized Quality Institutions (e.g. IMQ) at the request of Insurance Companies.
They provide information, requirements, performance of components and systems, as well as conformity criteria.

b. Installation

The control devices must be positioned so they will not accidentally trigger while the vehicle is travelling so as to avoid the hazard of it suddenly stopping.
If additional circuit breakers are installed to stop the vehicle from starting, in order to prevent them accidentally triggering while the vehicle is travelling (with the above-mentioned consequences), it is recommended to:

- Use suitable components to withstand vibration, changes in temperature, etc.
- Make the installation in areas protected against accidental bumps caused by persons and/or property.

b.1 Anti-theft devices acting on the fuel supply

The fuel supply system must maintain the design of the original circuit as given below:

- Fuel circuit with pumps in line (see Fig. 5.1)
- Fuel circuit with EDC pumps in line (see Fig. 5.2)
- Fuel circuit with rotary pumps (see Fig. 5.3)

If the anti-theft system shuts off the flow of fluel on the intake side, the operation must be done between the tank and the supply pump without causing any restriction in the circuit.

The maximum vacuum at the supply pump inlet, measured at full power and delivery corresponding to full load, must be less than 0.1 bar.

Caution: No work must be done on the injection pump. Tampering with it invalidates the warranty from both IVECO and the pump Manufacturer.

b.2 Anti-theft devices acting on the electrical system

Installation must be made in compliance with IVECO instructions as regards the system (see point 2.15) and the place of use (e.g. max temperatures).

Conventional systems

Fitting anti-theft systems must not alter the functioning of systems and components such as ABS, Tachograph, etc.

Systems with EDC (electronic supply control)

The anti-theft system must not be connected to or interface with the EDC system other than as instructed by IVECO.

Electrical connections either before or after the EDC control unit is strictly prohibited.

b.3 Instructions for the electrical system

Both for supply points (key positive and direct) and earth points, use the instructions given here and in the IVECO Workshop Manuals.

Electric cable routing, sizing, connections used and good insulation must meet IVECO quality and manufacturing standards (comply with the instructions of point 2.15.4).

The electrical system must be equipped with suitable protection (fuses, relays) to prevent overheating, flashing and gas emissions in the event of short-circuiting, especially close to the ventilation system or inside the cab.

When installing electronic, electromechanical, electro-pneumatic and electro-hydraulic components, the local temperatures in relation to their position (shown in table 5.1) must be considered.

Table 5.1

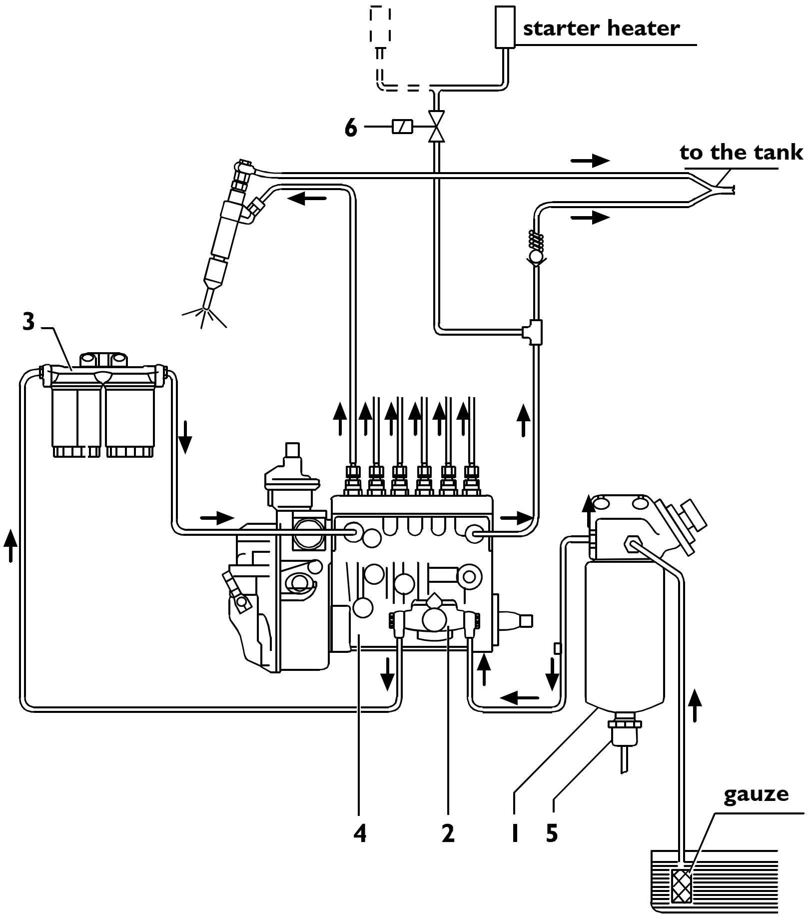
PLACE OF USE		TEMPERATURE °C MIN	MAX	PEAK HEAT
ENGINE	Engine bay	- 30	100	120
	Water circuit		130	140
	Oil circuit		140	140
CAB	Inside		60	80
	Outside		60	65
CHASSIS FRAME	Chassis frame		60	65

Precautions

Use electrical, electromechanical and electronic components with suitable certification or specific type approval (when envisaged) in compliance with the requirements for electromagnetic emissions given in point 2.15.
For non-metallic materials used in the cab and on the chassis frame (e.g. cables, boxes, etc.), check compliance with current standards for fire resistance (e.g. ISO 3795).

Diagram of fuel circuit with pumps in line
Engines: 8060, 8360, 8460, 8210, 8280

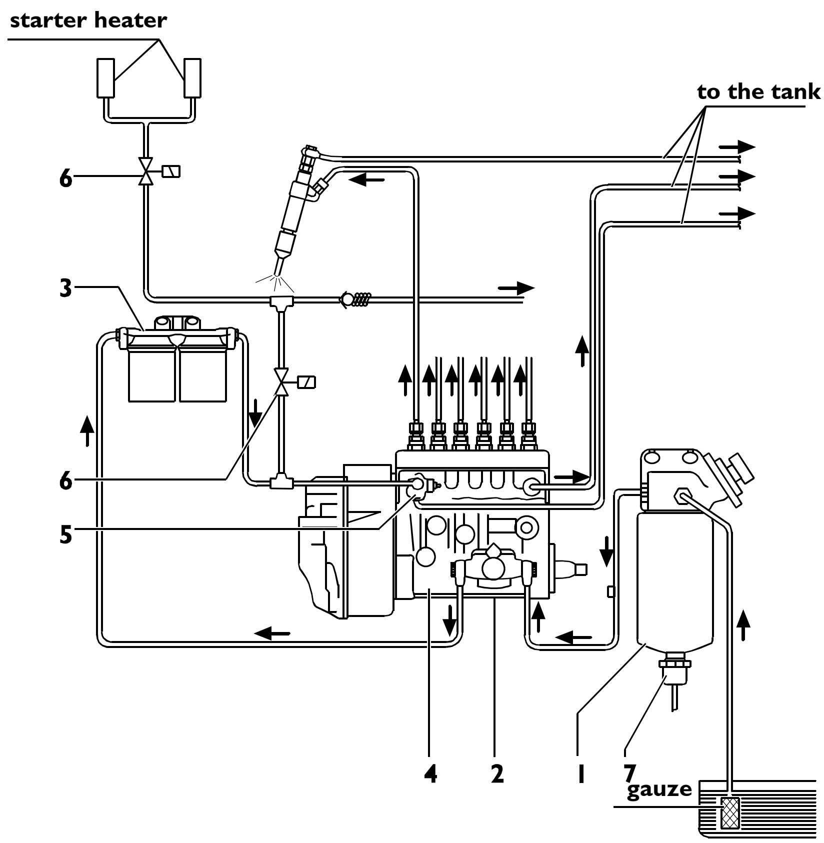
Figure 5.1



1) Settling vessel + pre-filter + priming pump
2) Fuel pump
3) Dual fuel filter in parallel
4) Injection pump in line
5) H_2O indicator
6) Solenoid valve

Diagram of fuel circuit with EDC pumps in line
Engines: 8460.41L, 8210.42M

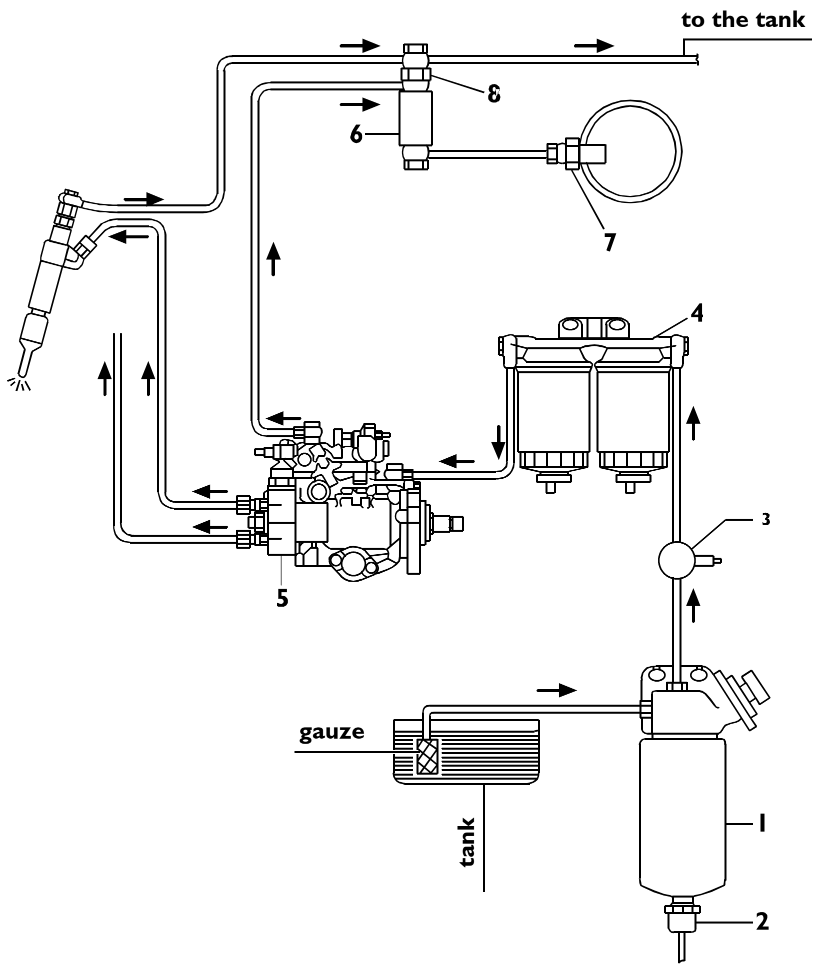
Figure 5.2



1) Settling vessel + pre-filter + priming pump
2) Fuel pump
3) Dual fuel filter in parallel
4) Injection pump in line
5) Elab valve
6) Solenoid valve
7) H_2O indicator

Diagram of fuel circuit with rotary pumps
Engines: 8060

Figure 5.3



1) Fuel pre-filter and H_2O separator
   Manual priming pump
2) H_2O indicator
3) Fuel pump
4) Dual fuel filter in parallel
5) Rotary injection pump
6) Solenoid valve
7) Starter heater
8) Controlled pressure valve

5.4 EuroTech EuroStar 6x2 Range: Checking rear axle air suspension load with ECAS electronic device

This system automatically controls the air suspension arrangement established for the specific use (see the specifications and functions in the specific documentation).

In addition to the functions of raising the 3rd axle, when conditions permit it and of transferring the load from the 3rd axle to the driving axle, when ground conditions require it, the system automatically divides the installed load (equipment plus payload) with priority over the driving axle in order to get the best driving conditions (optimized drive).

The following diagram (see Fig. 5.4) shows the load division on the driving axle and the 3rd axle in relation to their overall load (11.5 ton + 7.5 ton axle loads version). The following table 5.2 gives the different maximum limits of the masses that can be reached depending on the specific version or optional installed.

The braking efforts adjust automatically depending on the load on the axles.

For bodies with load distribution mainly on rear axles (e.g. refuse trucks with rear loading, cranes on rear overhang, etc.), it is possible, by means of Modus, to modify original load distribution on the rear axles.

Optimized drive:

Figure 5.4

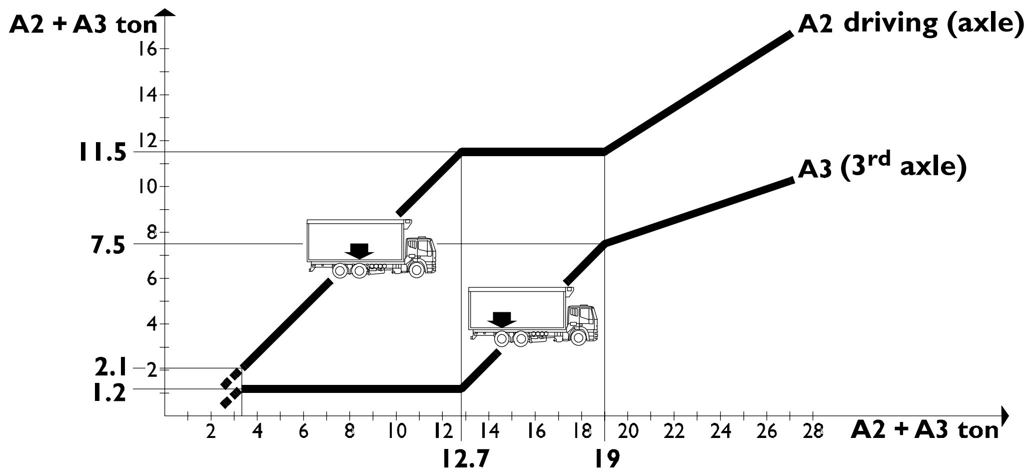


Table 5.2 Versions available

MODELS	AXLES	MAX AXLE LOADS (KG)	A2 + A3 LOADING (KG) AT VARIOUS IMPOSED LOADS			
Models P/PS/FS (Non-suspended masses 1300/700 kg)	driving axle	11500/12000	800	10200	10200	10700
	3rd axle	7500/8000	500	500	6800	7300
	driving axle	11500/12000	800	10200	10200	10700
	3rd axle	6300/6500	500	500	5600	5800
	driving axle	11500/12000	800	10200	10200	10700
	3rd axle	6500/6700	500	500	5800	6000
	driving axle	11500/12000	800	10200	10200	10700
	3rd axle	6700/7100	500	500	6000	6400
	driving axle	11500/12000	800	10200	10200	10700
	3rd axle	7100/7500	500	500	6400	6800
Models PT/FT (Non-suspended masses 1300/1200 kg)	driving axle	10500	800	9200	9200	
	3rd axle	10500	500	500	9300	
	driving axle	11500/12000	800	10200	10200	10700
	3rd axle	7500/8000	500	500	6300	6800

Note: Table 5.2 indicates drive axle priority and also displays how at different imposed bogie loads the C. of G. of the bogie moves.
During loading / diminishing loads this will effect the loads being transferred to the front axle.

5.5 EuroCargo Range: Towing trailers with central axle

The specific instructions below should be followed in addition to the general instructions given in paragraph 2.5.4.

a. Vehicles with genuine IVECO box-bodies

- Box-bodies with ”old series” base

  Insert a new section, with the minimum dimensions given below in table 5.3, into the existing body longitudinal section, starting from the rear end of the longitudinal. The material must have mechanical specifications no lower than those of FeE320 or Fe510D.

Table 5.3

Models	Section dimensions (mm)	Extension beyond the driving axle centreline (mm)
65E - 100E	90x50x5	1200
120E - 130E	120x50x5	1/3 of wheelbase (min. 1200mm)
150E	180x50x4	
150E27	180x50x5	

The new section has to be inserted by removing the fixings with the existing brackets.
The two sections need to be joined with the web upright, using screws to reposition the brackets.
Shear resistant plates should be used for fixing to the chassis frame as instructed in point 2.5.4.
To ensure the shear resistant plates are joined to the subframe securely, make the connections with weld-filled holes (alternative connections can be made with screws).

- Box-bodies with ”1994 new series” base

  For new series box-bodies, with longitudinal sections of the new thicknesses, make the connection to the chassis frame as instructed in point 2.5.4.

b. Towing cross members

The towing cross members originally mounted on the vehicles have a limited towing capacity, if used for trailers with a central axle (see Tab. 2.3).
Towing cross members are specially designed for this application are and available with options no. 3158 and 6154 on models 80E and 100E.
Vehicles fitted with the original towing crossmember and towing centre axle trailers must have the towing crossmember replaced with one having the minimum shown in table 5.4.

Table 5.4

Models	Max. vehicle mass (kg)	Max. towable mass (kg)[1)]	Max. vertical loads admitted on hook (kg)		Towing cross member [2)]		
			Static	Total [(*)]	Min. dim. (mm)	Conn. screws	Flange dim. (mm)
65E	6700	6800	650	1750	158x112x8	6+6 M14 Min. class 8.8	140x80
75E	7500	6000	650	1600			
80E	8000	10000	1000	2650	182x152x8	8+8 M14 Min. class 8.8 oppure M12 Min. class 10.9	140x80[a)] or 160x100
80E	7500	10500	1000	2750			
95EW/100 EW	9500	8500[a)]	1000	2350			
100E/120 EL	10000	8000[a)]	1000	2300			
120E	12000	14000	1000	3350	182x153x9	8+8 M14 Min. class 10.9	160x100
130E	13350	12650	1000	3100			
135EW/140 EW	14000	14000	1000	3350			
	13500	14500					
150E	15000	13000	1000	3200			
150E27/28	15000	17500	1000	4000		9+9 M14 Min. class 8.8	
170E/180 E	18000	10000	1000	2750			
170E27/180 E28	18000	14500					

(*) According to the ISO formula Fv = 3 . C . 0.6 + S (see point 2.5.4).

1) For trailers with central axle (with rigid drawbar).

2) Material with minimum specifications FeE420. Suitable strengthening must be applied in the hook installation area, as envisaged for the towing cross member for trailers with an articulated drawbar.
Example:

mod. 65E / 75E	:	Internal plate of dimensions 365x125x6 mm
mod. 80E / 100E	:	Internal channel section 350x160x21x6 mm External channel section 350x182x21x6 mm
from 120E to 170E	:	Internal channel section 380x160x50x6 mm External channel section 380x182x21x6 mm

Connect the reinforcements to the cross member with 3+3 screws.

5.6 EuroTech CNG Range: Vehicles equipped with gas supply systems

General Information

These instructions and precautions are for the benefit of bodybuilders working on IVECO vehicles equipped with gas engine supply systems, for both modifications to the chassis and fitting bodies.

It is recommended you follow these instructions meticulously as the equipment contains highly inflammable gas at high pressure (approx. 200 bar).

System

The gas supply equipment comprises:

- High-pressure system: cylinders, valves, cocks, fittings, metal pipes, filler pipe, pressure reduction unit.
- Low-pressure system: from the reduction unit to the engine, with appropriately protected hoses.
- Cylinder support structures.

Precautions

- It is recommended the supply system (from the cylinders to the engine), and cylinder support structures are not altered or involved in any modifications.
  Should this be essential, the work and modifications must be carried out by qualified, authorized personnel in the conditions required by current standards.
- The system is installed and certified by IVECO, any type of work on it invalidates the original certification. Routine maintenance (e.g. checks, replacing components) must only be carried out at specialized, authorized Garages that will issue the necessary certification for the work carried out. The specialized Garage must be chosen from those considered suitable by the relevant competent authorities (e.g. Traffic Control Authority).
- Remember that on vehicles fitted with this supply system, safety depends on observing the IVECO "Scheduled Maintenance Plan" (testing cylinders, periodically overhauling/replacing components).
  It is therefore necessary to keep to the instructions given in the specially prepared official documentation (e.g. Workshop Manual, Owner's Handbook, etc.).

  All components during scheduled maintenance must be replaced with genuine parts.
- When a vehicle is being checked and serviced, it must be positioned in well aerated and ventilated rooms, far away from areas where there may be sparks (welding, grinding, etc.).

Work on the vehicle (modifications, bodybuilding)

In compliance with the above precautions, after disconnecting the batteries and electronic control units, carry out the work as follows:

1. **Operations requiring use of naked flames or sources of heat**

   It is necessary to take the necessary safety precautions, such as:

   - **Emptying** the cylinders containing gas.
   - **Using shields of suitable** material to ensure the utmost safety during work.

2. **Mechanical operations**

   No mechanical operations are permitted on the vehicle (e.g. cutting/modifying the chassis frame) **in the area of the gas system.**

   When working on the chassis and installing bodies, keep to the following:

   - Protect the gas system (cylinders, pipes, valves, etc.) appropriately when working on the chassis (e.g. adding axles, modifying the chassis frame, etc.).
   - Make no earth connections on cylinders, gas pipes, relative supports or gas system components.
   - The exhaust system, between the engine and catalytic converter, must have no modifications made to it whatsoever.

   It is recommended not to have external masses acting on the cylinder assembly, not even when fitting the body onto the vehicle.
   Special attention must be paid to the gas supply pipes, valves, pressure reduction unit, etc., so they do not get damaged during the work.

3. **Installing bodies**

   Make provision for sufficient space between the chassis frame, body components and the assemblies connected with it in the areas of the engine exhaust and the gas supply system so as to ensure the necessary ventilation. Considering the high temperatures reached in the area of the turbine exhaust manifold, exaust pipes, catalytic converter and silencer (approx. 500 to 700°C), it is essential to take the necessary precautions by making provision for suitable clearance (min. 120 mm), or adequately protect the parts of the body that could get damaged (e.g. oil pipes, power take-offs, etc.).

   Also it is necessary that these areas are adequately protected against possible oil leaks from the components of the added superstructure. To this purpose, the bodybuilder will have to provide suitable guards.

Close to the valves on the cylinders, fit suitable safety guards to prevent the value from being blown off the cylinder should it be damaged (solutions to be agreed with IVECO). Make provision for suitable side/top guards on the cylinders to protect them from solar radiation.
Make sure there are no bays at the bottom of the body that are not ventilated and where gas may collect.

In the gas system installation area, ensure adequate room close to valves and other appliances for quick and easy inspection and/or maintenance.

Ensure sufficient room for removing the cylinders.

Make provision to house two 5kg CO_2 extinguishers in an easily accessible area.

4. **Electrical system**

When fitting appliances or electrical parts to the body, make sure that all parts are correctly insulated from the gas system (e.g. protection, cable sheathing, etc.).

Fitting a retarder brake

When installing an electromagnetic retarder the necessary measures must be taken to prevent overheating the system and gas cylinders.

Garaging gas-fuelled vehicles

Places used as garages for gas-fuelled vehicles must meet the fire-fighting, plant engineering, etc. safety requirements of current standards.

