DAILY M.Y. 2012

BODYBUILDERS INSTRUCTIONS

LIGHT RANGE

IVECO

ISSUE 2011

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Technical Application
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UPDATE DATA

Section	Paragraph	Description	Revision date

Foreword

This publication provides the data, features and instructions for vehicle fitting and modifications.

It is intended for qualified, skill personnel. The Bodybuilder is responsible for designing the fitting, its modification and execution, and will have to ensure compliance with the provisions both of this publication and the law regulations in force.

Prior to carrying out any work, make sure you have the publication of the vehicle model on which you are about to work. Also make sure that all the accident-prevention equipment such as, for instance, goggles, helmet, gloves, boots, etc. as well as the working, lifting and handling equipment are available and in good working order. Finally, make sure that you operate on the vehicle in such conditions as to ensure maximum safety.

The execution of the work by strictly complying with the above provisions, as well as the use of the components shown, ensure that the work is carried out correctly and safely.

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

IVECO is available to provide all and every explanation required to carry out the work and also help you handle the cases not dealt with in this publication.

After every single intervention, the functioning, efficiency and safety conditions established by IVECO shall be restored. Contact the IVECO service network for vehicle set-up, if necessary.

IVECO shall not be responsible for any change, modification or fitting concerning the vehicle.

The data and information contained in this publication may not be updated due to the changes made by IVECO, at any time, for technical or commercial reasons, or to make the vehicles comply with the law regulations in force in the different countries.

In the event of any discrepancy between the contents of this publication and the actual vehicle, please contact the Product Manager for your market before carrying out any operations.

Symbols - warnings

Danger for persons
Missing or incomplete observance of these prescriptions can cause serious danger for persons' safety.

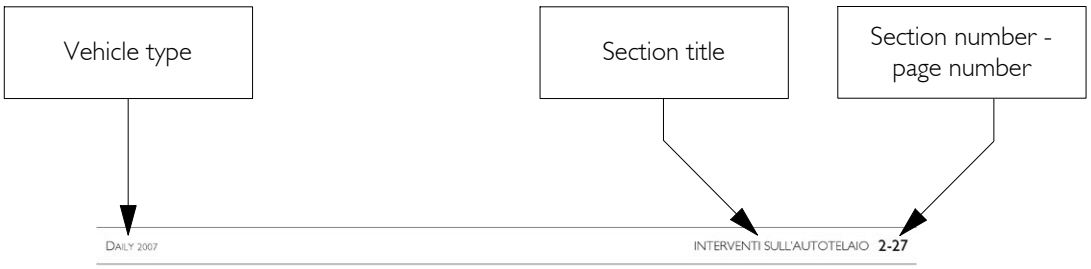
Danger of serious damage for the vehicle
Partial or complete non observance of these prescriptions can cause serious damages to the vehicle and sometimes guarantee lapse too.

General danger
It includes the dangers of above described signals.

Environment protection
It indicates correct behaviour in order that vehicle use is environmentally friendly as much as possible.

NOTE It indicates an additional explanation for a piece of information.

Page header and footer interpretation



2.7 Applicazione di un asse supplementare

Non è prevista l'applicazione di assi supplementari sul veicolo.

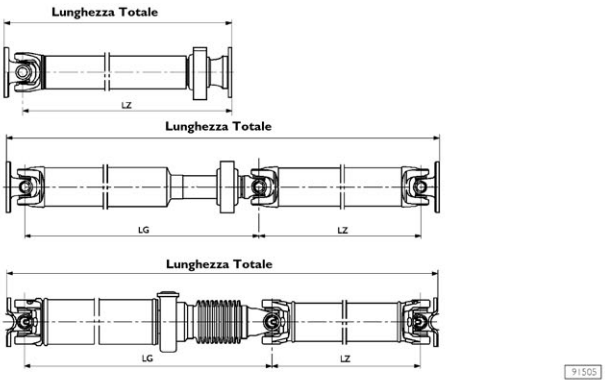
2.8 Modifiche alla trasmissione

L'intervento sulla trasmissione, a seguito della modifica del passo, dovrà essere fatto utilizzando, in linea di massima lo schema della trasmissione di un analogo veicolo avente all'incirca lo stesso passo. Dovranno essere rispettati i valori massimi delle inclinazioni degli alberi di trasmissione previsti sui veicoli di serie; ciò vale anche per i casi di interventi sulle sospensioni e sull' asse posteriore motore.
Nei casi di difficoltà, potrà essere interpellata l'IVECO, trasmettendo uno schema con riportate lunghezza ed inclinazione della nuova trasmissione proposta.
Le indicazioni tecniche riportate sulla manualistica dei Costruttori delle trasmissioni, potranno essere utilizzate per la corretta realizzazione e disposizione dei tronchi.
Le indicazioni qui contenute hanno lo scopo di salvaguardare il corretto funzionamento della trasmissione, limitarne la rumorosità ed evitare l'innesco di sollecitazioni trasmesse dal gruppo motopropulsore; ciò non esenta tuttavia l'allestitore dalla responsabilità dei lavori eseguiti.

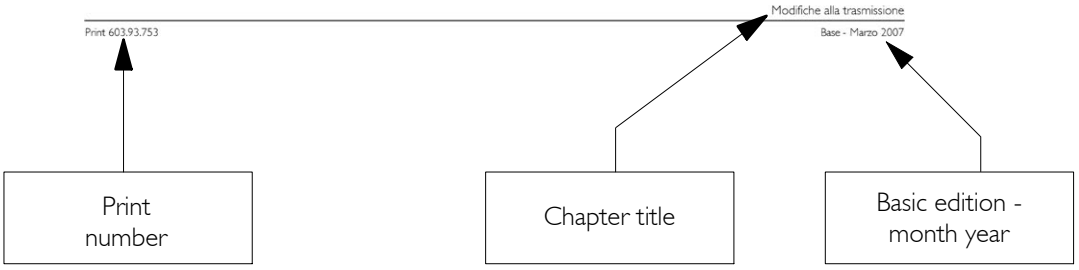
2.8.1 Lunghezze ammesse

Le massime lunghezze di esercizio realizzabili, sia per i tronchi intermedi che scorrevoli "LG" o "LZ" (ved. Figura 2.11), possono essere determinate in base al diametro esterno del tubo esistente sul veicolo e dal numero dei giri massimo di esercizio (vedere formula) e sono riportate nella Tabella 2.15.
Qualora la lunghezza dell'albero indicato in Tabella 2.15, in funzione del diametro del tubo non risulti sufficiente, si dovrà prevedere l'inserimento di un nuovo tronco con le stesse caratteristiche di quelli esistenti. In alternativa in alcuni casi potrà essere utilizzato un albero di trasmissione avente un diametro del tubo di maggiori dimensioni; la dimensione occorrente del tubo potrà essere determinata in base alla lunghezza necessaria ed al numero di giri massimo di esercizio, direttamente dalla Tabella 2.15.

Figura 2.11



LZ Tronchi intermedi
LG Tronchi scorrevoli



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SECTION 4

Power take-offs

4.1 General Specifications

Different types of power takeoffs (PTO) for motion withdrawal can be mounted to control of the ancillary control units. According to the type of use and the performances required, the application can be performed as follows:

- the gearbox;
- transmission;
- the front 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).

Choose the power take-off transmission ratio to ensure that power uptake occurs within the flexible engine operating range; avoid low speeds (lower than 1000 rpm) to rule out unevenness and jerkiness in vehicle operation.

The power taken in relation to the number of revolutions of the power take-off at the required torque.

$$P(CV) = \frac{M \cdot n \cdot i}{7023} \qquad P(kW) = \frac{M \cdot n \cdot i}{9550}$$

P = Useable power
M = Torque permitted for the power take-off (Nm)
n = power take-off rpm.
i = Transmission ratio = PTO output rpm/ engine rpm

Type of use

Applications may be sporadic or continuous.

In sporadic applications, the duration of power take-off operations does not exceed 30 minutes.

In continuous use this is significantly longer; however whenever the use is comparable to that of a stationary engine, it is necessary to evaluate the opportunity to reduce take off of torque also on the basis of the surrounding conditions (engine cooling, gearbox etc.).

Take off of torque is possible without problems if the type of use does not result in significant variations of torque in terms of frequency and amplitude.

Should this not be the case (e.g. hydraulic pumps, compressors), clutches or safety valves may be necessary to avoid overloading.

PTO transmissions

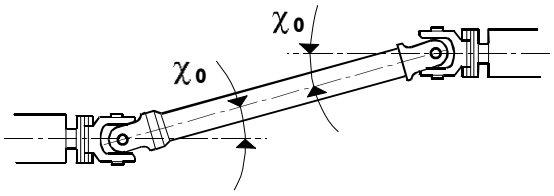
In respect of the transmission manufacturer's requirements, particular care must be given to the kinematics (angles, rpm, moment) from the PTO to the attached device during the design phase and dynamic behaviour during the production phase.
This means that:

- the forces which will be present during maximum power and torque output conditions must be considered when calculating scaling
- equal shaft-end angles must be realised for good homokinetics (see Figure 4.1); these must be no more than 7"
- solution Z is preferable to W, as the loads on the bearings of the PTO and the driven equipment are lower. In particular, when it is necessary to realise a transmission line with shafts inclined in the space according to an angle φ (as illustrated in Figure 4.2), it must be remembered that the overall homokinetics can only be ensured if the intermediate shaft is fitted with forks offset by the same angle φ and if the end angles $\chi 1$ and $\chi 2$ are equal.

For transmissions employing multiple sections, the instructions given at point 2.8.2 should be followed.

Figure 4.1

Solution Z



Solution W

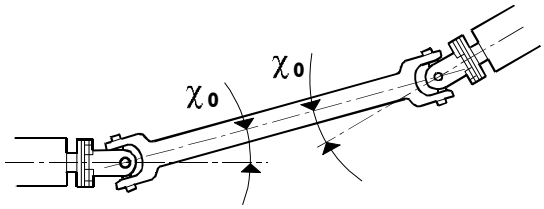


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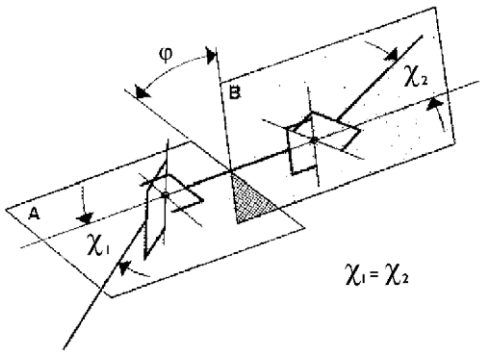
Figure 4.2



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4.2 Power Take-off from Gearbox

Take off from the transmission lay shaft is possible via flanges or couplings positioned in the left part of the casing (see fig. 4.3).

Table 4.1 lists the maximum torques and the output rpm to engine rpm ratios for the various transmission/IVECO optional PTO combinations.

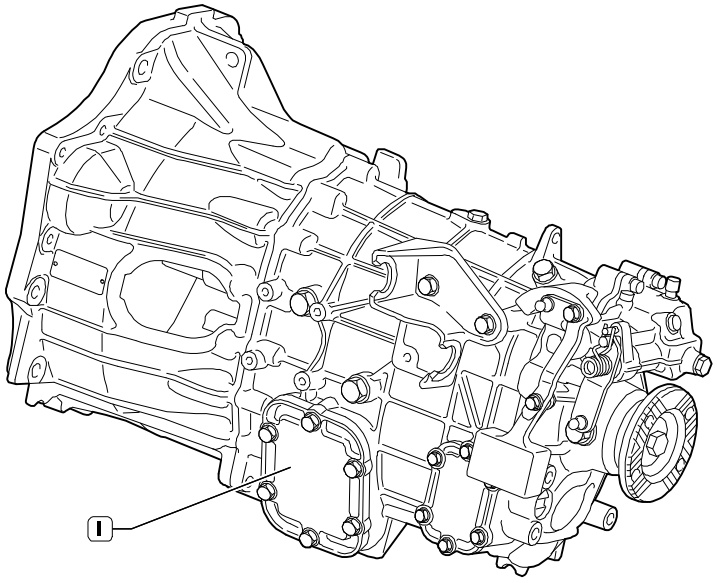
Any higher take-off torques, for occasional uses, must be individually authorised by IVECO on the basis of the type of use.

The PTO must normally be used with the vehicle parked and must be engaged and disengaged with the clutch disengaged to avoid excessive stress on the synchronisers.

When, under exceptional circumstances, it is used with the vehicle in movement, no gear changes must be performed.

The same PTOs for manual gearboxes can be used with gearboxes fitted with torque converters.
It must, however, be remembered that for engine rpm of below 60% of the maximum, the converter works hydraulically and in this stage the PTO rpm is subject to fluctuations depending on power draw, even if the engine rpm is constant.

Figure 4.3



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1. Cover for arranging power take-off

NOTE After the assembly of the power take-off perform the filling up and check the oil level from the speed gearbox.

Transmission PTO data

Post-production installation of a PTO requires reprogramming of the gearbox control unit (if automatic) as well as some work on the electrical system. As such, it is recommended you read section 4.6 "PTO management" before proceeding.

The control unit must be reprogrammed by following the instructions found in the relevant IVECO manuals, using the diagnostics tool available from Dealers and Authorised Workshops and supplying information on the PTO used.

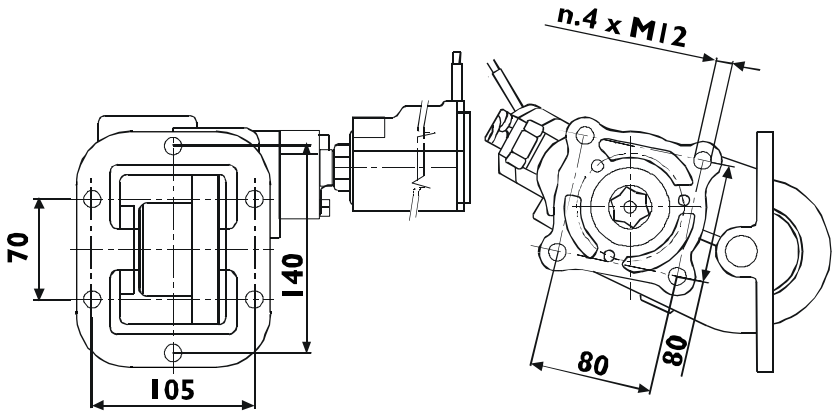
Table 4.1

Gearbox	Position (1)	Output (1)	Direction of rotation (2)	Max. torque Cmax (Nm) (2)	PTO ratio
2830.5 2835.6	Left-hand side	Rear	Clockwise	120	1.00
2840.6 2850.6 6AS400	Left-hand side	Rear	Clockwise	180	1.04

(1) With respect to forward direction of travel.
(2) When viewing the PTO output from the front.
(3) The maximum torque that can be taken refers to an engine speed of 1,500 r.p.m. output from the PTO For higher speeds, the value for the torque that can be taken must be reduced proportionally.

IVECO reserves the right not to honour any guarantees on the transmission where the malfunction can be traced back to the PTO and, in this case, the PTO installed by the Bodybuilder has specifications and performance different from those indicated in Table 4.1.

Figure 4.4



Direct Application of Pumps

In the case that pumps or other equipment are directly connected to the PTO, that is without intermediate shafts, you should first check that the there is a safety margin between the chassis and power unit, and then that the static and dynamic torques exerted by the mass of the pump and the PTO are compatible with the resistance of the gearbox casing walls.

Moreover, the inertial effects of any added masses must be verified so as not to induce resonance conditions in the power unit inside the operational range of engine speeds.

For torque drawing, keep values defined in Table 4.1.

Transmission oil temperature must not exceed 110 °C during prolonged use. Coolant temperature must not exceed 100 °C.

Not all types of power take-off available on the market are suitable for continuous use. When in use the specifications (working periods, pauses etc.) specific to the power take-off in question should be respected.

PTOs supplied by IVECO have a flange for direct attachment of pumps with UNI 4-hole connectors.
The output consists of a 21 ISO 14 splined shaft (Figure 4.4).

4.3 Power Take-off from Transfer Box

NOTE Not present on Daily 4x2.

4.4 Power Take-off from Drive line

Authorisation of the installation of a PTO on the transmission after the gearbox will be given after examination of the complete documentation which must be presented to IVECO.

The power and torque values are defined each time on the basis of the usage conditions.

As a general rule, bear in mind that:

- the PTO may only operate with the vehicle stationary;
- the power take-off r.p.m. is dependent on the gear selected;
- the installation must be performed immediately after the gearbox; for vehicles with transmissions of two or more shaft sections the PTO may also be installed in correspondence with the oscillating mount between the first and second section (follow indications in point 2.9.2);
- the original transmission angles in the horizontal and vertical planes must be maintained as closely as possible;
- anything added to the transmission must not cause abnormal vibrations or instability or otherwise damaging effects on the drive transmission components (from the engine to axle) either during driving or use of the PTO;
- the PTO must be attached to the chassis with its own suspension system.

The transmission is a component that is important to vehicle driving safety. Any operations on the transmission must be carried out only by highly specialised companies that have been approved by the supplier.

Any operation carried out on the propeller shaft without obtaining previous authorisation from IVECO will cause the vehicle warranty to immediately become null and void.

4.5 Power Take-off from Engine

The use of these PTOs is intended for equipment requiring continuous power and with low torque values (e.g. driving AC systems).

Power is taken from the front part of the engine via belt drive.

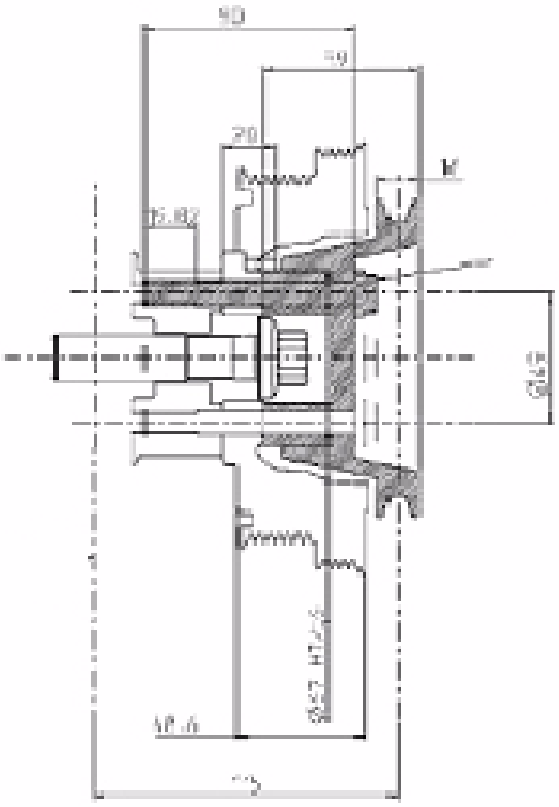
The data listed in Table 4.2 refer to take off with a specific pulley designed according to Figure 4.5.

Table 4.2 - Power take-off from the front of the engine

Engine	Engine code (1)	n_{max} (rpm) (2)	Max. take-off values			
			Max. no-load speed (r.p.m.)	Max. torque that can be taken (Nm)	Max. inertia moment (kgm^2)	Max. bending moment (Nm) (3)
F1A Euro 5 Series						
.11	F1AE3481A*A	3900	4600	35	0,005	42
.13	F1AE3481B*A	3600	4600	35	0,005	42
.15	F1AE3481C*A	3600	4600	35	0,005	42
F1C Euro 5 Series						
.15	F1CE3481J*B	3500	4200	35	0,005	42
.17	F1CE3481K*B	3500	4200	35	0,005	42
.21	F1CE3481D*B	3500	4200	35	0,005	42
F1C EEV Series						
.15	F1CE34818*C	3500	4200	35	0,005	42
.17	F1CE3481C*C	3500	4200	35	0,005	42
.14	F1CE0441A*B (CNG)	3500	4200	35	0,005	42

(1) Verify engine code on engine plate
(2) Maximum revs corresponding to the maximum rating
(3) With respect to the base front edge

Figure 4.5



BASE UNIT FRONT EDGE

F1A - F1C engine

102475

4.6 PTO management

4.6.1 General specifications

The vehicle may be equipped with the following alternative original equipment options:

a) only PTO (opt. 6364/6365);
b) PTO (opt. 6364/6365) and Expansion Module (opt. 8657);
c) only Expansion Module (opt. 8657);

where the Expansion Module is an electronic interface designed to manage certain types of conversion (additional lights, alarms, after-market PTOs, etc).

See the specifications in IVECO Guideline no. 603.95.231 of 12/2010 for description of the characteristics and methods of use.

In case **(a)** where only the PTO is present, a control panel is installed on the instrument cluster (Figure 4.6, page 4-11), which consists of:

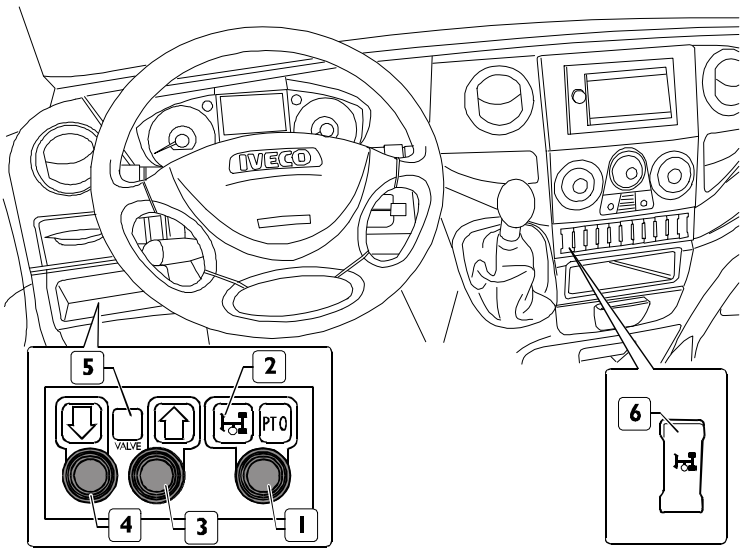
- **PTO section**, which provides management of the engagement and disengagement of the power take-off using a pushbutton (1) with a warning light (2) signalling the situation in progress;
- **VALVE section**, for managing the operation of a dump body (if present) and interaction with the hydraulic distributor fitted on the lifting system. For vehicles without a tipping body, the VALVE section is not operational.

For operation of the tipping body, see instructions on page 4-11.

In case **(b)**, in addition to the panel for the PTO, a special button (6, Figure 4.6, page 4-11) for operation of the Expansion Module is located in the centre of the dashboard.

In case **(c)** the Bodybuilder is left free to decide where to position the PTO controls.

Figure 4.6



PTO CONTROL PANEL EXPANSION MODULE ACTIVATION BUTTON

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Operating tipper box (if present)

Button (3) controls tipping body lifting: this action will be simultaneous and will be cancelled when the button is released.

A continuous LED light (5) indicates that lifting of the tipper truck is in progress.

Button (4) controls tipping body lowering: this action will be simultaneous and will be cancelled when the button is released.

See any additional functions and safety features in the manufacturer's handbooks.

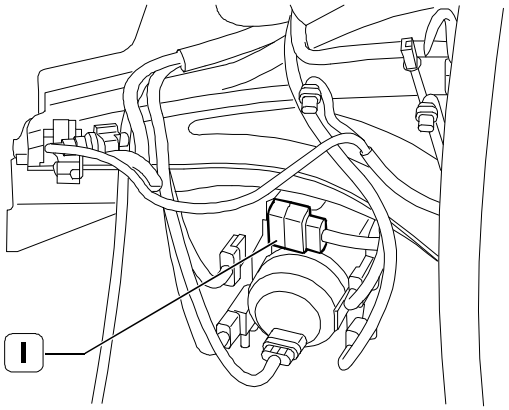
After-market PTO installation

After-market installation of the PTO is possible on vehicles with or without Expansion Modules.

Installation of the PTO is possible only where this is provided for on the vehicle.

a) For vehicles without an Expansion Module it is necessary to order the components for installation of the PTO, the cable for connection to the engine compartment cable connector (1) (connector on anti-theft bracket), the enabler relay to install on SCM1/B in the engine compartment (tab 5.14 pag. 5-46, relay T55) and the PTO control panel (fig 4.6) to connect to the dashboard cable.

Figure 4.7



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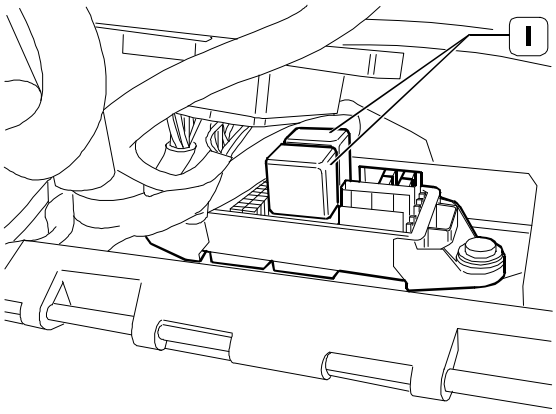
PTO connector on engine compartment cable

b) For vehicles with an Expansion Module it is necessary to order the components for installation of the PTO, the cable for connection of this to the engine compartment cable connector (1-fig. 4.7), the two relays (1-fig. 4.8) to install in the Expansion Module (fig 4.8) and the PTO activation/deactivation request button (6-fig 4.6).

Figure 4.8



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Relay and fuse module for PTO with Expansion Module

Table 4.3

SCM1/C	Power	Protection	Presence		Capacity	Type	EURO5 4x2	EUROV 4x2	BIFUEL
			S	OPT					
F79	30	Expansion Module relay T61 (30-87) for PTO		X	15	A0	X	X	X
F80	30	Expansion Module relay T62 (30-87) for PTO		X	15	A0	X	X	X
F86		AVAILABLE				A0			
F88		AVAILABLE				A0			
F89		AVAILABLE				A0			
F90		AVAILABLE				A0			

SCM1/C	Power	Protection	Presence		Capacity	Type	EURO5 4x2	EUROV 4x2	BIFUEL
			S	OPT					
T61		Expansion Module		X	20		X	X	X
T62		Expansion Module		X	20		X	X	X

NOTE - With the PTO installed, the Engine Control Unit can be configured by IVECO service in order to set the engine operating conditions with PTO engaged.