5. **Electric/electronic arrangements**

Bodybuilder connections in a connector located in the electronic control unit area (in the middle of the cab rear wall):

Fixed engine speed 800 r.p.m. – VDO control unit pin 48

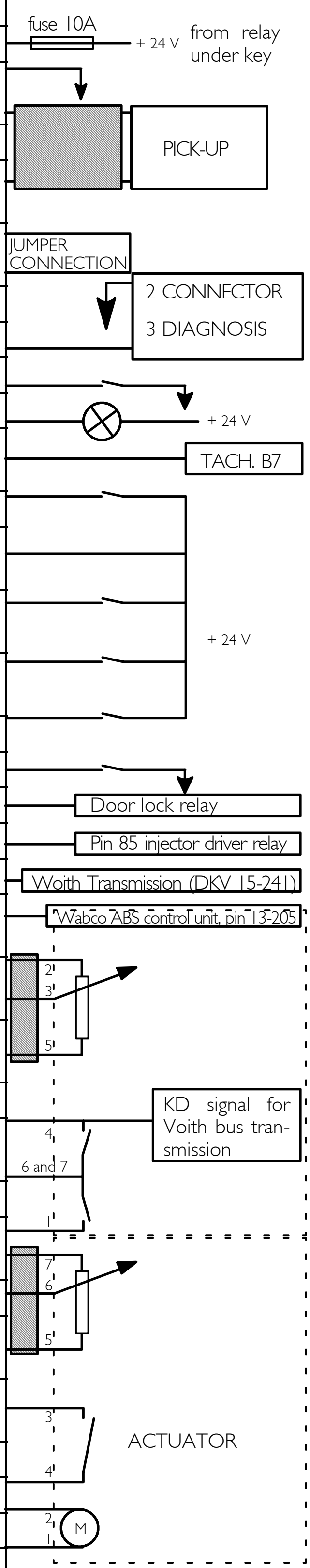
Fixed engine speed 1,000 r.p.m. – VDO control unit pin 33

Fixed engine speed 1,200 r.p.m. – VDO control unit pin 18

2nd speed limiter to 30 km/h – VDO control unit pin 12.

All these functions are activated with a 24V signal.
When the fixed engine speed function is active, the signal from the accelerator pedal is disabled.

Application	Description	in/ out	pin
ALL	Voltage supply + 24 V	I	28
ALL	Voltage supply -	I	1
ALL	Reference inductive transducer	O	42
ALL	Input inductive transducer	I	49
truck	Cruise control voltage supply	O	8
truck	Fixed engine speed enable (PTO)	I	10
ALL	Diagnostic ISO K line	I/O	44
ALL	Flasher code activation	I	13
ALL	Fault light	O	30
ALL	Speed signal	I	11
truck	2nd vehicle speed limitation 20 km/h	I	12
ALL	Limit engine speed ON	I	53
truck	Fixed engine speed 1 (800 rpm)	I	48
truck	Fixed engine speed 2 (1000 rpm)	I	33
truck	Fixed engine speed 3 (1200 rpm)	I	18
bus	Reduction 1 (0 %)	I	46
bus	Part load 3 (> 5 %)	O	2
ALL	Safety switch output	O	31
bus	Actuator position PWM	O	7
option	ASR signal input PWM	I	35
ALL	Set point potentiometer + supply	O	27
ALL	Set point potentiometer signal	I	55
ALL	Set point potentiometer - supply	O	26
ALL	KD (kick-down) switch	I	32
ALL	Voltage supply for SK and KD	O	25
ALL	SK (safety contact)	I	54
ALL	Actuator potentiometer + supply	O	24
ALL	Actuator position signal	I	52
ALL	Actuator potentiometer - supply	O	23
ALL	Supply actuator safety contact	O	51
ALL	Actuator safety contact	I	22
ALL	Engine end stage +	O	4
ALL	Engine end stage -	O	3
Twisted, shielded cable (control unit side shield)			
	PIN NUMBERS (CABLING SIDE CONNECTOR)		
27		I	
55			28



Information to the bodybuilder regarding IVECO MP240E26 CNG vehicles

PTO switching on – Operating engine speed control –

To operate the engine speed control (800, 1,000 or 1,200 rpm), the bodybuilder must send an earth signal to connector **ST** pin 5 **–** (see dwg. 50400 4580).

Connector (ST–):

- **Pin 2 – Pin 3** – +24V output, under lock and key. 24V can be used as a current tap.
- **Pin 4 – +24V input with gearshift in neutral.** This is a necessary condition to operate the power takeoff.
- **Pin 5 – EARTH** input for operating engine speed (800, 1,000 or 1,200 rpm).
  The earth signal must be sent when you want to engage the power takeoff.
  This function is actuated only if the gearshift is in neutral.
  Acceleration is not possible when this function is in use.
- **Pin 6 – SAFETY** – +24V input – Max. speed 30 km/h.
  In vehicles equipped with rear footboard for operator transport, when the operator gets on the footboard, the 24V signal is sent to pin 6 and the vehicle's maximum speed will be 30 km/h.
- **Pin 7 – SAFETY** – EARTH input – If the operator is standing on the rear footboard and the driver engages the reverse gear, an earth signal is sent to pin 7, which causes the engine to be switched off (connector **ST 24**, dwg. 504004580 – 504024067).

See the following drawings (available on workshop handbooks)

Drawing 504004580 – Connector **ST–** diagram.

Drawing 504004581 – Position of connector **ST–** and the respective outfitter interfaces.

Drawing 504024067 – Connector **ST24** connection diagram.

Drawing 97486955 – Cable-and-trunk schematic of the entire system.

Drawing 500377974 – VDO control unit wiring diagram.

Drawings 97487070 – ZF automatic transmission connection diagram.

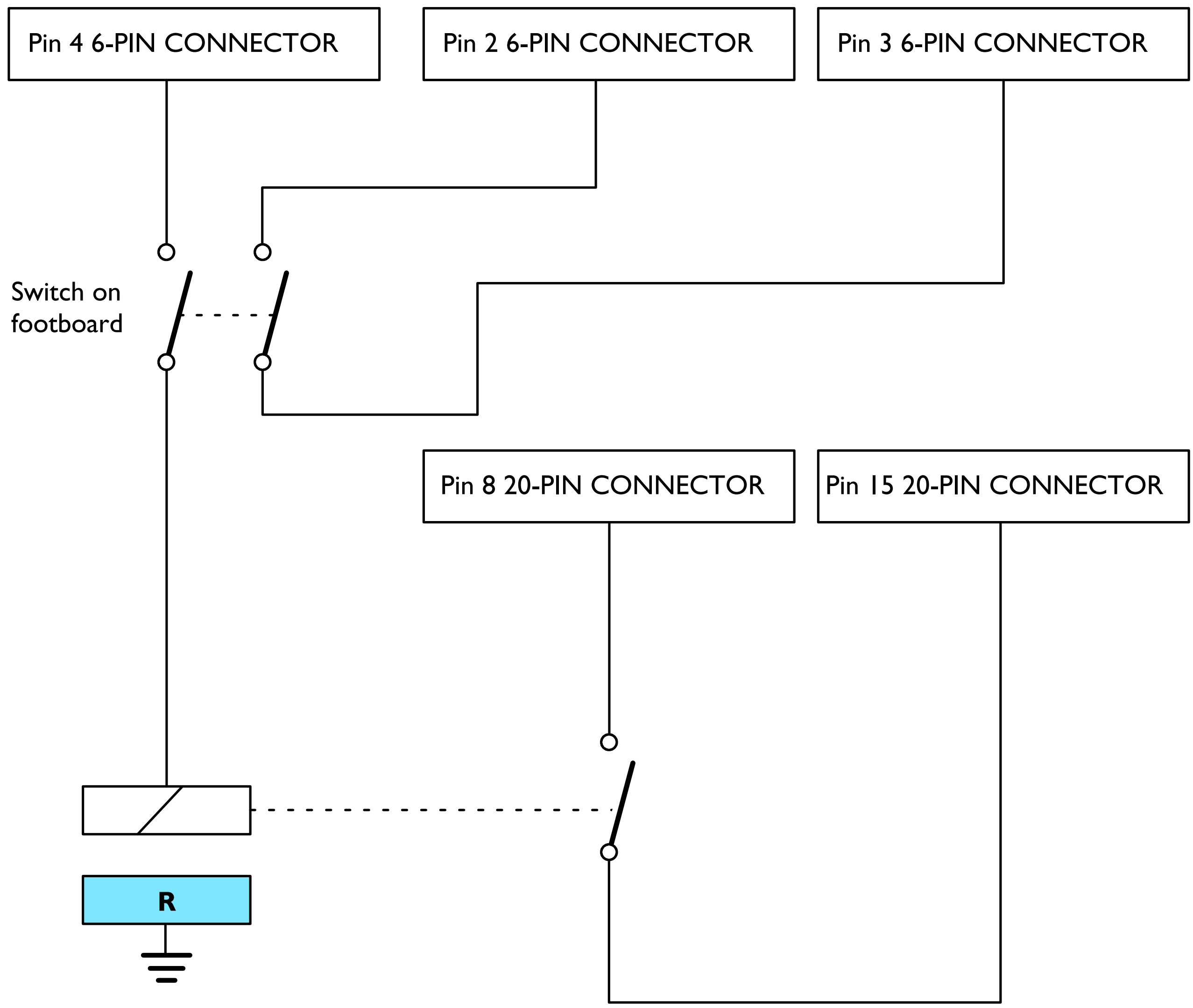
Diagram (VDO E-GAS throttle control system) – VDO control unit pin out.

5.1 Connection to stop the engine when a person is standing on the footboard and reverse gear is engaged.

Make a connection to the 6-pin connector for bodybuilders on the chassis, and to the 20-pin connector for bodybuilders in the cab. The switch on the footboard is closed when someone stands on the footboard.

A relay is to be added, as shown in the diagram.

The wiring to the 6-pin connector is to be added if the vehicle's speed is to be limited to 30 km/h when someone is standing on the footboard; in this case, the switch must consist of a double-contact switch.



5.7 EuroTech, EuroStar and EuroTrakker vehicle ranges with Cursor 8, Cursor 10 and Cursor 13 engines. Interfaces for electrical/electronic on-board systems.

5.7.1 General

This chapter contains descriptions of the functions available on the vehicle, as well as the position and functional details of the interfaces.
The usage examples serve to illustrate the range of functions available.

Functions available to the bodybuilder

- *Cruise Control Off, Resume, Set+, Set–*
  These functions can all be activated either by the driver using the appropriate controls, or directly from the control system on the body/ancillary using certain Pins on the "ST44" insulated socket connection.
  Note: RESUME / SET+ / SET– always work simultaneously whether controlled by the driver or from 'ST44'. If this is not appropriate for safety reasons, then two diodes must be incorporated in the vehicle's wiring harness (see point 5.7.2.3).
- *Second speed limiter*
  This allows the maximum speed to be limited to a programmable value. Values up to the maximum legal speed are allowed.
- *Configuration of the various EDC power take-off parameters*
  A number of EDC parameters may be configured depending on the requirements of the bodybuilder. IVECO Service can programme up to three independent engine configurations. Each configuration contains 14 parameters (see points 5.7.3 on).
- *Regulation of the idling speed*
  (see 5.7.3.5)
- *Engine start controlled from the body/ancillary*
  Under certain conditions, the engine can be started by the control system in the body/ancillary (see point 5.7.4).
- *Engine stop controlled from the body/ancillary*
  The engine can be stopped by the control system in the body/ancillary (see point 5.7.4).

5.7.2 Position of the insulated socket connection switches

The following sections contain the points that the bodybuilder should use as an interface for the electrical or electronic systems of the vehicle.
The status signals and the range of controls that are relevant for the bodybuilder have been concentrated in a separate insulated socket connection, the 'ST44'.
The list below contains the maximum electrical currents for each Pin. This list also contains the safety fuse required for the voltage supply to the body/ancillary (separate fuses in the fuse box). It is highly recommended that fuses are fitted to protect the cables, especially where the expected type of usage makes this particularly necessary.

5.7.2.1 Insulated socket connection 'ST44'

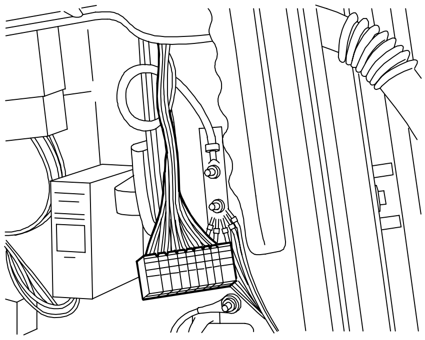
This insulated socket connection is part of an optional cable adapter, option number 2335. The table below shows which cable adapter is used on each of the different versions of the vehicle.

Range	Range	Drive hand	Cable-adapter part n°
Cursor 8	EuroTech + EuroTrakker	Left	4120 8590 KZ
		Right	4120 8591 KZ
Cursor 10	EuroTech + EuroStar	Left	4120 8537 KZ
		Right	4120 8588 KZ
EuroTrakker Cursor 13	EuroTech + EuroTrakker	Left	4120 8537 KZ
		Right	4120 8588 KZ

Position of the insulated socket connection 'ST44'

The insulated socket connection is located near to the ABS central control unit on the passenger side.

Figure 5.5



Pin	Cable n°	Maximum load	Description
1	5509	Max 1mA	Vehicle status stationary / in motion, tachograph (control) out 1)
2	7778	Max 1A	D+ of the alternator, +24V with engine operating
3	8050	Max 1A	Idling signal change, +24V if gearbox in neutral
4	2226	Max 1A	Reverse gear signal change, +24V if reverse gear selected
5	4442	Max 1A	Light status 1) With switching disconnected: +24V with driving lights on With switching connected: +24V with driving or daytime (Norway) lights on
6	6662	Max 200 mA	Hand brake status, earth signal with hand brake inserted 2) 3)
7	8879	Max 15A	Terminal 15
8	7772	Max 10A	Terminal 30
9	0000	Max 20A	Earth
10	7156	-	Exclusively for supplying the switches (Off / Res / Set+ / Set–)
11	8154	~ 10 mA	CC off, normally closed 4) Short circuit Pin 10-11 ➧ CC off not actuated Short circuit Pin 10-11 stopped ➧ CC off actuated
12	8155	~ 10 mA	CC resume, normally open, activated with short circuit Pin 10-12 5)
13	8156	~ 10 mA	CC Set+, normally open, activated with short circuit Pin 10-13
14	8157	~ 10 mA	CC Set–, normally open, activated with short circuit Pin 10-14
15	7172	~ 10 mA	2nd speed limiter, normally open, activated with short circuit Pin 7-15
16	0166	~ 10 mA	EDC power take off mode 1, normally open, activated with short circuit Pin 16-19
17	0167	~ 10 mA	EDC power take off mode 2, normally open, activated with short circuit Pin 17-19
18	0168	~ 10 mA	EDC power take off mode 3, normally open, activated with short circuit Pin 18-19
19	0158	-	EDC power take off mode – earth
20	9907	~ 100 mA	Engine start up, normally open, starts up with short circuit Pin 7-20 6)
21	0151	Min 1A	Engine cut out, normally open, cuts off with short circuit Pin 9-21

1) Voltage V_{D8} less than 2.5 V ⇒ vehicle stationary
V_{D8} ~ 8 V ⇒ vehicle in motion

2) The signal is also shown by pressing the "TEST" button (test indicator)

3) The Earth signal activates as soon as the spring cylinder pressure (energy accumulation) goes below:
5.5 ± 0.3 bar for Cursor 8;
6.6 ± 0.3 bar for Cursor 10;
6.6 ± 0.3 bar for Cursor 13 Euro Trakker.

4) At rest, Pins 10 and 11 are short circuited (for safety reasons, EDC waits until it receives a +24V signal. The opening of the circuit is signalled by the CC Off request).

5) CC Resume is accepted only after it has been established that the braking system is functioning correctly. For vehicles without EBS (Option 2318) the brake pedal must be pressed after ignition and after the engine has been switched off.

6) For safety reasons, the engine can only be started when the cab is not tilted.

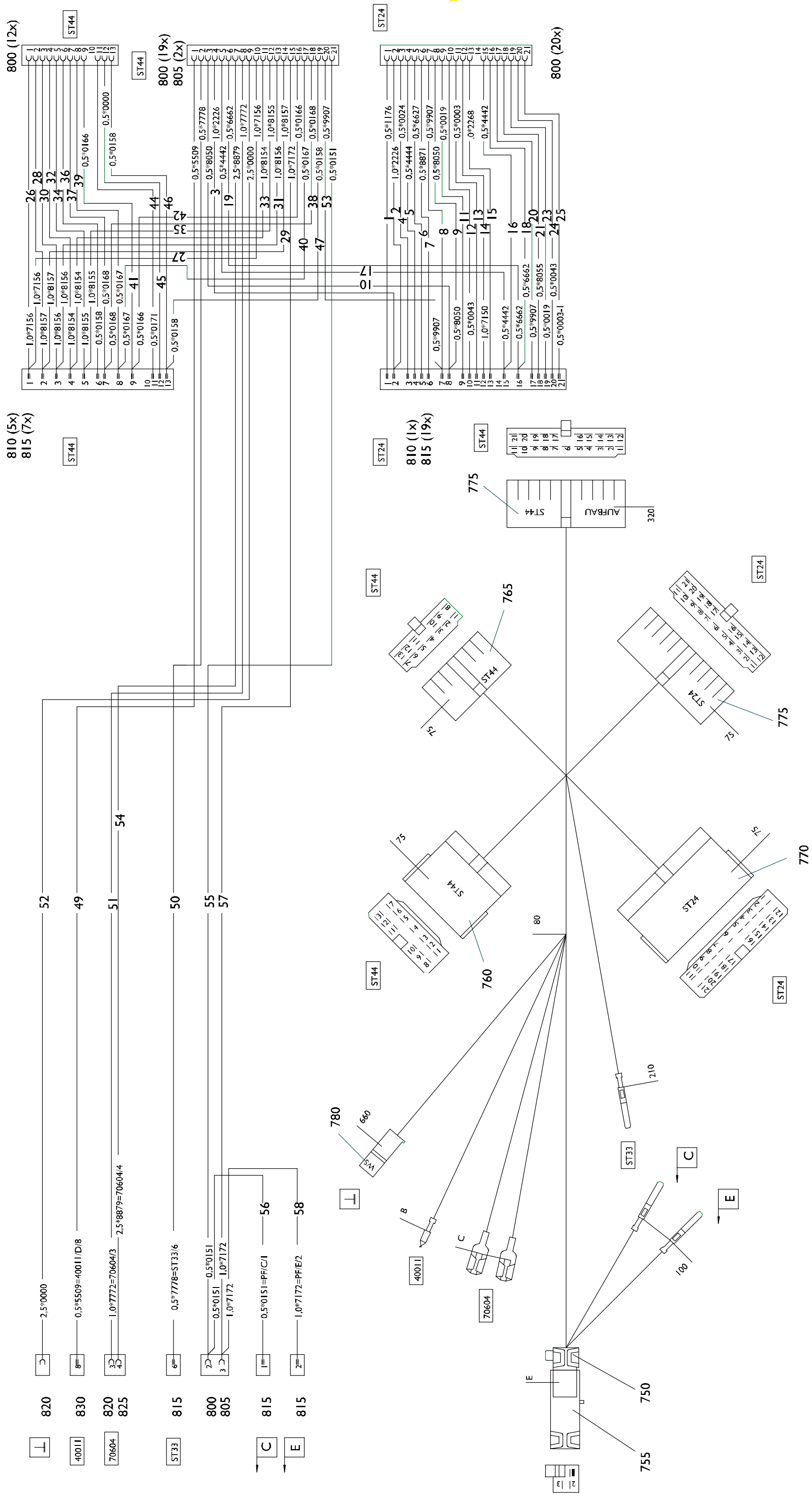
Warning: The signal for starting / stopping the engine requires safety devices to be fitted so that these operations may be performed safely, both for the operator and for the people or property nearby. Such devices must satisfy current legal requirements. It is the bodybuilder's responsibility to identify and install the relevant safety devices (for example, parking brake on, gearbox in neutral etc), using solutions that guarantee that the function works correctly, and using components that are certified as reliable.

5.7.2.1.1 Fitting option 2335

The cable adapter includes two insulated sockets with 13 and 21 pin connections respectively, and two female sockets again with 13 and 21 pin connections. The cable adapter is fitted between the existing insulated socket connections ST24 and ST44, which are fitted at the factory. The ST24 and ST44 connectors are located behind the electrical central unit. The cable adapter is fitted by removing the existing connectors ST44 and ST24, and reconnecting them using the appropriate socket on the cable adapter.
Further pins must then be connected to other sockets to establish the earth connection, the power supply and the signal transmission. Vehicles with Cursor 8 engines use wiring diagram 4120 8589 UB, whereas vehicles with Cursor 10 and EuroTrakker Cursor 13 engines use wiring diagram 4120 8587.
It is essential to prevent the ST24 and ST44 connectors from drawing single signals directly. It is strongly recommended that the adapter in question be used, since it has several advantages: (a) it is an interface used specifically by bodybuilders, and (b) it allows certain functions to operate safely and error free, simply by short circuiting certain Pins.
A further advantage of using this adapter is that it standardises the wiring for both the vehicle and for the external bodywork. Additionally, when looking for faults, it is easier to distinguish between failures related to the body/ancillary and those related to the vehicle.