- If you wish to install a PTO after market, you must check whether the vehicle is fitted with Cruise Control.

- The Expansion Module does not manage the tipper body. If a PTO is to be installed after market for this use, the kit with PTO control panel must be purchased (kit for vehicles without Expansion Module).

4.6.2 PTO mode

4.6.2.1 Mechanical Gearbox

PTO engagement

The purpose of this operation is to prepare the equipment installed on the vehicle for work.

When carrying out the operating sequence, the driver is assisted in order to avoid errors.

a) If the equipment is of the type working with vehicle stopped (stationary PTO):
   - stop the vehicle and apply the hand brake;
   - press the clutch pedal;
   - put the gearbox into neutral;
   - keeping the clutch pedal depressed, press and release button (1) on the PTO control panel (Figure 4.6, page 4-11). The PTO engagement indicator (2) blinks slowly at first and stays on fixed when the operation is successfully concluded;
   - slowly release the clutch pedal.

b) If the equipment is the type that works also when the vehicle is running (non-stationary PTO) the same procedure basically applies except for the need to engage the right gear for the work (first, reverse or possibly neutral) before slowly releasing the clutch pedal.

To adjust the engine speed, see paragraph 4.6.2.3.

PTO disengagement

Irrespective of the type of PTO installed:
- stop the equipment;
- press the clutch pedal;
- press the pushbutton (1): the indicator (2) goes off when the PTO is disengaged;
- release the clutch pedal.

For safety reasons, when the non-stationary PTO is engaged:
- gear changes (involving automatic disengagement) are not possible
- the vehicle should not be driven over 20 km/h.

The PTO must be disengaged when torque drawing is not in progress.

NOTE If an after market PTO is to be installed, check to ensure that the vehicle is equipped with the Cruise Control option.

NOTE After fitting an after-market PTO, refer to the IVECO Assistance Service for updating the engine ECU software via remote service.

4.6.2.2 Automatic Transmission

The power take-off of versions with automated gearbox (6AS400) is specific because the control system must recognise the status of the power take-off for safety reasons.

PTO engagement

The purpose of this operation is to prepare the equipment installed on the vehicle for work.

When carrying out the operating sequence, the driver is assisted in order to avoid errors.

a) If the equipment is of the type working with vehicle stopped (stationary PTO):
   - stop the vehicle and apply the hand brake;
   - put the transmission into neutral;
   - press and release button (1) on the PTO control panel (Figure 4.6, page 4-11).
     The PTO engagement indicator (2) blinks slowly at first and stays on fixed when the operation is successfully concluded.

b) If the equipment is the type that works also when the vehicle is running (non-stationary PTO) it will moreover be necessary to engage the right gear for the work (first, reverse or possibly neutral).

In both situations, with the gearbox in neutral and PTO correctly engaged, the ECU closes the clutch when 1100 rpm is reached. Also, pickup is possible in first or reverse gear: in this case the gearbox control unit is arranged for closing the clutch at approx. 900 rpm.

To adjust the engine speed, see paragraph 4.6.2.3.

PTO disengagement

Irrespective of the type of PTO installed:

- stop the equipment;
- press the pushbutton (1): the indicator (2) goes off when the PTO is disengaged.

For safety reasons, when the non-stationary PTO is engaged:
- gear changes (involving automatic disengagement)
- the vehicle should not be driven over 15 km/h.

The PTO must be disengaged when torque drawing is not in progress.

NOTE If an after market PTO is to be installed, check to ensure that the vehicle is equipped with the Cruise Control option.

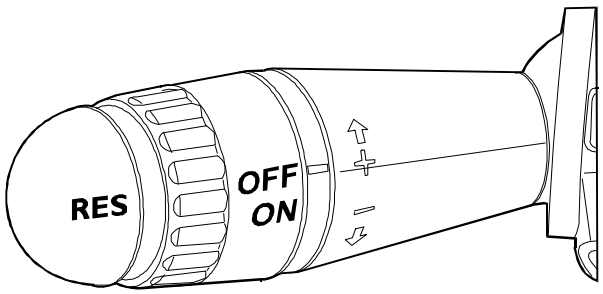
NOTE After fitting an after-market PTO refer to the IVECO Assistance Service for updating the engine ECU software via remote service.

4.6.2.3 Engine speed control for power take-off

The engine electronic control unit has provision for a function that performs isochronous adjustment of the engine and PTO speed.

As a result of this type of connection it is possible to adjust the speed of both directly with the Cruise Control lever (Figure 4.9).

Figure 4.9



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In addition, the control unit is able to check the set speed and keep or restore the balance according to the applied load.

NOTE Regulation of engine speed via Cruise Control takes place only up to 10 km/h.

After setting the selector in Figure 4.9 to ON, it is possible to adjust the Cruise Control lever in + or - direction in order to increase or decrease the rpm in two ways:

a) in steps of 50 rpm if the lever is operated for between 0.5 and 2 seconds;

b) with a ramp of 400 rpm for each second of continuous lever operation, over 2 seconds.

It is possible to store (with PTO activated) a new rpm setting by holding down the RESume button for at least 5 seconds.

Refer to the specific manual for management of engine speed, required torque and other parameters which can be programmed on the Expansion Module.

NOTE With Cruise Control ON it is possible to return to the condition of engine idling speed (setting deleted) by turning the selector of Figure 4.9 OFF or by pressing the brake or clutch pedal (if applicable).

4.6.2.4 Multiple State Switch

This is an additional function for engine rpm management with PTO engaged available on the 12-way Bodybuilder connector (pin 3 - pin 8).

To obtain this function, the circuit given in the diagram in fig. 4.10 must be created.

Figure 4.10

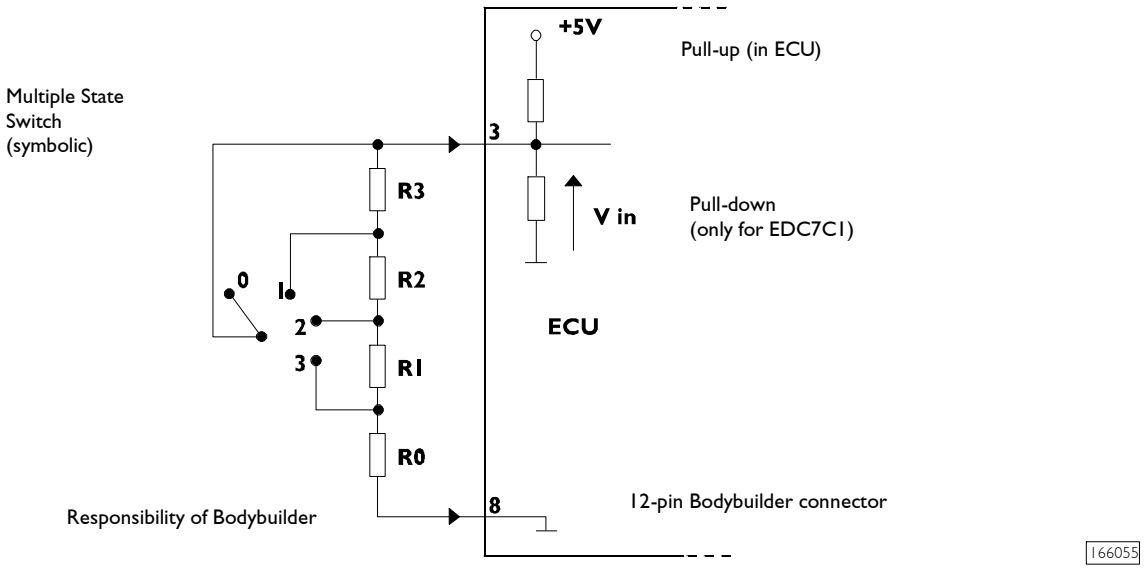


Table 4.4

Resistance (Ohm)	R0	R1	R2	R3
	120	270	510	2000

Programmable speed (rpm) - default setting		PTO 0	PTO 1	PTO 2	PTO 3
	CM	900	1200	900	1200
	CA	1200	1200	1200	1200

Resistances ¼ of W and tolerance 1%.

Operation:

1) Vehicle stationary, with switch in 0 position:

- Manual operation - press RESume button on the Cruise Control to bring the engine speed to the programmed rpm.
- Assisted operation - supplying a positive signal to pin 15 of the 20-way Bodybuilder connector, the engine speed will increase to the programmed rpm value.

2) Vehicle stationary, with switch in 0 position:

- without pressing the RESume button, the engine speed will remain at idle. Upon changing the position of the switch, the engine rpm will change to the programmed value for each switch position.

Placing the Cruise Control selector in the OFF position, or else by pressing the brake or clutch pedal, the engine speed control function will disengage independently of the position the switch is in.

Whenever it is necessary to store engine speed values different from the default values set by IVECO, the system allows the desired values to be programmed for each selector position by following the procedure described in section 4.6.2.3.

SECTION 5

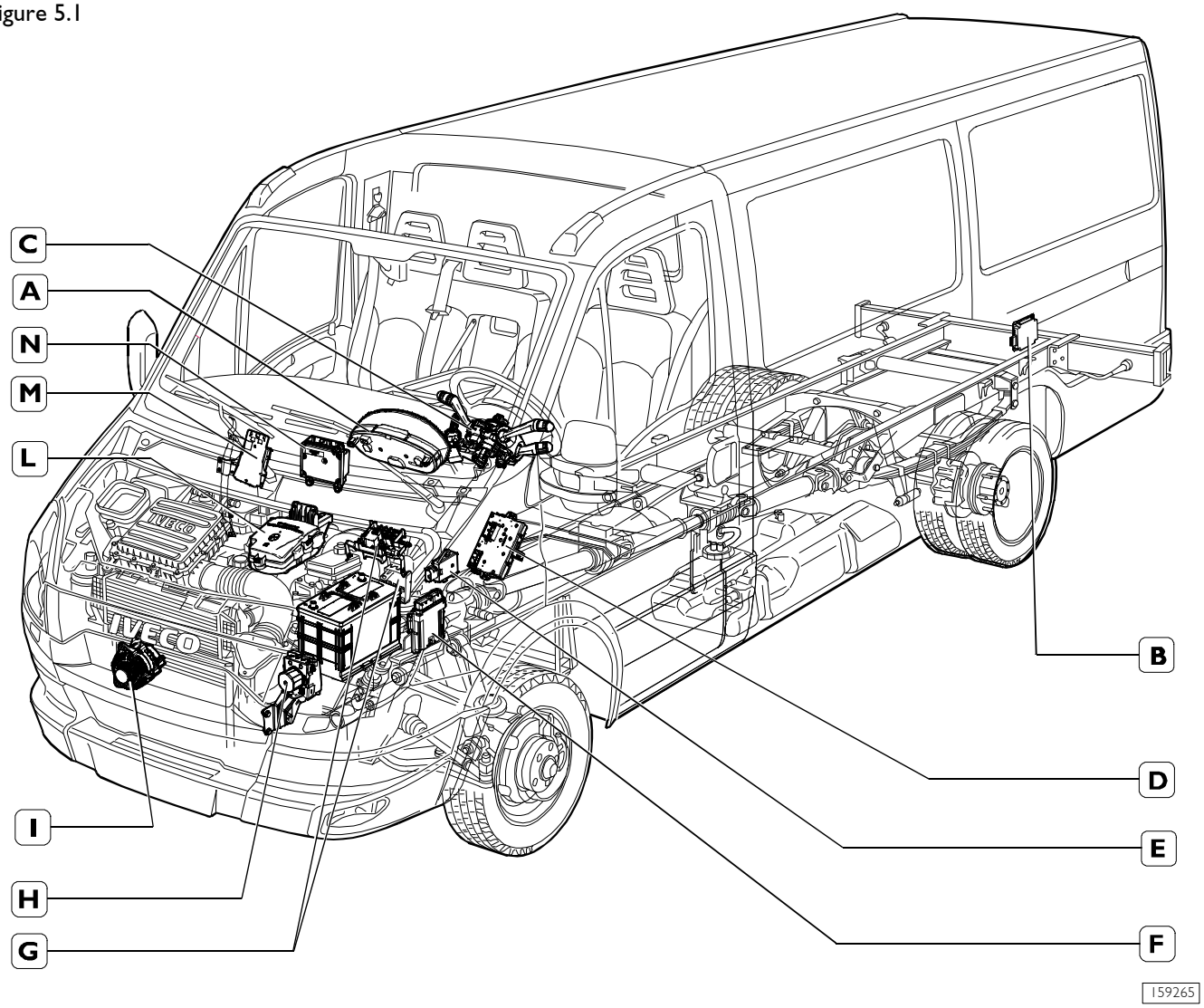
Special instructions for electronic subsystems

5.1 Electronic system

The following shows the location of the electronic control units and connectors that can be installed on the vehicle.

Devices or electrical circuits must not be connected directly to the control units described below. It is only possible to use the connectors listed in the following paragraphs.

Figure 5.1



A. Instrument panel - B. Trailer control unit - C. Steering column switch unit and ignition switch - D. "CPL" Connection control unit - Body Computer - E. Oil control unit - F. Engine control unit - G. Positive (+30) distribution "CBA" control unit and CFO - H. ABS/ESP control unit - I. Alternator - L "SCM" Connection control unit (engine) - M. Expansion Module - N. Airbag control unit

5.2 Bodybuilder connectors

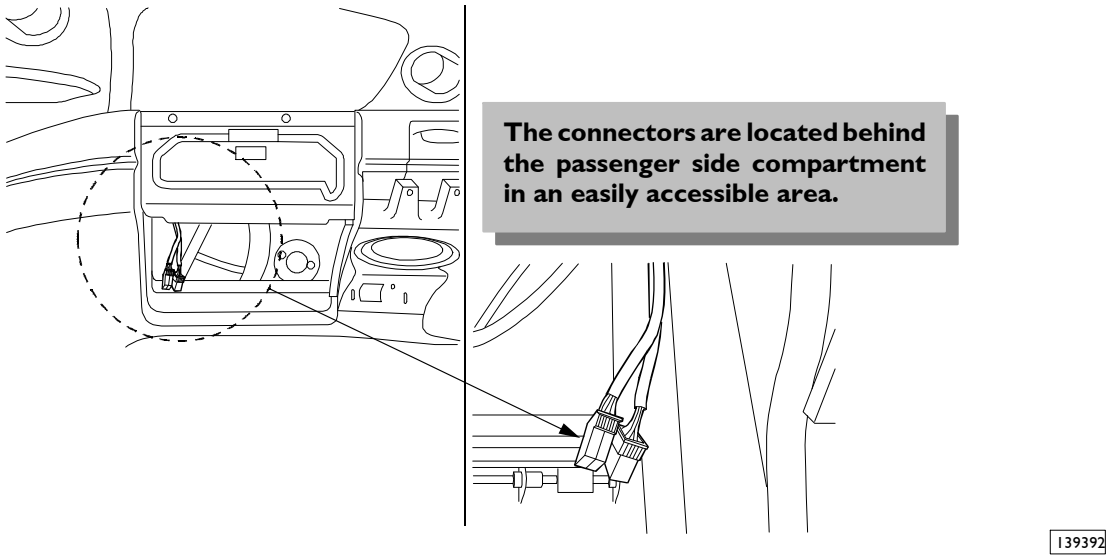
To allow the Bodybuilder to interface correctly and efficiently with the vehicle's electrical system, specific connection points have been provided to be used for supplementary systems.

This provision is necessary to avoid any manipulation of the system, in order to guarantee its functional integrity and therefore the validity of the guarantee.

Two connectors (61071 and 72068) are provided inside the cab. A special kit consisting of connectors and cable terminals must be ordered as a spare part in order to use these connectors.

NOTE Any interfacing between the body and the vehicle shall be made by means of diodes and relays (clean contact), unless otherwise specified in the manual.

Figure 5.2

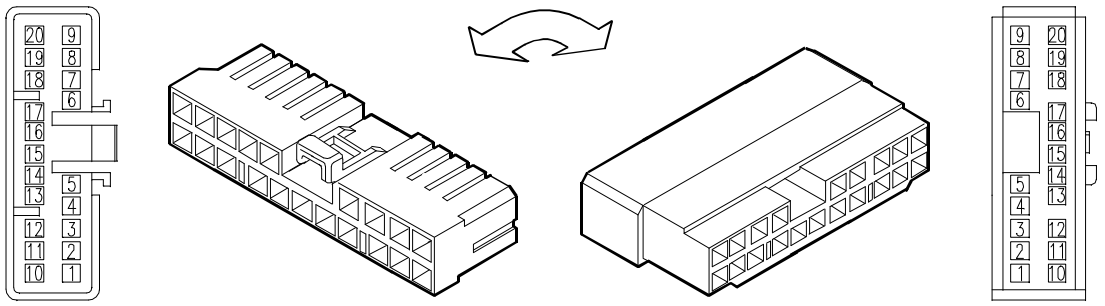


DIRECT CONNECTION TO THE CONNECTORS IS STRICTLY FORBIDDEN AND WILL IMMEDIATELY INVALIDATE THE GUARANTEE.

5.2.1 20 pin connector (61071)

20-way connector

Figure 5.3



Existing parts on the vehicle

Counterpart to be connected

Table 5.1

Code number	Description
500314817	20-way male holder joint
500314820	Male contact for 0.3 to 0.5 mm^2 cable
500314821	Male contact for 1 to 1.5 mm^2 cable

Table 5.2 - Basic functions of 20 pin connector

Pin	Description	Signal	Remarks
1	Engine start-up	Input max 20 mA	When positive signal is supplied, the starter motor is powered and starts the vehicle engine. Operation takes place only when the key is turned in the barrel. When starting the vehicle, NO SAFETY CHECKS OF ANY TYPE ARE CARRIED OUT e.g. gear engaged etc. For both normal vehicles and for Start & Stop vehicles
			+12 V = engine start-up Open circuit - no action
2	Engine shut-down	Input max 10 mA	When a positive signals is supplied, the vehicle engine is shut down
			+12 V = engine shut-down Open circuit = no action
3	Service braking	Output max 500 mA (interface with uncoupling diode)	When the brake pedal is pressed, a positive signal is generated.
			+12 V = service brake active Open circuit = service brake inactive
4	Vehicle stationary	Output max 500 mA	When the vehicle is stationary, a ground is obtained
			Earth = vehicle parked Open circuit = vehicle in motion
5	Parking brake	Output max 500 mA (interface with uncoupling diode)	When the handbrake is operated, an earth signal is generated.
			Earth = brake engaged Open circuit = brake released
6	Battery positive	Output max 20 A	Positive protected by a fuse present on the Body Computer - F34
7	Exterior light activation	Output max 500 mA	When the sidelights are on, a positive signal is obtained
			+12 V = lights on Open circuit = lights off
8	Alternator operation	Output max 500 mA (interface with uncoupling diode)	When the vehicle alternator is cranked, a positive signal is obtained
			+12 V = Battery charging Open circuit = battery not charging
9	Clutch engagement	Output max 500 mA (interface with uncoupling diode)	When the clutch pedal is pressed, the circuit is open.
			+12 V = clutch engaged Open circuit = clutch released
10	Reverse engagement	Output max 500 mA (interface with uncoupling diode)	When reverse is engaged, a positive signal is obtained
			+12 V = reverse engaged Open circuit = reverse engaged

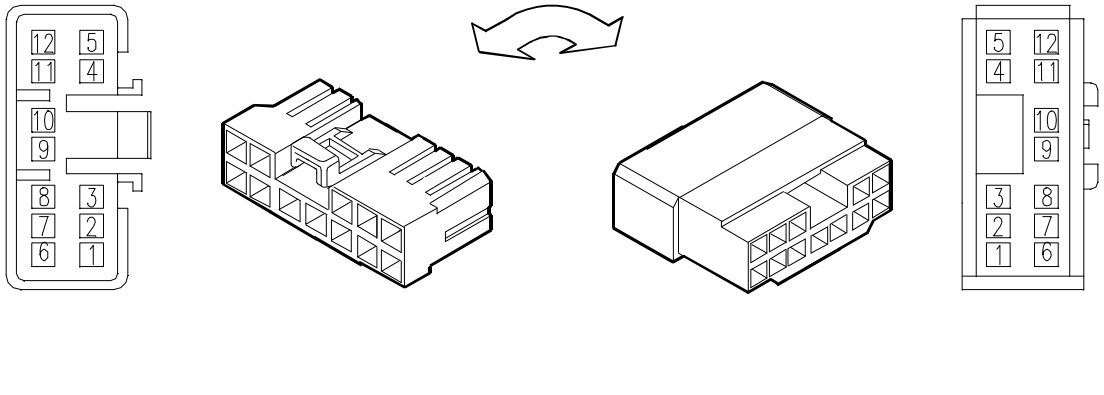
Table 5.2 - (continues) Basic functions of 20 pin connector

Pin	Description	Signal	Remarks
11	Ignition-operated positive	Output max 5 A	Ignition live positive protected by a fuse present on the Body Computer - F49
12	Cruise Control Command	Input max 10 mA	Cruise Control negative analogue signal (in parallel controlled from the steering column switch unit) **See specification 3**
13	Cruise Control command splitter reference ground	Input max 10 mA	**See specification 3**
14	Not connected		
15	Not connected		
16	Not connected		
17	Earth	Output max 15 A	
18	Not connected		
19	Not connected		
20	Not connected		

5.2.2 12 pin connector (72068)

12-way connector

Figure 5.4



Existing parts on the vehicle

Counterpart to be connected

Table 5.3

Code number	Description
500314814	12-way male holder joint
500314820	Male contact for 0.3 to 0.5 mm^2 cable
500314821	Male contact for 1 to 1.5 mm^2 cable

Table 5.4 - Basic functions of 12 pin connector

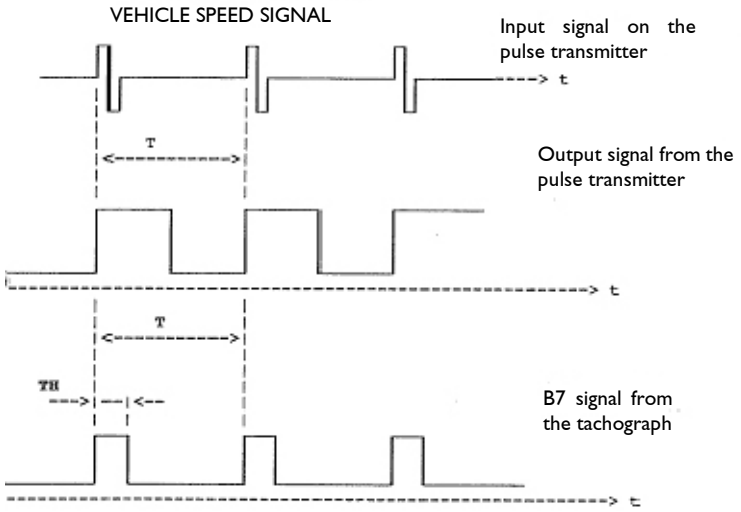
Pin	Description	Signal	Remarks
1	Speed limiter	Input max. 10 mA	When an earth signal is supplied, vehicle speed is limited to 30 km/h
			Earth = active speed limitation
2	Programmable speed limiter	Input max. 10 mA	When earth is connected, limitation is activated/deactivated at the current speed
			Earth = speed limitation activated/deactivated
3	Multiple switch	Available for power take-offs	
4	Speed signal (B7)	**See Specification 1**	
5	Key ON-repeat	Input max 500 mA	Positive signal supplied to simulate initial key rotation (key ON position) Only the main loads are powered, the vehicle cannot be started from outside because key recognition absent:
			+12 V = key active Open circuit = Key inactive
6	Power take-off activation	Output max 500 mA	When the power take-off is engaged, an earth signal is present
			Earth = power take-off engaged Open circuit = power take-off disengaged.
7	Horn	Output max 150 mA	Additional horns (to interface with relay)
			Earth = horn active Open circuit = horn not active
8	Multiple switch	Available for power take-offs	
9			
10	Engine revs (r.p.m.)	**See Specification 2**	
11	Not connected		
12	Not connected		

Specification I

Vehicle speed signal

B7 is a square-wave signal having the same frequency as the input signal (from the pulse generator) and a variable duty-cycle, due to the vehicle's tachometric constant.

Figure 5.5



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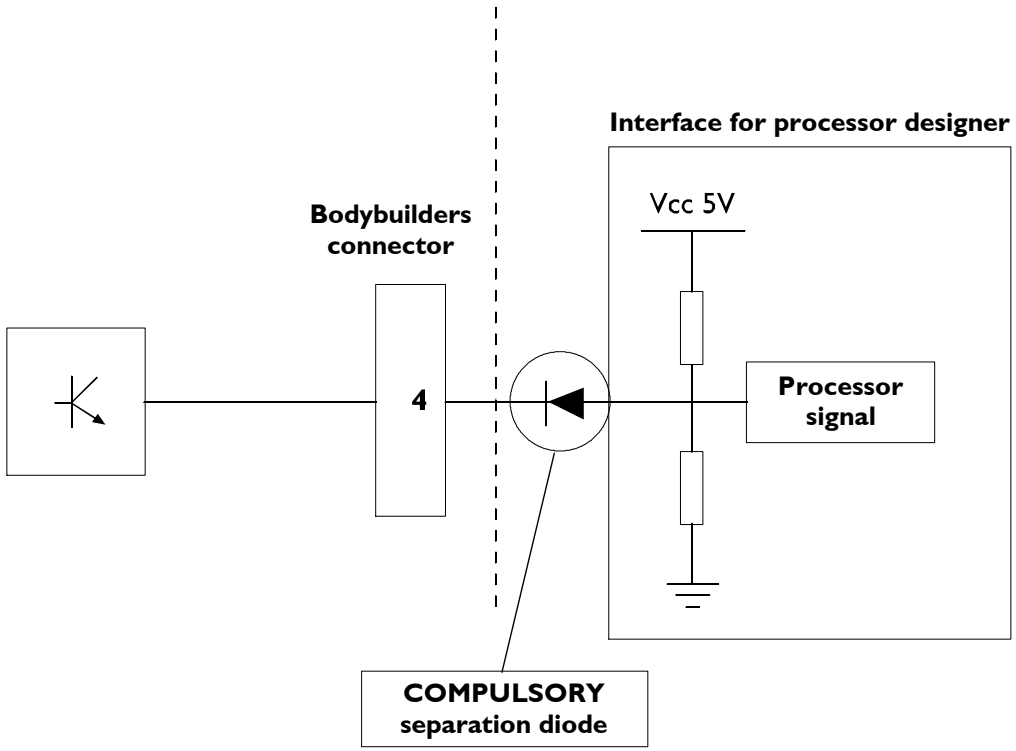
Below are the electric features of the signal:

-	Minimum voltage level	< 1.5 V
-	Maximum voltage level	> 5.5 V
-	Max. frequency	1.5 kHz
-	Pulse duration (TH)	0.67 ÷ 6.7 ms
-	Pulse duration tolerance	1%
-	Load impedance minimum value	5.5 kΩ
-	Load impedance typical value	15 kΩ

Figure 5.6



The Bodybuilder must fit a separation diode so that the V_{ON} voltage is not lowered.

The signal processing designer must ensure an input interface equal to that shown with a max Vdc of 5 volt and "pull-up/pull-down" in order not to lower the V_{ON} voltage and increase the response time set by the vehicle interface.

Speed calculation, following signal B7 reading, involves controlling both the frequency and the "duty-cycle" of the signal itself, since the frequency is a function of the vehicle whereas the "duty-cycle" is a function of the tachometric constant.

Below is the formula used to calculate the vehicle speed from signal B7:

$$Vehicle\ speed = 225\ \frac{TH}{T}$$

where the speed is expressed in km/h and TH, T are in thousandths of a second.

Specification 2

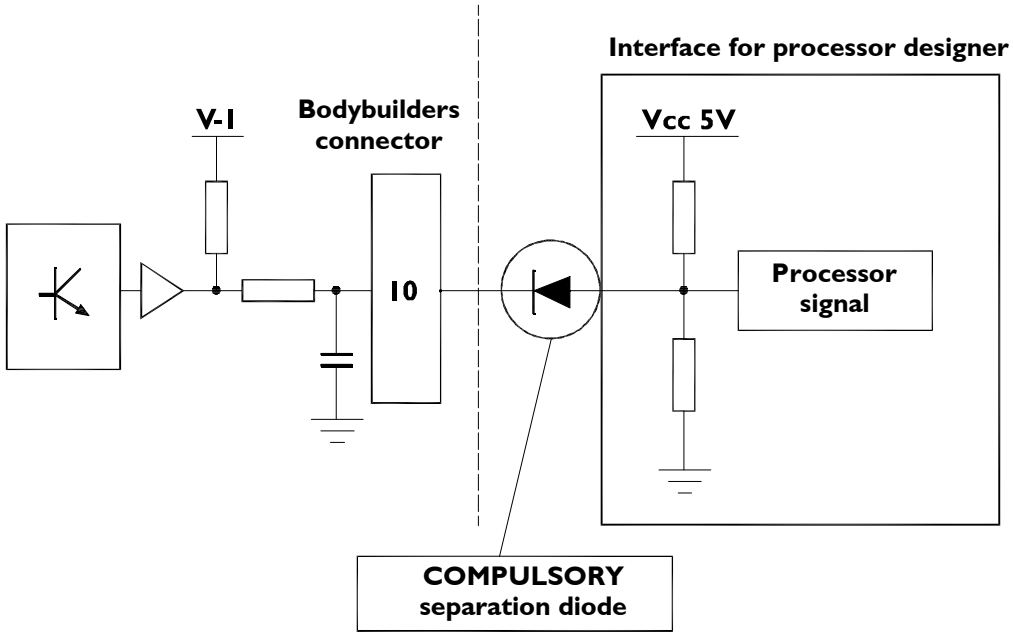
Engine revs signal

The engine revs signal is represented by a square wave.
Below are the features of the engine revs signal:

Table 5.5

Features	Condition	Minimum	Typical	Maximum	Unit
C-IO	To container / VBat-	1.2		1.85	nF
R-IO	To VBat+	2.57		2.65	kΩ
I-Out				50	mA
t-Rise	Signal output time from 10% to 90%			10.5	µs
R-ON	Output current < 0.05 A			33.8	Ω
V-I		5.4	13.5	15.7	V
Pulses per rev			4		

Figure 5.7



The Bodybuilder must fit a separation diode so that the V_{ON} voltage is not lowered.

The signal processing designer must ensure an input interface equal to that shown with a max Vdc of 5 V and "pull-up/pull-down" in order not to lower the V_{ON} voltage and increase the response time set by the vehicle interface.

Specification 3

Cruise Control via Bodybuilder socket

The Bodybuilder must fit the splitter outlined below by connecting it to the 20 way Bodybuilder connector by referring to the pins shown.

Figure 5.8

R1	**2490Ω**	**1%**
R2	**649Ω**	**1%**
R3	**261Ω**	**1%**
R4	**133Ω**	**1%**

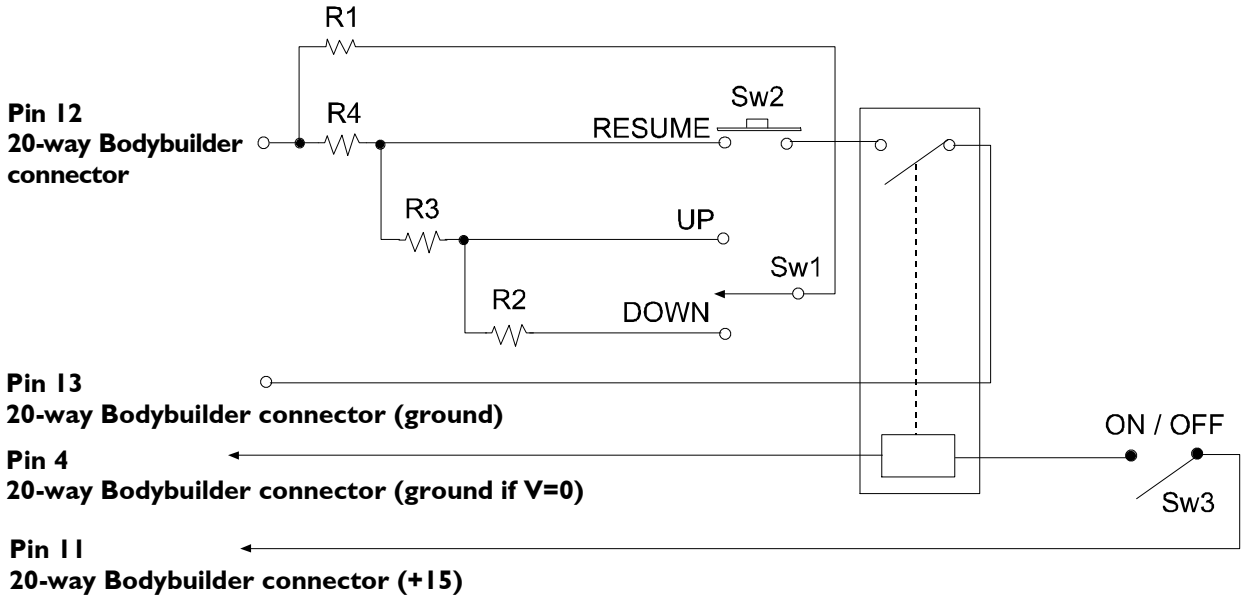


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Diagram provided for Bodybuilder panel

Provision for an additional central rear door locking system (Vans)

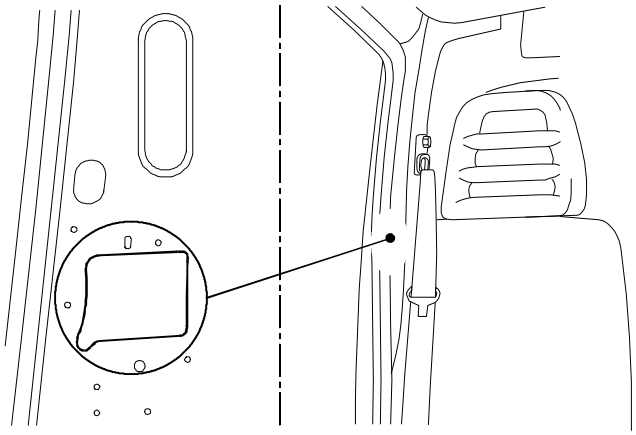
The following exist for "van" versions:

- option 5864 "Central door locking + Provision for an additional central rear door locking system", which provides a socket on the central pillar. The Bodybuilder may fit a remote controlled door on the body in combination with the remote-controlled central door locking system (lock/release).
- option 5865 "Anti-theft system + Provision for an additional central rear door locking system", which offers the anti-theft system in combination with RCL (Remote Control Look) + Provision for rear door.

These options offer a key with a 3 button remote control (one button is dedicated to the rear door) to control the additional rear door, as well as a button (locks/unlocks all the doors) on the dashboard.

The connector is located beneath the plastic pillar trim behind the passenger seat (see Figure 5.9).

Figure 5.9



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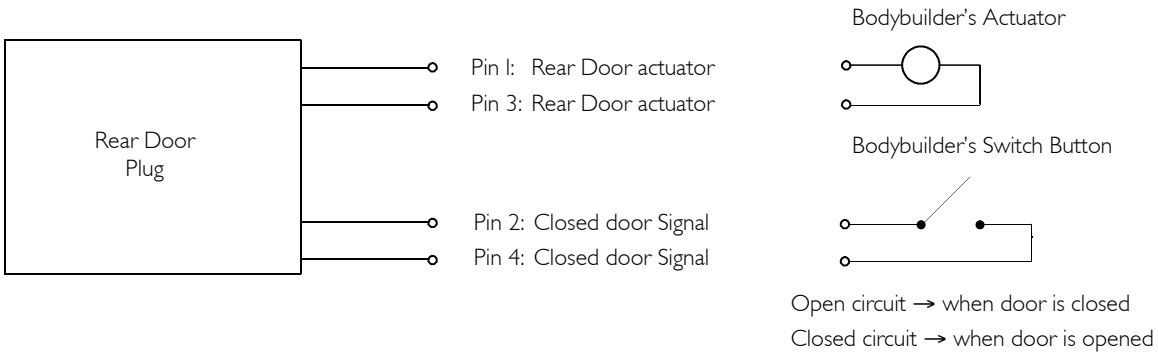
The Diagram below shows the connection between to rear door plug and the Bodybuider's Actuator/close door switch (Figure 5.10).

Figure 5.10



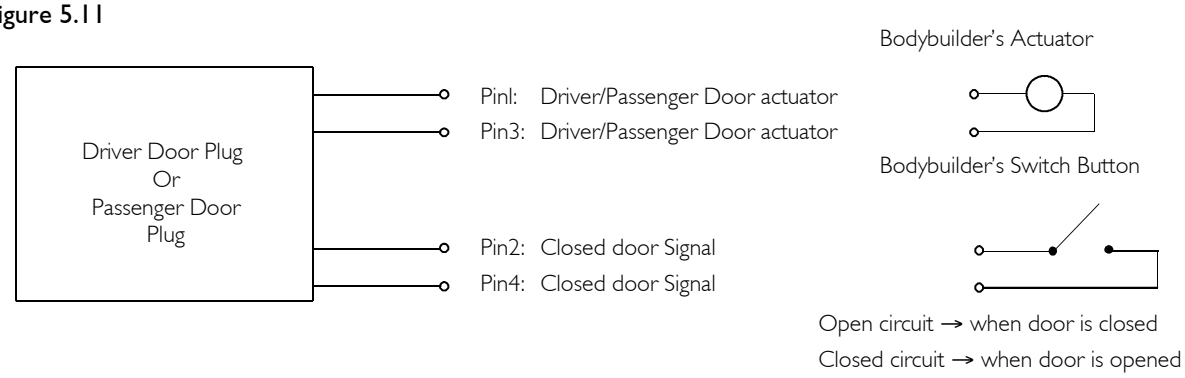
Rear door provision conneting diagram

In order to let the system working correctly a "closed door signal" (vehicle with closed door return info) is mandatory.

An identical connection must also be done for the driver and passenger's doors by the Bodybuilder to the side doors plug.

Driver door and passenger door connecting diagram(1)

Figure 5.11



(1) Only for Stripped Camper Cowl, Chassis cowl and Stripped Chassis Cowl version.

5.2.3 Antitheft System

In combination with central closing, the vehicle can be equipped with a perimeter type anti-theft system controlled from the Body Computer.

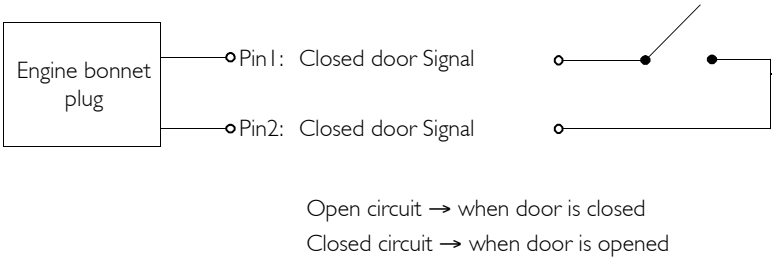
This system consists of:

- a key with remote control, buttons for remote locking/unlocking;
- actuators to close the cab doors, the sliding side doors and the rear doors in the case of a van;
- perimeter door open sensors and bonnet open sensor (Figure 5.12);
- alarm siren (12 V) (Figure 5.13).

Current absorption of the antitheft device is 30-40 mA.

The Bodybuilder must provide a "door closed" signal so that the anti-theft system can also monitor any break-in attempt on the bonnet.

Engine bonnet button connecting diagram(2)



(2) Only for Stripped Camper, Chassis cowl and Stripped Chassis Cowl version with opt 5865

Figure 5.12

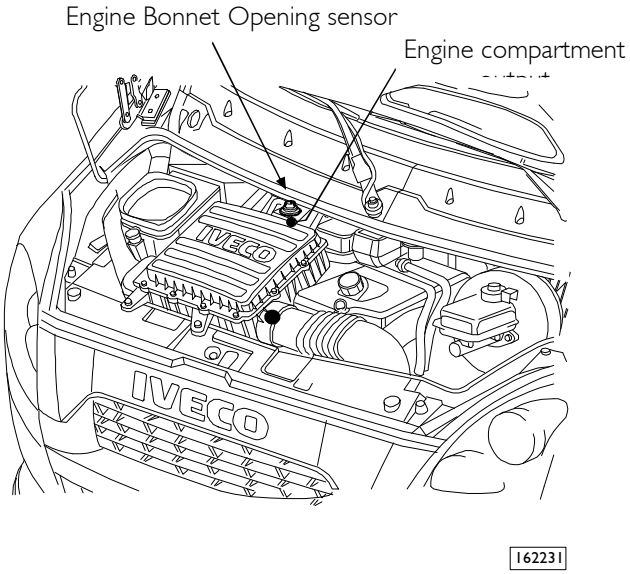
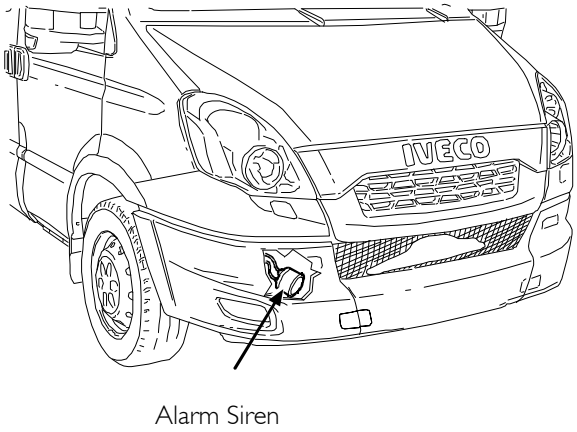


Figure 5.13



For the method of use, refer to the Use and Maintenance handbook.

5.3 Electronic control units

5.3.1 Precautions to be taken with the installed electronic control units

In order to avoid any operations that could permanently damage or cause the operation of the vehicle ECUs to deteriorate, it is good practice to:

- remember that connecting to and disconnecting from the battery terminals generates voltage that can cause problems for the vehicle's electronic systems and ECUs;
- do not remove and/or connect the connectors from the control units when the engine is running or the control units are powered;
- disconnect the electronic control units whenever particular operations involve temperatures above 80 °C;
- avoid using a rapid battery charger for emergency starting under all circumstances, because it could damage the electrical systems and in particular the systems that manage ignition and power supply functions;
- do not power the components interlocked with electronic modules with the vehicle's nominal voltage via movable cables;
- connect ECUs supplied with a metal casing to the system ground using a screw or bolt, unless otherwise specified.

In case of actions to the taken on the chassis, which require electric arc welding, the following shall be done:

- disconnect the CBA from the positive battery terminal and do not connect it to the chassis ground;
- remove the connector form the control units;
- disconnect the ECU from the chassis (in the case of welding close to the ECU itself);
- make the welds by using direct current;
- ground the welding machine as near the welding point as possible;
- do not lay the battery cables parallel to the vehicle's electric cables.

Only use fuses with the correct specifications for the specific function.
NEVER USE FUSES WITH HIGHER CAPACITY THEN THE PRESCRIBED ONE.
Replace only with keys and appliances disconnected.

Whenever work has been carried out on the electrical system, once the work has been completed the cabling must be restored to its original condition (paths, protection, ties), absolutely avoiding the cables coming into any contact at all with metal surfaces on the structure which could erode their integrity.

Warnings

Vehicles are equipped with sophisticated electrical/electronic systems that control their operation (e.g. ABS, EDC, etc.).
Before installing additional heaters, power take-offs, speed limiters, anti-theft devices, mobile phones and cooling system compressors that could interact with the above electronic systems, it is advisable to check the feasibility of application with IVECO.
It is also necessary for appropriate diagnostic checks to be carried out in order to confirm that the system has been correctly set up.
For more detailed information on the vehicle electrical system, refer to the specific Workshop Manuals.

Operations on the electrical system (e.g. removal of cables, addition of circuits, replacement of equipment or fuses, etc) carried out in a manner not compliant with IVECO's instructions or carried out by unqualified staff may cause serious damage to the on-board systems, affecting safety and reliability.

Operations carried out on the electrical system in a non-compliant manner may cause significant damage (e.g. short-circuits with the possibility of fire and destruction of the vehicle) and authorise IVECO to declare the contractual warranty forfeit.

It is absolutely prohibited to make changes to or connections to the CAN lines, which should be considered inviolable. Any diagnosis and maintenance operations must be carried out exclusively by authorised staff using equipment approved by IVECO.

NOTE Written authorisation from IVECO is required for any exemption from the assembly guidelines.
Failure to comply with the above prescriptions will cause the warranty to become null and void.

5.3.2 Disconnecting ECUs

Work carried out which does not conform with IVECO instructions, or that is carried out by unqualified personnel, can cause serious damage to the on-board systems, compromise driving safety, the good functioning of the vehicle and cause associated damage that is not covered by the contractual guarantee.

Before disconnecting an ECU, the following instructions must be rigorously followed:

- turn the key in the ignition block to the OFF position and remove it;
- switch off the additional heaters and wait for the end of the cooling down cycle (the warning light in the button will go out);
- turn on the map reading lights located in the middle of the header rail;
- isolate the battery by disconnecting the power cables, first the negative pole then the positive; the spots mentioned above are out;
- disconnect the ECU.

5.3.3 Repositioning ECUs

IVECO recommends to avoid modifications which entails moving ECUs. Follow the instructions below if repositioning ECUs is unavoidable:

- ECUs must be positioned on the chassis or in the cab and secured with a fastening similar to the original one (i.e. bracket). To avoid malfunctions, the ECU in the chassis must not be turned (e.g. to avoid water ingress). Consequently, the original orientation must be preserved.
- ECUs must not be fitted on the subframe;
- the cover must always be refitted;
- avoid subjecting ECUs to knocks from debris and stones from the road when travelling.

5.4 Electrical System: Modifications and Drawing-Off Power

General Information

The vehicles are designed to operate normally with a 12 V electrical system.

The chassis represents the ground (it acts as a power return conductor between the components located on it and the batteries/alternator energy source) and the negative pole for the batteries and the components is connected to it, therefore an isolated return is not provided.

The installation of auxiliary equipment or additional circuits must take account of the instructions given below and, according to the complexity of the operation, suitable documentation (e.g. electrical diagram) must be provided to accompany that for the vehicle.

The use of cables and connections with colours identical to those used on the original vehicle makes the installation more accurate and facilitates any repair work.

For efficient and correct use of the electrical system, specific connection points have been provided for auxiliary systems. This condition is necessary to rule out any adaptions of the basic design in order to ensure operational integrity and thus maintenance of the vehicle warranty.

NOTE For more detailed information on the vehicle electrical system, refer to the special workshop manual, printed 603.95.161 (Daily MY 2012).

This manual is available at the Service network and can be requested from the relevant Departments of the IVECO Sales Organisation.

Precautions for operations on the system

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.

Before removing any electrical and/or electronic components, disconnect the ground cable from the negative terminal of the battery.
To avoid damaging the vehicle's electrical system, carefully follow the cable manufacturer's instructions.
The cables must have a section suited to the type of load and the positioning of said load within the vehicle;

- The power cables (+ direct) must:
  - be inserted individually in corrugated sheaths (with suitable diameter) and not together with others with different signals and negative cables;
  - be positioned at a distance of at least 100 mm (reference value = 150 mm) from very hot parts (engine turbine, exhaust manifold, etc.);
  - be positioned at least 50 mm from containers of chemical agents (batteries, etc.);
  - be positioned at least 50 mm from moving parts.
- The route of the cables must be defined as much as possible with dedicated brackets and clamps and moved closer, to avoid hanging parts and provide the possibility (and obligation) to rebuild the same installation in the case of repairs or outfits.

- The cables must have a section suited to the type of load and the positioning of said load within the vehicle.
- The passage of cables in holes and on edges of various panels must be protected by cable glands (besides the corrugation).
- The corrugated pipe must protect the whole cable completely and must be joined (with heat shrink sections or taping) to the rubber caps on the terminals. In addition the corrugated pipe clamps (cut longitudinally) must not be in contact with the sharp edge of the pipe.
- All the terminals (+) for connecting the aforesaid cables and their lugs must be protected by rubber caps, (airtight for zones exposed to the weather or with any stagnation of water).
- The fastening of the lugs on the terminals (also negative) must be assured to avoid loosening, applying a tightening torque where possible and fanning out the lugs in the case of multiple connections (preferably to be avoided).

It is always necessary to isolate the battery before doing any work on the electric system, disconnecting the power cables, first the negative pole then the positive one.

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

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

Precautions for operations on the frame

During work on the chassis frame, to safeguard the electrical system, disconnect the relevant components and the earth connections, follow the guides given in points 2.1.1 and 2.3.4.

When required by the use of auxiliary equipment, protective diodes must be installed for any inductive current peaks.

The ground signal coming from the analogue sensors must only be wired to the special receiver; further ground connections could falsify the output signal coming from these sensors.

The cable bundle for low intensity signal electronic components must be placed parallel to the reference plane, that is attached to the chassis/cab structure, in order to reduce parasitic capacity to a minimum; distance the path of the additional cable bundle as far as possible from the existing path.

Auxiliary systems must be connected to the system ground with the utmost care (see point 5.4.1); associated cabling must not run alongside the electronic systems already on the vehicle 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.

Engine cranking

When failure to start is due to low battery voltage and not to problems in the electric system avoid starting the vehicle by towing.

To prevent damage to the vehicle, it is important to ensure the tanks contain sufficient fuel during start-up. Attempting to start the engine with insufficient fuel could cause serious damage to the injection system.

Do not start the engine without having first permanently connected the battery.

If the batteries require charging, disconnect them from the vehicle circuit.

ABSOLUTELY avoid using a fast battery charger for emergency starting: due to the high voltages applied, the electronic systems, and in particular the control units that manage the ignition and supply functions, could get damaged.

Auxiliary method start-up must only be carried out using an external battery carriage, according to the following procedure:

- observe all current accident prevention precautions (including the use of gloves);
- use a battery trolley with specifications similar to those of the vehicle battery;
- using a suitable cable, connect the positive pole of the battery trolley to the positive pole of the CBA control unit fitted on the positive pole of the vehicle battery (see Figure 5.33 paragraph 5.4.5);
- using a suitable cable, connect the negative clamp of the battery trolley to the ground of the vehicle with a flat battery;
- when starting the engine on vehicles with a manual gearbox: turn the key ON and wait for all the engine warning lights on the instrument panel to go off. Start the vehicle engine. The starter motor must not be used for longer than 10 seconds. Do not depress the accelerator pedal during start-up;
- when starting the engine on vehicles with an automatic gearbox: turn the key ON and press the brake pedal. Wait for all the engine warning lights on the dashboard to go off and for a "Gearbox OK" message to appear on the display. Start the vehicle engine. The starter motor must not be used for longer than 10 seconds. Do not depress the accelerator pedal during start-up;
- wait for the vehicle engine to reach idling speed;
- do not activate the vehicle's electric services, for example low-beam headlights, heater, both in order to allow the accumulation of a sufficient amount of energy and to avoid any current peaks which could damage the electronic control units when the battery trolley is disconnected;
- firstly disconnect the vehicle negative terminal and then the battery trolley negative terminal;
- first disconnect the CBA cable fitted to the vehicle battery positive terminal and then the battery trolley positive terminal;
- the battery must in any case by recharged subsequently by disconnecting form the circuit using the correct slow, low current recharging procedure;
- do not use other devices (battery charger) to start the engine. If in doubt, contact the IVECO service network.