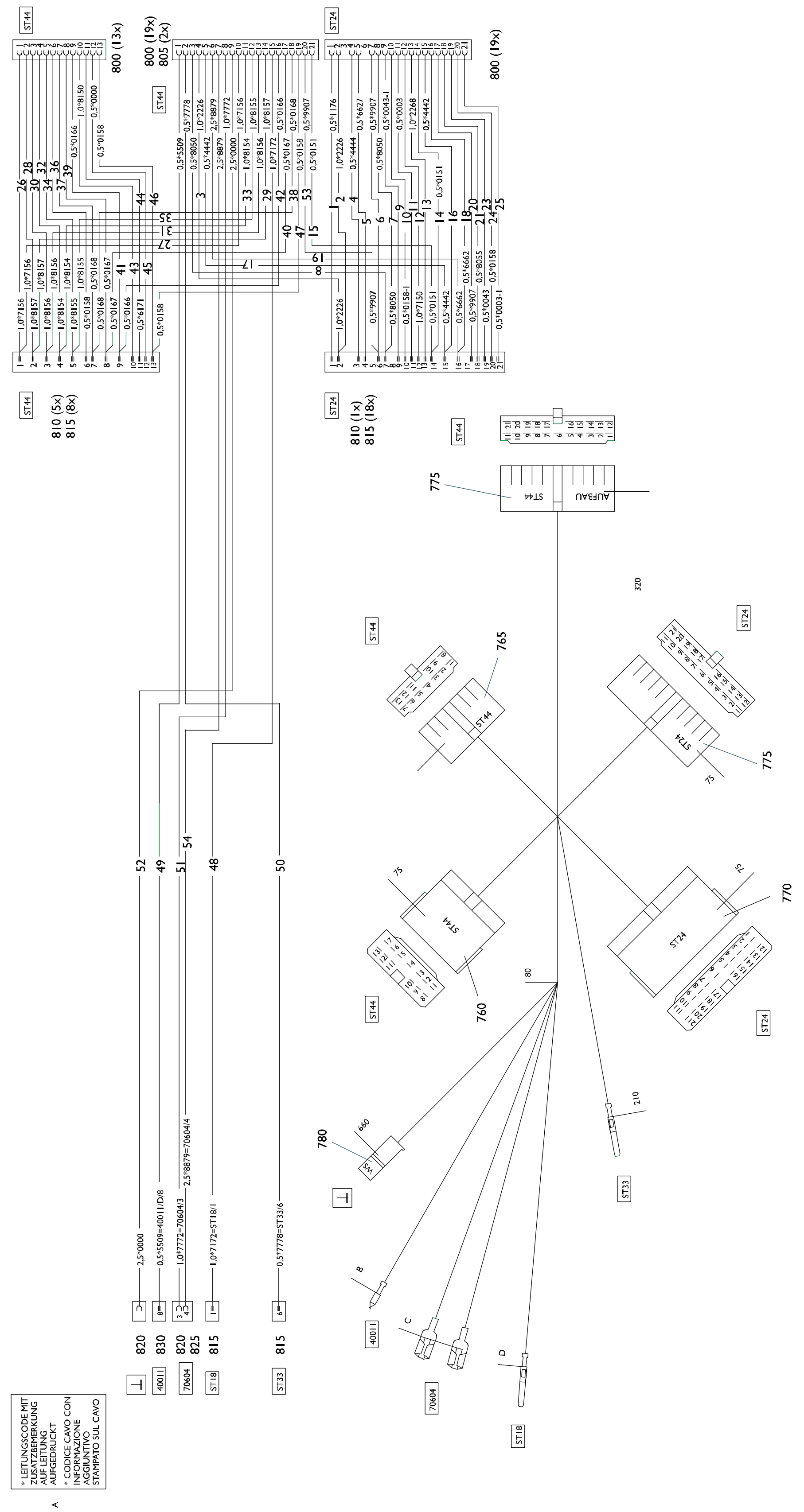
CURSOR 8 Wiring Diagram

Figure 5.6



CURSOR 10 and EuroStar/EuroTrakker Cursor 13 Wiring Diagram

Figure 5.7

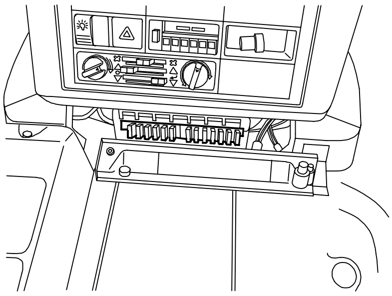


5.7.2.2 Fuse box

Position of the fuse box

The fuse box, from which a power supply can be taken from inside the cab, is located at the bottom of the central section of the instrument panel. A permanent power supply can be taken from terminal 30 (max 10A), or when the ignition is switched on, a supply can be taken from terminal 15 (max 15A).
There is another connector, ST81, on the chassis from which power can also be taken. This gives a maximum of 10A (terminal 15) when the ignition is switched on. The relevant fuse is similarly found in the fuse box mentioned above.
For supplementary lighting, there is a power supply on the chassis for external lighting (max. 5A, connector ST81). The relevant fuse is again found in the fuse box mentioned above.

Figure 5.8

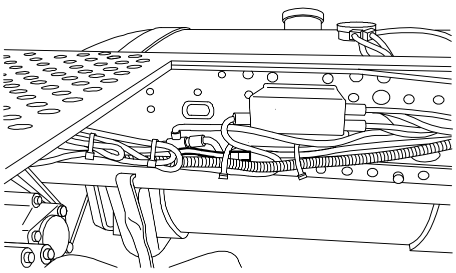


Fuse position

Pin	Cable n°	Maximum load	Description
1	-	-	Not available
2	-	-	Not available
3	-	Max 10A	Terminal 30, for bodybuilder use only
4	-	Max 15A	Terminal 15, for bodybuilder use only
5	8075	Max 10A	Terminal 15, accessed via connector ST81, Pin 1
6	3375	Max 5A	Lighting, accessed via connector ST81, Pin 2

Warning: The fuse at position 5 also supplies the trailer or the semi-trailer (see 72001: Pin 6). In this case, the total current of 10A must not be exceeded.

Figure 5.9



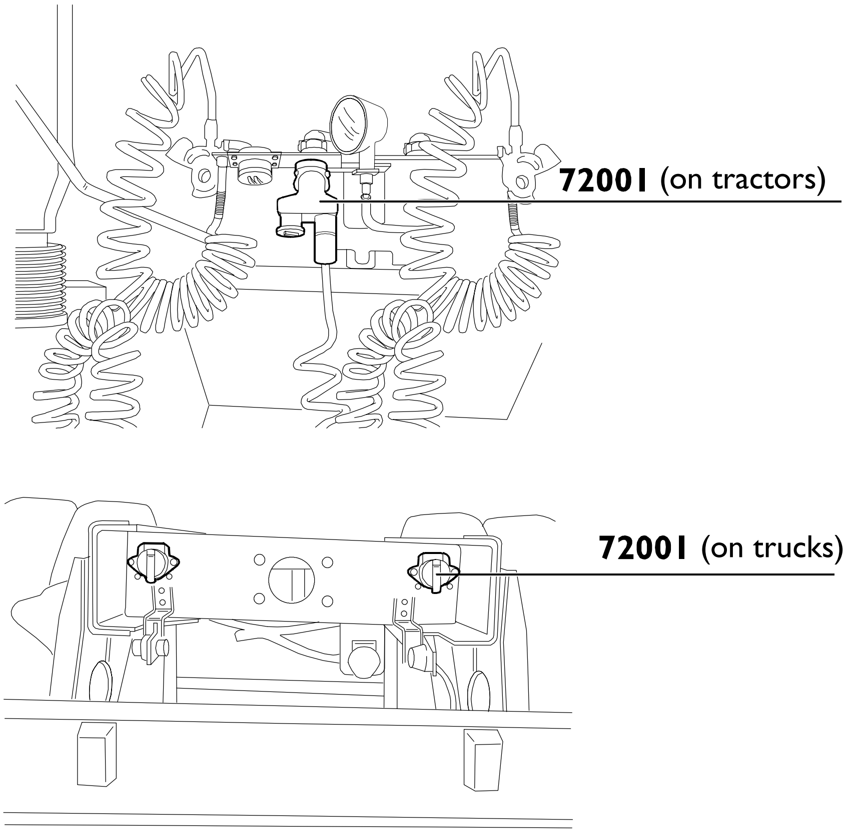
ST81 connection table

Pin	Cable n°	Maximum load	Description
1	8075	Max 10A	Terminal 15, accessed via connector ST81, Pin 1
2	3375	Max 5A	Terminal 15, accessed via connector ST81, Pin 1

5.7.2.3 Supplementary insulated socket connections for the trailer / semi-trailer

Position of the connectors

Figure 5.10



72001 connection table

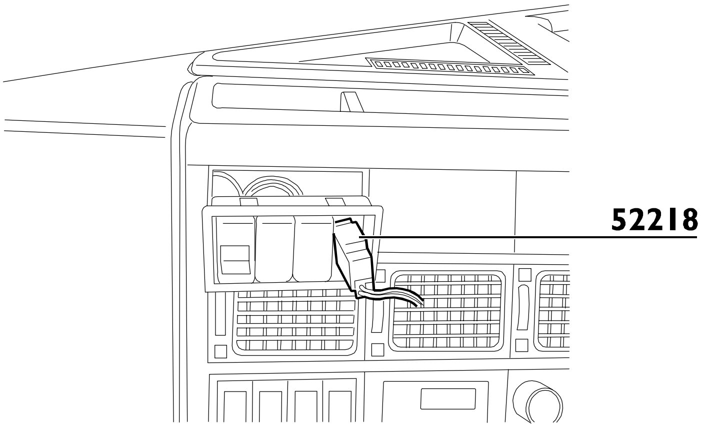
Pin	Cable n°	Maximum load	Description
1	0		Earth
2	7790		2.5 mm^2 cable, connected directly to the cable connection H in cab, pin 1
3	2226	-	Reversing lights
4	Free		
5	Free		
6	8890	Max 10A	Terminal 15, connected directly to the fuse box at position 5 and to the ST81 connector on the chassis, Pin 1
7	2283	-	Rear fog lights

Pin 2 of this insulated socket connection for Cursor vehicles is used up to cable connection H. Pin 1 is wired to the front side of the cab and is for bodybuilder use only.

5.7.2.4 Insulated socket connection for the internal / external Cruise Control switch

Position of the connection

Figure 5.11



52218 connection table

Pin	Cable n°	Maximum load	Description
1	4442	-	Lighting signal, + 24V when lighting on
2	8871	-	Terminal 15
3	Free	-	
4	Free	-	
5	Free	-	
6	7154	-	Internal CC (driver controlled device), activated by short circuit of Pins 6-7
7	7153	-	Power supply to all CC buttons, activated by short circuit of Pin 6 **or** Pin 8 [1])
8	7156	-	External CC (via "ST44" connector), activated by short circuit of Pins 7-8
9	0000	-	

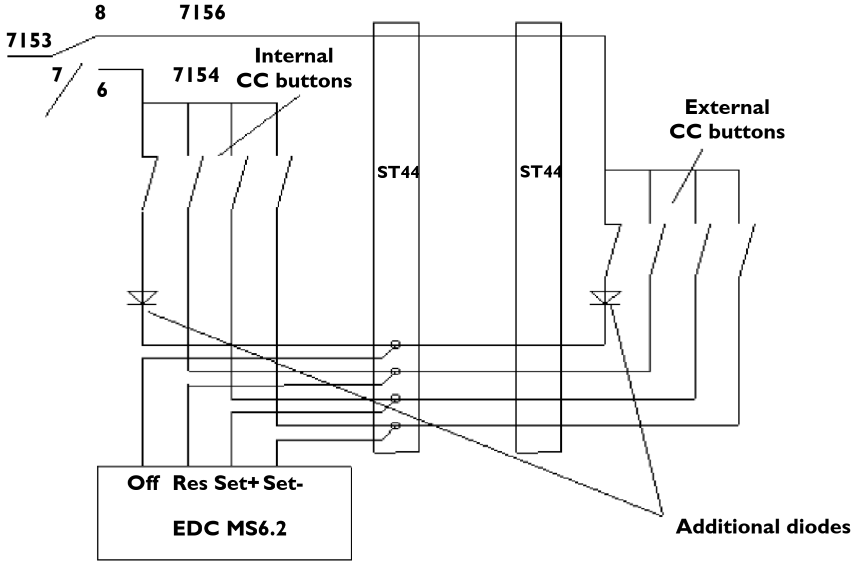
1) Pin 7 supplies the power for all CC buttons (Internal CC or External CC).
In the event that there is no short circuit 6-7 or 7-8, for safety reasons EDC reads CC off.

IVECO P/No 4104 0351 is recommended for the switching, and is already a suitable instruction. CC Resume is only accepted once it has been established that the braking system is functioning correctly. For vehicles without EBS (Option 2318) the brake pedal must be pressed after ignition and after the engine has been switched off. For vehicles with EBS (Option 2318) this check is made automatically by the braking system. It is not necessary to press the brake pedal.

Warning: Regardless of the connection position
Internal CC / External CC
- **CC Resume**
- **CC Set+**
- **CC Set–**

can always be activated by the control device and also by the "ST44" connector.
If this is not acceptable for safety reasons, then two diodes must be fitted – by an authorised workshop – using the drawing for the vehicle's wiring harness.
When these diodes have been fitted, either all the internal CC buttons (on the control device) or all the external buttons (via the "ST44" socket) may be activated.
The bodybuilder must pay particular attention to the technical safety aspects of this application. Under no circumstances can the "ST44" insulated socket connection be allowed to activate a CC button (Resume or Set+ or Set–) when the vehicle is in motion. This could result in the vehicle accelerating unexpectedly, and thus must be avoided at all costs. In case of doubt, the two diodes should be fitted as shown on the drawing.
The bodybuilder has sole responsibility for evaluating all technical safety aspects. IVECO accepts no responsibility whatsoever in this regard.
NB: In general, diodes should be fitted for all non-stationary applications. Where the application is to be stationary, diodes can be dispensed with since, of course, no commands should be allowed from the body/ancillary to activate the CC Res, CC Set+ or CC Set– functions.

Figure 5.12



5.7.3 Activating the various EDC power take off modes

The EDC central control unit (engine regulation) allows the bodybuilder to make specific adjustments to the engine's parameters. As well as the normal "driving" mode (power take off mode 0), up to 3 independent EDC power take off modes can be activated (power take off modes 1, 2 or 3). Each of these modes requires a separate configuration that can be programmed by IVECO Service. When the power take off is engaged, the bodybuilder can then activate the corresponding EDC power take off modes automatically, for example.

5.7.3.1 Driving mode (power take off mode 0)

In the normal "driving" mode, the vehicle allows an intermediate engine speed setting up to a speed of 20 km/h. (Warning: at speeds above 20 km/h, the speed limiter is activated). The function is activated by pressing the RESUME button. A new intermediate engine (rev) speed setting can be stored by the driver by holding the RESUME button down for a minimum of 5 seconds, thus avoiding the need for it to be reprogrammed by IVECO Service (see point 5.7.3.4).
The maximum number of revs possible with SET+ is identical for all power take off modes ("driving" mode 0, power take off modes 1, 2 and 3). The idling speed is set by the factory at 100 min^{-1}. After reprogramming by IVECO Service, this can be increased to 200 min^{-1}. The idling speed is identical for all power take off modes ("driving" mode 0, power take off modes 1, 2 and 3).

<u>Settings for "driving" mode (power take off mode 0)</u>

The following settings for the "driving" mode cannot be modified:

Resume / Off	Activation / deactivation of the intermediate engine speed setting (intermediate speed set at the factory at 900 min^{-1}; this can be modified by the driver)
Set+ / Set-	Increase / decrease in the active intermediate engine speed
Accelerator pedal	Activated
Max number of revs	2,700 min^{-1} for Cursor 8 2,460 min^{-1} for Cursor 10 2,340 min^{-1} for EuroStar/EuroTrakker Cursor 13
Torque	Maximum torque specified for the vehicle (for example, 1280 Nm for engine type E35; 1900 Nm for E43)
Conditions for cut out	The number of intermediate revs is deactivated by: - pressing the brake pedal or clutch; - activating CC Off - engaging the exhaust brake - engaging the Intarder

5.7.3.2 Configuring EDC power take off modes (modes 1, 2 and 3)

In each power take off mode, it is possible for IVECO Service to configure various EDC parameters. The EDC power take off mode is activated via the corresponding Pin on the "ST44" insulated socket connection.

5.7.3.2.11 Parameters

The following table shows the parameters that can be configured within a power take off mode. These parameters can only be configured using a MODUS (IVECO Service) diagnostic station.

Parameter	Possible values
Possible range for power take off settings 1)	N_{LL} - 2700 min-1 (Cursor 8) 2) N_{LL} - 2460 min-1 (Curso10) 2) N_{LL} - 2340 min-1 (Curso13) 2)
Maximum number of revs – engine speed Nmax (no load on engine)	N_{LL} - 2700 min-1 (Cursor 8) 2) 3) N_{LL} - 2460 min-1 (Curso10) 2) 3) N_{LL} - 2340 min-1 (Curso13) 2) 3)
Max. number of revs, intermediate engine speed (using Set+) NSET_max	N_{LL} - 2700 min-1 (Cursor 8) 2) N_{LL} - 2460 min-1 (Cursor 10) 2) N_{LL} - 2340 min-1 (Curso13) 2)
Increase in number of revs using Set+	125 / 250 U/s (Cursor 8 Euro 2) 125 /250 / 500 / 1000 U/s (Cursor 8 Euro3 + Cursor10+EuroStar/EuroTech Cursor 13)
Reduction in number of revs using Set– / as above	As above
Torque limitations	400, 500, 600, 950, max Nm 3)
Steepness of the regulator at maximum revs	~2 / ~1 / ~0,65 PS / min-1 3)
CC buttons (Resume / Off / Set+ / Set–)	Activated / deactivated
Recording intermediate number of revs Nres	Fixed programming (MODUS) / free programming (driver)
TIP function, for Set+ / Set– buttons	Activated / deactivated (not on Cursor 8 Euro 2)
Damping time of the input jumpers for the power take off (Pins 16, 17, 18 in the "ST44 Connection" 5)	500 ms / 100 ms
Idling setting range 6)	100 min-1 / 200 min-1
Deactivation of intermediate revs using either the brake or the clutch	Activated / deactivated
Accelerator pedal	Activated / deactivated
VZDR-aus - Driving speed at which the intermediate revs function is deactivated	Between 2 km/h and 25 km/h

Abbreviations:
N_{LL} Number of revs at idling speed
Nmax Maximum number of revs
Nres Intermediate number of revs stored. This is activated by pressing Resume or by using the EDC power take off mode.
Nset_max Maximum number of intermediate revs achievable with Set+. It is identical for all power take off modes (0, 1, 2 and 3).

1) This number of revs is the maximum number of revs for the engine. The corresponding number of revs for the power take off must be calculated using the reduction ratio for the power take off.

2) To regulate the revs setting, the following rules apply:
- Never go below the N_{LL} value;
- Never exceed the valid Nmax value (power take off modes 0, 1, 2 and 3)
- If Nres greater than Nmax or NSET_max>Nmax, then the number of engine revs is always limited to the Nmax value each time this occurs (power take off modes 0, 1, 2 and 3).

3) Where it is permissible to operate the power take off with limited torque and/or limited revs, it is possible to calculate a point at which the revs intersect as shown in figure 5-3.1. Where the revs are lower than the intersection point, the maximum programmed torque is available. Where the engine speed is greater than the intersection point, then the fine adjustment (overrun) setting comes into action (see 5.7.3.2.2).

Note: The conversion by calculating the torque at a determined number of engine revs uses the following formula:
$P[CV] = (M[Nm] \times [min^{-1}]/9550)$

4) The TIP function allows a gradual variation on the regulator for the intermediate revs, i.e. the speed limiter. This is done by pressing briefly on the Set+ / Set– button (for less than half a second). When the speed is less than 20 km/h, the intermediate engine speed regulator can be activated, but when the speed is greater than 20 km/h the speed limiter is activated. The variation for the intermediate engine speed setting is equal to 20 min^{-1} for each TIP (pressing slightly on the toggle button) or 1 km/h for each TIP on the speed limiter.
This configuration is identical for all power take off modes (power take off modes (0, 1, 2 and 3).

5) For safety reasons, the engine EDC setting only switches to the new mode selected - EDC power take off mode - ("ST44" insulated socket connection – Pins 16, 17 or 18) after the damping time for the contact jumpers. This is the time in which the modified signal must be present in an uninterrupted state in order to be accepted as valid. This damping time can be reduced from the value set by the factory (500 ms) to 100 ms.
In this way, an ANTI-GAS operation, for example, can be performed. To do so, the following values should be selected in mode 3 of the power take off (maximum priority):
- Maximum number of revs, Nmax, set at the number of revs for idling speed (550 min^{-1} or 600 min^{-1})
- Damping time for the contact jumpers 100 ms.

In this case, after 100 ms the engine would change to the idling power supply.

6) The setting of the minimum revs (idling) can be extended to various uses (for example, cement mixers, refuse collection vehicles etc). The setting of the idling speed is described in the operator's instruction manual.

Minimum and maximum number of revs based on vehicle model and settings range:

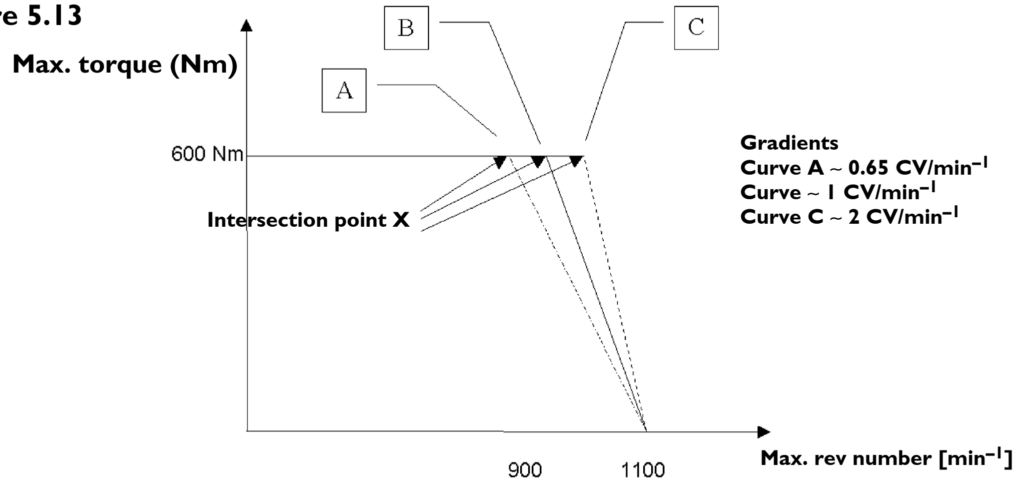
Vehicle	Seyyings Range	
	100 min^{-1}	200 min^{-1}
Cursor 8	600 - 700 min^{-1}	600 - 800 min^{-1}
Cursor 10	550 - 650 min^{-1}	550 - 750 min^{-1}
Cursor 13	550 - 650 min^{-1}	550 - 750 min^{-1}

5.7.3.2.2 Modifying the torque curve, maximum number of revs and slope (of the curve) of the overrun regulator

In order to protect the power take off mechanically, it is possible to limit
- the maximum torque of the engine (to protect against overloading) and
- the maximum engine revs (to protect against overrun).

The slope (of the curve) of the overrun regulator defines the engine speed setting (intersection point X), at which the chosen torque is available.
If the engine speed setting goes above the intersection point X, the overrun regulator is activated. The reduction ratio of the power take off must be considered separately.
All three limitations can be chosen independently of each other, although a combination of two limitations is more usual. In this case, the bodybuilder may need to know up to which engine speed (intersection point X) his chosen torque is available.

Figure 5.13



To illustrate an example relating to figure 5.13:

- maximum engine torque 600 Nm
- the standard setting of the power take off that should be expected is 900 min^{-1}
- the number of engine revs must not exceed 1100 min^{-1} (the power take off is sensitive to the number of revs)
- the number of revs must be determined for all gradients of the overrun regulator (intersection point X) until the chosen torque of 600 Nm is available.

The slope of the curve for the overrun regulator depends on the particular nature of the vehicle usage. For this reason, when stationary, it is generally sufficient for the overrun regulator to have a steep curve, whereas in "driving" mode, this might give rise to rapid changes in load. This may cause problems, for example, for refuse collection vehicles.

Power at 1100 min^{-1} equals:

P = (600 Nm x 1100 min-1) / 9550

P = 69 kW (NB: 1 HP = 0.735 kW; 1 kW = 1.36 HP)

- Using the "steep" overrun regulator (curve C; gradient 2HP/ min^{-1}), we obtain a power of 69 kW = 94 HP with the following difference in number of revs compared to the overrun setting :

  Difference in number of revs:

  94 HP / ~2HP / min^{-1} = 47 min^{-1}: 45 min^{-1} selected

  Number of engine revs up to which 600 Nm is available:

  1100 min^{-1} - 45 min^{-1} = 1055 min^{-1}

- Using the "normal" overrun regulator (curve B; gradient 1HP/ min^{-1}), we obtain a power of 69 kW = 94 HP with the following difference in number of revs compared to the overrun regulator setting:

  Difference in number of revs:

  94 HP / ~1HP / min^{-1} = 94 min^{-1}: 95 min^{-1} selected

  Number of engine revs up to which 600 Nm is available:

  1100 min^{-1} – 95 min^{-1} = 1005 min^{-1}

  Using the "flat" overrun regulator (curve A; gradient 0.65 HP/ min-^{1}), we obtain a power of 69 kW = 94 HP with the following difference in number of revs compared to the overrun regulator setting :

  Difference in number of revs:

  94 HP / ~0.65HP / min^{-1} = 145 min^{-1}: 145 min^{-1} selected

  Number of engine revs up to which 600 Nm is available:

  1100 min^{-1} - 145 min^{-1} = 955 min^{-1}

So, based on the example above, the number of intermediate revs, Nres, should be set to 900 min^{-1}. This will then be activated automatically when the power take off mode is selected. From the example, we see the influence of the overrun regulator. Depending on the usage, the chosen torque of 600 Nm is available up to 1055 min^{-1}, 1005 min^{-1} or 955 min^{-1}.