Any damage to electronic control units caused by failure to comply with procedure is not covered by the warranty.

See Chapter 5.3 for precautions to be adopted for installed control units.

5.4.1 Earth points

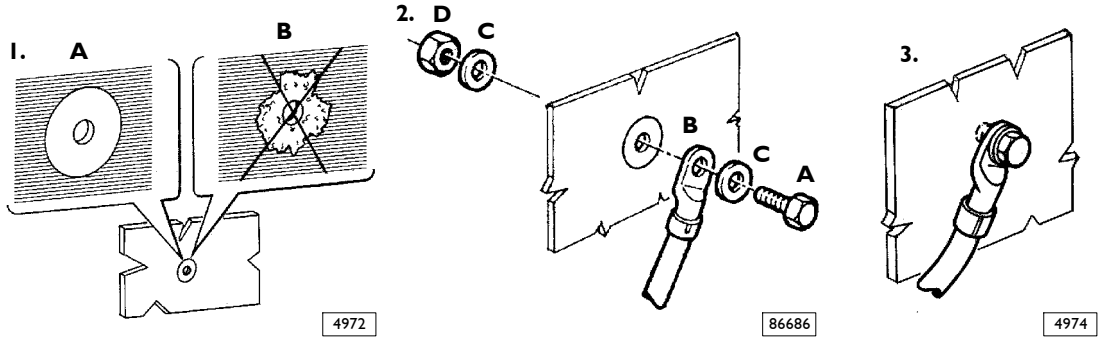
The vehicle's original ground connections should not be modified in principle. In the event that such connections need be displaced or addition ground points need be realized, use the holes found on the chassis as much as possible, taking care to:

- remove the paint on the chassis side and also the terminal side mechanically by sanding and/or by using an appropriate chemical product to create a contact surface without notches or steps;
- apply a suitable paint with high electric conductivity properties between the cable terminal and the metal surface;
- connect the earth within 5 minutes of applying the paint.

As regards the signal-related ground connections (e.g. sensors or low-absorption devices), do not use the standardized points for engine ground connection and chassis ground connection.

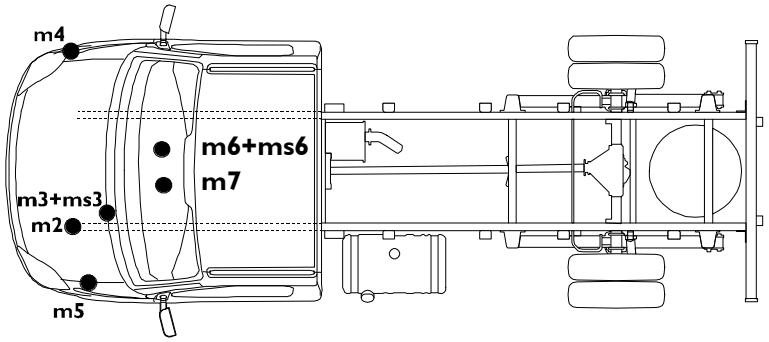
Additional signal grounds must be positioned at different points from the power grounds.

Figure 5.14



1. Ground connections: (A) in the first instance, connection is correct; (B) in the second instance, connection is incorrect - 2. Correct cable fastening to the ground point by using: (A) screw, (B) cable terminal, (C) washer, (D) nut - 3. Cable connected to the ground.

Figure 5.15

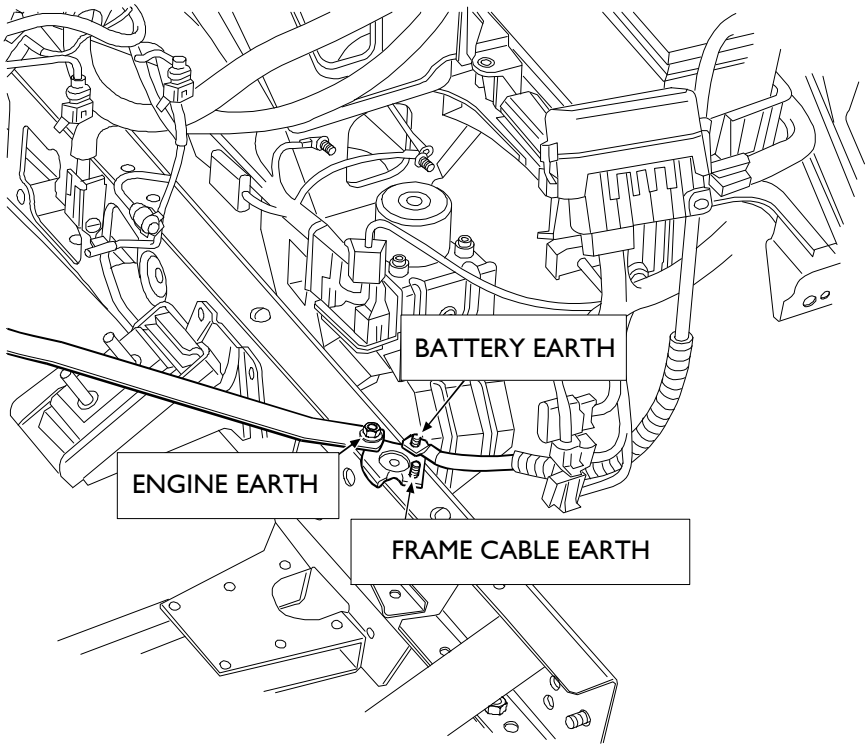


m = power grounds
ms = signal grounds

POSITION OF EARTH POINTS ON VEHICLE

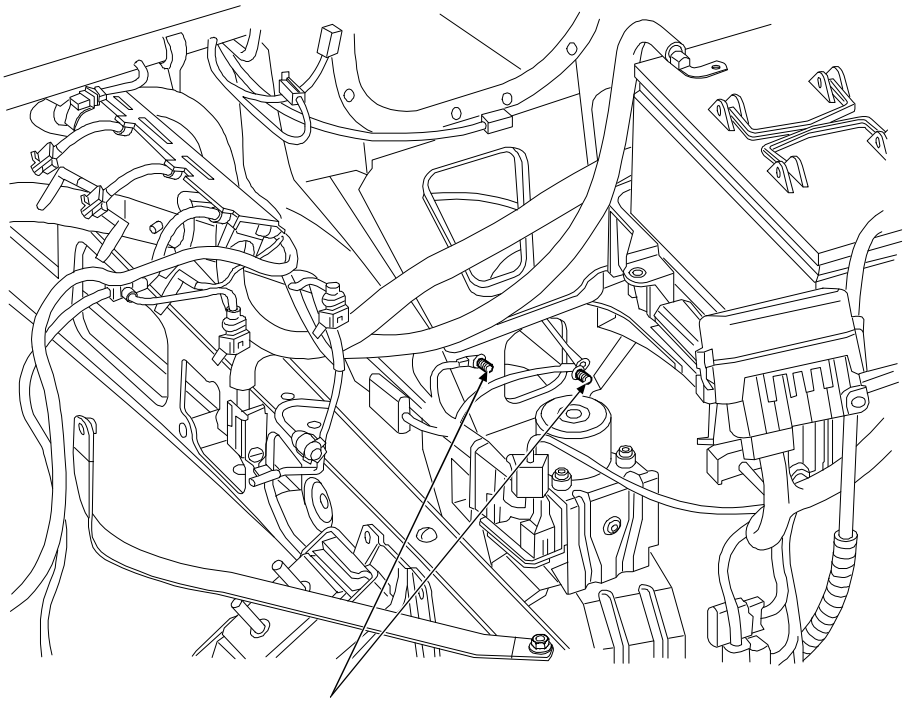
m2. Engine compartment ground left chassis side member - m3 + ms3. Engine compartment ground under the servo brake - m4. Engine compartment ground near right front light - m5. Engine compartment ground near left front light - m6 + ms6. Ground inside cab central zone - m7. Ground inside cab central zone

Figure 5.16



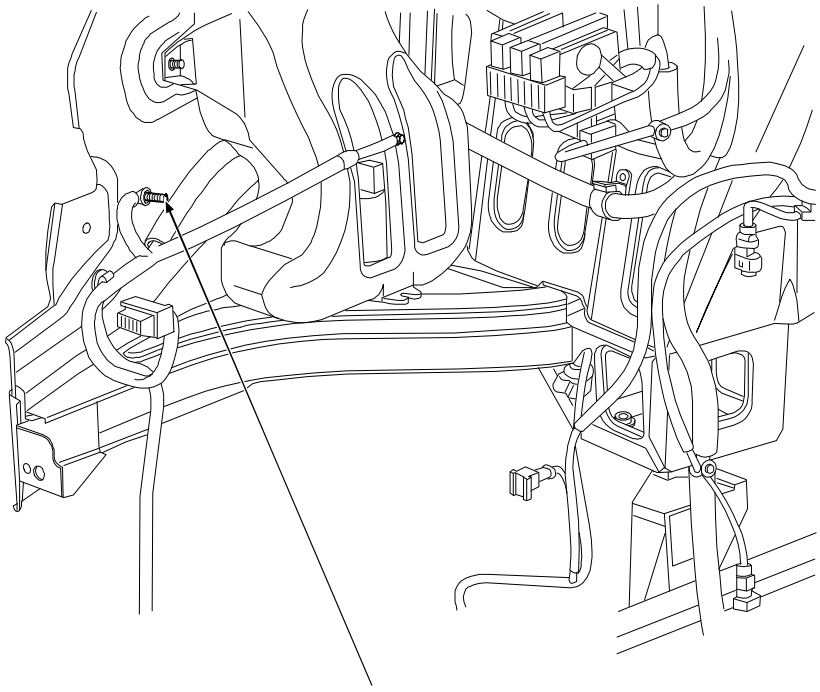
m2. Left frame rail engine compartment earth

Figure 5.17



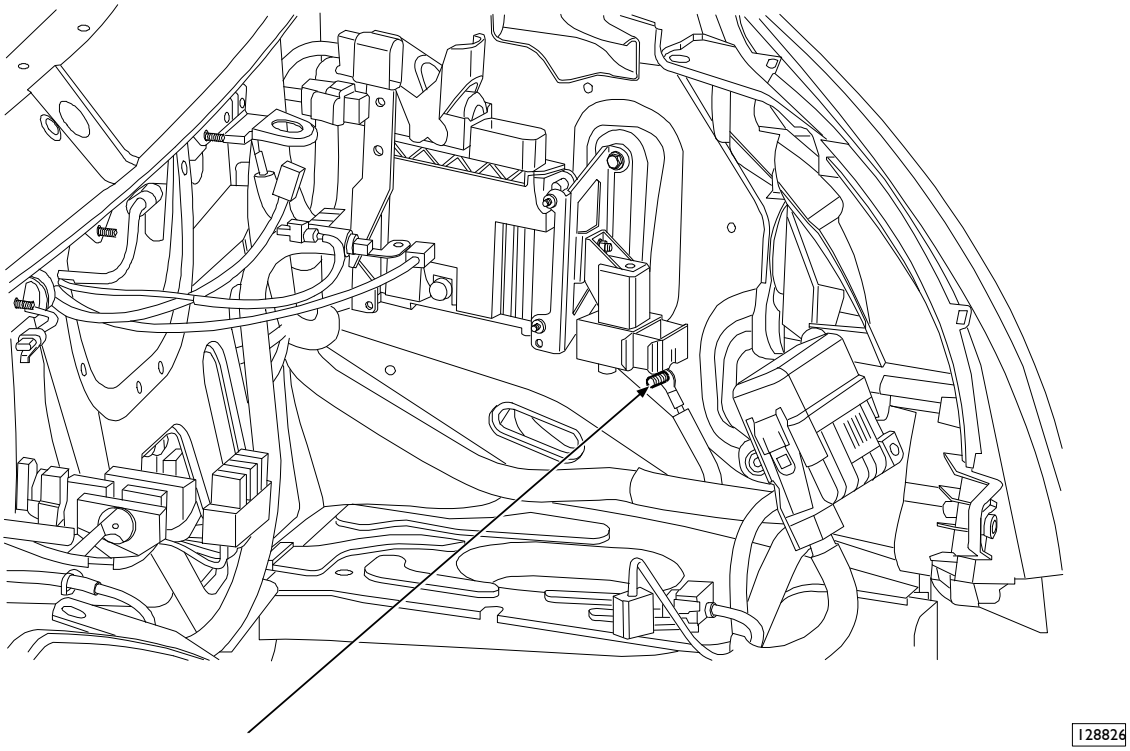
m3 + ms3. Engine compartment earth beneath brake servo

Figure 5.18



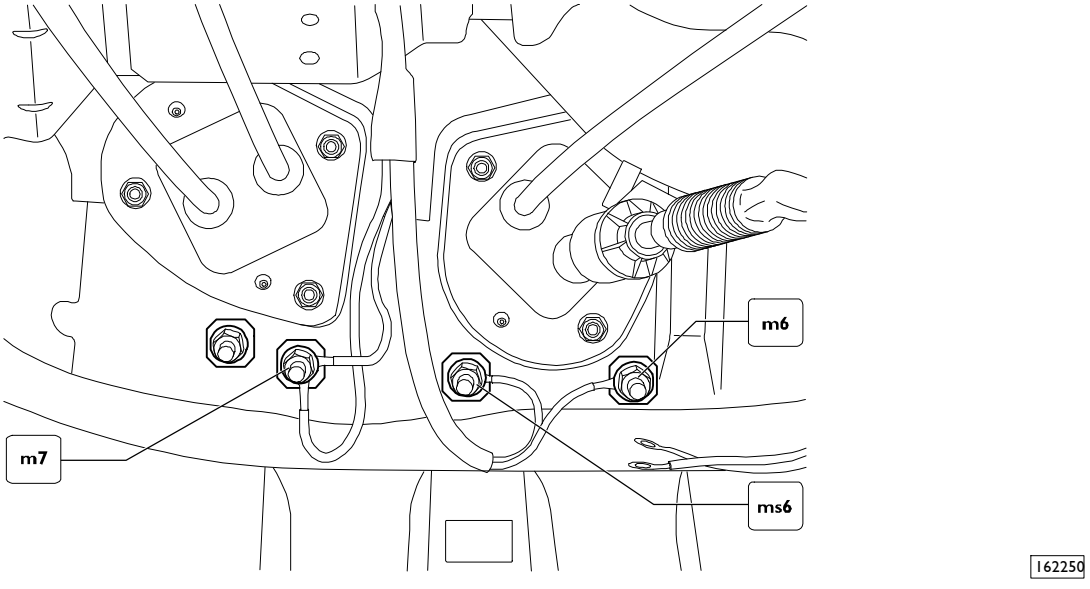
m4. Engine compartment earth near right front light

Figure 5.19



m5. Engine compartment earth near left front light

Figure 5.20



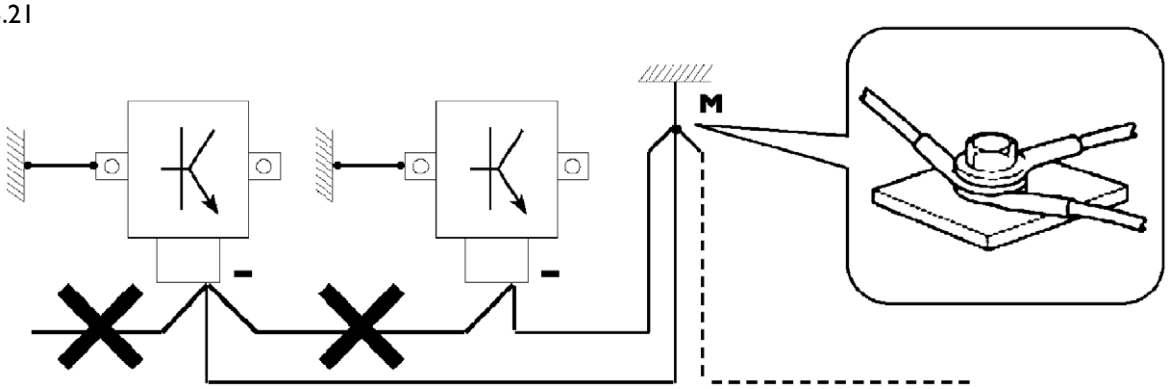
m6 + ms6, m7. Grounds inside cab on the central body under the tachograph

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

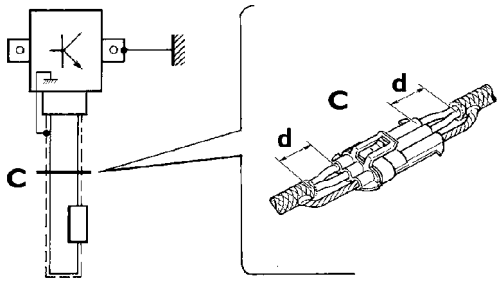
As far as electronic components are concerned, the following instructions shall also be followed:

- the electronic control units shall be connected to the system ground when they are equipped with metal cases;
- the negative cables of the electronic control units shall be connected both to a system ground point, connected to the negative terminal of the battery;
- the analog grounds (sensor) shall feature very good conductivity, though they are not connected to the system ground/negative terminal of the battery. As a result, the greatest care shall be taken with the cable terminal stray resistance: oxidation, seaming defects, etc.;
- the screened circuit metal sheath shall come into electric contact only at the end facing the control unit into which the signal is fed;
- if junction connectors are available, the unscreened length "d" next to the same shall be as short as possible;
- the cables shall be laid in such a way that they are parallel to the reference plane, i.e. as near the chassis/body structure as possible.

Figure 5.21



"Y" or "X" connection of various negatives with the system ground



Metal-braid screening of a cable to an electronic component

5.4.2 Electromagnetic compatibility

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

The level of electromagnetic immunity of the electronic devices equipping the vehicle, at a distance of 1 metre from the transmitting aerial must be:

- 50 V/m immunity for devices performing secondary functions (not impacting on direct vehicle control), for frequencies varying from 20 MHz to 2 GHz;
- 100 V/m immunity for devices that carry out primary functions (impacting on direct vehicle control), for frequencies varying from 20 MHz to 2 GHz.

The maximum excursion allowed for transition voltage with equipment powered by 12 V is +60 V measured on the terminals of the artificial network (L.I.S.N.) if tested on the bench. Alternatively, if tested on the vehicle, the excursion must be read at the most accessible point near to the conflicting device.

NOTE Devices powered by 12 V must be immune to negative interference such as -300 V spikes, +100 V positive spikes, bursts of +/-150 V.

They must operate correctly during the phase when voltage drops to 5 V for 40 ms and 0 V for 2 ms.

Moreover, they must resist the load dump phenomena up to 40 V.

The maximum radiated emission levels measured at the bench and levels of conducted emissions generated by devices and also by 12 V power supplies are given in the following table:

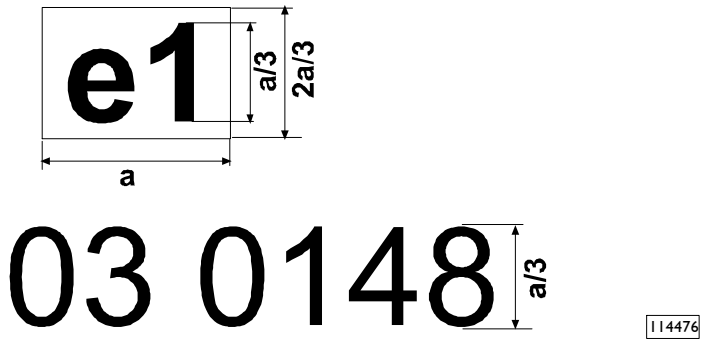
Table 5.6

Type of emission	Type of transducer	Type of disturbance	Type of detector	Frequency range and limits acceptable by noise in dBµV/m									Unit of measure
				150 kHz 300 kHz	530 kHz 2 MHz	5.9 MHz 6.2 MHz	30 - 54 MHz	68-87 MHz mobile services only	76-108 MHz broadcast only	142-175 MHz	380-512 MHz	820- 960 MHz	
radiated	Aerial at a distance of 1 metre	Broad-band	Nearly peak	63	54	35	35	24	24	24	31	37	dBµV/m
radiated		Broad-band	Peak	76	67	48	48	37	37	37	44	50	
radiated		Narrow-band	Peak	41	34	34	34	24	30	24	31	37	
conducted	LISN 50 Ω 5 µH 0.1 1µF	Broad-band	Nearly peak	80	66	52	52	36	36	Not applicable			dBµV
conducted		Broad-band	Peak	93	79	65	65	49	49				
conducted		Narrow-band	Peak	70	50	45	40	30	36				

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

An example of the mark prescribed by the current European Directive on electromagnetic compatibility in the automotive field is shown below:

Figure 5.22



a ≥ 6 mm

If in any doubt, call the IVECO Service Network.

These levels are granted only if the system comes from "IVECO Spare Parts" or it has been certified as per ISO, CISPR, VDE international regulations.

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

5.4.3 Two-way radio systems

The most frequent applications include:

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

General instructionss

a) The equipment must be approved according to the law and be of fixed type (not portable).
The use of non approved transmitters or supplementary amplifiers could seriously impede the correct functioning of the electric/electronic devices normally supplied, with negative effects for the safety of the vehicle and/or the driver.

b) The system already provided on the vehicle must be used to power the transmitters and they must be connected to terminal 30 on the Bodybuilder connector (and 15 where necessary) via a supplementary fuse.
Any additional power lines must be created respecting the correct sizing of cables and protection.

c) The coaxial antenna cable must be positioned taking care to:

- use a low loss, top quality product, with the same impedance as the transmitter and the antenna (see Figure 5.24);
- in order to avoid interference and malfunctioning, create a path that maintains an adequate distance (min. 50 mm) from pre-existing cabling or from other cables (radio, amplifiers and other electronic equipment), fixed keeping the minimum distance from the metal structure of the cab and using existing holes in the sheet metal;
- do not shorten or lengthen; avoid unnecessary tangles, tension, folds and crushing.

d) Outside the cab, the antenna must be installed on the vehicle on a metal base with a wide surface if possible; otherwise it must be fitted as vertically as possible, with the connecting cable pointing downwards and therefore following the Manufacturer's fitting instructions and warnings (see Figure 5.23).
Installation on the centre of the roof is to be considered the best by far, as the grounding surface is proportional in all directions, while fitting on a side or any other part of the vehicle makes the grounding area proportional to the grounding of that part.
Inside the cab, the transmitter equipment must be positioned as shown in Diagram 5.25.

e) The quality of the antenna, the mounting position and a perfect connection to the vehicle structure (ground) are factors of fundamental importance to guarantee the best performance of the transmitter equipment.

Some specific instructions are given below for each type of equipment

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

The transmitter part must be installed in a separate area from the vehicle's electronic components.

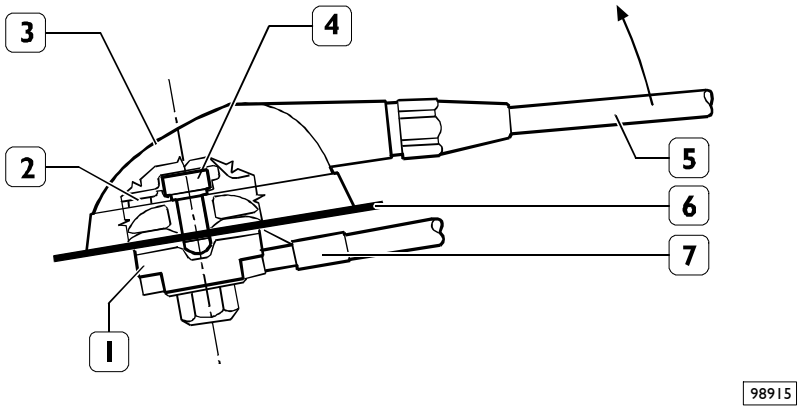
- The SWR ratio (Standing Wave Ratio) must be as close as possible to the unit (1.5 is recommended) while the maximum must not be greater than 2.
- The ANTENNA GAIN values must be as high as possible and guarantee a sufficient level of spatial uniformity, characterised by deviations in relation to the average value of the order of 1.5 dB in the typical CB band (26.965-27.405 MHz).
- The value of the RADIATED FIELD in the cab must be as low as possible, and therefore < 1 V/m.
  The limits imposed by the current European Directive must not be exceeded in any case.

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

1) if the SWR is higher on the lower channels than on the higher ones, the antenna should be lengthened
2) if the SWR is higher on the higher channels than on the lower ones, the antenna should be shortened

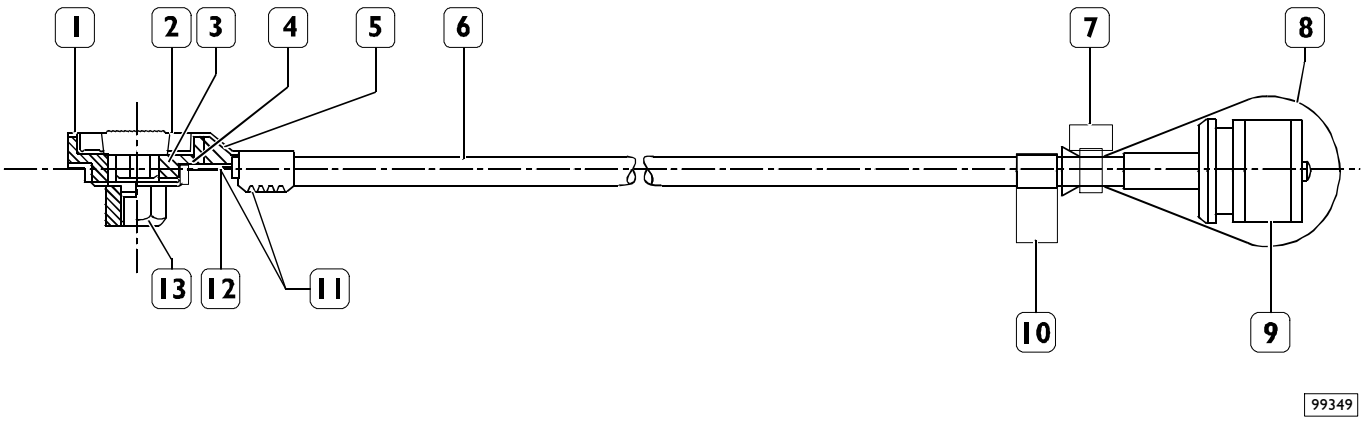
After having calibrated the antenna, it is advisable to re-check the SWR value on all the channels.