The same is true in reverse. When the engine torque, the intersection point X and the slope of the overrun regulator are predetermined, it is possible to calculate the number of revs of the end speed.

<u>Warning regarding this application:</u>

The maximum number of revs, Nmax, is a theoretical value. It is the number of engine revs at which the control unit reduces the quantity injected to 0 mg/stroke. However, given that depending on the engine speed (warm engine without load) all engines need an injection quantity of between 20 and 30 mg/stroke to maintain that speed, this "theoretical" number of maximum engine revs, Nmax, is never achieved. Depending on the slope (of the curve) for the overrun regulator, the number of revs effectively achieved is lower than 10 – 40 min^{-1}. If this should have an impact for the desired application, we would recommend that the overrun speed be determined by practical trials.

5.7.3.2.3 Intermediate rev speed limiter

5.7.3.2.3-1 Maximum number of revs for the intermediate speed regulator (with Set+) NSET_max

The maximum number of revs that can be achieved using Set+ on the intermediate speed regulator can be configured. This limit is identical for all power take off modes ("driving" mode 0, power take off modes 1, 2 and 3).

5.7.3.2.3-2 Priority on the maximum regulator setting – intermediate speed regulator (with Set+) NSET_max

The maximum valid number of revs, Nmax, ("driving" mode 0, power take off modes 1, 2 and 3) has a higher priority compared to the maximum number of revs of the intermediate speed regulator, NSET_max, that can be achieved using Set+. It also has higher priority compared to the valid number of intermediate revs, Nres, stored periodically in the memory ("driving" mode 0, power take off modes 1, 2 and 3).
The maximum Nmax setting can be programmed to accommodate the requirements of the bodybuilder in modes 1, 2 and 3 of the power takeoff. The number of intermediate revs, Nres, stored in the respective modes, must be less than or equal to the maximum number of revs for the intermediate speed regulator, NSET_max, this being the maximum that can be achieved using Set+. (This is identical for all modes of the power take off: "driving" mode 0, power take off modes 1, 2 and 3).

5.7.3.2.3-3 TIP function

By pressing quickly (for less than 0.5 sec) on the Set+ / Set– button, the TIP function allows a gradual variation on the regulator for the intermediate revs, i.e., the speed limiter. When the speed is less than 20 km/h, the intermediate engine speed regulator can be activated, and when the speed is more than 20 km/h the speed limiter is activated. The variation for the intermediate engine revs is equal to 20 min^{-1} for each TIP (pressing slightly on the toggle button) or 1 km/h for each TIP on the speed limiter.
If the Set+ / Set– buttons are pressed for longer (for more than 0.5 sec), the setting of intermediate revs, i.e. the value required by the speed, is modified continuously. The numbers of revs, that is, the driving speed at the time that the CC Set+ or CC Set– keys are actually released, is stored as the new required value.
The TIP function with CC Set+ / Set– can be deactivated. This configuration is available for all power take off modes (mode 0, power take off modes 1, 2 and 3). Deactivating the TIP function results in a functional restriction of the speed limiter. Therefore, this modification should only be used after due and careful consideration.

Note: This function is designed for the regulation of hydraulic equipment.

5.7.3.2.3-4 Increase in the number of revs using the Set+ button / reduction in revs using the Set– button

By pressing for longer (greater than 0.5 sec) on the Set+ / Set– buttons, when the TIP function has been deactivated, it is possible to change the value required for the intermediate speed regulator by a given value per second. The time interval needed for this modification may be calculated using the following formula:
Difference in the number of revs / increase in the number of revs = necessary time interval.

Example: The number of intermediate revs must be increased from 800 min^{-1} to 1800 min^{-1} using the CC Set+ button. The difference in number of revs is 1000 min^{-1}.
At 125 revs/sec, the time interval is 1000 revs/125revs/sec = 8 seconds.
At 250 revs/sec, the time interval is 1000 revs/250revs/sec = 4 seconds.
At 500 revs/sec, the time interval is 1000 revs/500revs/sec = 2 seconds.
At 1000 revs/sec, the time interval is 1000 revs/1000revs/sec = 1 second.

5.7.3.2.4 Accelerator pedal activated / deactivated

In normal operating mode (power take off mode 0) the accelerator pedal is always activated. In power take off modes 1, 2 or 3, the accelerator pedal may be deactivated. In this case, the EDC regulator for the engine ignores the accelerator pedal. If, however, the accelerator pedal remains activated, it is possible to increase the number of engine revs using the pedal until the maximum number of revs, Nmax, valid at the time is reached.

5.7.3.2.5 Standard configurations

The following table contains the settings used in the factory.

	EDC power take off mode			
	Mode 0 "driving" mode	**Mode 1**	**Mode 2**	**Mode 3**
Activated by the "ST44 Connector"	No activation necessary	Short circuit Pin 16-19	Short circuit Pin 17-19	Short circuit Pin 18-19
Maximum torque	Maximum engine torque	Maximum engine torque	Maximum engine torque	Maximum engine torque
Maximum number of revs achievable using Set+	1800 min^{-1}			
Maximum number of engine revs, Nmax	Cursor 8: 2700 min^{-1}	1800 min^{-1}	2700 min^{-1}	2700 min^{-1}
	Cursor10: 2460 min^{-1}		2460 min^{-1}	2460 min^{-1}
	Cursor13: 2340 min^{-1}		2340 min^{-1}	2340 min^{-1}
Slope on the curve for max. revs speed regulator	Depends on the engine power	~ 1 HP/ min^{-1}	~ 1 HP/ min^{-1}	~ 1 HP/ min^{-1}
Increased revs using Set+	250 min^{-1}/sec	250 min^{-1}/sec	250 min^{-1}/sec	250 min^{-1}/sec
Reduced revs using Set–	250 min^{-1}/sec	250 min^{-1}/sec	250 min^{-1}/sec	250 min^{-1}/sec
Accelerator pedal	Activated	Activated	Activated	Activated
CC buttons (Res / Off / Set+ / Set–)	Activated	Activated	Activated	Activated
Setting the number of intermediate revs Nres	Programmable (by the driver)	Programmable (by the driver)	Programmable (by the driver)	Programmable (by the driver)
TIP function for the Set+ / Set– buttons	Activated			
Damping time of the input contact jumpers for the power take off (Pins 16, 17, 18 of ST44)	500 ms			
Setting for the number of revs while idling	100 min^{-1}			
VZDR-aus - Driving speed at which the intermediate revs function is deactivated	25 km/h	25 km/h	25 km/h	25 km/h
Release of number of intermediate revs via the brake or clutch	Activated	Activated	Activated	Activated

5.7.3.2.6 Activating the EDC Power Take Off modes

1 A voltage divider diode plate (IVECO part number 50033 4927) must be fitted at position S of the electrical control unit (C.I.U). A suitable 5-pin connector socket is already fitted at this location.

Figure 5.14

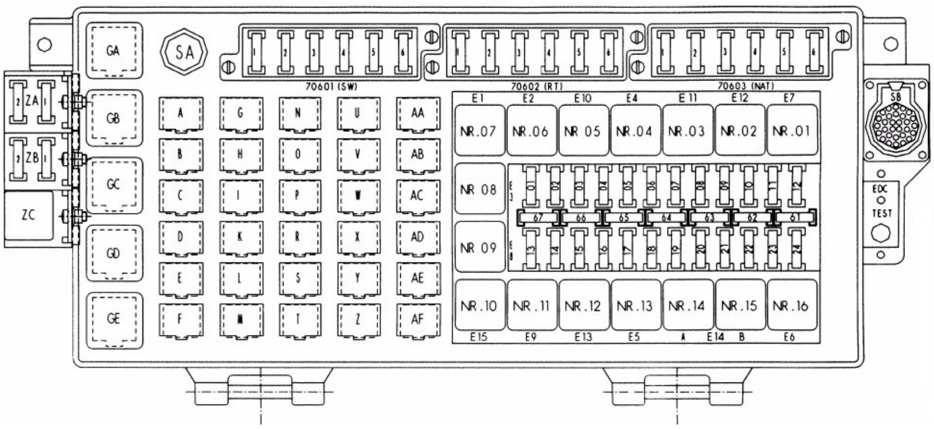
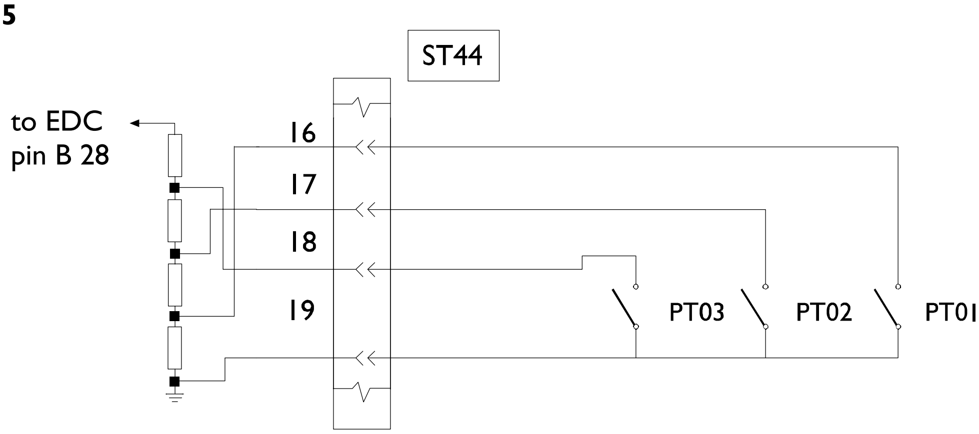


Illustration of the control unit for Cursor 8 (Cursor 10 and Cursor 13 are similar)

Part numbers:	Cursor 8	4120 9033 DH, Table 1
	Cursor 10/13	4120 7930 DH, Table 1

2 Modes 1, 2 and 3 of the EDC power take off can be activated via the "ST44" insulated socket connection (see figure 5.15).

Figure 5.15



The contacts shown in figure 5.15 can be simple switches, relay contacts or contacts that are free of interference from field disturbances, electromagnetic currents, etc.
All contacts must be able to handle currents of ~10mA reliably.
Regardless of the control from the body/ancillary, consideration must be given to the fact that, inside the vehicle, a voltage divider will be needed to determine the corresponding power take off modes.
For this:

- by closing the mode 1 switch, a bridge is used to bypass one resistor (between Pin 19-16)
- by closing the mode 2 switch, a bridge is used to bypass two resistors (between Pin 19-16 and 16-17)
- by closing the mode 3 switch, a bridge is used to bypass three resistors (between Pin 19-16, 16-17 and 17-18)

Under this set up, the contacts will be given different priorities:

Mode 3: maximum priority (the contacts for mode 2 and mode 1 are ignored)
Mode 2: medium priority (the mode 3 contact must be open, the mode 1 contact is ignored)
Mode 1: minimum priority (the mode 3 and mode 2 contacts must be open)
Mode 0: driving mode (the contacts for modes 3, 2 and 1 must be open).

Warning: These priorities must be considered at the programming stage. If not, problems may arise causing malfunctions, and it may become necessary to modify the wiring of the body/ancillary, or to reconfigure the EDC central control unit of the engine, etc.

Vehicle response when the power take off mode is selected

When the damping time for the jumpers has elapsed (100 ms or 500 ms)

- the chosen mode is activated (therefore, all the chosen parameters are activated)
- at speeds of less than 20 km/h, the stored intermediate number of revs, Nres, is activated automatically for the power take off mode (without pressing the CC Resume button)
- at speeds of more than 20 km/h, only the chosen parameters are activated.

If the CC Res button is pressed, the last stored speed is activated. This value is independent of the chosen power take off mode (driving mode 0, power take off modes 1, 2 and 3). When the ignition is switched off, the stored value is cancelled. Therefore, each time it is switched on again, it is first necessary to set a new speed using the Set+ and Set– buttons.

5.7.3.2.7 Correlation between the EDC configuration and the installed power take offs

There is no direct connection between the EDC power take off mode (which can be activated using the "ST44" connection) and the power take offs physically fitted to the vehicle. Therefore, the bodybuilder can define the necessary connections to suit his purpose.
This set up therefore makes it possible to use the power take off(s) with the various EDC configurations (for example, for particular work cycles). Should a work cycle be established, for example, in which the fitted power take off is made to operate in different conditions, then up to a maximum of 3 modes can be used for the EDC power take off. The corresponding EDC power take off modes must be activated from the body/ancillary at the relevant times.
In a similar way, it is possible to correlate an EDC power take off mode even without there being a power take off physically fitted to the vehicle, or conversely when there is more than one fitted.

5.7.3.2.8 Use of EDC power take off modes with option 4036 ('ECONOMY/POWER')

If option 4036 has been ordered, then only modes 2 and 3 for the power take off can be used. Power take off mode 1 is used to limit the torque when "ECONOMY" mode is functioning.

5.7.3.3 Engaging the power take off

It is not sufficient just to select an EDC power take off mode in order for the physical power take off to be activated, i.e., two operations are generally necessary:
1) mechanical engagement of the power take off;
2) activation of a suitable EDC power take off mode.

The two operations can take place at the same time, or may be staggered. However, it is necessary to consider how the power take off(s) fitted by the bodybuilder are activated. The command from the body/ancillary must co-ordinate how the two operations are scheduled, and how this happens depends on the work cycle defined by the bodybuilder and the user.

5.7.3.3.1 Engine dependent power take off

<u>Multipower:</u> A multipower power take off can be engaged only when the engine is not running. The EDC power take off mode can be selected separately (even when the engine is turned off). A limit switch (feedback signal) checks that the multipower power take off has been correctly engaged.
This feedback signal can be taken at the following position:
on insulated socket ST13 (pin 1).

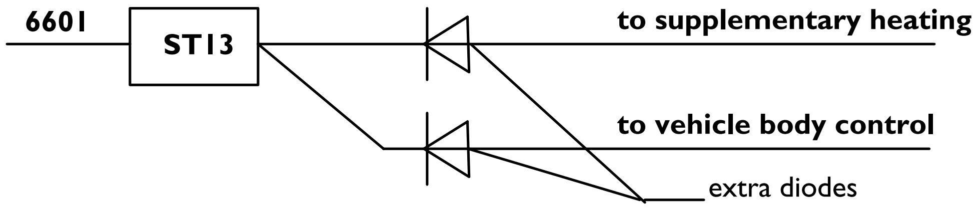
Location: On the rear of the cab, rear cable connector linked with plug D, Pin 2, length ~ 100 mm.

Engine PTO: The engine power take off can be engaged even when the engine is running. Depending on the vehicle type (Cursor 8 / Cursor 10 / EuroStar / EuroTrakker Cursor 13), certain torque levels cannot be exceeded for a given number of revs once the power take off has been engaged (see section 4.5.2).
A pressure switch ensures that the Engine PTO is correctly engaged.
The relevant signal can be taken from the following location on plug ST13 (single-pin):

Location: On the rear of the cab, rear cable connector linked with plug D, Pin 2, length ~ 100 mm

Warning: ST13 is already used on vehicles that carry dangerous loads, with power take offs and supplementary heating (Options 2658 or 6656). In this case, the bodybuilder must fit two additional diodes (Iveco part number 480 3560) (see figure 5.16).

Figure 5.16



Cable number	6601
Power take off not engaged signal	Open
Power take off engaged signal	Earth
Maximum absorption of current	100 mA

Manoeuvring is made easier when the feedback signal selects the EDC power take off mode automatically.

5.7.3.3.2 Clutch dependent power take off

Power take offs fitted to the gearbox must only be engaged when the clutch is fully depressed. The EDC power take off mode can, however, be selected separately.

5.7.3.3.2.1 Mechanical gearboxes

At the time that the power take off is engaged, the clutch pedal must be fully depressed.
The EDC power take off mode can be selected separately (even when the engine is switched off).
A limit switch (definitive position) ensures that the Engine PTO is correctly engaged.
The relevant signal can be taken from the following location on plug ST13 (single-pin):
Location: On the rear of the cab, rear cable connector linked with plug D, Pin 2, length ~ 100 mm

5.7.3.3.2.2 With Allison Gearbox (Cursor 8)

When the vehicle has an Allison gearbox, the selection of the power take off is co-ordinated by the gearbox central control unit. The operation uses the following procedure:

- request to engage the power take off (the gearbox central control unit checks the internal conditions so that the operation can be effected safely: engine speed less than 900 rpm and output speed from the gearbox less than 250 rpm)
- the solenoid valve used to engage the power take off is activated by the central control unit
- if the power take off and handbrake are engaged at the same time, the gearbox is automatically put into neutral, and EDC power take off mode 2 is activated
  (relay 25710 is supplied, located at: the relay plate on the gearbox central control unit, located on the rear wall of the cab)
- a check is made that the power take off is functioning safely (output speed from the gearbox less than 300 rpm).

The button for engaging the power take off is located in the central section of the dashboard.

Before engaging the power take off, the gearbox central control unit checks a number of parameters (engine speed less than 900 rpm and output speed from the gearbox less than 250 rpm). If all the necessary conditions inside the gearbox are satisfied, the Allison gearbox central control unit automatically engages the power take off. The restrictions (end speed, maximum torque etc) for the EDC power take off mode selected therefore remain valid even while the engagement takes place.
Certain values may be modified by Allison Customer Assistance, as required by the bodybuilder.

Option 32: Power take off for Allison gearbox (power take off for automatic gearbox)

Factory settings

For this vehicle configuration, the power take off is engaged only if the engine revs are lower than 900 rpm and the number of gearbox revs is lower than 250 rpm.
If the power take off and handbrake are engaged at the same time, the gearbox is automatically put into neutral, and EDC power take off mode 2 is activated (the factory wiring, relay 25710, activates EDC power take off mode 2). The bodybuilder does not therefore need to provide this wiring if EDC power take off mode 2 is to be used.

Figure 5.17

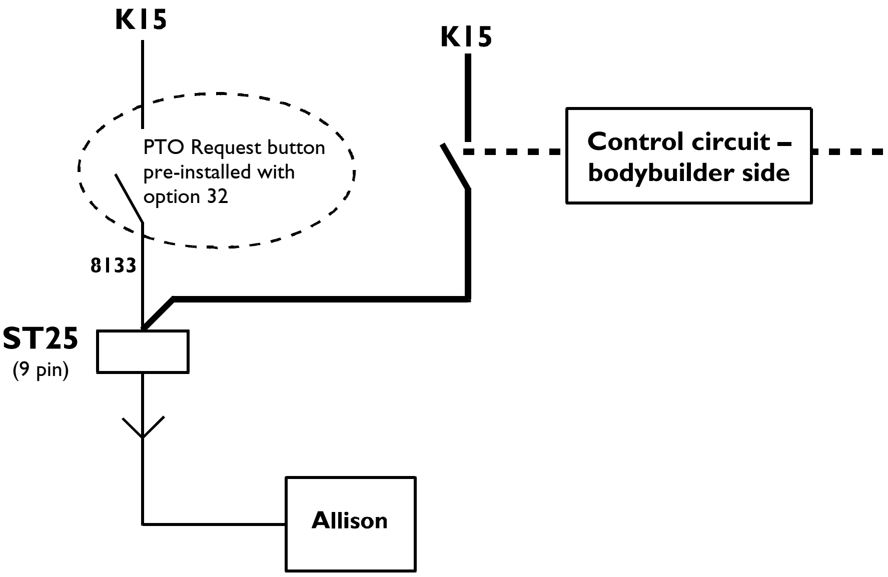
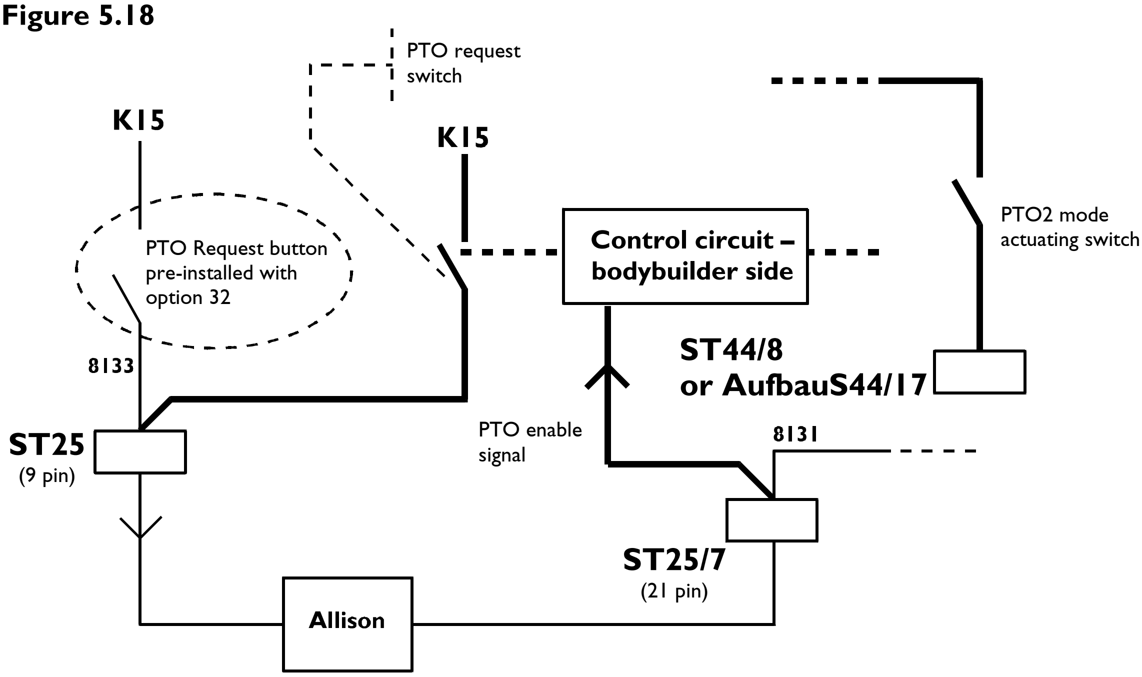


Figure 5.18



The connections that need to be added are shown in the two illustrations.