Figure 5.23



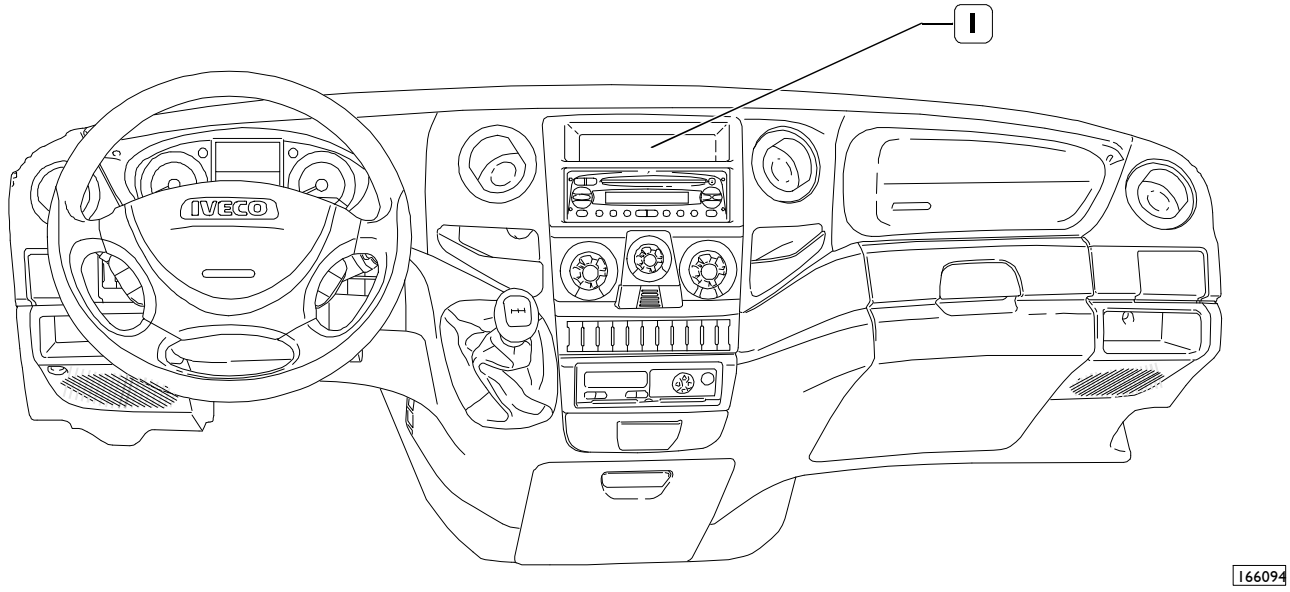
1. Antenna support - 2. Gasket - 3. Fixed joint cover - 4. Fixing screw M6x8.5 (torque to 2 Nm) - 5. Antenna - 6. Roof - 7. Antenna extension lead

Figure 5.24



1. Antenna connector - 2. Ground wire - 3. Insulator - 4. Signal wire - 5. Capacitor (100 pF) - 6. Cable RG 58 (characteristic impedance = 50 Ω) - 7. Clamp - 8. Protective cap - 9. Connector (N.C. SO - 239) transceiver side - 10. Test executed sticker - 11. The 100 pF capacitor must be soldered on the lower pin and crimped to the ground braid - 12. The lower pin must be soldered to the core conductor of the cable - 13. Nut

Figure 5.25



1. Location of the CB transceiver unit (City Band)

Equipment for cellular telephones

The transmitter part of the equipment must be installed in a flat, dry area, separate from the vehicle's electronic components and away from damp and vibrations.

- The SWR ratio (Standing Wave Ratio) must be as close as possible to the unit (1.5 is recommended) while the maximum must not be greater than 2.
- The ANTENNA GAIN values must be as high as possible and guarantee a sufficient level of spatial uniformity, characterised by deviations in relation to the average value of the order of 1.5 dB in the 870-960 MHz band and 2 dB in the 1710-2000 MHz band.
- The value of the RADIATED FIELD in the cab must be as low as possible, and therefore < 1 V/m.
  The limits imposed by the current European Directive must not be exceeded in any case.

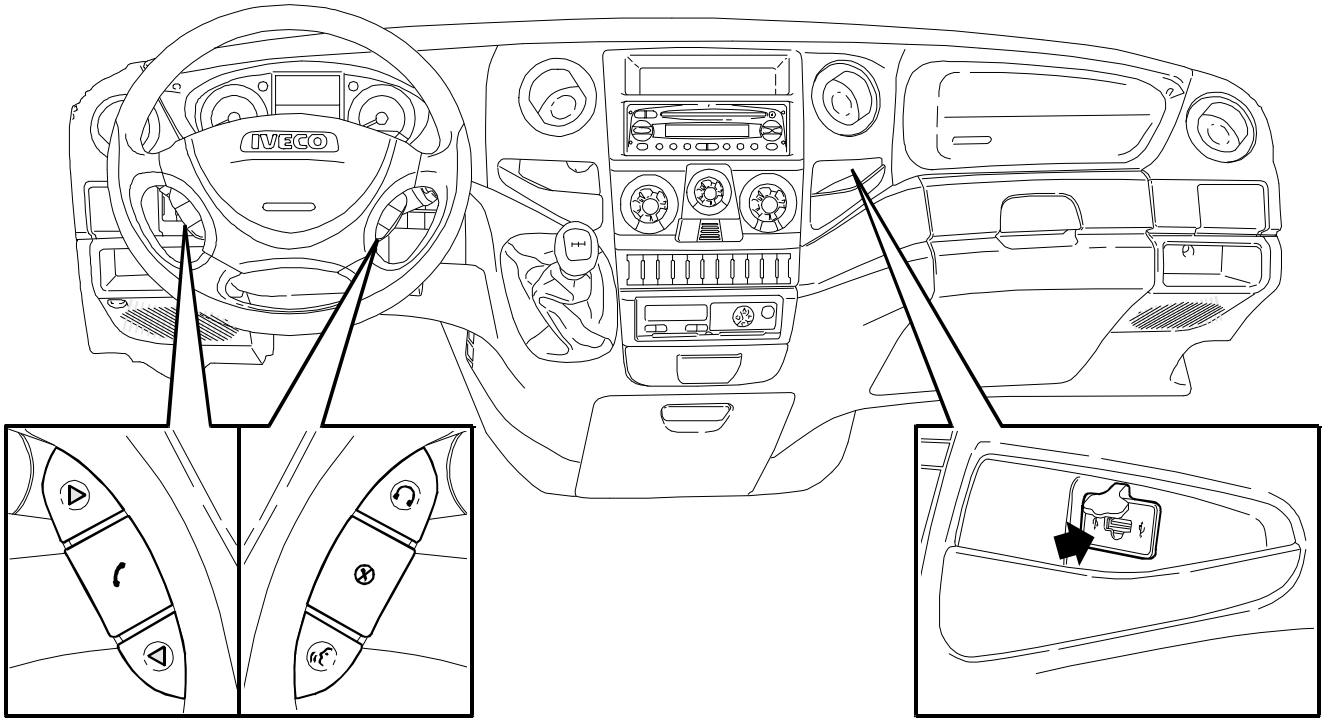
An optimum position for the antenna would be the front of the cab roof, at a distance of not less than 30 cm from other antennas.

Blue&Me provision

The Blue&Me provision consists of:

- special control unit, positioned above the car radio and hidden by a plastic cover,
- buttons on the steering wheel,
- ceiling fitting with microphone,
- USB socket,
- cabling.

Figure 5.26



Blue&Me provision components

In the case of shielded vehicles, the ceiling fitting with microphone is supplied in the equipment kit case.
If required by the installation in the cab, the microphone can be removed and replaced. It must however be positioned at a point distant from possible noise sources and according to the reception area described in the following picture.

Figure 5.27

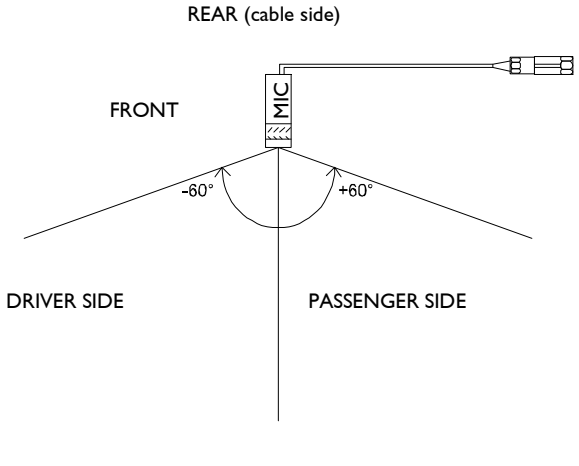
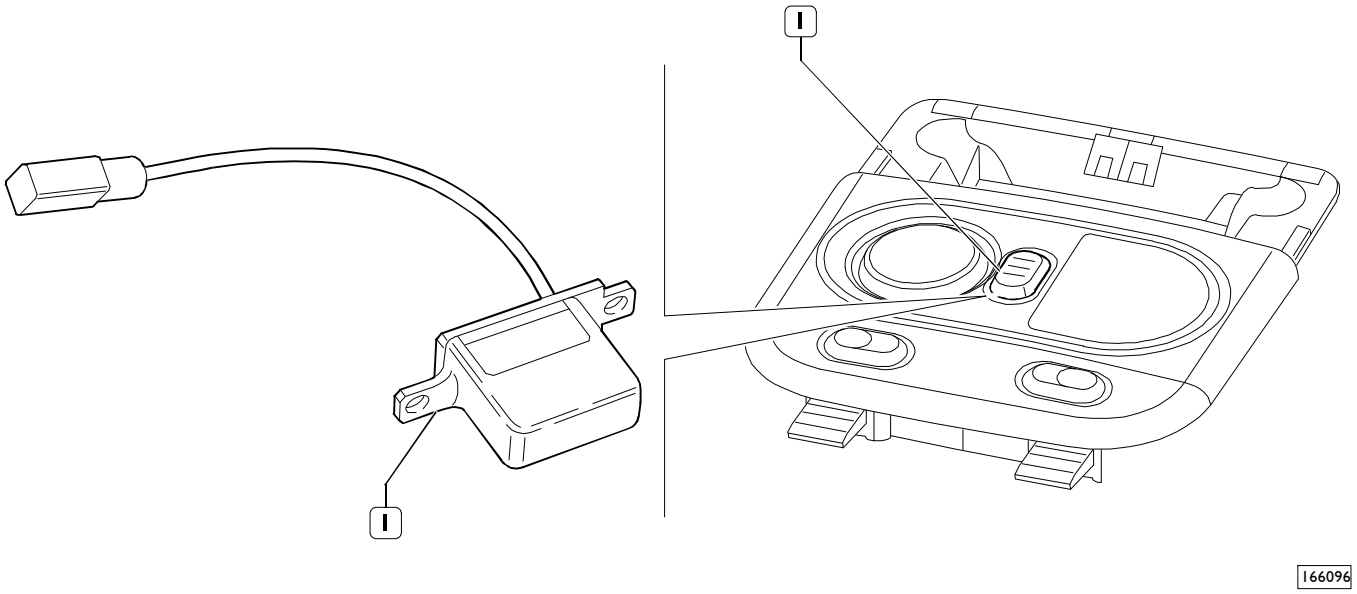
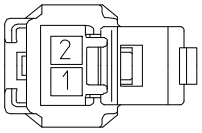
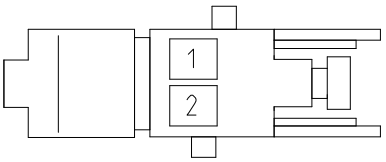


Figure 5.28



Blue&Me microphone

Table 5.7

Pin	Description	Cable		
1	Ground	White		
2	Signal + Vdc	Shielded	Cab cable	Convergence cable

The microphone connector, cab side cable, is with the associated connectors on the ceiling fitting.

GPS reception and satellite navigation equipment

The transmitter part of the equipment must be installed in a flat, dry area, separate from the vehicle's electronic components and away from damp and vibrations.

The GPS antenna must be installed so as to have the maximum visibility possible of the sky.

In fact, as the signals received from the satellite are at very low power (around 136dBm), almost any obstacle can influence the quality and performance of the receiver.

The following should therefore be guaranteed:

- an absolute minimum angle of vision of the sky of 90°,
- a distance no less than 30 cm from any other antenna,
- a horizontal position that is never underneath any metal making up part of the cab structure.

Moreover:

- the SWR ratio (Standing Wave Ratio) must be as close as possible to the unit (1.5 is recommended) while the maximum must not be greater than 2 in the GPS frequency range (1575.42 ± 1.023 MHz).
- the ANTENNA GAIN values must be as high as possible and guarantee a sufficient level of spatial uniformity, characterised by deviations in relation to the average value of the order of 1.5 dB in the 1575.42 ± 1.023 MHz band.

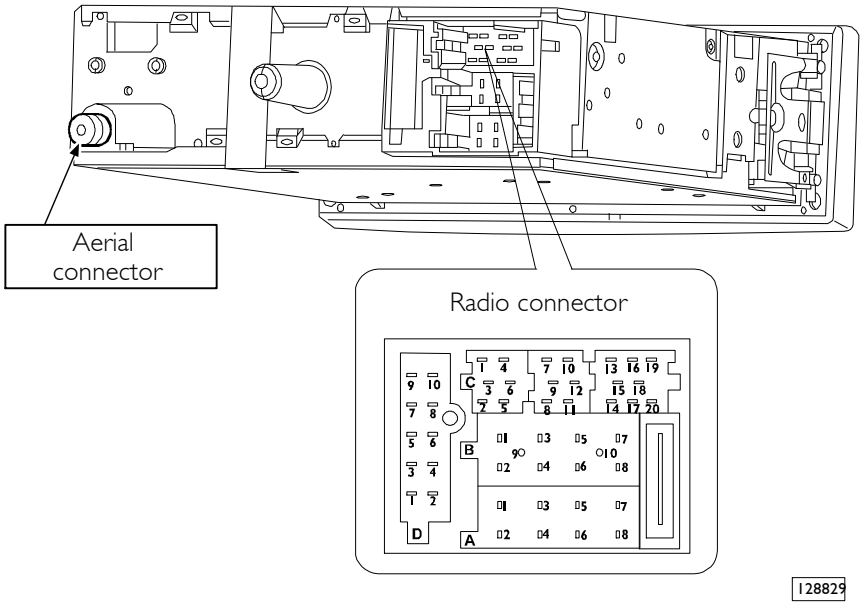
Car radio installation

The original equipment (or aftermarket) IVECO car radio is integrated into the system on the CAN network and allows:

- message repetition to comfort control panel;
- volume adjustment according to vehicle speed;
- integration with Convergence V2 system;
- integration with the Blue&Me system;
- recognition/antitheft system with Body Computer.

Car radios of other types do not allow access to the previous functions.
The pins available for the installation are listed in fig. 5.29.

Figure 5.29



Box pin	Description
A 1	CAN-B (CAN-H)
A 2	NC
A 3	CAN-A (CAN-L)
A 4	Permanent 12V (KL 30)
A 5	Automatic Antenna
A 6	NC
A 7	NC
A 8	GND (KL31)
B 1	LS RR +
B 2	LS RR -
B 3	LS RF +
B 4	LS RF -
B 5	LS LF +
B 6	LS LF -
B 7	LS LR +
B 8	LS LR -
B 9	MAUS Bus out
B 10	MAUS Bus in

5.4.4 Additional equipment

Power for the equipment, when the voltage required is different to that for the system, must be obtained using a suitable DC/DC 12 - 24 V convertor if not already provided. The power cables must be as short as possible, avoiding any twists (coils) and maintaining the minimum distance from the reference plane.

If devices are fitted that could interact with the electronic systems already present (Retarders, Extra heaters, Power take-offs, Air conditioners, Automatic transmissions, Telematics and Speed limiters) contact IVECO to optimise the application.

NOTE **For the operations which might cause interference with the basic system, it is necessary to carry out diagnostic checks in order to make sure that the system has been properly fitted. These tests can be carried out using on-board diagnostic ECUs (Electronic Control Units) or IVECO service.**

IVECO reserves the right to void vehicle warranty if work is carried out in a way which does not comply with IVECO directives.

Using receiving-transmitting devices not approved or fitting auxiliary amplifiers may seriously affect correct operation of the electric/electronic units fitted to the vehicle, with adverse effects on the vehicle and/or driver safety.

Any damage to the system caused by the use of receiving-transmitting units not approved or the addition of auxiliary amplifiers shall not be covered by the warranty.

The vehicle system is designed to supply the power necessary for the equipment supplied, to each piece of equipment, as required by their respective functions, and specific protection and correct sizing of the cables is ensured.

Suitable protection must be provided for supplementary equipment used and the equipment must not overload the vehicle system.

The ground connection for additional users must be carried out with an adequate section of cable, as short as possible and created so as to allow any movement of the additional equipment in relation to the vehicle chassis.

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

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

Supplementary batteries

The insertion of a supplementary battery into the vehicle circuit requires a separate charging system, integrated with that of the vehicle. In this case, supplementary batteries must be provided with an equal capacity to those fitted originally (110 Ah) for correct charging of all the batteries.

If the supplementary battery is installed, it is possible to use:

a) recombination batteries (AGM or gel)

b) traditional batteries.

In both cases, the battery must be completely separated from the occupants in the vehicle. A suitable air tight container could be used in case of:

- vapour escape (e.g. in case of alternator voltage regulator failure);
- battery explosion;
- electrolyte leaks, even in case of vehicle overturning.

In the event that type a) batteries are used:

- a vent to the passenger compartment exterior shall be provided.

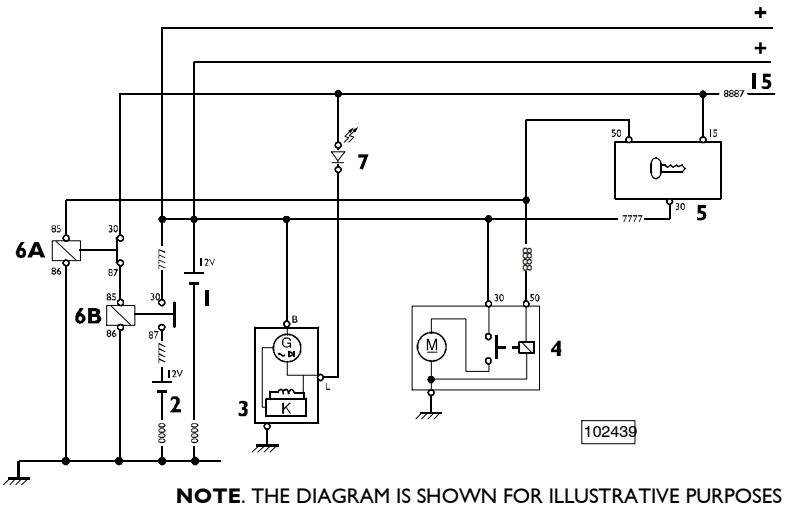
In the event that type b) batteries are installed, the batteries shall be equipped with:

- a cover with a system for blowing the gas off to the outside, fitted with tube for conveying the acid spray to the outside;
- a flame anti-return system by means of a porous pellet (flame arrester).

Moreover, gas escape shall take place far from points liable to spark ignition as well as mechanic/electric/electronic members and parts. The exhaust shall be positioned in such a way that vacuum shall not be generated inside the battery.

Ground connection of the added battery shall be made by using a cable of adequate section, as short as possible.

Figure 5.30



NOTE. THE DIAGRAM IS SHOWN FOR ILLUSTRATIVE PURPOSES ONLY

1. Standard battery - 2. Auxiliary battery - 3. Alternator with built-in regulator - 4. Starting motor - 5. Ignition key - 6A. Load excluder contactor during start-up - 6B. Battery cut-off for supplementary battery - 7. No battery recharge warning light

All the lines downstream all the batteries shall be adequately protected, under any possible fault condition. Failure to ensure adequate protection may pose a fire hazard and a danger to the persons.

Auxiliary alternators

Suitable protection must be provided for supplementary equipment used and the equipment must not overload the vehicle system.

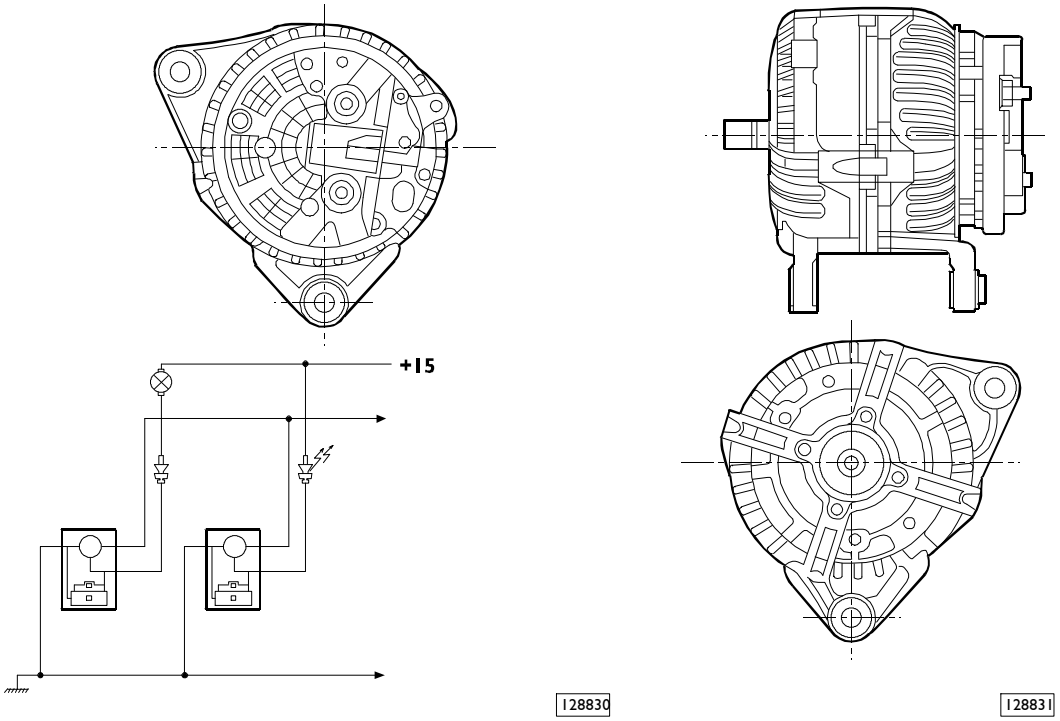
In cases when it is necessary to use an additional battery in parallel to the standard one, it is recommended that a larger alternator is used, or an additional alternator is fitted.

The additional alternators must be the type with rectifiers with Zener diodes to avoid damage to the electric/electronic equipment, due to accidental removal of the batteries. Each alternator must also have a no battery charging warning light or led.

The auxiliary alternator shall feature the same characteristics as the standard one, and the cables shall be properly dimensioned.

If it is necessary to make modifications to the system that are different to those described in this manual (for example, the addition of more batteries in parallel), the operation must be shared with IVECO.

Figure 5.31

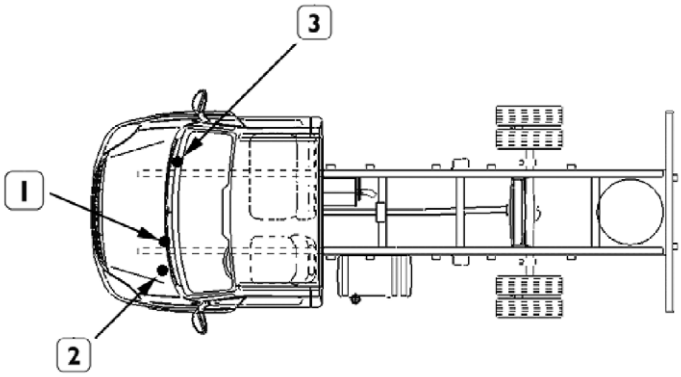


NOTE. THE DIAGRAM IS SHOWN FOR ILLUSTRATIVE PURPOSES ONLY

5.4.5 Current drawing

The following gives information related to the points where it is possible to draw off the available power and the instructions to observe.

Figure 5.32



1. Bodybuilders node - 2. Passage of wires between cab/engine compartment - 3. Bodybuilders' connector (cab interior)

Drawing current from CBA (on battery)

The battery is fitted with a control unit to deliver the positive (+) and protect the services (CBA).

Figure 5.33

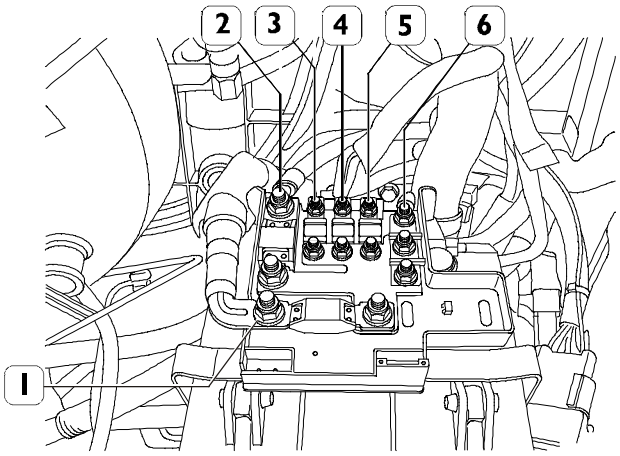


Table 5.8

Ref.	Function	Fuse rating (A)	Cable section (mm^2)
1	+30 positive from F75 for starter motor, alternator and retarder (if present)	500	50 or 35
2	+30 positive from F70 for SCM BUS-BAR	150	35
3	+30 positive from F73 for pre-heating glow plugs	60	10
4	+30 positive from F72 for braking node	40	4
5	+30 positive from F71 for 1st Body Computer power	80	16
6	+30 positive to F64 in SCM/A for IBS sensor for Stop & Start	-	4

Precautions

In general it is wise to:

- where necessary use appropriate fuses that can be fitted near the tap;
- protect the added cables in special sheaths or corrugation, installing them in compliance with point 5.4.6.