For some applications, it may not be appropriate for mode 2 of the EDC power take off to be selected automatically. In this case, relay 25710 must be removed. The selected power take off can be recognised from the following set up:

Cable number	8831
Power take off not engaged signal	Open
Power take off engaged signal	+ 24V
Maximum absorption of current	100mA

Examples of specific requirements of bodybuilders

- Facility to engage the power take off from the body/ancillary control.
  The switch fitted to the vehicle must be replaced by an output from the body/ancillary control (+ 24V on the ST25 insulated socket, cable 8133, Pin 1)
- Automatic selection of EDC power take off mode 2 through the power take off control.
  This function is available on vehicles with Allison gearbox with option 32 fitted by the factory. The necessary wiring is already provided. Some adjustments may be needed to the parameters for EDC power take off mode 2.
- Automatic selection of the various EDC power take off modes through the power take off control.
  If various EDC power take off modes are to be activated by the power take off control, the bodybuilder needs to remove the 25710 relay and activate EDC power take off modes 1, 2 and 3 (via the "ST44" insulated socket connection, Pins 16, 17, 18). He must use suitable alternative relays.
  In this case, however, the various EDC power take off modes can only be selected when the power take off command itself is actually activated + 24V relay 25710).
- No direct connection between the various EDC power take off modes and the power take offs fitted.
  For this application, the bodybuilder must only remove relay 25710.
  He will then be able:
  - to engage the installed power take off
  - using the switch fitted by the factory (with option 32) or directly from the body/ancillary control (using ST25, cable 8133, pin 1) activate the required EDC power take off mode using the ST44 connection, Pins 16, 17, 18.

The following table shows the different operating conditions (functional characteristics provided by the factory when Allison gearbox and option 32 are ordered).

Request 1)	Command 2)	EDC Selection 3)	Observations
Open	Open	No	Running without power take off
+ 24V	Open	No	Power take off requested. The conditions are checked or they are ignored.
+ 24V	+ 24V	Yes	Power take off engaged, EDC power take off mode 2 selected.

1) "Engage power take off" requested, ST25 (9 pin connections), Pin 1 cable 8133.
2) Solenoid valve command "Engage power take off" ST25 (21 pin connections), Pin 7 cable 8131.
3) Automatic selection of EDC power take off mode 2.

Method for retrofitting a power take off for an Allison gearbox

If the power take off is being fitted afterwards, the wiring must be done by an authorised workshop, based on option 32.
It will also be necessary for Allison to programme the gearbox's central control unit.

5.7.3.3.2.3 Eurotronic (option 6198)

In the same way as for Allison, the Eurotronic gearbox (option 6198) allows power take offs to be used. The following procedure applies:

- Request to engage the power take off (the gearbox central control unit checks that the vehicle is stationary, that the gearbox is in neutral and that the accelerator pedal is not depressed).
- The solenoid valve is moved by the gearbox central control unit to engage the power take off, or more than one solenoid valve is used if there is more than one power take off.
- The gearbox central control unit checks that the power take off is correctly engaged (by activating the limit switch / feedback signal switches).
- "Power take off engaged" signal is used by the bodybuilder (ST13, cable 6601, the Pin is earthed).

Note:

- **the Eurotronic gearbox (option 6198) is able to control 2 different power take offs (side or rear mounted).**
  The physical connection between the power take offs and the request for power take off 1 or 2 must be configured using a separate MODUS programme on the gearbox central control unit.
  The power take off (s) are disengaged when the engine is switched off.
- **The gearbox central control unit only checks the change in the "engage power take off" signal. Thus, after every "ignition on" and every "engine off", the "engage power take off" signal must be requested again.**
- **When a request cannot be effected (conditions within the gearbox are not satisfied etc) the request must be made again.**

⚠ **Warning: the gearbox central control unit only allows the power take off to be activated after the gearbox calibration phase has been completed. This occurs after the engine has been started, and lasts about 5 seconds.**
Once the calibration has been completed, the symbol "N" appears on the display.
Before the power take off is activated, the gearbox central control unit checks a range of parameters (for example, vehicle stationary, gearbox in neutral, accelerator pedal fully released). If all the necessary conditions inside the gearbox are satisfied, the Eurotronic (option 6198) gearbox central control unit engages the power take off (s) automatically. While this is happening, the engine is idling (the gearbox central control unit checks the EDC engine management system).
While the power take off (s) is/are being engaged, neither the driver nor the body/ancillary control can change the engine speed. The restrictions (end speed, maximum torque, etc) of any EDC power take off modes that may be active therefore remain valid during this phase. With this gearbox type, the EDC power take off mode is not selected automatically.
The appropriate wiring must be provided by the bodybuilder.

The button, or buttons, to engage the power take off (s) are located near the gearshift lever.

Figure 5.19

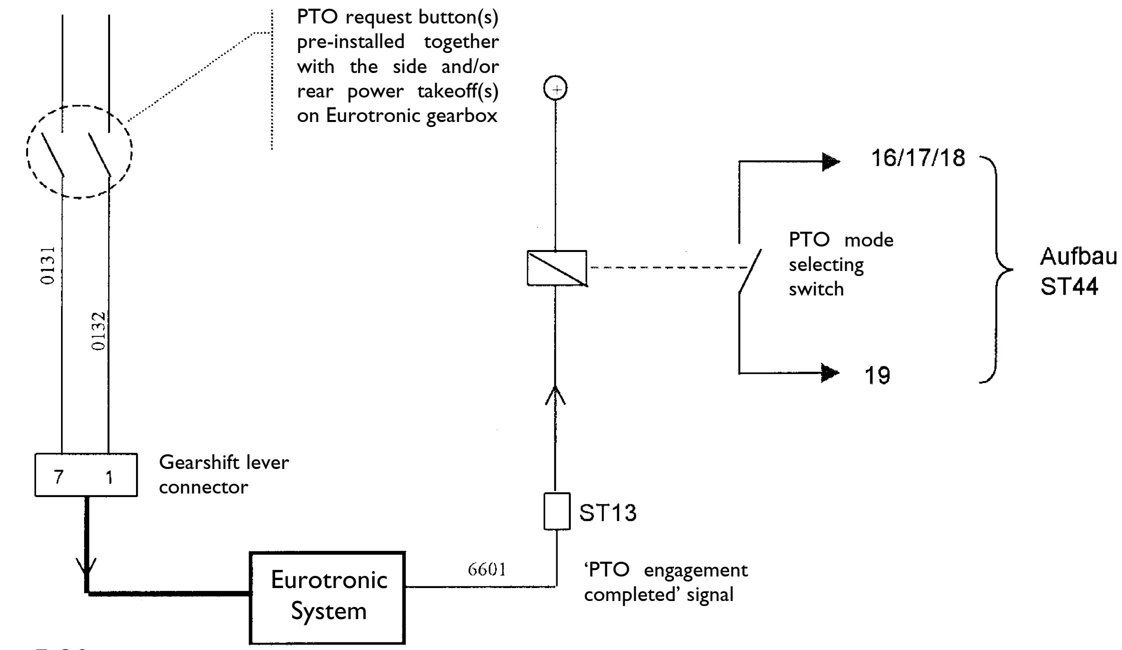
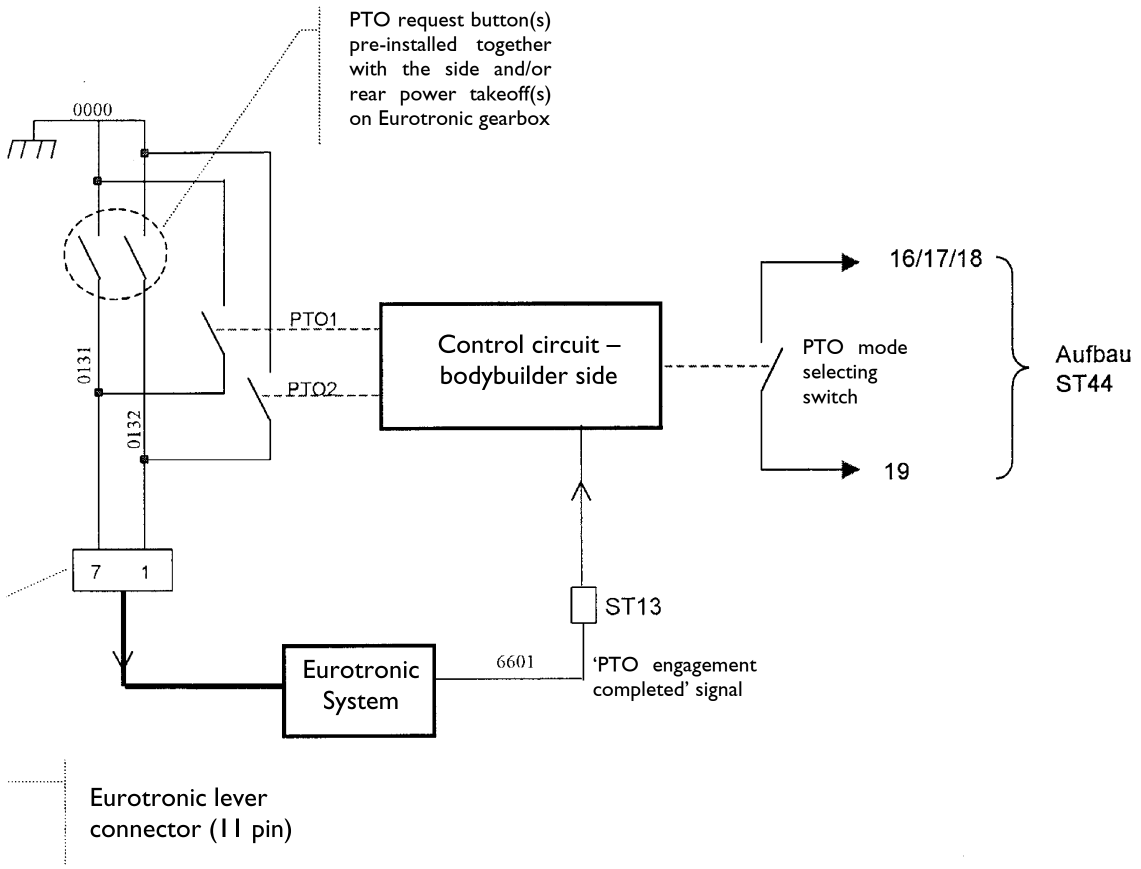


Figura 5.20



A limit switch (feedback signal) checks that the multipower power take off has been correctly engaged. This feedback signal can be taken at the following position on insulated socket ST13 (single-pin): Location: On the rear of the cab, rear cable connector linked with plug D, Pin 2, length ~ 100 mm.

Warning: ST13 is already used on vehicles that carry dangerous loads, with power take offs and supplementary heating (Options 2658 or 6656). In this case, the bodybuilder must fit two additional diodes (Iveco part number 480 3560) (see figure 5.16).

Cable number	6601
Power take off not engaged signal	Open
Power take off engaged signal	Earth
Maximum absorption of current	100mA

Warning: If both power take offs are activated at the same time, the "Power take off engaged" signal (ST13, 6601 to earth) is earthed if one of the two power take offs is engaged.

Examples of specific requirements of bodybuilders

- Facility to engage the power take off from the body/ancillary control.
  The switch fitted to the vehicle must be replaced by an output from the body/ancillary control - an 11 connection insulated socket on the gearshift lever (52059)
  power take off 1: earth on Pin 7, cable 0131
  power take off 2: earth on Pin 1, cable 0132
- Automatic selection of an EDC power take off mode when the power take off is engaged.
  If it is sufficient when a power take off is engaged for only one EDC power take off mode to be used, then the bodybuilder must install the wiring between ST13 (cable 6601) and the "ST44 Connection". Then, depending on his requirements, he must use a relay to activate the EDC power take off mode (using the "ST44" insulated connection socket, Pin 16, 17 or 18). In this case, the corresponding EDC power take off mode can only be selected when the power take off itself is actually activated (ST13, cable 6601 to earth).
- Automatic selection of various EDC power take off modes when the power take off is engaged.
  If various EDC power take off modes are to be activated when the power take off is engaged, the bodybuilder must install the wiring between ST13 (cable 6601) and the "ST44 Connection". Then, depending on his requirements, he must use a number of relays to activate the EDC power take off modes 1, 2 or 3 (using the "ST44" insulated connection socket, Pin 16, 17 or 18). The body/ancillary must control the switching function between the various EDC power take off modes.
  In this case, the various EDC power take off modes can only be selected when the power take off itself is actually activated.
- No direct connection between the EDC power take off mode and the power take off fitted.
  For this application, the bodybuilder can use the following outputs, independently of each other:
  - engage power take off 1 (socket connection on gearshift lever 52059, Pin 7 to earth)
  - engage power take off 2 (socket connection on gearshift lever 52059, Pin 1 to earth)
  - activate the required EDC power take off mode using the ST44 connection, Pins 16, 17, 18.

General warning regarding the use of a power take off when the vehicle is operating

- If restrictions are not required (e.g. restrictions on torque, reduced maximum number of engine revs, etc) when the power take off is engaged, it is not necessary to use any EDC power take off mode.
  In this case, however, the engine power available for running the vehicle is reduced (given that power is being taken simultaneously by the ancillary). This could lead to acceleration problems. In typical usages (e.g. cement mixers, refuse collection vehicles etc) this problem can be minimised by increasing the idling speed. This increased number of revs would, however, also then be present even when the power take off was disengaged. In general, a reduction in the maximum torque in this field of operation would not be considered sensible.
- If, however, restrictions are required (e.g. restrictions on torque, reduced maximum number of engine revs, etc) then an EDC power take off mode should be used.

Warning: Particularly when the vehicle is operational, care must be taken to ensure that if an EDC power take off mode is activated, then the stored intermediate number of revs must also be activated at the same time. This could, however, result in an unexpected increase in vehicle speed. It is the bodybuilder's responsibility to ensure that the chosen solution is safe.

- The engagement or disengagement of the power take off depends both on the particular power take off chosen and on the requirements of the bodybuilder.
- Regarding vehicle operation (up to a maximum speed of 25 km/h) with an increased number of revs when the power take off is engaged. For a range of applications, (e.g. use of a tipping body, cement mixer, refuse collection etc) higher revs are also required during operation. This can be achieved using the following set up:
  - Stored intermediate number of revs Nres: fixed programming
  - Intermediate number of revs (Nres): as defined by the bodybuilder
  - Disengagement of the intermediate number of revs: deactivated via the clutch or brake pedals
  - Accelerator pedal: activated
  - CC buttons: deactivated

In this way, the engine can only operate again when the accelerator pedal is regulated between the stored intermediate number of revs, Nres, and the maximum number of revs, Nmax. If VZDR-aus is ever reached, the intermediate number of revs, and therefore also the increase in revs, is deactivated.

5.7.3.4 Changing the stored intermediate number of revs

The intermediate number of revs can be modified separately for each EDC power take off mode. It is necessary to make a distinction between two possibilities:

1 Fixed programming (MODUS)
For power take off mode 0 (driving mode), this option is not available. Modification is only possible if IVECO Service re-programmes the device using MODUS.

2. Free programming (by the driver)
To modify the intermediate number of revs, the following procedure is used:
a) select the particular EDC power take off mode whose intermediate number of revs are to be modified;
b) set the desired intermediate number of revs using the Set+/Set– button;
c) press CC Resume for more than 5 seconds.

5.7.3.5 Setting the idling speed

The idling speed must only be set when the engine is warm. There are three stages in the process:

Setting the minimum idling speed

The engine must operate at idling speed.

- Press and hold down the service brake (until the regulation is completed);
- Press the Resume button for more than 3 seconds (and then release)
  Immediately afterwards, the idling speed reduces automatically to the minimum value.

Modifying the minimum idling speed

It is possible to regulate the idling speed by intervals of 20 min^{-1} using the Set+ or Set– buttons.

Recording the minimum idling speed (in revs)

The speed is stored by pressing the CC Resume button again (for more than 3 seconds).

⚠ **Warning: The idling speed can only be adjusted in the various EDC power take off modes which are used to activate the CC buttons, otherwise the regulation of the number of intermediate revs is disengaged using the brake or clutch.**

The adjusted interval for the idling speed, set at the factory, is 100 rpm. IVECO Service can increase this interval to 200 rpm. The adjusted interval for the idling speed is identical for all power take off modes (drive mode 0 or power take off modes 1, 2 and 3).

5.7.3.6 Influence of the retarder on the intermediate number of revs

The engagement of the retarder causes the intermediate number of revs regulator to be deactivated (this has the identical effect as pressing the CC Off button). All the CC buttons (CC Res / Set+ / Set–) are ignored when the retarder is engaged.

⚠ **Warning: The regulator for the intermediate number of revs <u>will not</u> be deactivated if the retarder is engaged when the following combination occurs: "intermediate number of revs deactivated through either the brake or clutch = deactivated" and the "intermediate number of revs is lower than 900 rpm". When the retarder is activated, the engine speed is instead lowered to the idling speed and all the CC buttons (CC Res / Set+ / Set–) are ignored. Once the retarder has then been disengaged, the original number of revs will be restored.**

5.7.3.7 Influence of the exhaust brake on the intermediate number of revs

There are three types of operation for the exhaust brake depending on the driving conditions. These are selected via a three-position switch mounted in the dash and operate as follows:

Switch in central position	The exhaust brake is activated by pressing on the control button in the cab floor
Switch in down position	The exhaust brake is coupled to the service brake and is operated automatically when the brake pedal is first pressed.
Switch in up position	The exhaust brake is coupled to the accelerator and is automatically operated upon the release of the accelerator.

If the exhaust brake is activated by one of the above methods, the intermediate revs regulator is automatically deactivated (in the same way as by pressing CC Off).
All the CC buttons (CC Res / Set+ / Set–) are ignored while the exhaust brake is operational.

5.7.4 Example: Commands of all the Cruise Control functions, engine start / stop, second speed limiter

Figure 5.19

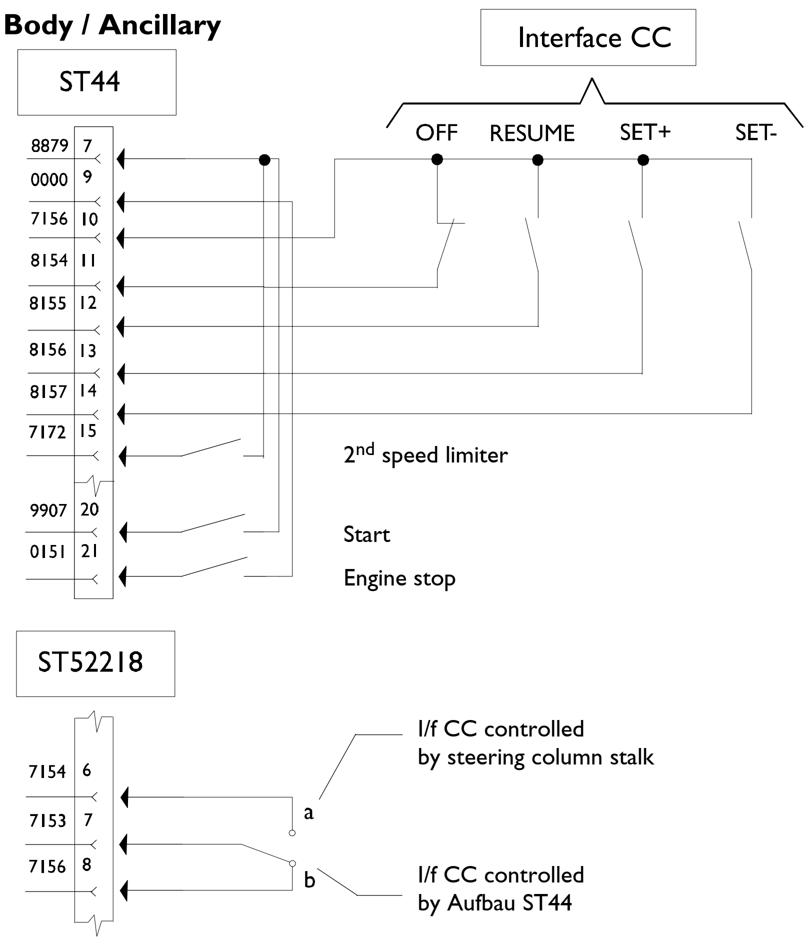


Figure 5.19 shows how all the functions listed above are controlled. The contacts shown may be simple switches, relays or SPS outputs (central control unit programmable with a memory), etc.Pins 7 and 9 are used to feed the body/ancillary command. Pin 10 is used exclusively for the power supply to the CC functions (CC Res / Set+ / Set–).

The warnings given for the control of the CC functions must be complied with in their entirety (see point 5.7.2.3).

Warning: Switching between the internal CC functions (on the control device) and the external CC buttons (via "ST44") can be made either by using the IVECO switch (IVECO part number 41404 0351) or by using a relay activated by the body/ancillary command. In this case, the jumper fitted by the factory on ST 52218 must be replaced by the switch or the relay.
We would stress again that with the wiring supplied by the factory, the CC Resume / Set+ / Set– functions can always be activated simultaneously by the driver or by the ST44 connection. If this is not appropriate for safety reasons, then two diodes (IVECO P/NO 480 3560) must be fitted by an authorised workshop (see point 5.7.2.3 above).

If the external CC buttons are used (using the "ST44" connection) then there must be a short circuit with Pins 10-11 if the CC Off button is not activated. If not, all the CC buttons will be ignored (the CC Off command will be recognised permanently).

5.7.4.1 CC Set+ / Set– buttons

These functions are mutually exclusive. Should both be activated simultaneously, then for safety reasons the CC Off button is activated immediately or after 500 ms. If, however, the buttons were pressed simultaneously, the engine's EDC central control unit recognises an error after 500 ms (EDC error 1.3, control device).

5.7.4.2 Second speed limiter

This function can be activated independently of the various EDC power take off modes (driving mode 0, power take off modes 1, 2 and 3). The value can be set by IVECO Service, using a MODUS station. The second speed limiter is activated using a +24V signal on Pin 15.

5.7.4.3 Engine start

Connection through Pin 20 in the "ST44" connector must be made.
For safety reasons, the engine can only be started up when the cab is <u>not</u> tilted.
All other precautionary devices, such as those relating to, for example, gearbox in neutral, hand brake engaged, vehicle stationary, engine not running, etc, must be fitted by the bodybuilder.

Warning: The signal for starting / stopping the engine requires safety devices to be fitted so that these operations may be performed safely, both for the operator and for the people or property nearby. Such devices must satisfy current legal requirements. It is the bodybuilder's responsibility to identify and install the relevant safety devices (for example, parking brake on, gearbox in neutral etc), using solutions that guarantee that the function works correctly, and using components that are certified as reliable.

5.7.4.4 Engine stop

It is recommended that Pin 21 in the "ST44" connector is used. Only in this way can it be guaranteed that the other central control units that communicate with the EDC engine central control unit will not produce any errors.
If not, it is possible that communication errors that occur between the various central control units on the vehicle might not be correctly and safely diagnosed.

5.7.5 EUROMOVER RANGE
Interfaces for on-board electrical systems

Supplementary information for bodybuilders and other equipment installers

A) POWER TAKE OFF FUNCTIONS AND IDLING SPEED SETTINGS
("Euro 3" and "Euro 2" engines)

B) INTERFACES FOR HIGH CURRENT LOADS

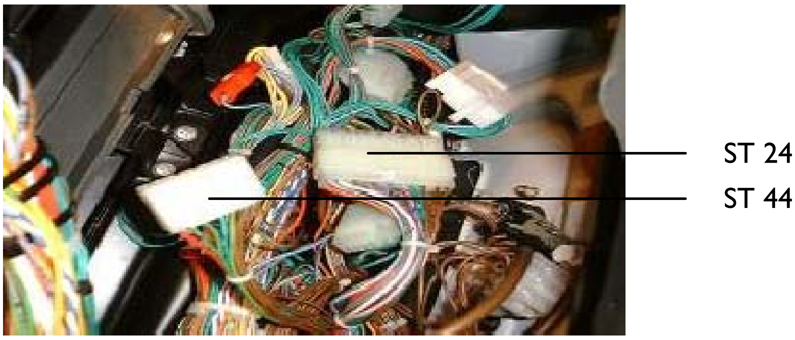
C) PROTECTING THE ENGINE ECU

General information

Special interfacing connectors on vehicles of the EuroMover range which are fitted with "Cursor" engines have functions which are used exclusively by bodybuilders and other equipment installers. The EDC central control unit can be programmed specifically to satisfy a wide range of user requirements.