And in fitting the CBA it is necessary to:

- avoid removing fuses from their position;
- insert the terminals into the studs and secure them using the special nuts (M5 flanged nut, self-locking, etc.) tightened to torque (4 ÷ 6 Nm);
- then fix the CFO control unit (optional fuse control unit) to the CBA control unit, as in Figure 5.34, fitting the hole of the strip on the stud bolt of the battery terminal (no. 6, incorporated in the CBA of Figure 5.33) and tightening the special nut to the required torque (8.8 ÷ 13.2 Nm).

Figure 5.34

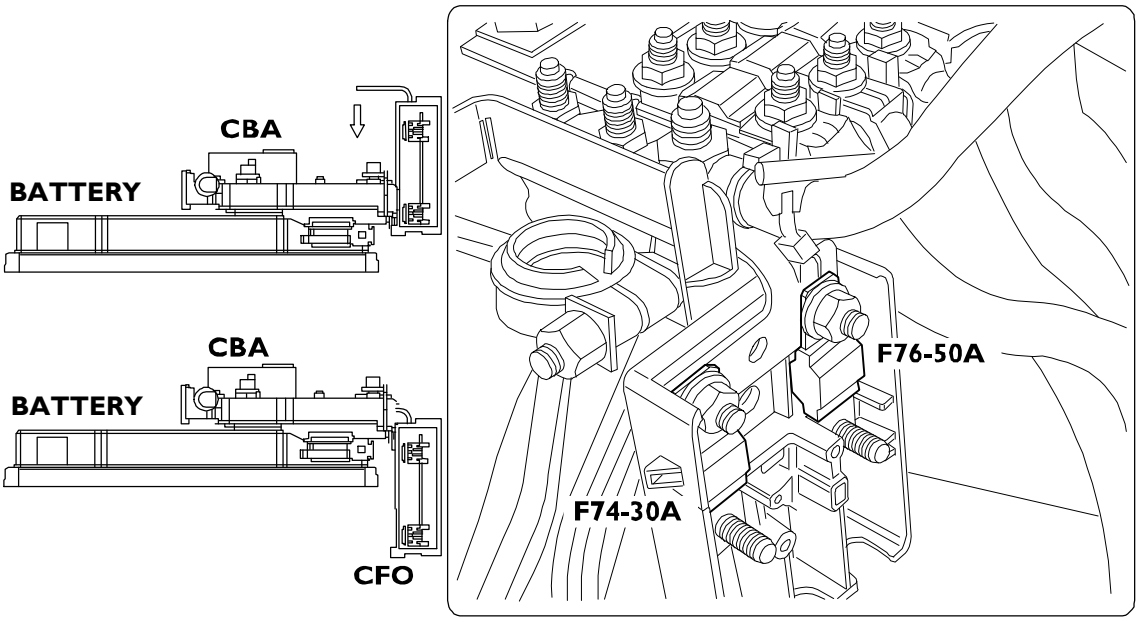
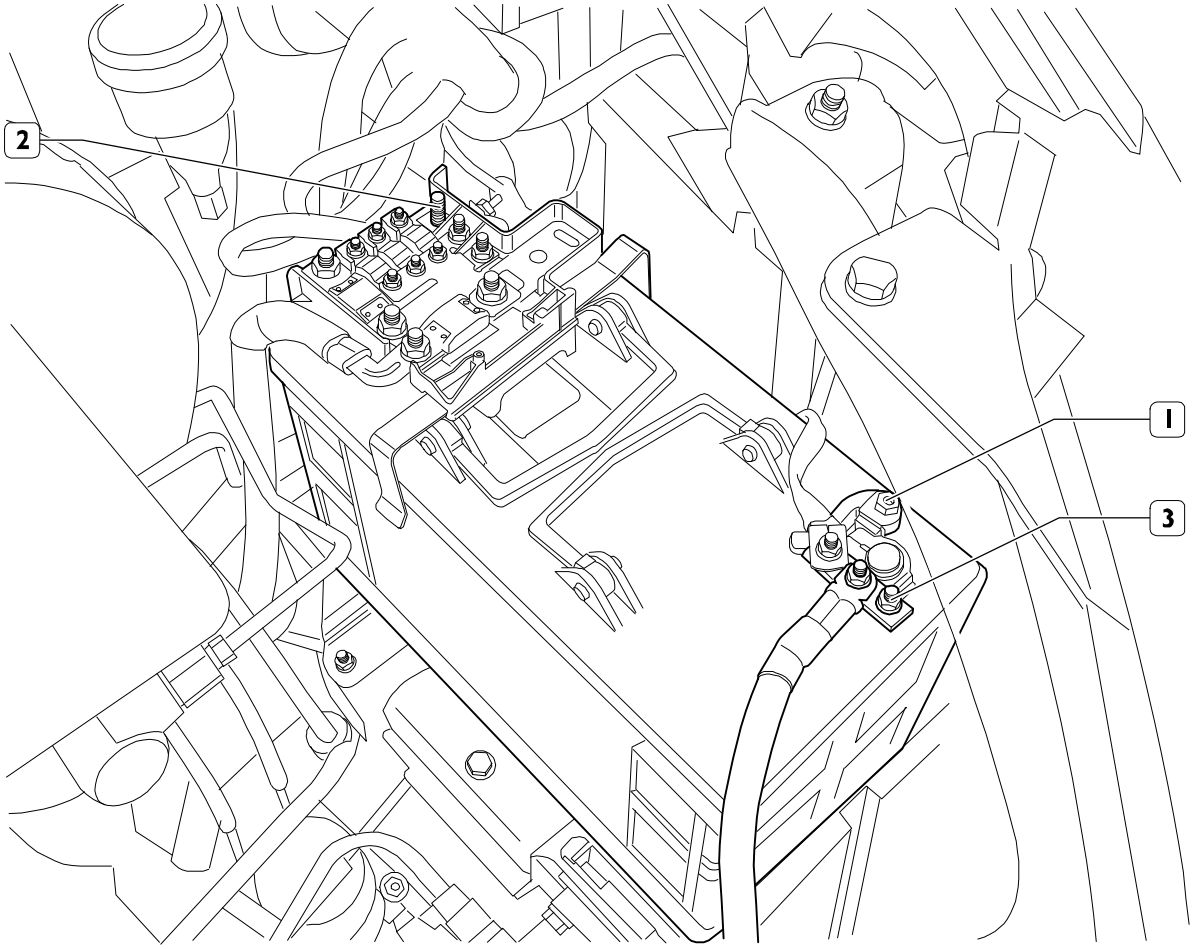


Table 5.9

CFO	Power	Protection	Presence		Capacity	Type	EURO5 4x2	EUROV 4x2	BIFUEL
			S	OPT					
F74	30	Bodybuilder socket 1	X		50	C0	X	X	X
F76	30	Bodybuilder socket 1	X		50	C0	X	X	X

The only points (2) and (3) from which current may be taken are shown in the figure. It is absolutely prohibited to take current from points that are not shown.

Figure 5.35



1. Lever for fast disconnection of battery negative terminal (-) from the electrical system - 2-3. Only current take-off points

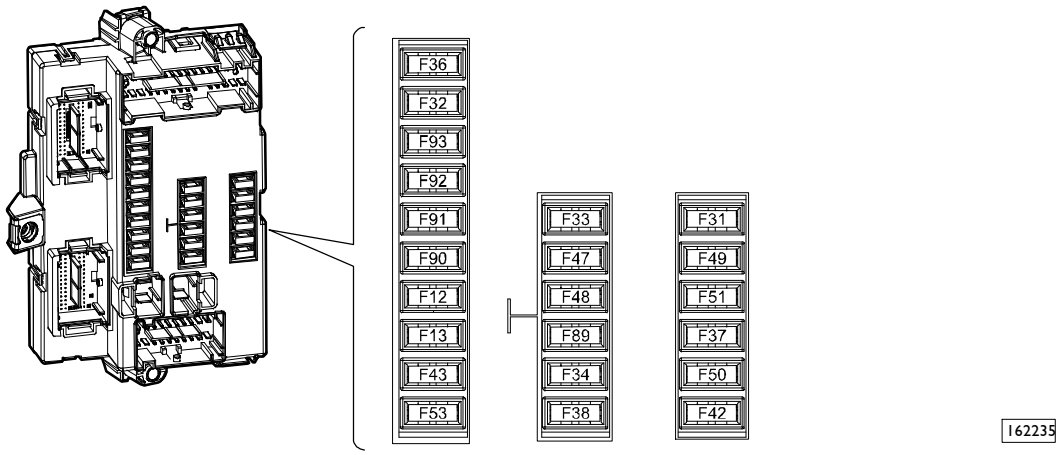
To secure the additional terminal on the free pin (M6) of the negative battery terminal (3), tighten the nut with a tightening torque of 5.5 Nm.

It is absolutely forbidden to draw power from unauthorized points.
RISK OF FIRE.

Fuse and relay box under the dashboard

Located in a special compartment, shut in a fitted drawer, it is on the left side of the dashboard.
The fuse layout is shown in fig. 5.36 (the relays are not visible).

Figure 5.36



List of fuses under the dashboard:

Table 5.10

BC	Power	Protection	Presence		Capacity	Type	EURO5 4x2	EUROV 4x2	BIFUEL
			S	OPT					
F12	30	T1b relay (30-87) for right low beam headlight	X		7,5	A0	X	X	X
F13	30	T1a relay (30-87) for left low beam headlight - headlight adjuster	X		7,5	A0	X	X	X
F31	15/A	T54 relay (86) for headlight washers and T50 - T51 - T52 - T53 - eln motors and controls for electric windows	X		5	A0	X	X	X
F32	30	T44 relay (30-86) for battery removal with minimum voltage - internal lighting	X		7,5	A0	X	X	X
F33	30	outswinging door	X		15	A0	X	X	X
F34	30	fitter socket	X		20	A0	X	X	X
F36	30	T20 relay for MODUS car radio - tachograph - convergence - siren - parking sensor	X		15	A0	X	X	X
F37	15	instrument panel - stop lights - trailer socket	X		7,5	A0	X	X	X
F38	30	central locking		X	20	A0	X	X	X
F42	15	ABS9 or ESP9	X		5	A0	X	X	X
F43	30	T23a relay (86-87) for windscreen washer and T23b relay (86-87)	X		20	A0	X	X	X
F47	30	T25a relay (86-87) and T25b (86-87) for driver's side electric window		X	25	A0	X	X	X
F48	30	T26a relay (86-87) and T26b (86-87) for passenger side electric window		X	25	A0	X	X	X
F49	15	control panel - tachograph - exp. module - fitter socket - ASR control - Telma (coil) - video camera - outswinging - rear differential lock	X		5	A0	X	X	X
F50	15	airbag		X	5	A0	X	X	X
F51	15	green filter - car radio - toe-in - parking sensors - CAF			5	A0	X	X	X
F53	30	instrument panel - timer for supplementary heater	X		5	A0	X	X	X
F89		AVAILABLE				A0			
F90	30	T11a relay (30-86) for left full beam headlight	X		7,5	A0	X	X	X
F91	30	T11b relay (30-86) for right high beam headlight	X		7,5	A0	X	X	X
F92	30	T12a relay (30-86) for left foglight	X		7,5	A0	X	X	X
F93	30	T12b relay (30-86) for right foglight	X		7,5	A0	X	X	X

List of relays under the dashboard:

Table 5.11

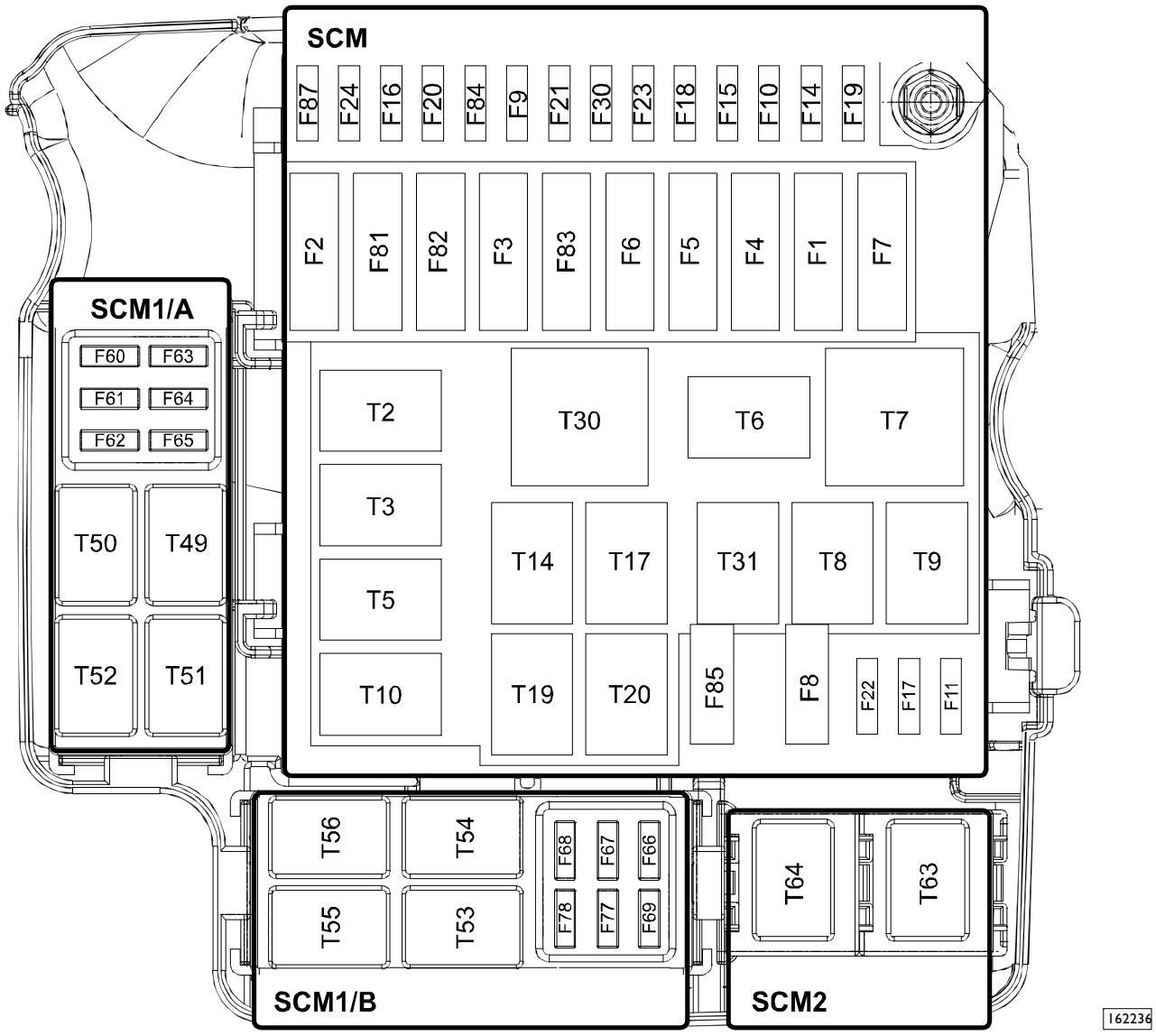
BC	Power	Protection	Presence		Capacity	Type	EURO5 4x2	EUROV 4x2	BIFUEL
			S	OPT					
T01a	30	left low beam headlight - headlight adjuster	X				X	X	X
T01b	30	right low beam headlight	X				X	X	X
T11a	30	left high beam headlight	X				X	X	X
T11b	30	right high beam headlight	X				X	X	X
T12a	30	left foglight	X				X	X	X
T12b	30	right foglight	X				X	X	X
T23a	30	windscreen washer	X				X	X	X
T25a		driver's side electric window UP		X			X	X	X
T25b		driver's side electric window DOWN		X			X	X	X
T26a		passenger side electric window UP		X			X	X	X
T26b		passenger side electric window DOWN		X			X	X	X
T37a		rear doors central closing		X			X	X	X
T37b		central closing (common)		X			X	X	X
T37c		side doors central closing		X			X	X	X
T37d		rear door central closing		X			X	X	X
T44	30	battery removal with minimum voltage	X				X	X	X

Only use fuses of the type and with the rated current prescribed.
DANGER OF FIRE.

Only replace the fuses after having eliminated the cause of them blowing and checked the integrity of the cables.

Fuse box and relay in engine compartment

Figure 5.37



SCM fuse list:

Table 5.12

SCM	Power	Protection	Presence		Capacity	Type	EURO5 4x2	EUROV 4x2	BIFUEL
			S	OPT					
F01	30	air suspensions		X	40	B	X	X	X
F02	30	ignition switch	X		30	B	X	X	X
F03	30	cab climate control fans and engine coolant supplementary heater		X	40	B	X	X	X
F04	30	braking system (valves)	X		30	B	X	X	X
F05	30	air suspensions		X	40	B	X	X	X
F06	30	SCM1/A - SCM1/B - SCM2 power supply	X		40	B	X	X	X
F07	30	T7 relay (30-87) for power discharge from ignition switch	X		40	B	X	X	X
F08	30	T8 relay (30-87) for fuel pump	X		15	A	X	X	X
F09	30	automatic transmission	X		30	A0	X	X	
F10	30	T64 relay (30-87) for heated exterior mirrors and heated windscreen		X	15	A0	X	X	X
F11		EDC F1A (primary loads) from MAIN RELAY	X		15	A0	X	X	
		injectors (CNG)							X
F14	30	automatic transmission - MAIN RELAY T9 (86)	X		10	A0	X	X	X
F15	30	T2 relay (30-87) for BOSCH cooling pump	X		10	A0	X	X	
F16	15/A	cigarette lighter from T7	X		15	A0	X	X	X
F17		EDC F1C (secondary loads) from MAIN RELAY	X		10	A0	X	X	
		Smart Drive Unit (CNG)			15				X
F18	30	rear differential lock		X	30	A0	X	X	X
F19	30	T6 relay (30-87) for horn	X		7,5	A0	X	X	X
F20	30	13 pin socket	X		10	A0	X	X	X
F21	30	T14 relay (30) for cylinder solenoid valves (CNG)	X		7,5	A0			X
F22		EDC F1A and F1C (primary loads) from MAIN RELAY - lambda probe	X		20	A0	X	X	
		waste gate (CNG) - lambda probes (CNG)			15				X
F23	30	T19 relay (30-87) for wipers	X		30	A0	X	X	X
F24	15/A	power socket from T7	X		15	A0	X	X	X
F30	30	T3 relay (30-87) for side marker lamps	X		7,5	A0	X	X	X
F81	30	automatic transmission	X		30	B	X	X	X
F82	30	body computer 2nd power	X		70	B	X	X	X
F83	30	T30 relay (30-87) for heating fans inside cab	X		40	B	X	X	X
F84	30	T5 and T14 relays for Baruffaldi coupling	X		7,5	A0	X		
		solenoid valve power for the cylinders			15				X
F85	30	T31 relay (30-87) for fuel filter and sediment filter heater		X	25	A	X	X	
F87	15	EDC - automatic transmission	X		5	A0	X	X	
		5SF - automatic transmission							X

SCM relay list:

Table 5.13

SCM	Power	Protection	Presence		Capacity	Type	EURO5 4x2	EUROV 4x2	BIFUEL
			S	OPT					
T02		BOSCH cooling pump	X		20		X	X	
		Baruffaldi coupling from trinary (CNG)		X					X
T03		side marker lamps	X		30		X	X	X
T05		1st gear Baruffaldi coupling	X		30		X	X	X
T06		horn	X		20		X	X	X
T07		power discharge from ignition switch	X		50		X	X	X
T08		fuel pump	X		20		X	X	X
T09		MAIN RELAY	X		30		X	X	X
T10		engine start-up prevention	X		30		X	X	X
T14		2nd gear Baruffaldi coupling	X		20		X	X	
		cylinder solenoid valves (CNG)							X
T17		windscreen wiper 1st or 2nd speed	X		10/20		X	X	X
T19		windscreen wiper speed activation	X		10/20		X	X	X
T20		diagnostics with MODUS	X		20		X	X	X
T30		cab heating fans	X		50		X	X	X
T31		fuel filter heater and sediment filter	X		30		X	X	X

SCM1/A fuse and relay list:

Table 5.14

SCM1/A	Power	Protection	Presence		Capacity	Type	EURO5 4x2	EUROV 4x2	BIFUEL
			S	OPT					
F60	30	supplementary climate control		X	30	A0	X	X	X
F61	30	T51 relay (30-87) for air conditioner compressor		X	7,5	A0	X	X	X
F62	30	T52 relay (30-87) for right heated rear window		X	10	A0	X	X	X
F63	15	and left heated rear window blow-by - unit heater - T56 relay (86) for compressor		X	7,5	A0	X	X	X
F64	30	IBS sensor for Stop & Start	X		5	A0	X	X	X
F65	15/A	T7 relay (30-87) for heated seats		X	20	A0	X	X	X

SCM1/A	Power	Protection	Presence		Capacity	Type	EURO5 4x2	EUROV 4x2	BIFUEL
			S	OPT					
T49		stop & start	X		30		X	X	X
T50		AVAILABLE							
T51		compressor activation from climate control		X	20		X	X	X
T52		heated rear windows		X	20		X	X	X

SCM1/B fuse and relay list:

Table 5.15

SCM1/B	Power	Protection	Presence		Capacity	Type	EURO5 4x2	EUROV 4x2	BIFUEL
			S	OPT					
F66	30	T54 relay (30-87) for headlight washers		X	15	A0	X	X	X
F67		AVAILABLE				A0			
F68		AVAILABLE				A0			
F69	30	optional 4448 for bus		X	5	A0	X	X	
F77		AVAILABLE				A0			
F78		AVAILABLE				A0			

SCM1/B	Power	Protection	Presence		Capacity	Type	EURO5 4x2	EUROV 4x2	BIFUEL
			S	OPT					
T53		unit heater		X	20		X	X	X
T54		headlight washers		X	20		X	X	X
T55		power take-off		X	10/20		X	X	X
T56		stop lights with TELMA retarder activated		X	10/20		X	X	X

SCM2 relay list:

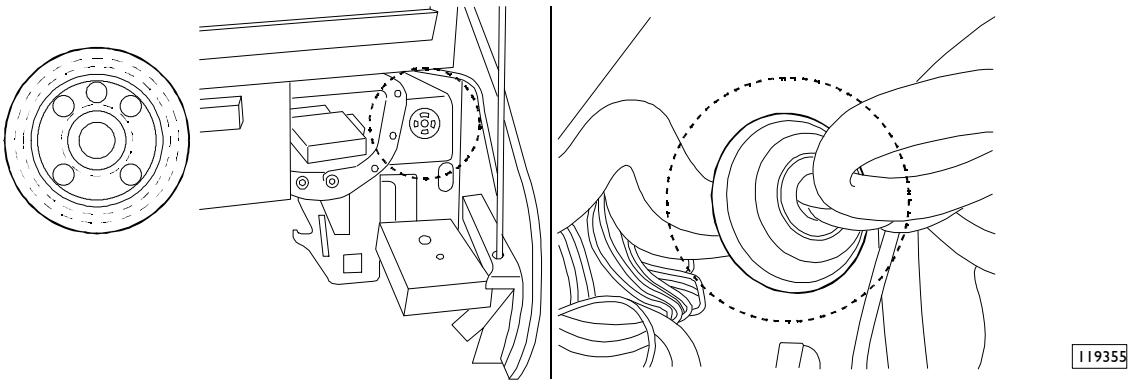
Table 5.16

SCM2	Power	Protection	Presence		Capacity	Type	EURO5 4x2	EUROV 4x2	BIFUEL
			S	OPT					
T63		AVAILABLE							
T64		external heated mirrors - heated windscreen		X	20		X	X	X

Passing cables from inside the cab to outside

Electric cables may be passed from outside the cab to the engine compartment through five 10 mm diameter holes stamped in the bulkhead coupling near the brake servo. Seal the cable routing point to prevent fumes passing from the engine compartment to the cabin.

Figure 5.38



Any damage caused by failure to comply with procedure is not covered by the warranty.

5.4.6 Additional Circuits

They must be separate and protected from the main vehicle circuit with a suitable fuse.
The cables used must be of a suitable size for their use and must be well isolated. They must be properly protected in sheaths (not in PVC) or in corrugated pipe ducting in the case of more functions (polyamide type 6 material is recommended for the corrugated pipe) and they must be correctly installed, **away from impacts and heat sources**. **Take care to avoid any chaffing with other components, particularly with live edges of the bodywork.** When passing them through structural components (cross members, profiles, etc.), suitable cable raceways or protection must be provided; they must be secured separately with isolating cable clips (e.g. nylon) at appropriate intervals (approx. 200 mm). It is forbidden to drill holes in the chassis and/or bodywork for passing cables through.
In the case of external panels use a suitable sealant on both the cable and on the panel, to avoid the risk of infiltration of water, dust, or fumes.
Establish suitable distance between electrical wiring harnesses and other components as follows:
- 10 mm from static components;
- 50 mm from moving components (minimum distance = 20 mm);
- 150 mm from components that generate heat (e.g. engine exhaust).

Wherever possible it is good practice to follow a different cable route for signal cables interfering at high absorbed intensity (e.g. electric motors, solenoid valves) and signals that are susceptible to low absorbed intensities such as sensors, maintaining in any event a position as close as possible to the metal structure of the vehicle in both cases.
The plug connections and terminals must be protected and weather resistant, by using the same type of component as that originally used on the vehicle.
Use cables and fuses with the characteristics shown in the following table in accordance with the current draw:

Table 5.17

Max. continuous current [1] (A)	Cable cross-section (mm^2)	Fuse capacity [2] (A)
0 ÷ 4	0.5	5
4 ÷ 8	1	10
8 ÷ 16	2.5	20
16 ÷ 25	4	30
25 ÷ 33	6	40
33 ÷ 40	10	50
40 ÷ 60	16	70
60 ÷ 80	25	100
80 ÷ 100	35	125
100 ÷ 140	50	150

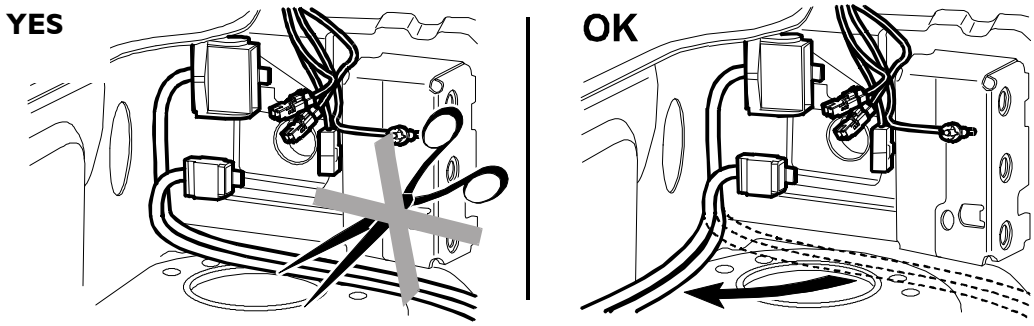
[1] For uses of more than 30 seconds.
[2] Depending on the position and hence the temperature that may be reached in the housing, choose fuses that can be loaded to up to 70% - 80% of their maximum capacity.

The fuse must be connected as close as possible to the current take-off point.

Precautions

- Incorrect installation of electrical accessories may affect occupant safety and cause severe damage to the vehicle. Contact IVECO if you have any questions.
- Avoid coupling with signal transmission cables (e.g. ABS), for which a preferential path has been defined for electromagnetic requirements (EMI).
  It should be noted that when grouping several cables together, in order to compensate for the lower heat dispersal capacity current intensity must be reduced with respect to the nominal value of a single cable.
- In vehicles with frequent engine start-ups, with limited current drawn and engine rotations (e.g. vehicles with refrigeration chambers), provide for periodic battery charging to maintain efficiency.
- The connections with plugs and terminals shall be of the protected, weather-proof type. Components of the same type as the one originally fitted to the vehicle shall be used.
- Whenever various applications or modifications should require assemblies (various components etc.) to be moved, this is permissible on the condition that their functionality is not compromised, that the original type of connection is restored and that their transverse position on the chassis is not substantially changed when required by their weight.
- In the event that a component has be installed just next to the route of a cable belonging to the original system, or a cable route needs be changed, the same can be relocated provided that its integrity is maintained (cuts shall not be made).

Figure 5.39



Any damage caused by the failure to comply with the procedure shall not be covered by the warranty.

5.4.7 Harness Modifications due to Changes to Wheelbase or Overhang

If cable length on the frame is altered due to a new 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 far as electronic control device function is concerned, no joins are permitted: the cable must be rep laced by a new cable with the same specifications as that used on the vehicle, and of appropriate length.

5.4.8 Provision for trailer

If the tail-lights are repeated on the trailer, fit the vehicle with a 13-pin trailer point.

It is not permitted to connect directly to the original equipment tail-light lights. Connection to the original vehicle tail-lights could cause current overloads that will be indicated by the on-board computer as operating faults.

If it is necessary to make changes to the system other than those described in this manual (e.g. inclusion of LED lights), the operation must be carried out in conjunction with Iveco.

a) Trailer connector added by the Bodybuilder

If the vehicle is not ordered with a trailer point, a set may be ordered from parts. This consists of:

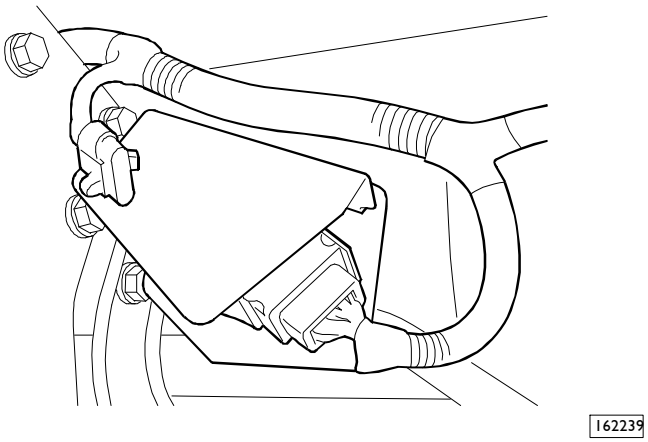
- electronic control unit;
- ECU mounting bracket with guard;
- chassis cable with provision for trailer;
- rear bridle for trailer socket.

Installation

For correct installation it is necessary to:

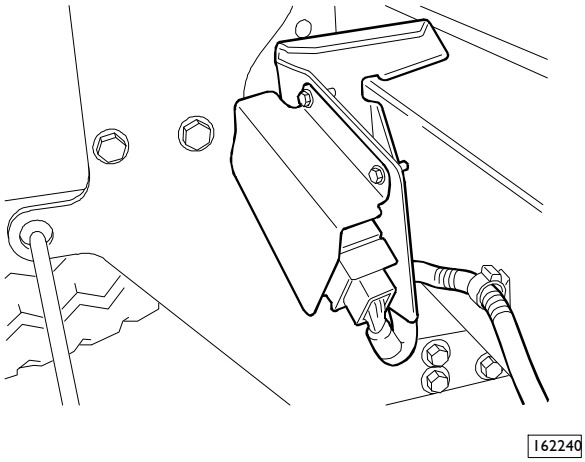
- mount the ECU on the bracket; also fit the guard on the cab;
- fit the bracket unit and the ECU on the chassis, as shown in figg. 5.40 - 5.41;
- replace the chassis cable with the new one provided for the trailer socket - fig. 5.43;
- fit the connecting bridle for the 13 pin socket according to the type of hook (high or low) - fig. 5.42.

Figure 5.40



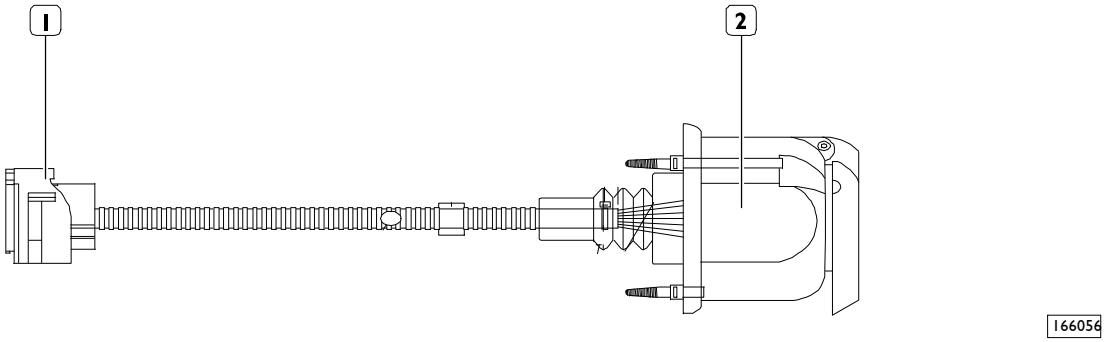
VAN - Rear View

Figure 5.41



CAB - Rear View

Figure 5.42



1. To be connected to the chassis cable - 2. 13 pin socket for trailer

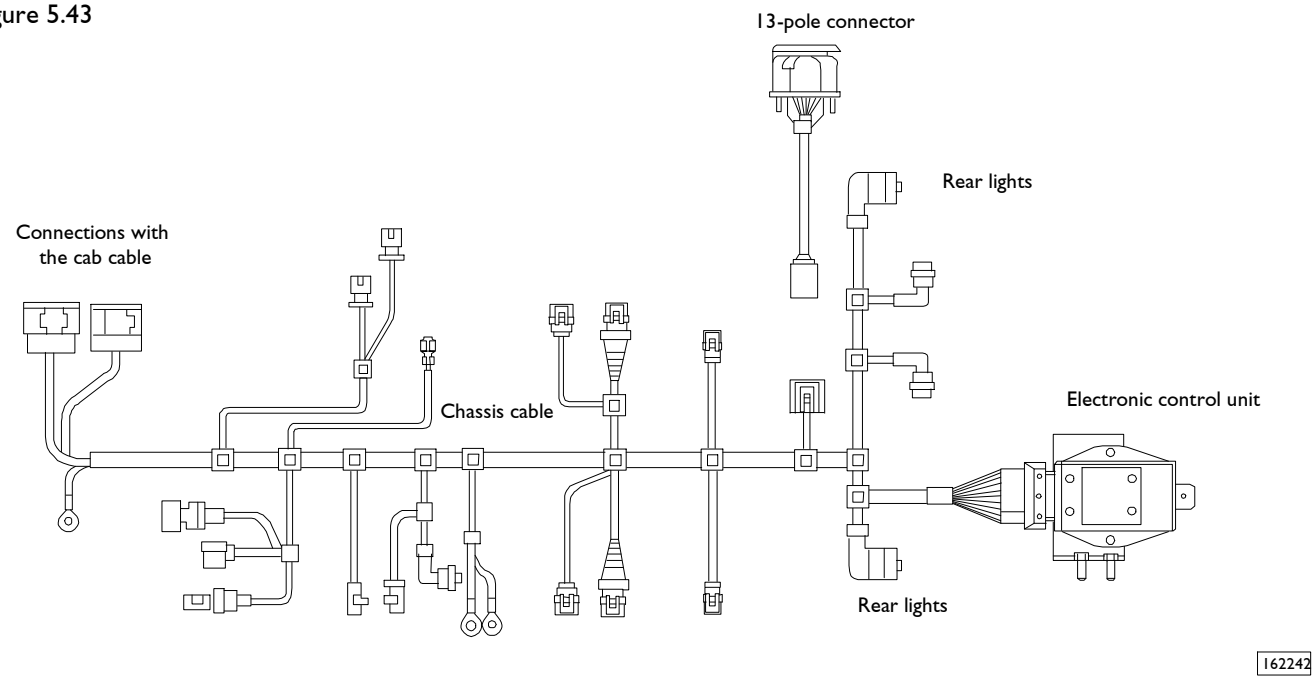
For more details on connections and assembling, ask IVECO for the wiring diagrams.

Any damage to the lighting system caused by the failure to comply with the above procedure shall not be covered by the warranty.

b) Factory-installed trailer connector (optional item 06520)

If the vehicle is ordered complete with the trailer connector, the full circuit will be delivered, which is made up of the electronic control unit (already fitted into place), the set chassis cable and the 13-pole connector.

Figure 5.43



Chassis cable with 13 pin socket and trailer ECU

NOTE The diagram is shown for illustrative purposes only.

Description of 13-pin interface

Table 5.18

13-pole connector pin	Cable no.	Description	Remarks
1	1120	Rear left turn indicator	1 bulbs (21 W- 12 V)
2	2283	Right rear direction indicator bulb	2 bulbs (21 W, 12 V)
3	0000	Ground	-
4	1125	Rear right turn indicator	1 bulb (21 W, 12 V)
5	3335	Front left and rear right parking light Left number plate light Left clearance light	3 bulbs (5 W, 12 V)
6	1175	Brake light power supply	2 bulbs (21 W, 12 V)
7	3334	Front right and rear left parking light. Right number plate light Right clearance light	3 bulbs (5 W, 12 V)
8	2268	Reversing light power supply	2 bulbs (21 W, 12 V)
9	7777	After fuse F23 on the CVM	Battery positive
10	8879	After fuse F16 on the CVM	Ignition-operated positive
11	0000	Ground	-
12	6676	Trailer connection signal (ground)	Signal to be supplied if the parking sensors are available
13	0000	Ground	-

5.4.9 Side Marker Lights

The local or EC standards in force in some countries lay down that the vehicles specially manufactured by the Bodybuilders should be fitted with side marker lights on the overall length of the vehicle itself.

The Daily range vehicles are equipped with specific terminals to make the electric connection required to power the side marker lights.

The external Bodybuilders shall take care to make the connections and install the lights on the respective added structures (boxes, vans, etc.).

To ensure the electrical properties of the female connector contacts remain unchanged over time, leave the cap provided by IVECO in place.

Below is an illustration of the position for the above terminal on the chassis-cab.

It is not possible to draw current from side parking lights.

Figure 5.44

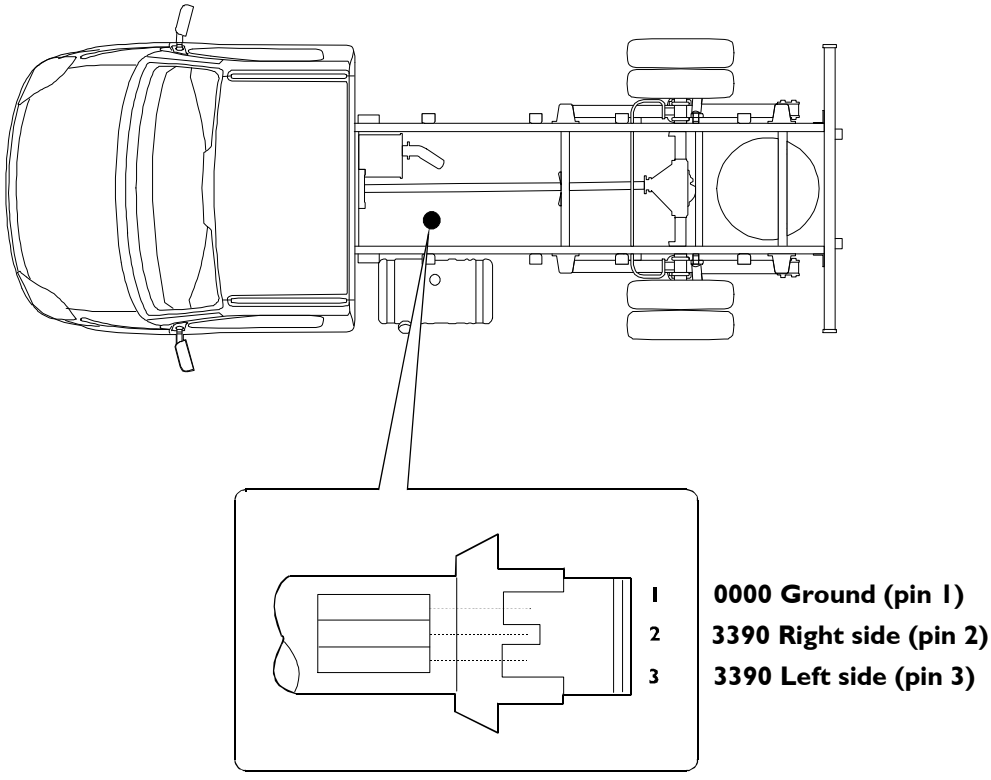


Table 5.19

Connector on the vehicle	IVECO code	Interface to be used	Part number	Quantity
Male connector	98435341	Female connector	98435344	1
		Half shell		1
		Cable terminal		3
		Gasket (rubber piece)		3
		Cap		1

Connector pin-out:

Table 5.20

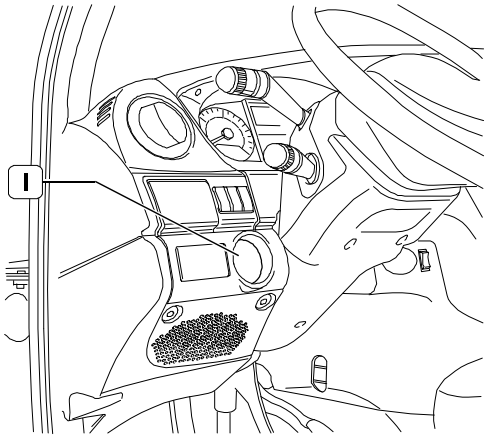
Pin	Cable code	Function	Cable section (mm^2)	Max. current (A)
1	0000	Ground	1	10
2	3390	Vehicle right-side marker lights	1	10
3	3390	Vehicle left-side marker lights	1	10

As regards the vehicles on which the side dimmers are not compulsorily required, the respective connectors are in any case available. In the event that the side dimmers need be installed, the vehicle shall be delivered to an IVECO service centre, in order to have the body computer enabled.
Side marker lights are compulsory for vehicles of total length greater than 6 m.

5.4.10 Operation of emergency control on dashboard (option)

The dashboard central emergency control is used in hazardous situations.

Figure 5.45



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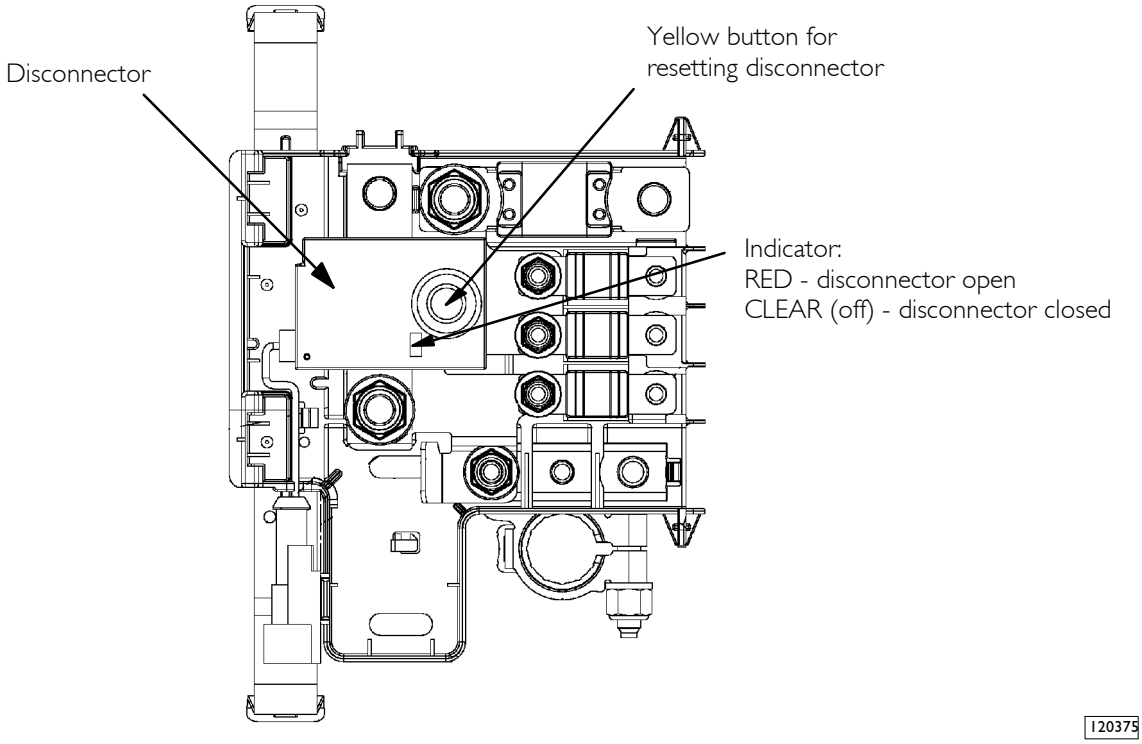
1. Emergency control

When the central emergency control on the dashboard is pressed, the vehicle behaves as follows:
- the engine goes off;
- the turn signals come on;
- the disconnector on the battery (CBA) operates to disable secondary loads;
- the locks are released and the turn and slide door opens (if an original IVECO part)
- the courtesy lights remain active
- the side lights go off and all loads are inhibited

Figure 5.46



Circuit breaker reset button and relative indicator on battery control unit (CBA)

To restore the vehicle to its original conditions:

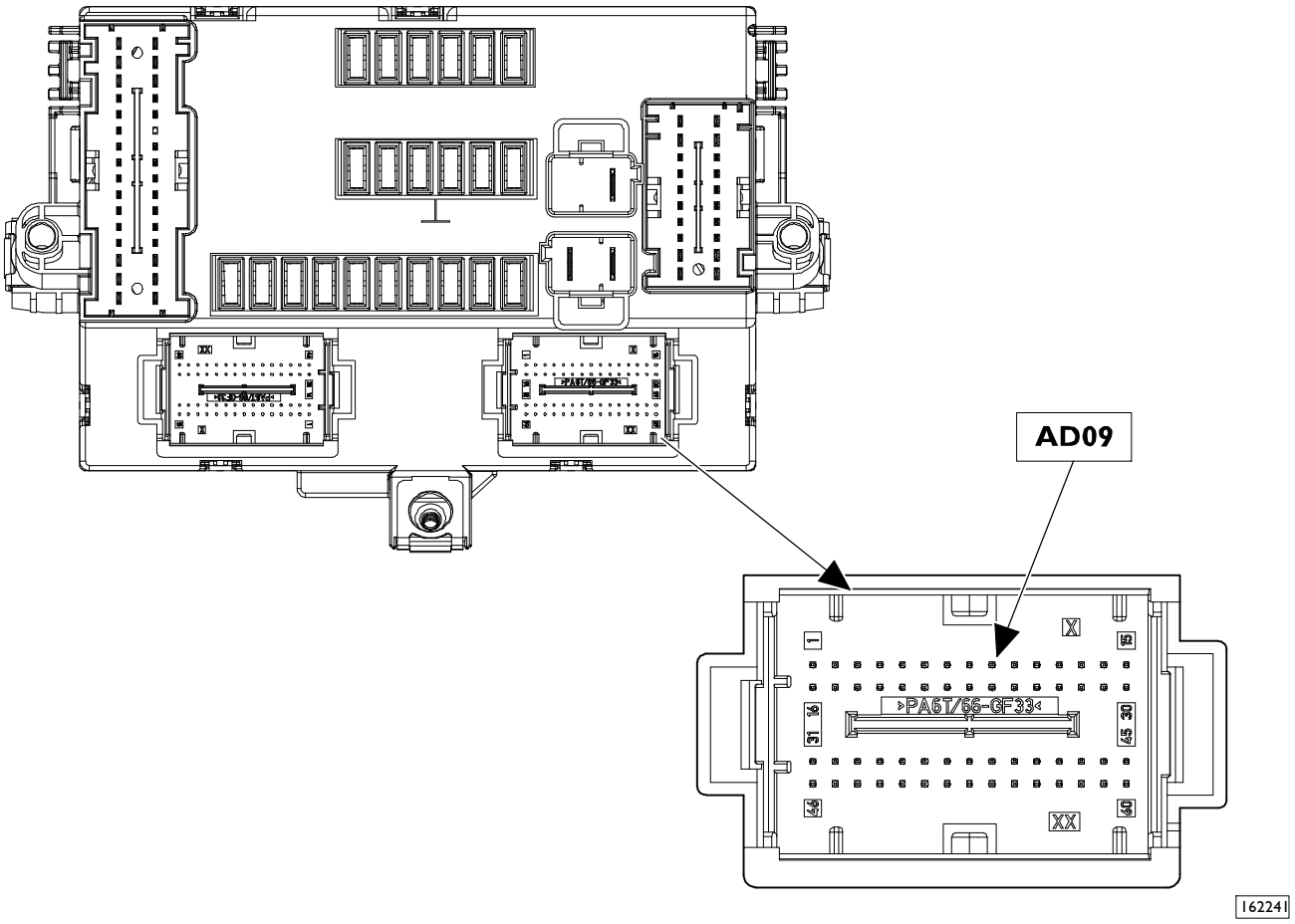
- press the central emergency control again;
- open the bonnet and press the yellow button on the CBA to reset to the disconnector;
- turn the key to STOP;
- re-start the vehicle.

External hazard control

In some cases, activation of the direction indicators is required according to the functioning of the version.

This functionality can be managed by supplying an unstable negative signal (via a button) to pin AD09 of connector D (see fig. 5.47) on the Body Computer.

Figure 5.47



APPENDIX A

Daily PASSENGER TRANSPORT

NOTE Keep to what is prescribed in the previous sections for everything not specified in this appendix.

A.1 Chassis

A.1.1 Transport

The chassis without the bodywork is not drivable and must therefore be transported using a transporter.

A.1.2 Lifting for transportation by ship, rail etc.

When the chassis must be loaded onto ships, railway freight trucks etc., it is essential that it be lifted by the axles or wheels only.

NOTE It is expressly forbidden to attach crane cables to the cross-pieces or side members.

The chassis must only be secured to the transporter by fastening the axles only, and the weight must only be supported by the wheels.

A.1.3 Delivery

The chassis is subjected to detailed quality checks prior to delivery.

At the time of delivery, the Bodybuilder must perform an inspection to check for missing materials or faults that may have occurred during transportation.

IVECO accepts no claims subsequent to delivery that are not recorded in the specific forms signed by the vehicle transporter.

The vehicle identification number must be quoted in any claims: this number may be found on the core of the right side-member, in the wheel arch near the suspension.

A.1.4 Storage

If the vehicle is to remain unused for a prolonged period of time, it is essential that it is protected in an effective manner, suitable for the environmental characteristics of the area.
The Bodybuilder is particularly responsible for protecting the instrument panel, batteries, fuse box and relays, etc., the lifespan and reliability of which must not be compromised.

A.1.5 Weights and weighing

The bodywork, position of the seats and the goods compartment must be designed without the total and individual axle permitted loads being exceeded.
To take into account the manufacturing tolerances, data relating to the weights of the models: 40C, 50C and 65C have a tolerance of ± 3%.
Therefore, prior to fitting, it is good practice to verify the vehicle weight (cab, van or chassis) and its distribution over the axles.

A.2 General rules for fixing the bodywork to the chassis

Particular attention should be paid to the joints between chassis components and the sides of the bodywork: since these joints must guarantee perfect transmission of forces.

At the same time, the localised application of forces resulting in high pressures at the joints should be avoided.

The structure of the bodywork must be designed as a load-bearing unit together with the chassis; bending, torsional and thrust stresses must be absorbed by the entire structure.

This is necessary due to the relative flexibility of the chassis. For further information, contact IVECO Quality Department.