SPECIAL INTERFACE CONNECTORS ST24 AND ST44: these are located inside the cab on the passenger's side, behind the central interconnection unit (CIU).

Figure 5.20



ST24 Pin-out Table

PIN	CABLE	COLOUR	DESCRIPTION
1	1176	Blue	Service brake signal – 24V when the service brake is applied (circuit is open when not engaged).
2	2226	White	Reverse gear engaged signal – 24V when reverse gear is engaged (circuit is open when gear deselected).
3	0024	Brown	From the test button for the warning light on the dash panel, short-circuited to earth when the test button is pressed.
4	4444	Grey	Instrument lighting output (using the attenuation switch) – 0 – 24V when the lights are switched on.
5	6627	Purple	Exhaust brake signal (24V on, 0V off).
6	8871	Green	Position 15 ignition key on the ignition switch (24V supply from the ignition switch).
7	9907	Pink	Normally connected to pin 7. If the existing connection is broken, it is not possible to start the vehicle (but if it is already running, the engine will not stop). To start the engine from outside the cab, short circuit pin 7 with pin 6 using a remote switch (Note 1)
8	8050	Green	Not used on EuroMover models.
13	2258	White	Position 15 ignition key on the ignition switch (24V supply from the ignition switch).
14	-		Free position
15	4442	Grey	Instrument lighting output (24V when the lights are switched on).
16	6662	Purple	Parking brake signal – 0V when engaged (open circuit when not engaged).
17	9907	Pink	Normally connected to pin 7 (see above).

1) ⚠ **Warning: The signal for starting / stopping the engine requires safety devices to be fitted so that these operations may be performed safely, both for the operator and for the people or property nearby. Such devices must satisfy current legal requirements. It is the bodybuilder's responsibility to identify and install the relevant safety devices (for example, parking brake on, gearbox in neutral etc), using solutions that guarantee that the function works correctly, and using components that are certified as reliable.**

In the following table, the abbreviation CC stands for Cruise Control. Its functions are normally activated using the relevant buttons on the windscreen wiper control lever.

ST44 Pin-out table

PIN	CABLE	COLOUR	DESCRIPTION
1	7156	Red	24V voltage (supplied for the functions of controlling the cruise control remotely using Pins 2, 3, 4 and 5)
2	8157	Green	To activate the CC Set– button – short circuit with Pin 1.
3	8156	Green	To activate the CC Set+ button – short circuit with Pin 1.
4	8154	Green	To disengage the Cruise Control, using CC Off, disconnect it from Pin 1. At all other times, the remote CC control must always be connected to Pin 1 when it is being used.
5	8155	Green	To activate the CC Resume function, short circuit with Pin 1.
6	0158	Brown	EDC Earth connected to Pin 13 (this connection MUST NOT be interrupted).
7	0168	Brown	To set the "type 3" power take off configuration to "high priority", short circuit with Pin 13.
8	0167	Brown	To set the "type 2" power take off configuration to "normal priority", short circuit with Pin 13.
9	0166	Brown	To set the "type 1" power take off configuration to "low priority", short circuit with Pin 13.
10	-	-	Free.
12	0000	Brown	Earth – only to be used for remote CC control functions.
13	0158	Brown	EDC Earth connected to Pin 6 (this connection MUST NOT be interrupted).

To switch the cruise control (CC) function from the buttons on the windscreen wiper lever to the ST44 connector, an appropriate switch (Iveco code 41010351) needs to be fitted instead of the ST52218 connector which is located behind the central console, near to the exhaust brake selector mode.

Figure 5.21

ST 52218

ST12: The vehicle is fitted with a second speed limiter, set in the factory to 30 km/h. This limiter is activated using the 21 pin ST12 connector, located inside the cab on the passenger side, near the ABS central control unit, as shown below.

Figure 5.22

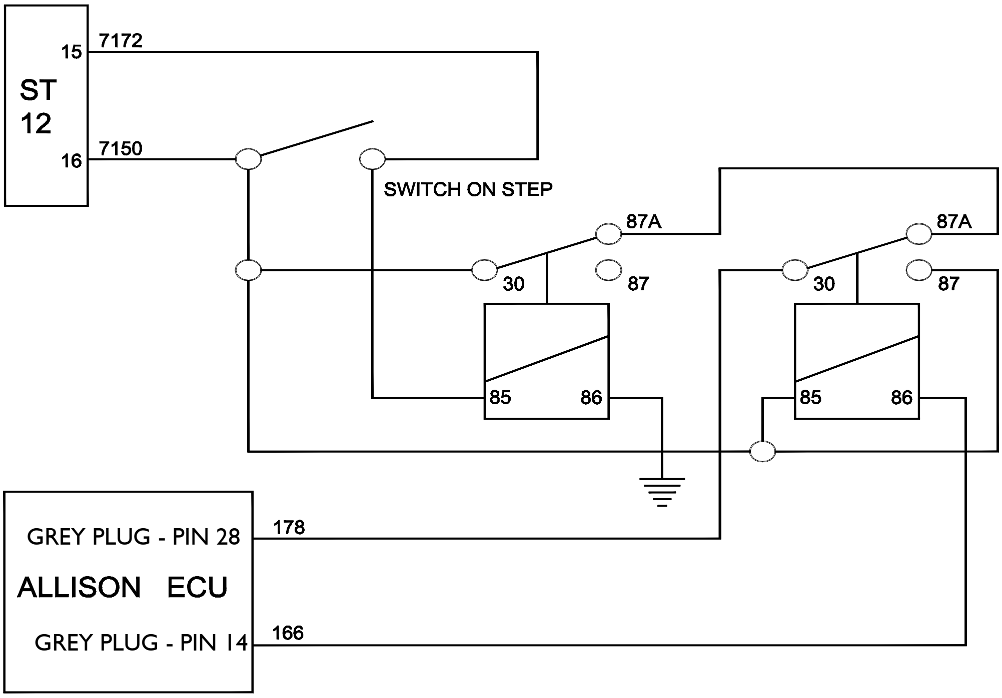
PIN	CABLE	DESCRIPTION
15	7172	To activate the second speed limiter, short circuit with Pin 16.
16	7150	+ 24V

This has been designed, for example, to be activated by a switch fitted on the vehicle, and can be connected in either of the following ways, depending on the system required:

a) To limit the vehicle speed to 30 km/h, connect a switch as shown on the diagram below:

b) To limit the vehicle speed to 30 km/h and prevent reverse gear from being selected, connect as shown on the diagram below using two relays (Iveco code 98441017).

Figure 5.23



Using the PTO control system

When the vehicle leaves the factory, it is already possible to activate the power take off by using the buttons for the cruise control. Simply press the Resume button (located on the windscreen wiper control lever) to take the engine to the speed required. In the basic configuration (called PTO 0) the only parameter that can be modified is the engine speed. However, other, more flexible options are available for controlling the PTO. Each series of selected options makes up a configuration, and up to three configurations can be stored in the memory. These are known as PTO 1/2/3. New vehicles already have three configurations in their memory. To modify these pre-set configurations, the engine ECU has to be reprogrammed using a MODUS station at the local dealership, or alternatively, the data can be pre-set at the production plant.

Characteristics of the base configuration (PTO 0)

In this configuration, all the buttons for the cruise control located on the windscreen wiper control lever can be used.

Resume / Off: to engage / disengage the PTO (speed set at the factory to 900 rpm)

Set +/-: to increase / decrease the engine speed manually once the PTO has been engaged.

Other conditions for automatic disengagement: By pressing the service brake pedal
By pressing the floor-mounted exhaust brake control

Maximum speed that can be set using Set+: 1,800 rpm

Maximum speed available by pressing the accelerator pedal: 2,700 rpm

Torque supplied: the torque supplied can reach the maximum value available from the engine.

Note: In this configuration, it is not practical to use the PTO while the vehicle is in motion, since the "PTO 0" function is deactivated as soon as the service brake pedal is pressed.

Proceed as follows to modify the "stored" engine speed using the Resume button:

Activate the PTO 0 configuration
Set the required speed using the Set+ / Set– buttons
Hold the Resume button down for more than 5 seconds

The new engine speed for the PTO 0 configuration will then be stored, even after the engine has been switched off.

B) Characteristics of the PTO 1/2/3 configurations

The following table shows the parameters that collectively make up a configuration:

PARAMETERS	OPTIONS AVAILABLE
Maximum speed achievable using Set+	600 – 2700 rpm (1)
Maximum torque supplied by the engine	400, 500, 600, 950, unlimited (limited only by the engine's performance)
Torque curve gradient *	1-2-3
Max. no load engine speed (engine speed when there is no power absorption)	600 – 2700 rpm (1)
Use of cruise control buttons	Opt 1 Buttons disabled Opt 2 Buttons enabled but it is not possible to store a new engine PTO speed Opt 3 Buttons enabled The user can store a new engine PTO speed
Disengagement of the PTO using the service brake pedal	Activated – Deactivated
Use of the accelerator in the PTO mode	Enabled – Disabled
Vehicle speed at which the PTO mode is disabled	2 – 85 km/h
Revs per second to reach operating speed	125, 250, 500 and 1000 revs per second (2)
Revs per second to return to idling speed	125, 250, 500 and 1000 revs per second (2)
TIP function for the Cruise Control *	Enabled – disabled
Waiting time to engage PTO *	500 ms or 100 ms
No load idling speed adjustment range	100 or 200 rpm

(1) This speed refers to the engine drive shaft and not to the PTO, and is related to the ratio between the engine revs and those of the PTO. On vehicles with "Euro 2" engines, the options available are 440 – 2700 rpm.
(2) On vehicles with "Euro 2" engines, the options available are 125 or 250 revs per second.
* These parameters are available only on "Euro 3" engines. They operate as follows:

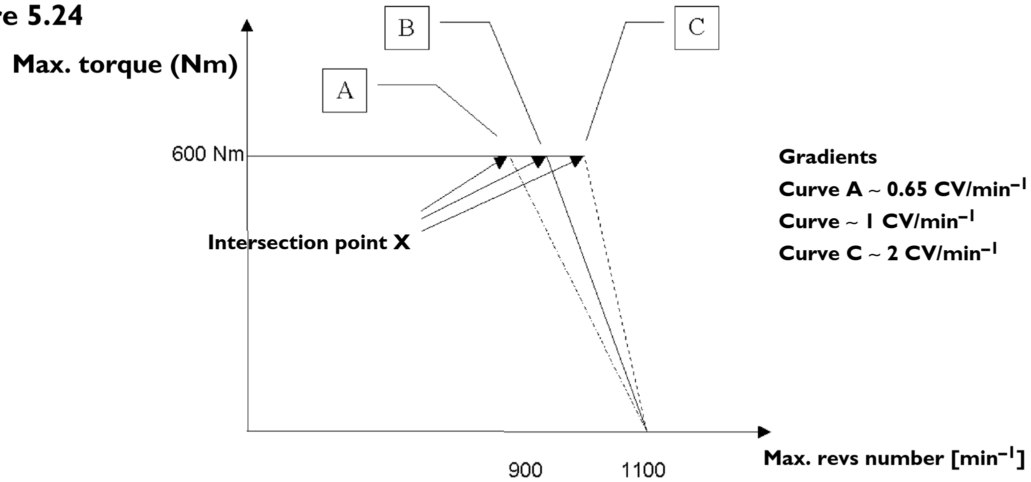
The TIP function for the Cruise Control can be activated by pressing briefly (for less than 0.5 sec) on the Set+ / Set– buttons. This function allows the driver to increase / decrease the engine speed by 20 rpm each time the button is pressed while the engine is at high idling speed. If the vehicle is in driving mode, this function increases / decreases the vehicle speed by 1 km/h each time the Cruise Control Set+ button is pressed.

The waiting time to engage the PTO is due to a time delay within the engine ECU. This is the delay between the moment that the engine ECU receives the request for high idling speed and the time that that engine speed is achieved. This function allows the PTO to be engaged completely before the high idling speed mode is activated. The standard setting for this parameter is 500 ms, as shown below.
The minimum speed (normal engine minimum) can be regulated to vary between a range of 100 rpm, i.e. 50 rpm above or below a nominal value of 650 rpm. This variation range can be increased to 200 rpm, i.e. to 100 revs above or below the speed of 700 rpm.

- The engine must be at its normal operating temperature of 50°C or higher.
- Press the brake pedal down to the floor and keep it there.
- Press and hold the Resume button for more than 1 second.
- Increase / decrease the engine speed using the Set+ / Set– buttons.
- Release the brake pedal.
- To store the speed setting permanently, press and hold down the Resume button for more than 5 seconds before releasing the brake pedal.

Note: the diagram below shows the torque curves, with the torque limited to 600 Nm and the working speed for the PTO set to 900 rpm.

Figure 5.24



When the PTO is in operation, it is possible to limit the maximum torque permitted by the curve. This function has been provided for the following reasons:

To protect the PTO	to use this function, it is necessary to activate the maximum torque limit shown on the previous table
To prevent the PTO from exceeding a given speed when in motion	to achieve this, the high idling speed must be selected for the engine (maximum engine speed with no torque). The curves shown on the previous diagram show the point at which the engine ECU reduces the flow of fuel to the engine (point "A") when the accelerator pedal is pressed (assuming this has been activated *) while the PTO mode is engaged. Consequently, starting from point "A" there will be a reduction in torque which will make it impossible to reach the high idling speed.

Since the three parameters "Maximum Torque", "Torque Curve" and "High Idling Speed" are independent, it is not always necessary to modify the torque curve. For example:

900 rpm is the normal operating speed for the PTO (torque limited to 600 Nm).
Point "A" shows the point at which it is necessary to start to reduce the torque (1000 rpm and 600 Nm).
The high idling speed corresponds to delivering a power of about 85 HP.

Using the torque curve 1:- 0.65 HP/revs/minute
we achieve a high idling speed equal to - 1,130 rpm

Using the torque curve 2:- 1 HP/revs/minute
we achieve a high idling speed equal to - 1,085 rpm

Using the torque curve 3:- 2 HP/revs/minute
we achieve a high idling speed equal to - 1,042 rpm

Consequently, if we know point "A" and the torque curve, we can establish the high idling speed, and conversely, if we take the high idling speed and the torque curve, we can establish where point "A" is.

***Note:** in a particular configuration, if the accelerator is enabled by pressing the pedal, this will result in an increase in speed. This increase ranges between the default value and the point at which the engine reaches the maximum permitted speed (this value is defined by setting the parameters of maximum torque and torque curve).

The following table shows 3 configuration types for a new vehicle.

TYPE OF PTO	1	2	3
Maximum speed achievable using Set+	1800 rpm	1800 rpm	1800 rpm
Maximum torque supplied by the engine	No limit (i.e. limited only by the engine's performance)		
Torque curve gradient	100 HP / 100 rpm	100 HP / 100 rpm	100 HP / 100 rpm
Reference value for high idling speed	900 rpm	900 rpm	900 rpm
Use of cruise control buttons	Activated	Activated	Activated
Ability to change the PTO speed using the Resume button *	Programmable	Programmable	Programmable
Disengagement of the PTO using the service brake pedal	Deactivated	Activated	Activated
Use of the accelerator in the PTO mode	Enabled	Enabled	Disabled
Maximum engine speed achievable using the accelerator	1800 rpm	2700 rpm	Disabled
Vehicle speed at which the PTO mode is deactivated	25 km/h	25 km/h	2 km/h
Revs per second to reach operating speed	250 revs per sec	250 revs per sec	250 revs per sec
Revs per second to return to idling speed	250 revs per sec	250 revs per sec	250 revs per sec
TIP function for the Cruise Control **	Enabled		
Waiting time to engage PTO **	500 ms		
No load idling speed adjustment range **	100 rpm		

* These settings correspond to Option 3 as described in the previous table.

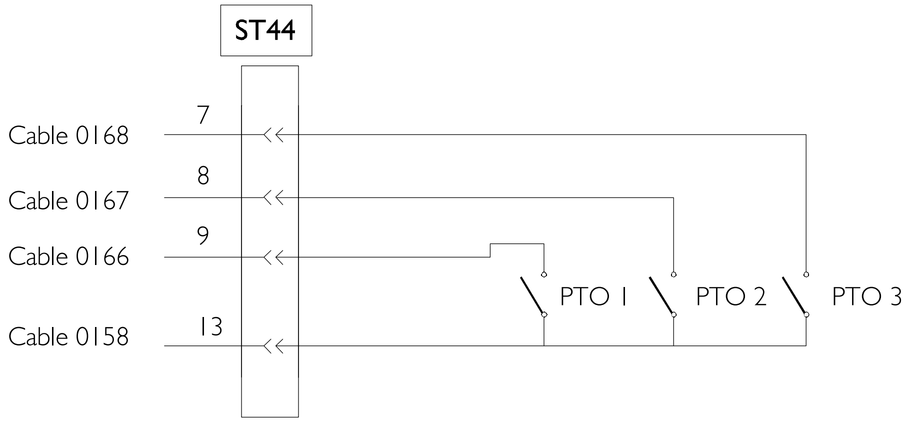
** These are the general settings which are valid for **ALL** PTO configuration modes.

C) Activating the PTO 1/2/3 configurations

The three PTO configuration modes can be activated as long as there is a resistance divider (Iveco code 500334927) in position "S" of the central interconnection unit (CIU), and as long as a connection is made with the ST44 connector, as shown in the following diagram. Activating a PTO configuration does not involve mechanically connecting the PTO. In order for the PTO to be completely activated, two operations are necessary:

- the PTO must be connected mechanically
- the required PTO configuration must be engaged.

Figure 5.25



The three switches shown in the diagram are individual switches, relay contacts or the three positions of a rotating switch. Regardless of the selection method chosen, it must be borne in mind that, when activated, the PTO 3 switch has priority over the other two (even if PTO1 and/or PTO 2 had already been engaged). Similarly, the PTO 2 switch has priority over PTO 1. It is not recommended that more than one switch be activated at any time.

Selecting one of the PTO 1/2/3 switches has two effects:

- the selected configuration is activated (i.e., all the parameters shown in the previous table are activated);
- the high idling speed set for that configuration is automatically restored.

D) Modifying the speed for the PTO 1/2/3 configurations

Select PTO 1/2/3 configuration (by activating the relevant switch).
Use the Set+/- buttons to set the speed.
Hold the Resume button down for more than 5 seconds.
Deselect PTO 1/2/3 mode (turn the ignition key to OFF).

E) Interaction between the exhaust brake and the PTO 1/2/3 modes

The exhaust brake deactivates the PTO function. When the PTO function is enabled, always ensure that the three-pin selector for the exhaust brake is set to the central position in order to avoid the exhaust brake being engaged accidentally.

F) Connecting PTO 1/2/3 mode (interface with Allison gearbox)

There are many ways of interfacing the control system for the PTO with the Allison gearbox. However, it is recommended that the system uses the following inputs and outputs for the Allison ECU central control unit.

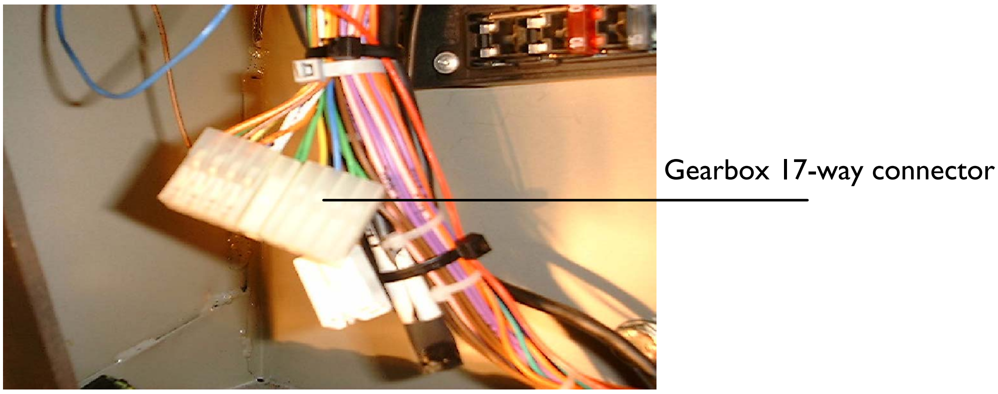
Cable number	112	Located at position "Z" on the CIU. Function: the circuit is normally open, but supplies a voltage of 24V from the Allison ECU when the PTO is engaged (using cable 118) and the gearbox parameters are correct.

Cable number 114 Located at position “AF” on the CIU.
Function: the circuit is normally open, but supplies a voltage of 0V from the Allison ECU when the gearbox is in neutral.

Cable number 118 Located at pin 3 of the 17-pin gearbox connector in the electrical box of the ECU, under the central console.
Function: when connected to a supply of 24V, it tells the gearbox ECU that the PTO has been requested.

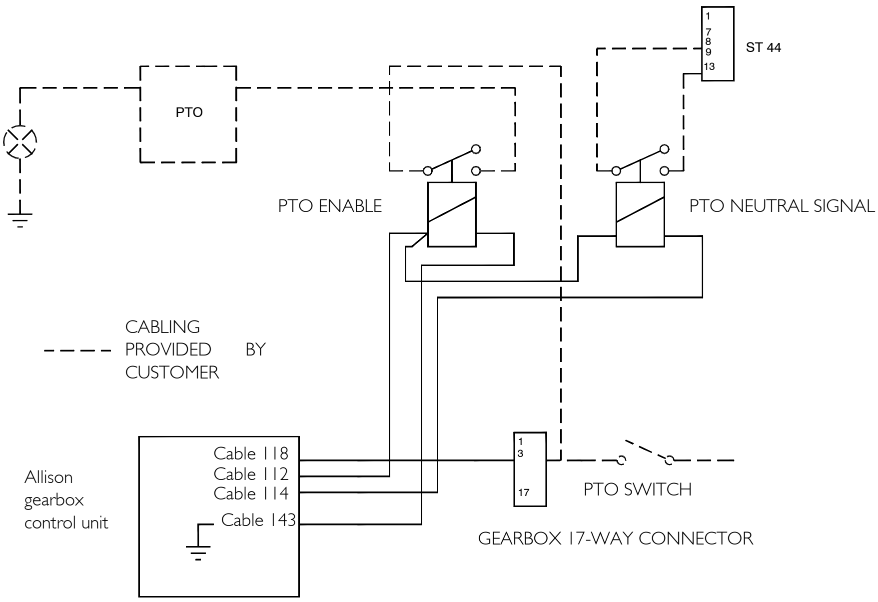
Cable number 143 Located at position “Z” of the CIU
Function: it supplies a voltage of 0V through the Allison ECU when the vehicle ignition key is in the “ON” position.

Figure 5.26



The following diagram explains the layout of a simple PTO circuit using the four inputs and outputs recommended for the Allison ECU.

Figure 5.27



B) Interfaces for high current loads

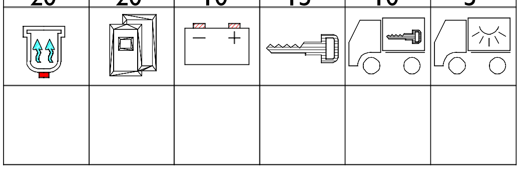
All the interface wiring mentioned previously must be used ONLY for the specific functions described above, and the electrical load in those cables must not exceed 1A. Provision is made, however, for equipment that will draw a higher current. They can be found in the electrical box for the ECU central control unit, located under the central console. Refer to the fuses listed below:

Fuse board on the left (black):
– Fuse 3 – 10A permanent supply of 24V directly taken from the battery
– Fuse 5 – 10A ignition supply of 24V from the ignition switch – also present in connector ST81
– Fuse 6 – 5A power supply for the vehicle's lights – also present in connector ST81

Figure 5.28

BLACK/NERO/NOIR/SCHWARZ

NO	1	2	3	4	5	6
A	20	20	10	15	10	5



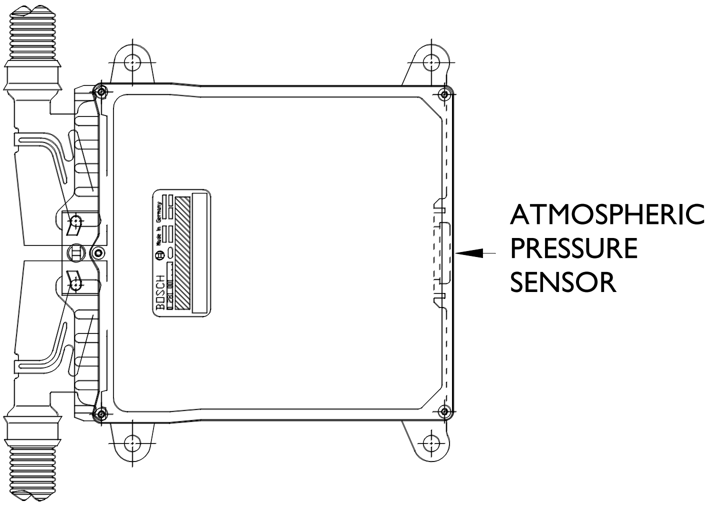
Note: connector ST81 is located within the rear chassis section, near to the electrical connection box. There is also an earth connection in the upper left corner of the electrical box for the ECU,. For further information on the vehicle's fuses, refer to the EuroMover Handbook.

C) Protecting the engine Electronic Control Unit

Under no circumstances should the engine ECU ever be painted or covered in any way. The ECU leaves the factory already sealed to airborne agents and requires no further protection.

When the vehicle or bodywork are being painted, take particular care to ensure that the paint DOES NOT enter the atmospheric pressure sensor located on the end of the ECU – see the following illustration.

Figure 5.29



5.8 Eurocargo TECTOR range. Interfaces for electrical/electronic on-board systems.

5.8.1 General

This chapter contains descriptions of the functions available on the vehicle, as well as the position and functional details of the interfaces.
The usage examples serve to illustrate the range of functions available.

Functions available to the bodybuilder

- *Cruise Control Off, Resume, Set+, Set–*
  These functions can all be activated either by the driver using the appropriate controls, or directly from the control system on the bodywork using certain Pins on the 20-pin connector.
  Note: RESUME / SET+ / SET– always work simultaneously whether controlled by the driver or by the bodywork. If this is not appropriate for safety reasons, then a switch must be incorporated in the vehicle's wiring harness.
- *Second speed limiter*
  This allows the maximum speed to be limited to a programmable value. Values up to the maximum legal speed are allowed.
- *Configuration of the various EDC power take-off parameters*
  A number of EDC parameters may be configured depending on the requirements of the bodybuilder. IVECO Service can programme up to three independent engine configurations. Each configuration contains the parameters listed below (see points 5.8.3 and following).
- *Regulation of the idling speed*
  (See point 5.8.3.5).
- *Engine start controlled from the body/ancillary*
  Under certain conditions, the engine can be started by the control system in the body/ancillary (see point 5.8.4).
- *Engine stop controlled from the body/ancillary*
  The engine can be stopped by the control system in the body/ancillary (see point 5.8.4).

5.8.2 Position of the insulated socket connection switches

The following sections contain the points that the bodybuilder should use as an interface for the electrical or electronic systems of the vehicle.
The status signals and the range of controls that are relevant for the bodybuilder have been concentrated in two separate connections, one a 20-pin connector and the other a 6-pin connector. These are located in the cab and on the chassis respectively.

5.8.2.1 20-pin and 6-pin connectors

Pin	Cable No.	∅ mm	Maximum load	Description
1	5509	0.5	1 mA	Vehicle status stationary, signal D8 (8V) of standard tachograph
2	7778	0.5	100 mA	Engine running, alternator L 24V when engine is running
3	**4442**	**1**	**5A**	**Light ON; Ignition key OFF: 24V only when the parking lights are ON Ignition key ON: 24V when the parking and dipped headlights are ON** [1]
4	6662	0.5	200 mA	Handbrake signal, to earth when the spring brake is engaged [1]
5	**8879**	**1**	**5A**	**Terminal 15**
6	**7772**	**1**	**10A**	**Terminal 30**
7	8050	0,5	10 Ma	Engine start – activated with connection to Pin 15 [4]
8	9906	0,5	10 mA	Engine stop – activated with connection to Pin 15
9	0000	0.5	10A	Earth
10	7156	0.5	10 mA	Power supply to the Cruise Control switches
11	8154	0.5	∼ 10mA	CC OFF: activated by opening the connection to Pin 10 [3]
12	8155	0.5	∼ 10mA	CC RESUME: activated via connection to Pin 10
13	8157	0.5	∼ 10mA	CC SET+: activated via connection to Pin 10
14	8156	0.5	∼ 10mA	CC SET– : activated via connection to Pin 10
15	0150	0,5	∼ 10mA	W2 mode power supply
16	0158	0,5	∼ 10mA	PTO earth
17	0166	0,5	∼ 10mA	PTO1 - activated via connection to Pin 16
18	0167	0,5	∼ 10mA	PTO2 - activated via connection to Pin 16
19	0168	0,5	∼ 10mA	PTO3 - activated via connection to Pin 16
20				Not connected

1) Permanent signal even when the TEST MODULES button is pressed.
2) The signal is earthed when the pressure on the spring is less than 5.5 bar.
3) Pins 10 and 11 must be connected on vehicles without Cruise Control for the CC RESUME, CCSET–, CCSET+ functions and for PTO 1,2,3.

4) **Warning: The signal for starting / stopping the engine requires safety devices to be fitted so that these operations may be performed safely, both for the operator and for the people or property nearby. Such devices must satisfy current legal requirements. It is the bodybuilder's responsibility to identify and install the relevant safety devices (for example, parking brake on, gearbox idling etc), using solutions that guarantee that the function works correctly, and using components that are certified as reliable.**

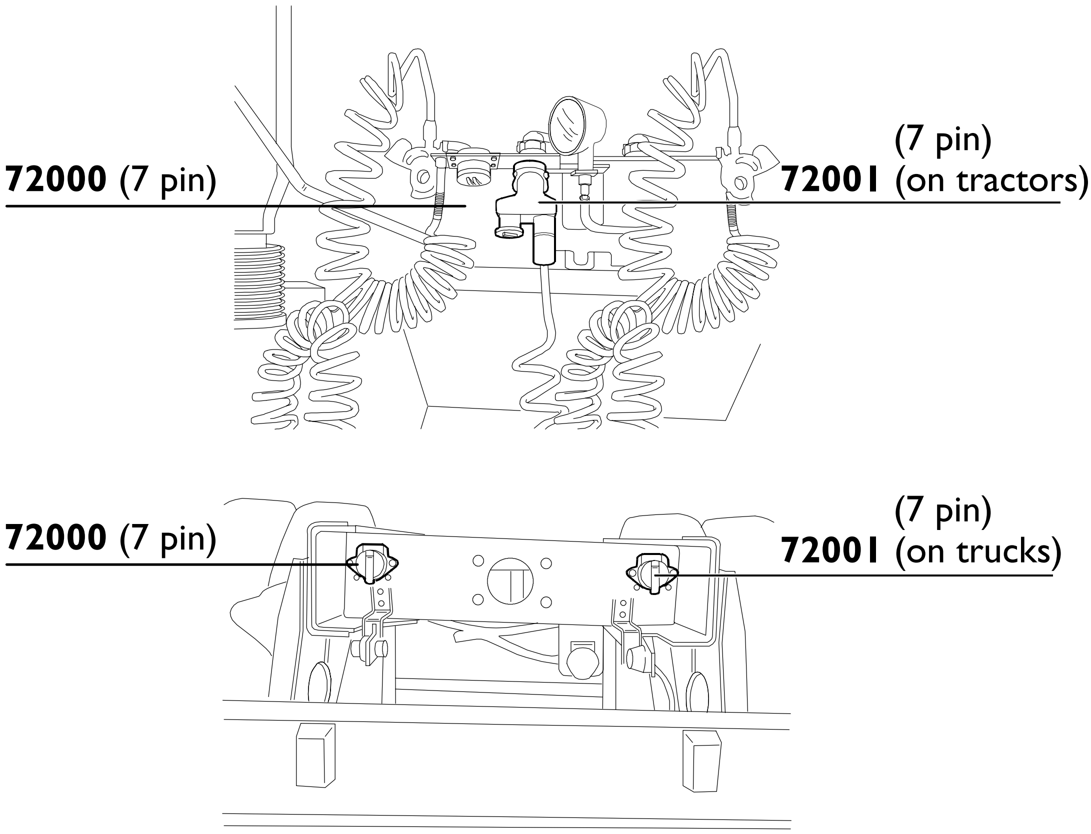
Pin	Cable No.	∅ mm	Maximum load	Description
1	-	-	↰	Not connected
2	7151	0.5	∼ 10mA	Node V2 (24V) power supply
3	5502	0.5	∼ 10mA	Second speed limiter, to activate connect to PIN 2
4	2226	0.5	10 mA	Gearbox in reverse gear, 24V in reverse gear
5	5519	0.5	10 mA	Engine speed signal
6	8050	0.5	10 mA	24 volts in neutral

Warning: Vehicles that do not have the CRUISE CONTROL option need a normally closed (NC) switch between Pins 10 and 11 of the 20 pin connector in order to activate the PTO 1, 2, 3 modes. The chosen mode is activated only if Pins 10 and 11 are short circuited.

5.8.2.2 Supplementary insulated connectors for trailer / semitrailer – two-7 pin or one-15 pin

<u>Position of the connections</u>

Figure 5.10



<u>Pin out 72000</u>

Pin	Cable No.	Maximum load	Description
1	0000		Earth
2	3331		Sidelights and outline marker lights – rear RHS
3	1180	-	Indicator lights – rear LHS for trailer
4	1117		Central control unit connection in cab
5	1185		Indicator lights – rear RHS for trailer.
6	3332	Max 10A	Sidelights and outline marker lights – rear LHS
7	8890	-	Power supply for solenoid valve - trailer brakes

or

Pin out 72010 (15 pin)

Pin	Cable No.	Maximum load	Description
1	1180		Indicator lights – rear LHS for trailer
2	1185		Indicator lights – rear RHS for trailer
3	2286		
4	0000		Earth
5	3332		Sidelights and outline marker lights – rear LHS
6	3331		Sidelights and outline marker lights – rear RHS
7	1179		Trailer stop lights
8	2226		Reversing lights
9	free		
10	free		
11	free		
12	free		
13	free		
14	free		
15	free		

Pin out 72001

Pin	Cable No.	Maximum load	Description
1	0000		Earth
2	8869		2.5 mm^2 cable, on bulkhead connector H pin 1
3	2226	-	Reversing lights
4	1100		Connection between “Iveco Control” central control units
5	free		
6	free		
7	2283	-	Rear fog lights

5.8.3 Activating the various EDC power take off modes

The EDC central control unit (engine regulation) allows the bodybuilder to make specific adjustments to the engine's parameters. As well as the normal "driving" mode (power take off mode 0), up to 3 independent EDC power take off modes can be activated (power take off modes 1, 2 or 3). Each of these modes requires a separate configuration that can be programmed by IVECO Service.

5.8.3.1 Driving mode (power take off mode 0)

In the normal "driving" mode, the vehicle allows an intermediate engine speed of up to 25 km/h. (Warning: at speeds above 25 km/h, the speed limiter is activated). The function is activated by pressing the RESUME button. A new intermediate engine speed setting can be stored by the driver by holding the RESUME button down for a minimum of 5 seconds, thus avoiding the need for the EDC to be reprogrammed by IVECO Service (see point 5.8.3.4) if the corresponding option has been set up.
The maximum number of revs possible with SET+ is identical for all power take off modes ("driving" mode 0, power take off modes 1, 2 and 3). The idling speed is set at the factory at 100 min^{-1}.

<u>Settings for "driving" mode (power take off mode 0)</u>

The following settings for the "driving" mode cannot be modified:

Resume / Off	Activation / deactivation of the intermediate engine speed setting (intermediate revs speed set at the factory at 900 min^{-1}; this can be modified by the driver)
Set+ / Set-	Increase / decrease in the active intermediate engine speed
Accelerator pedal	Activated
Max number of revs	2700 min^{-1} (2500 on .28 engines)
Torque	Maximum torque specified for the vehicle (see table 5.X)
Conditions for cut out	The intermediate rev setting is deactivated by: - pressing the brake or clutch pedals; - activating CC Off - engaging the exhaust brake

5.8.3.2 Configuring EDC power take off modes (modes 1, 2 and 3)

In each power take off mode, it is possible for IVECO Service to configure various EDC parameters. The EDC power take off mode is activated via the corresponding Pin in the 20-pin insulated connector.

5.8.3.2.11 Parameters

The following table shows the parameters that can be configured within a power take off mode. These parameters can only be configured using a MODUS (IVECO Service) diagnostic station.

Parameter	Possible values
Maximum number of revs – Nmax (no load on engine)	N_{LL} - 2700 min^{-1} 2) 3)
Max. number of revs, intermediate engine speed (using Set+) NSET_max	N_{LL} - 2700 min^{-1} 2)
Increase in number of revs using Set+	125 / 250 / 500 / 1000 U/s
Reduction in number of revs using Set– / as above	As above
Torque limitations	See table 5.5 (below)
Steepness of the regulator at maximum revs	~2 / ~1 / ~0.65 PS / min^{-1} 3)
CC buttons (Resume / Off / Set+ / Set–)	Activated / deactivated
Recording intermediate number of revs Nres	Fixed programming (MODUS) / free programming (driver)
TIP function, for Set+ / Set– buttons 4)	Activated / deactivated
Deactivation of intermediate revs using either the brake or the clutch pedals	Activated / deactivated
Accelerator pedal	Activated / deactivated
Select engine speed using RESUME button or directly by the selector	Activated / deactivated
Minimum engine speed achievable using SET button	more than 500 min $^{-2}$
Disengage PTO using the parking brake	Activated / deactivated
VZDR-aus - Driving speed at which the intermediate revs function is deactivated	Between 2 km/h and 95 km/h
Possible power take off range	N_{LL} - 2700 min^{-1} 2)

Abbreviations:

N_{LL} Number of revs at idling speed

N_{max} Maximum number of revs

N_{res} Intermediate number of revs stored. This is activated by pressing Resume or by using the EDC power take off mode.

$NSET_{\_max}$ Maximum number of intermediate revs achievable with Set+. It is identical for all power take off modes (0, 1, 2 and 3).

1) This number of revs is the maximum number of revs for the engine. The corresponding number of revs for the power take off must be calculated using the reduction ratio for the power take off.

2) To regulate the engine speed, the following rules apply:
- Never go below the N_{LL} value;
- Never exceed the valid Nmax value (power take off modes 0, 1, 2 and 3)
- If Nres is greater than Nmax or NSET_max is greater than Nmax, then the number of engine revs is always limited to the Nmax value each time this occurs (power take off modes 0, 1, 2 and 3).

3) Where it is permissible to operate the power take off with limited torque and/or limited engine speed, it is possible to calculate a point at which the engine speed intersects as shown in figure 5-3.1. Where the revs are lower than the intersection point, the maximum programmed torque is available. Where the engine speed is greater than the intersection point, then the fine adjustment (overrun) setting comes into action (see 5.7.3.2.2).

Note: Calculating the torque at a determined number of engine revs uses the following formula:
$P[CV]=(M[Nm] \times [min^{-1}])/9550$

4) The TIP function allows a gradual variation on the regulator for the intermediate revs, i.e. the speed limiter. This is done by pressing briefly on the Set+ / Set– button (for less than 0.5 sec). When the speed is less than 25 km/h, if the VZDR-aus parameter has not been changed, the intermediate engine speed regulator can be activated. If the speed is more than 25 km/h, the speed limiter can be activated. The variation for the intermediate engine speed setting is equal to 20 min^{-1} for each TIP (pressing slightly on the toggle button) or 1 km/h for each TIP on the speed limiter. This configuration is identical for all power take off modes (power take off modes (0, 1, 2 and 3).

5) The slope gradient % is calculated as follows: $\frac{(Nmax - Nx) \times 100}{Nmax}$ (see Figure 5.23).

6) The setting of the minimum revs (idling) can be extended to various uses (for example, cement mixers, refuse collection vehicles etc). The setting of the idling speed is described in the operator's instruction manual.

Torque characteristics for PTO 1, 2, 3 for Modus

Table 5.5

	POWER rpm	95 kW (129 HP) 2700	110 kW (150 HP) 2700	125 kW (170 HP) 2700	134 kW (182 HP) 2700	154 kW (210 HP) 2700	176 kW (240 HP) 2700	202 kW (275 HP) 2500
STD EOL	TORQUE rpm	430 Nm (44kgm) 1200 - 2100	490 Nm (50kgm) 1200 - 2100	560 Nm (57kgm) 1200 - 2100	570 Nm (58kgm) 1200 - 2100	680 Nm (69kgm) 1200 - 2100	810 Nm (82kgm) 1200 - 2100	930 Nm (94kgm) 1200 - 2100
Values that can be set with Modus	1st torque level 2nd torque level 3rd torque level 4th torque level	200 Nm 250 Nm 300 Nm 350 Nm	200 Nm 250 Nm 300 Nm 400 Nm	200 Nm 300 Nm 400 Nm 500 Nm	200 Nm 300 Nm 400 Nm 500 Nm	250 Nm 400 Nm 500 Nm 600 Nm	250 Nm 450 Nm 600 Nm 800 Nm	250 Nm 450 Nm 600 Nm 800 Nm

5.8.3.2.2 Modifying the torque curve, maximum number of revs and slope (of the curve) of the overrun regulator

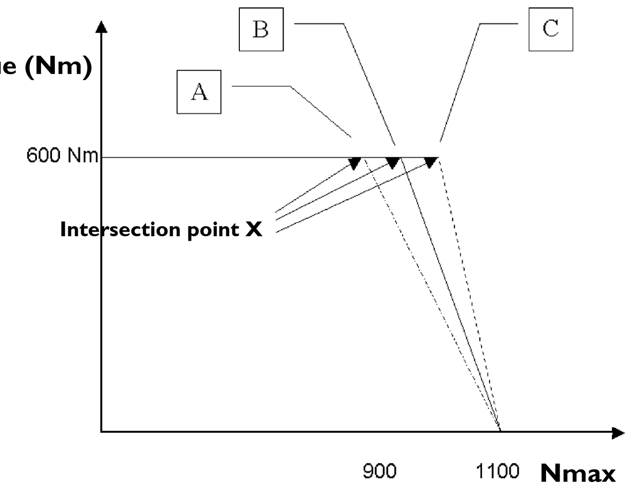
In order to protect the power take off mechanically, it is possible to limit

- the maximum torque of the engine (to protect against overloading) and
- the maximum engine revs (to protect against overrun).

It is possible to draw the C-N curve by defining the maximum torque (for example, 600 Nm), the maximum number of revs (for example, 1100 rpm) and the gradient of the curve (parameter number 6).
Point X is the intersection between the horizontal line for maximum torque and the line that passes through 1100 rpm on the particular curve gradient chosen.
If the engine speed setting goes above the intersection point X, the overrun regulator is activated. The reduction ratio of the power take off must be considered separately.
All three limitations can be chosen independently of each other, although a combination of two limitations is more usual. In this case, the bodybuilder may need to know up to which engine speed (intersection point X) his chosen torque is available.

Figure 5.23

Max. torque (Nm)



Gradients
Curve A ~ 0.65 CV/min^{-1}
Curve ~ 1 CV/min^{-1}
Curve C ~ 2 CV/min^{-1}

Max. rev number [min^{-1}]

To illustrate an example relating to figure 5.23:

- maximum engine torque 600 Nm
  the standard setting of the power take off that should be expected is 900 min^{-1}
- the number of engine revs must not exceed 1100 min^{-1} (the power take off is sensitive to the number of revs)
- the number of revs must be determined for all gradients of the overrun regulator (intersection point X) until the chosen torque of 600 Nm is available.

The slope of the curve for the overrun regulator depends on the particular nature of the vehicle usage. For this reason, when stationary, it is generally sufficient for the overrun regulator to have a steep curve, whereas in "driving" mode, this might give rise to rapid changes in load. This may cause problems, for example, for refuse collection vehicles.

Power at 1,100 min^{-1} equals:

$P = (600\ Nm \times 1{,}100\ min^{-1}) / 9550$

P = 69 kW (NB: 1 HP = 0.735 kW : 1 kW = 1.36 HP)

So, based on the example above, the number of intermediate revs, Nres, should be set to 900 min^{-1}. This will then be activated automatically when the power take off mode is selected. From the example, we see the influence of the overrun regulator. Depending on the usage, the chosen torque of 600 Nm is available up to a value N 1100 min^{-1}.

The same is true in reverse. When the engine torque, the intersection point X and the slope of the overrun regulator are predetermined, it is possible to calculate the number of revs of the end speed.

<u>Warning regarding this application:</u>

The maximum number of revs, Nmax, is a theoretical value. It is the number of engine revs at which the control unit reduces the quantity injected to 0 mg/stroke. However, given that depending on the engine speed (warm engine without load) all engines need an injection quantity of between 20 and 30 mg/stroke to maintain that speed, this "theoretical" number of maximum engine revs, Nmax, is never achieved. Depending on the slope (of the curve) for the overrun regulator, the number of revs effectively achieved is lower than 10 – 40 min^{-1}. If this should have an impact for the desired application, we would recommend that the overrun speed be determined by practical trials.

5.8.3.2.3 Intermediate rev speed limiter
5.8.3.2.3-1 Maximum number of revs for the intermediate speed regulator (with Set+) NSET_max

The maximum number of revs that can be achieved using Set+ on the intermediate speed regulator can be configured. This limit is identical for all power take off modes ("driving" mode 0, power take off modes 1, 2 and 3), and must be less than or equal to the value Nmax set in figure 5.23 and achievable using the accelerator pedal.

5.7.8.2.3-2 Priority on the maximum regulator setting – intermediate speed regulator (with Set+) NSET_max

The maximum valid number of revs, Nmax, ("driving" mode 0, power take off modes 1, 2 and 3) shown in figure 5.23 has a higher priority compared to the maximum number of revs of the intermediate speed regulator, NSET_max, that can be achieved using Set+. It also has higher priority compared to the valid number of intermediate revs, Nres, stored periodically in the memory ("driving" mode 0, power take off modes 1, 2 and 3).
The maximum Nmax setting can be programmed to accommodate the requirements of the bodybuilder in modes 1, 2 and 3 of the power takeoff. The number of intermediate revs, Nres, stored in the respective modes must be less than or equal to the maximum number of revs for the intermediate speed regulator, NSET_max, this being the maximum that can be achieved using Set+. (This is identical for all modes of the power take off: "driving" mode 0, power take off modes 1, 2 and 3).

5.8.3.2.3-3 TIP Function

By pressing quickly (for less than 0.5 sec) on the Set+ / Set– button, the TIP function allows a gradual variation on the regulator for the intermediate revs, i.e. the speed limiter. When the speed is less than 20 km/h, the intermediate engine speed regulator can be activated, and when the speed is more than 20 km/h the speed limiter is activated. The variation for the intermediate engine rev setting is equal to 20 min^{-1} for each TIP (pressing slightly on the toggle button) or 1 km/h for each TIP on the speed limiter.
If the Set+ / Set– buttons are pressed for longer (for more than 0.5 sec), the setting of intermediate revs, i.e. the value required by the speed, is modified continuously. <u>The number of revs, i.e., the driving speed at the time that the CC Set+ or CC Set– keys are actually released</u>, is stored as the new required value.
The TIP function with CC Set+ / Set– can be deactivated. This configuration is available for all power take off modes (mode 0, power take off modes 1, 2 and 3). Deactivating the TIP function results in a functional restriction of the speed limiter. Therefore, this modification should only be used after due and careful consideration.

Note: This function is designed for the regulation of hydraulic equipment.

5.8.3.2.3-4 Increase in the number of revs using the Set+ button / reduction in revs using the Set– button

By pressing for longer (for more than 0.5 sec) on the Set+ / Set– buttons, when the TIP function has been deactivated, it is possible to change the value required for the intermediate speed regulator by a given value per second. The time interval needed for this modification may be calculated using the following formula:
Difference in the number of revs / increase in the number of revs = necessary time interval.

Example: The number of intermediate revs must be increased from 800 min^{-1} to 1800 min^{-1} using the CC Set+ button. The difference in number of revs is 1000 min^{-1}.
At 100 revs/sec, the time interval is 1000 revs/100revs/sec = 10 seconds.
At 250 revs/sec, the time interval is 1000 revs/250revs/sec = 4 seconds.
At 500 revs/sec, the time interval is 1000 revs/500revs/sec = 2 seconds.

5.8.3.2.4 Accelerator pedal activated / deactivated

In normal operating mode (power take off mode 0) the accelerator pedal is always activated. In power take off modes 1, 2 or 3, the accelerator pedal may be deactivated. In this case, the EDC regulator for the engine ignores the accelerator pedal. If, however, the accelerator pedal remains activated, it is possible to increase the number of engine revs using the pedal until the maximum number of revs, Nmax, valid at the time for the selected PTO is reached.

Brake / Clutch

Depending on whether the DISENGAGEMENT value for each power take off mode 1, 2 or 3 in table 5.8.3.2.5 has been set to 0 or 1, the following condition will exist:

Disengagement = 0	the power take off mode is disengaged when the service brake or the clutch pedals are pressed.
Disengagement = 1	the power take off mode is not disengaged when the service brake or the clutch pedals are pressed.

In PTO mode 0, the power take off mode is disengaged when the service brake or the clutch pedals are pressed.

Parking brake

Depending on whether the PTO DEACTIVATED using the parking brake value for each power take off mode 1, 2 or 3 has been set to 0 or 1, the following condition will exist:

Disengagement = 0	the power take off mode is disengaged when the parking brake or the clutch pedals are pressed.
Disengagement = 1	the power take off mode is not disengaged when the parking brake or the clutch pedals are pressed.

In PTO mode 0, the power take off mode is not disengaged when the parking brake is engaged.

Selecting the engine revs using the Resume button or directly using the selector

When the power take off has been activated (Mode 0, Mode 1, Mode 2 or Mode 3), then depending on the value described in table 5.8.3.2.5 that has been chosen (0, 1) the following condition will exist:

DIRECT MODE	the engine goes automatically to the chosen Nres value for that power take off mode.
RESUME BUTTON MODE	the engine remains at the previous speed. To go to the Nres value, it is necessary to press the Resume button (Pins 10 and 12) bodybuilder connection.

5.8.3.2.5 Standard configurations

The following table contains the PTO 1, 2, 3 default settings set in the factory for Tector SWVs 4.0 Engine.

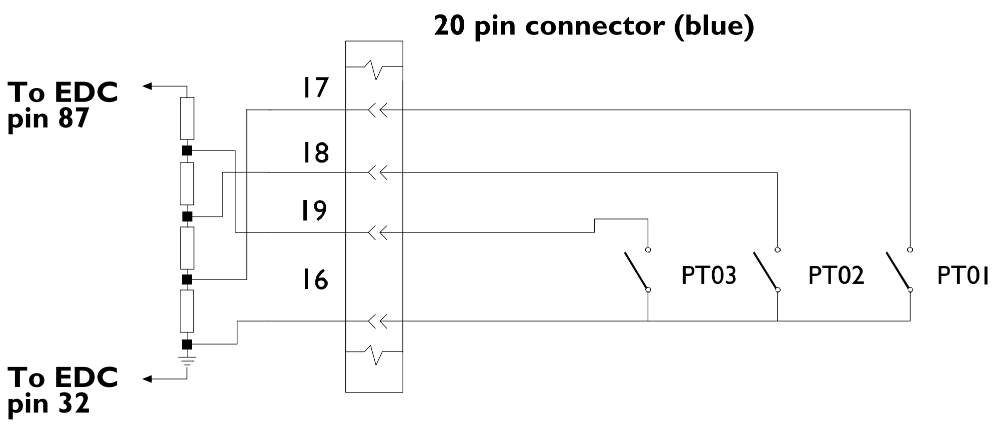
Functions	Basic	EDC power take off mode			Notes
	PTO 0	PTO 1	PTO 2	PTO 3	
Activation	No selection	Short circuit Pin 16	Short circuit Pin 16	Short circuit Pin 16	
Maximum torque	Maximum engine torque	Maximum engine torque	Maximum engine torque	Maximum engine torque	
Maximum speed achievable using the Set+ button	2700 rpm	1800 rpm	1700 rpm	1900 rpm	
Minimum speed achievable using the Set– button	700 rpm (low idle)	800 rpm	1050 rpm	700 rpm	
Maximum speed (high idle) achievable using the accelerator pedal	2700 rpm	1800 rpm	-	2000 rpm ?	
Slope of the torque curve at the cut off point	Depends on the nominal slope	(-1) HP/ rpm	(-1) HP/rpm	(-1) HP/rpm	
Speed of increasing/decreasing engine revs	250 revs per sec	250 revs per sec	250 revs per sec	250 revs per sec	
Accelerator pedal	Yes	Yes	No	Yes	
CC buttons	Yes	Yes	Yes	Yes	
Engine speed N that can be re-called by the RESUME button	900 rpm	1100 rpm	1100 rpm	1450 rpm	
TIP function for Cruise Control	Yes	Yes	Yes	Yes	
Maximum vehicle speed after which the PTO mode is deacti-vated	10 rpm	60 km/h	90 km/h	25 km/h	
PTO disengaged using the brake / clutch pedal	No	Yes	Yes	Yes	
Select engine speed using RESU-ME button or directly using the selector	1	0	0	0	
Minimum speed achievable using the SET button	500 rpm (low idle)	800 rpm	1250 rpm	700 rpm	
PTO disengaged using the par-king brake	0	0	0	1	
Typical use		Hydrostatic		Firefighting	

The parameters referred to in Table 5.8.3.2.1 must be set the same for each PTO mode.

5.8.3.2.6 Activating the EDC Power Take Off modes

Modes 1, 2 or 3 of the EDC power take off can be activated using the 20-pin connector.

Figure 5.24



The contacts shown in figure 5.24 can be simple switches, relay contacts or contacts that are free of interference from field disturbances, electromagnetic currents etc.
All contacts must be able to handle currents of ~10mA reliably.
Regardless of the control from the body/ancillary, consideration must be given to the fact that, inside the vehicle, a voltage divider will be needed to determine the corresponding power take off modes.

For this:

- by closing the mode 1 switch, a bridge is used to bypass one resistor (between Pin 16-17)
- by closing the mode 2 switch, a bridge is used to bypass two resistors (between Pin 16-18 and 16-17)
- by closing the mode 3 switch, a bridge is used to bypass three resistors (between Pin 16-19, 16-17 and 16-18)

Under this set up, the contacts will be given different priorities:

Mode 3: maximum priority (the contacts for mode 2 and mode 1 are ignored)
Mode 2: medium priority (the mode 3 contact must be open, the mode 1 contact is ignored)
Mode 1: minimum priority (the mode 3 and mode 2 contacts must be open)
Mode 0: driving mode (the contacts for modes 3, 2 and 1 must be open).

Warning: These priorities must be considered at the programming stage.
If not, problems may arise causing malfunctions, and it may become necessary to modify the wiring of the body/ancillary, or to reconfigure the EDC central control unit of the engine, etc.

5.8.3.2.7 Correlation between the EDC configuration and the installed power take offs

There is no direct connection between the EDC power take off mode (which can be activated using the 20-pin connector) and the power take offs physically fitted to the vehicle. Therefore, the bodybuilder can define the necessary connections as suits him.
This set up therefore makes it possible to use the power take off(s) with the various EDC configurations (for example, for particular work cycles). Should a work cycle be established, for example, in which the fitted power take off is made to operate in different conditions, then up to a maximum of 3 modes for the EDC power take off can be used. The corresponding EDC power take off modes must be activated from the body/ancillary at the relevant times.
In a similar way, it is possible to correlate an EDC power take off mode even without there being a power take off physically fitted to the vehicle, or conversely when there is more than one fitted.

5.8.3.3 Engaging the power take off

It is not sufficient just to select an EDC power take off mode in order for the physical power take off to be activated, i.e., two operations are generally necessary:

1) mechanical engagement of the power take off;
2) activation of a suitable EDC power take off mode.

The two operations can take place at the same time, or may be staggered. However, it is necessary to consider how the power take off(s) fitted by the bodybuilder are activated. The command on the body/ancillary must co-ordinate how the two operations are scheduled, and how this happens depends on the work cycle defined by the bodybuilder and the user.

5.8.3.3.1 Clutch dependent power take off

Power take offs fitted to the gearbox must only be engaged when the clutch is fully depressed. The EDC power take off mode can, however, be selected separately.

5.8.3.3.1.1 With Allison Gearbox

When the vehicle has an Allison gearbox, the selection of the power take off is co-ordinated by the gearbox central control unit. The operation uses the following procedure:

- request to engage the power take off (the gearbox central control unit checks the internal conditions so that the operation can be effected safely: engine speed less than 900 rpm and output speed from the gearbox less than 250 rpm);
- the solenoid valve used to engage the power take off is activated by the central control unit;
- if the power take off and handbrake are engaged at the same time, the gearbox is automatically put into neutral, and EDC power take off mode 2 is activated;
  (a relay is supplied with power, located at: the relay plate on the gearbox central control unit, found on the rear wall of the cab);
- a check is made that the power take off is functioning safely (output speed from the gearbox less than 300 rpm).

The button for engaging the power take off is located in the central section of the dashboard.

⚠ **Before engaging the power take off, the gearbox central control unit checks a number of parameters (engine speed is less than 900 rpm and output speed from the gearbox is less than 250 rpm). If all the necessary conditions inside the gearbox are satisfied, the Allison gearbox central control unit automatically engages the power take off. The restrictions (end speed, maximum torque etc) for the EDC power take off mode selected therefore remain valid even while the engagement takes place.**
Certain values may be modified by Allison Customer Assistance, as required by the bodybuilder.

General warning regarding the use of a power take off when the vehicle is operating

- If restrictions are not required (e.g. restrictions on torque, reduced maximum number of engine revs, etc) when the power take off is engaged, it is not necessary to use any EDC power take off mode. In this case, however, the engine power available for running the vehicle is reduced (given that power is being taken simultaneously by the ancillary). This could lead to acceleration problems. In typical usages (e.g. cement mixers, refuse collection vehicles etc) this problem can be minimised by increasing the idling speed. This increased number of revs would, however, also then be present even when the power take off was disengaged. In general, a reduction in the maximum torque in this field of operation would not be considered sensible.
- If, however, restrictions are required (e.g. restrictions on torque, reduced maximum number of engine revs, etc) then an EDC power take off mode should be used.

Warning: Particularly when the vehicle is operational, care must be taken to ensure that if an EDC power take off mode is activated, then the stored intermediate number of revs must also be activated at the same time. This could, however, result in an unexpected increase in vehicle speed. It is the bodybuilder's responsibility to ensure that the chosen solution is safe.

- The engagement or disengagement of the power take off depends both on the power take off chosen and the requirements of the bodybuilder.
- Regarding vehicle operation (up to a maximum speed of 25 km/h) with an increased number of revs when the power take off is engaged. For a range of applications, (e.g. use of a tipping body, cement mixer, refuse collection etc) higher revs are also required during operation. This can be achieved using the following set up:

• Stored intermediate number of revs Nres:	fixed programming
• Intermediate number of revs (Nres):	as defined by the bodybuilder
• Disengagement of the intermediate number of revs:	deactivated via the clutch or brake pedals
• Accelerator pedal:	activated
• CC Buttons:	deactivated

In this way, the engine can only operate again when the accelerator pedal is regulated between the stored intermediate number of revs, Nres, and the maximum number of revs, Nmax. If VZDR-aus is ever reached, the intermediate number of revs and therefore also the increase in revs is deactivated.

5.8.3.4 Changing the stored intermediate number of revs

The intermediate number of revs can be modified separately for each EDC power take off mode.
It is necessary to distinguish between two possibilities:

1. Fixed programming (MODUS)
   For power take off mode 0 (driving mode), this option is not available. Modification is only possible if IVECO Service re-programmes the device using MODUS.
2. Free programming (by the driver)
   To modify the intermediate number of revs, the following procedure is used:
   a) select the particular EDC power take off mode whose intermediate number of revs are to be modified;
   b) set the desired intermediate number of revs using the Set+/Set– button;
   c) press CC Resume for more than 5 seconds.

5.8.3.5 Setting the idling speed

The idling speed must only be set when the engine is warm. There are three stages in the process:

Idle running actuation

The engine must operate at idling speed.

- Actuate the service brake (until the end of adjustment)
- Press the Resume button for more than 3 seconds (and then release)
  Immediately afterwards, the idling speed reduces automatically to the minimum value.

Modifying the minimum idling speed

It is possible to regulate the idling speed by intervals of 20 min^{-1} using the Set+ or Set– buttons.

Recording the minimum idling speed (in revs)

The speed is stored by pressing the CC Resume button again (for more than 3 seconds).

Warning: The idling speed can only be adjusted in the various EDC power take off modes which are used to activate the CC buttons, otherwise the regulation of the number of intermediate revs is disengaged using the brake or clutch.

The adjusted interval for the idling speed, set at the factory, is 100 rpm. IVECO Service can increase this interval to 200 rpm. The adjusted interval for the idling speed is identical for all power take off modes (drive mode 0 or power take off modes 1, 2 and 3).

5.8.3.6 Influence of the retarder on the intermediate number of revs

The engagement of the retarder causes the intermediate number of revs regulator to be deactivated (this has the identical effect as pressing the CC Off button). All the CC buttons (CC Res / Set+ / Set–) are ignored when the retarder is engaged.

Warning: The regulator for the intermediate number of revs will not be deactivated if the retarder is engaged when the following combination occurs: "intermediate number of revs deactivated through either the brake or clutch = deactivated" and the "intermediate number of revs is lower than 900 rpm". When the retarder is activated, the engine speed is instead lowered to the idling speed and all the CC buttons (CC Res / Set+ / Set–) are ignored. Once the retarder has then been disengaged, the original number of revs will be restored.

5.8.3.7 Influence of the exhaust brake on the intermediate number of revs

There are three types of operation for the exhaust brake depending on the driving conditions.
These are selected via a three-position switch mounted in the dash and operate as follows:

Switch in central position	The exhaust brake is activated by pressing on the control button in the cab floor
Switch in down position	The exhaust brake is coupled to the service brake and is operated automatically when the brake pedal is first pressed.
Switch in up position	The exhaust brake is coupled to the accelerator and is automatically operated upon the release of the accelerator.

If the exhaust brake is activated by one of the above methods, the intermediate revs regulator is automatically deactivated (in the same way as by pressing CC Off).
All the CC buttons (CC Res / Set+ / Set–) are ignored while the exhaust brake is operational.

5.8.4 Example: Control of all the Cruise Control functions, engine start / stop, second speed limiter

Figure 5.27

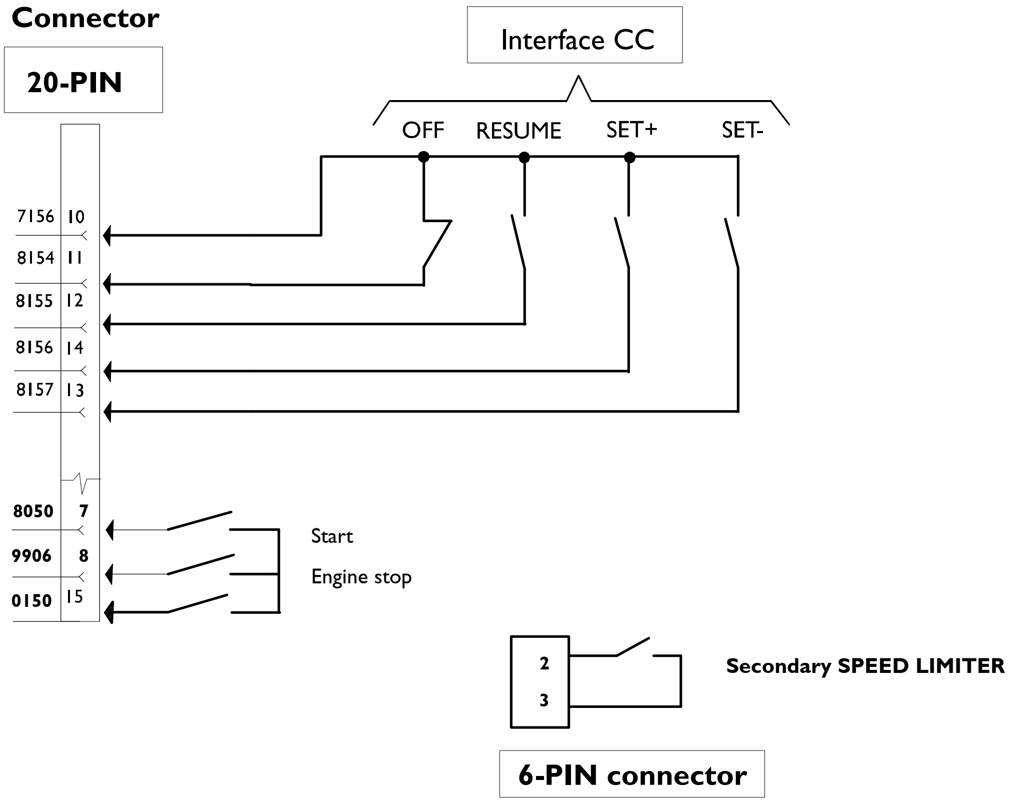


Figure 5.27 shows how all the functions listed above are controlled. The contacts shown may be simple switches, relays or SPS outputs (central control unit programmable with a memory), etc.
Pin 10 is used exclusively for the power supply to the CC functions (CC Res / Set+ / Set–).

The warnings given for the control of the CC functions must be complied with in their entirety.

Warning: The signal for starting / stopping the engine requires safety devices to be fitted so that these operations may be performed safely, both for the operator and for the people or property nearby. Such devices must satisfy current legal requirements. It is the bodybuilder's responsibility to identify and install the relevant safety devices (for example, parking brake on, gearbox in neutral etc), using solutions that guarantee that the function works correctly, and using components that are certified as reliable.

If the external CC buttons are used (via the 20-pin connector) then there must be a short circuit with Pins 10-11 if the CC Off button is not activated. If not, then all the CC buttons will be ignored (the CC Off command will be recognised permanently).

In vehicles without Cruise Control, a normally closed (NC) switch must be inserted between Pins 10 and 11 to allow the OFF function to work. When this switch is pressed, the OFF function will be activated.

Warning: Vehicles that do not have the CRUISE CONTROL option need a normally closed (NC) switch button between Pins 10 and 11 of the 20 pin connector in order to activate the PTO 1, 2, 3 modes. The chosen mode is activated only if Pins 10 and 11 are in short circuit.

5.8.4.1 CC Set+ / Set– buttons

These functions are mutually exclusive. Should both be activated simultaneously, then for safety reasons the CC Off button is activated immediately or after 500 ms. If, however, the buttons were pressed simultaneously, the engine's EDC central control unit recognises an error after 500 ms (EDC error 1.3, control device).

5.8.4.2 Second speed limiter

This function can be activated independently of the various EDC power take off modes (driving mode 0, power take off modes 1, 2 and 3). IVECO Service can set the value using a MODUS station. The second speed limiter is activated using a closed contact between Pins 3 and 2 of the 6-pin connector.

5.8.4.3 Engine start

All other precautionary devices, such as those relating to, for example, gearbox in neutral, hand brake engaged, vehicle stationary, engine not running, cab tilted etc, must be fitted by the bodybuilder.

Warning: The signal for starting / stopping the engine requires safety devices to be fitted so that these operations may be performed safely, both for the operator and for the people or property nearby.
Such devices must satisfy current legal requirements. It is the bodybuilder's responsibility to identify and install the relevant safety devices (for example, parking brake on, gearbox in neutral etc), using solutions that guarantee that the function works correctly, and using components that are certified as reliable.

5.9 Chassis frame side members: Sections available from IVECO Spare Parts

In order to change the wheelbase or chassis frame overhang, the following sections are available from IVECO Spare Parts:

Models	Dimensions (mm)	Length (mm)	Part No.
EuroCargo	180.5x65x4	1500	1908966
EuroCargo	182.5x65x5	1500	1908967
EuroCargo	203x65x4	1500	1908964
EuroCargo	205x65x5	1500	1908965
EuroCargo	250x70x5	1500	1908962
EuroCargo	252x70x6	1500	1908963
EuroCargo	275.9x80x6.7	2000	1908958
EuroCargo	230.9x80x6.7	2000	1908959
EuroCargo	277.9x80x7.7	2000	1908960
EuroCargo	232.9x80x7.7	2000	1908961
EuroTech/Star	302.4x80x6.7	2000	1908955
EuroTech/Star	212.4x80x6.7	2000	1908956
EuroTrakker	304.4x80x7.7	2000	1908957
EuroTrakker	309x80x10	2000	2992010