Fittings may be fixed to bodywork by welding or using screws.
Mixed type joints are not recommended.
In any case, bodywork components must be fixed using sandwich plates.

A.3 Building the bodywork

This chapter provides instructions for assembling the bodywork, with the main technical aspects and regulations.
The definition of the bodywork is left to the Bodybuilder's decisions, according to requirements.

A.3.1 Main dimensions

For all vehicles, the entry and exit angles must be greater than or equal to 7°.

Construction of the bodywork must allow the vehicle turning circle parameters established in ECE Regulation 107 or the equivalent Regulations in force in the country where the registered vehicle will be on the road.

At the rear of each wheel, vehicles must be fitted with mudguards reaching a distance of 75 mm from the ground.

The configuration of the bodywork must allow inspection of the vehicle identification number.

A.3.2 Vehicle interior configuration and capacity

For all vehicle classes the surface area available for the number of seats must comply with the provisions of ECE Regulation 107 or the applicable regulations in the country of sale.

A.3.3 Characteristics of the driver's seat

Heating system

Provision of a sufficient output of hot air for demisting the windscreen is obligatory.

Sun visor

The driver must be able to make use of a sun visor, which must be capable of being adjusted in height and reversed while driving. A sun roller blind assembly or partial or fully tinted glass may also be fitted.

Driver's seat (if different from the one provided)

The height, angle and longitudinal distance of the steering wheel must be adjustable, and each of these adjustments must be independent. The seat must offer sufficient support and be covered with breathable material.

Driver station - ergonomics

In the case where the instrument unit supplied with the vehicle is disassembled and reassembled into a custom built dashboard, it is recommended the relative positions of the instruments and controls be maintained for optimal ergonomics.
In addition, since the dashboard supplied complies with the Directive in relation to "signals, controls and luminous dials", after each modification it will be necessary to verify this aspect and, if necessary, obtain new authorisation.
Care must be paid when fitting the driver side flooring and coverings so as not to restrict the movement of the pedals.

A.3.4 Requirements concerning the fire-proofing materials

The covering materials used inside the engine compartment must be inflammable and non-absorbent for fuel and lubricants, unless said material is coated with an impermeable layer.

The remainder of the materials used for the bodywork must be "flame retarder" or self-extinguishing, depending on the number of passengers that can be transported and/or the applicable regulations in the country for which the vehicle is intended.

Polyamide pipes or bundles of electrical cables passing close to hot parts of the engine (exhaust manifold or pipes, turbocharger etc.) must be protected by an aluminium or stainless steel screen covered with insulating material.

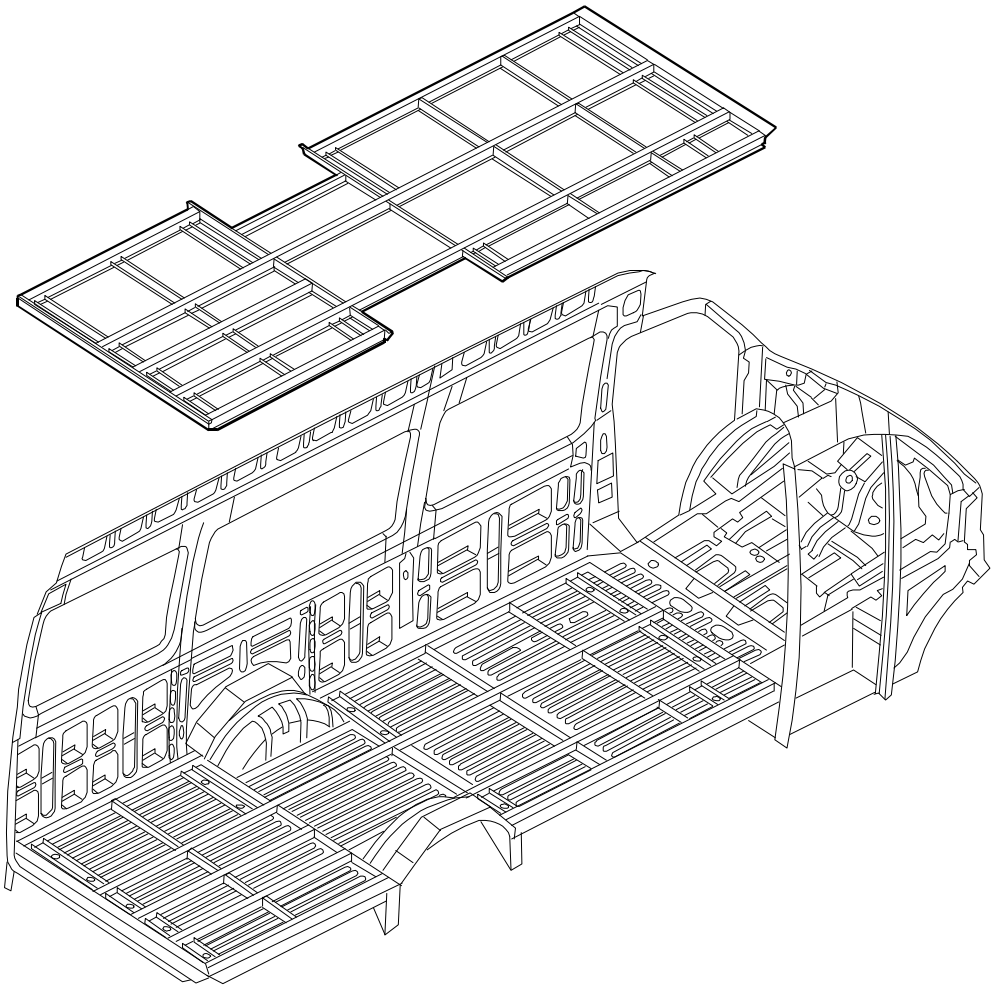
A.3.5 Seat supporting structures, and their fixing

Direct anchoring of the seats to the floor or the wheel arches is not permitted.

Therefore, a structure capable of distributing stress over the entire internal surface of the floor of the passenger compartment must be used; said structure must be made from 2 mm thick galvanised sheeting with plates of suitable thickness for the threading.

The following figures illustrate examples of the structures and the methods for fixing fixed and rail-mounted seats.

Figure A.1



Floor frame for fixing seats

Figure A.2

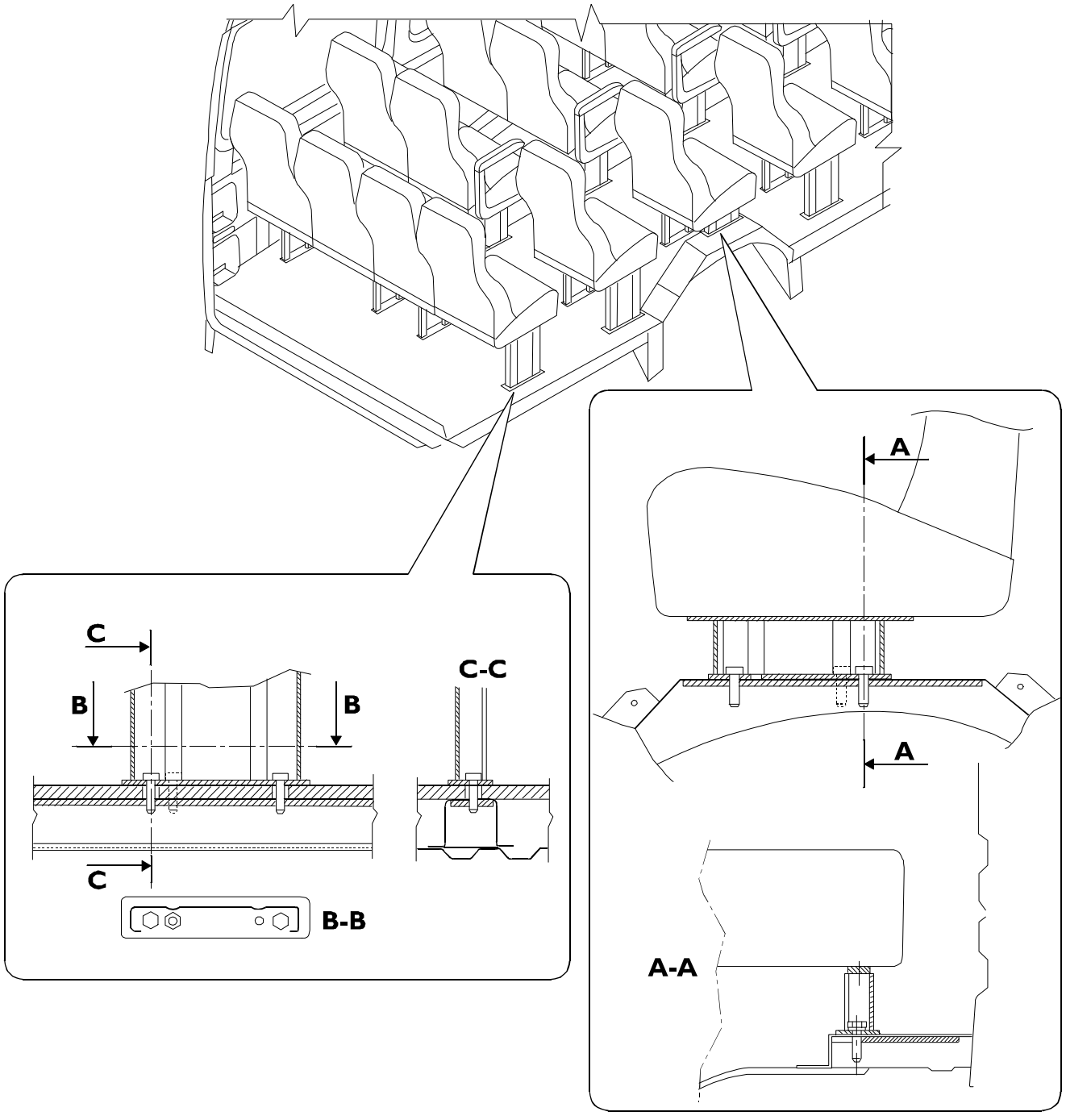


Diagram for installing fixed seat

Figure A.3

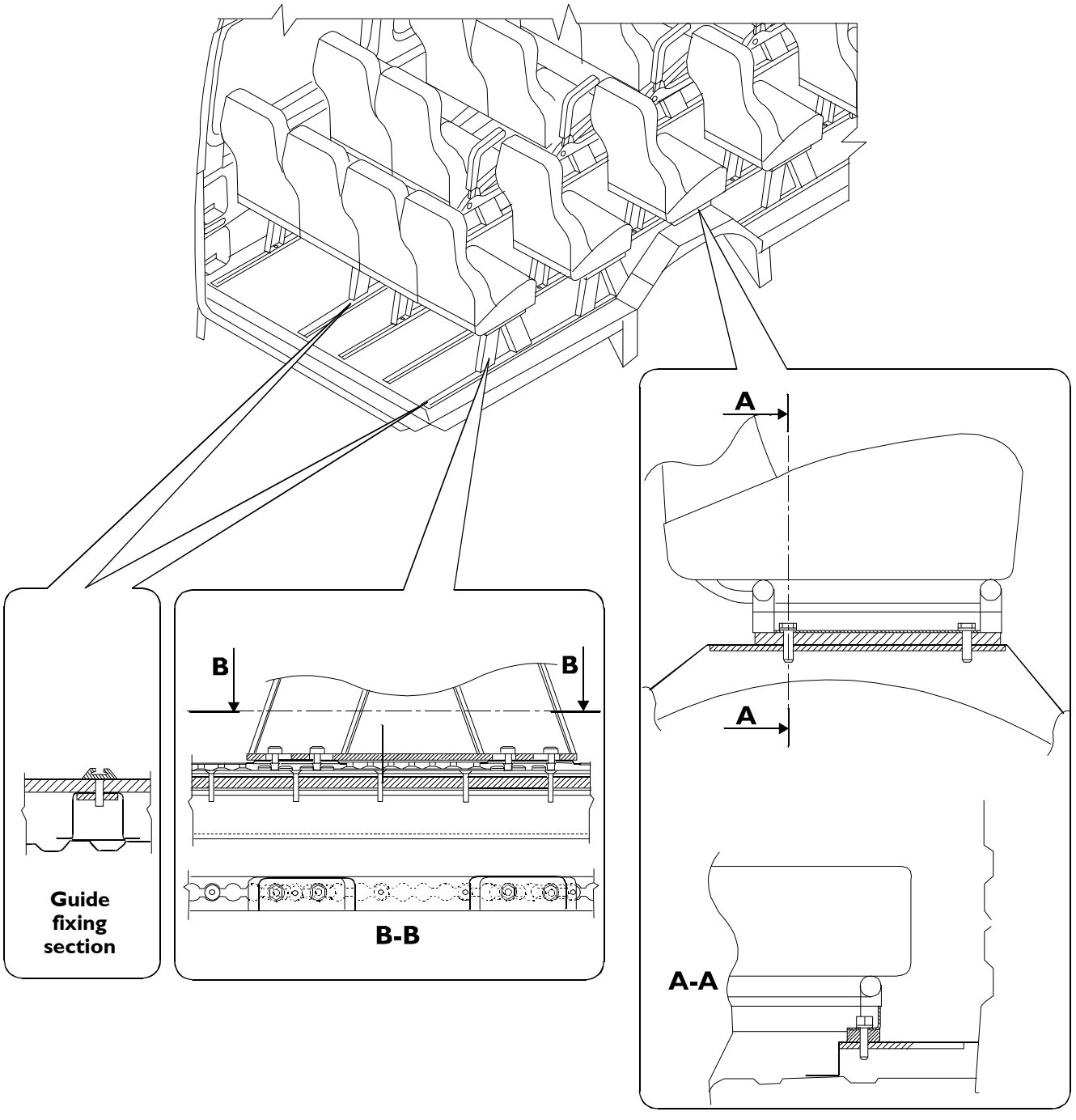


Diagram for installing seats on guides

A.3.6 Rear baggage compartment

The baggage compartment volume depends on the maximum weight technically permissible for the vehicle and its axles; the size and position must be validated by structural tests and calculations.

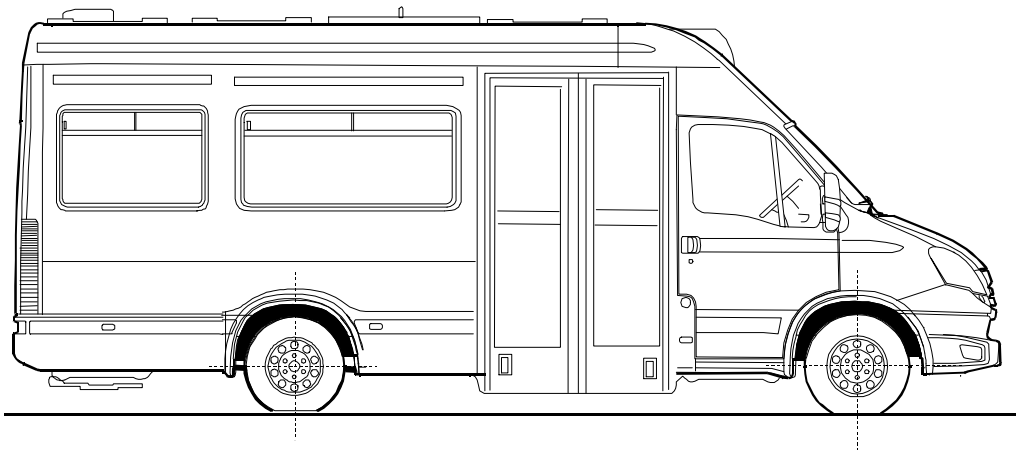
A.3.7 Side access door

Creation of the door frame must guarantee that the structure in the area of the frame itself be non-deformable.

NOTE Only the upper or lower sections of door compartments in the original body shell may be modified, but not both.

European Directive 2001/85/EC or ECE107 must also be respected with regard to the access bay and steps.

Figure A.4



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A.3.8 Inserted structures and handrail fixing

The handrails must be installed in such a way as not to entail risks of injury for passengers, their surface must be in a contrasting colour with a non-slip finish. Construction and application on the vehicle must respect European Directive 2001/85/EC or ECE107. The zones where the handrails are anchored to the original vehicle structure must be properly reinforced.

A.3.9 Fixing the disabled persons ramp and lift to assemble the wheelchair area

For the transport of wheelchair users, the access door must be equipped with a ramp and lift; a reserved space with specific dimension must also be provided inside the vehicle. In any case European Directive 2001/85/EC or ECE107 must be respected. Where the rear door is used, it is necessary to refer to the methods for fixing the tail lift described in section 3.9.

A.4 Noise emissions and thermal insulation

The Bodybuilder must ensure that the finished vehicle complies with the recommendations relating to noise emissions, specific for each case, and is also obliged to have the vehicle approved/reapproved, if necessary.

A.4.1 External noise

According to Directive 2007/34/EC, noise emissions for Daily "People Carrier" vehicles must not exceed 79 dB(A), with regard to the exhaust silencer.

A.4.2 Internal noise

Measurements must be performed in compliance with the provisions set out in ISO 5128, and at constant speed:

a) 60, 80 and 100 km/h in the second-last gear

b) 80 and 100 km/h in top gear

whether with manual or automatic transmission.

With regard to the position of the noise meter, it is essential to distinguish between:

- rear area: centre of second-last row of seats, at the height of the passenger's ears.
- front area: at the height of the driver's ears.

Under these conditions, in no case may the results obtained exceed the following values:

Table A.1

Vehicle	Without air conditioning at maximum power	With air conditioning at maximum power
Front area	72 dBA	74 dBA
Rear area	74 dBA	76 dBA

A.4.3 Soundproofing insulation

In order to achieve good insulation, care must be taken to ensure installation of the soundproofing materials is as continuous as possible, avoiding any interruptions; it is very important that the communicating hatchways between the passenger compartment and the engine compartment, gearbox, rear axle etc., be well sealed.

It is recommended panels at least 15 mm thick with a layer of interposed septum be used for covering the floors, door wells and steps.
Step compartment fasteners should have no cracks or interruptions allowing noise to enter; the same is also valid for the areas under the doors.

Insulating and sound absorbent materials must be fixed in a manner that is sturdy and durable in order to prevent them becoming detached and coming into contact with hot spots or moving parts. The use of good quality adhesives or metal meshes or other holding devices is recommended.

A.4.4 Thermal insulation

From the thermal viewpoint, the most critical areas are near the turbocharger, manifold and exhaust pipes, silencer and the rotors of the electric retarder.

When a non-metallic component of the bodywork is located near a critical area it must be protected, for example by means of a layer of insulating felt covered with a sheet of aluminium, capable of withstanding a constant temperature of 250°C and with maximum coefficient of thermal conductivity of 0.1 W/mK.
In any case, the minimum distance between a critical point and the insulation must be no less than 80 mm.

When the available space is limited, especially to protect the polyamide piping and the electrical wiring harnesses, it is advisable to shield them by means of an aluminium plate with sandwich insulation. The plate must have a conduction coefficient equivalent to the felt coefficient value. Between the protected component and the shield there must be a minimum distance of 20 mm.

In order to maintain a pleasant temperature inside the vehicle, the insulation located inside the engine/gearbox compartment must have a minimum coefficient of conductivity of 0.08 W/mK and a minimum temperature of 85°C.
This acoustic-thermal insulation must cover the entire partitioning surface between the engine housing and the interior, including steps, bulkheads and other potential heat penetration surfaces.

In areas where acoustic insulation is not necessary, such as near the electric retarder, thermal insulation using polyurethane foam, with characteristics similar to those described, is acceptable.

Some points are not critical from the point of view of heat transmission, but must be taken into account to keep them away from the bodywork components or installations which can be damaged by an excessive temperature.

A.4.5 Insulation for cold climates

The insulation on vehicles intended for cold climates must guarantee that the temperature of the engine cooling water does not drop below 80°C during constant running.
The thermostat fitted in the circuit ensures correct engine operation if the opening temperature is 68 ± 2.°C

If, despite the insulation, the engine runs at less than 80°C and the temperature of the water reaching the heater is not sufficiently hot enough, then it is necessary to install a pre-heater capable of providing at least 25000 kCal/h.
The pre-heater becomes compulsory when the vehicle operates routinely at temperatures below 0°C.

Having defined the insulation for the engine, it is necessary to measure its efficacy by testing the capacity of the cooling system and the capacity of the heating system.

After the tests it may be necessary to complete preparation by:

- increasing the power or the insulation if the heating test temperatures are low;
- increasing the air passage and reducing the insulation if the temperatures obtained in the cooling test are too high.

It is recommended that IVECO be informed of the results obtained and consultancy be sought regarding any modifications for fine tuning.

A.5 Electrical power draw-off

A.5.1 People Transport version CBA

The CBA distribution and protection control unit for passenger transport versions is fitted with a disconnector to turn off loads in emergencies.

Figure A.5

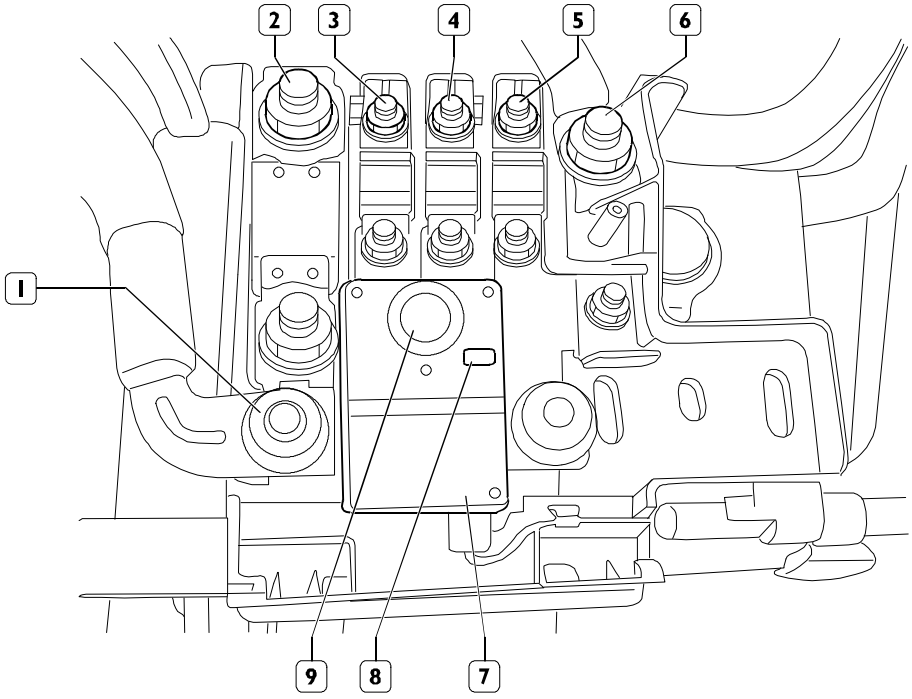


Table A.2

Pin	Function	Cable cross section mm^2	Fuse rating A
1	power supply +30 from F75 for starter motor and TELMA	50 or 35	500
2	power supply +30 from F70 for SCM BUS	35	150
3	power supply +30 from F73 for pre-heating glow plugs	10	60
4	power supply +30 from F72 for braking node	4	40
5	power supply +30 from F71 for Body Computer	16	80
6	power supply +30 from F64 in SCM/A for IBS sensor for Stop & Start	4	-

1) Starter motor and Telma power supply
2) SCM power supply
3) Pre-heating glow plug power supply
4) Braking node power supply
5) Body Computer power supply
6) Wiring for Bodybuilders' interface
7) Disconnector
8) Disconnector status indicator (red = open; off = closed)
9) Yellow button for resetting disconnector

After disconnecting the loads, to restore the vehicle to its original conditions:

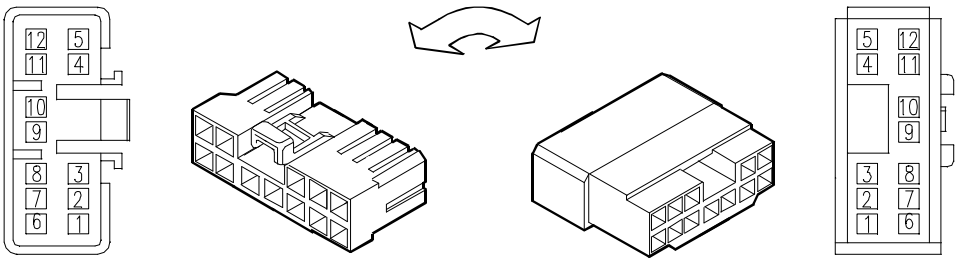
- press the central emergency control again;
- open the bonnet and press the yellow button on the CBA to reset to the disconnector;
- Turn the key to STOP;
- re-start the vehicle.

A.6 Bodybuilder connectors

NOTE For information regarding the 20 PIN connector (61071) please refer to Section 5.

12 PIN connector (72068) for People Carrier

Figure A.6



Existing parts on the vehicle Counterpart to be connected

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Table A.3

Code number	Description
500314814	12-way male holder joint
500314820	Male contact for 0.3 to 0.5 mm^2 cable
500314821	Male contact for 1 to 1.5 mm^2 cable

Table A.4 - Basic functions of the 12 pin connector for People Transport

Pin	Description	Signal	Remarks
1	Hazard warning light repetition	Output max. 500 mA	A repeater led may be supplied with an intermittent positive signal, in time with the hazard warning lights
2	Speed limiter programming	Input max. 10 mA	Applying ground activates/deactivates the current speed restriction
			Max. Open circuit = no action. Ground = speed limiter ON/OFF.
3	Turn and slide door status	max Output 10 mA (interface with uncoupling diode)	Indicates when the door is open
			Ground = door closed. Open circuit = door open.
4	Speed signal (B7)	**See specification 1 - Section 5**	
5	Door status	Output max. 500 mA	With central locking, an led indicates door status
			+12 V = doors closed. Open circuit = doors open.
6	Not connected		
7	Supplementary acoustic signal control	Output max. 10 mA	Additional horns (interfaced by relay) or duplicate of horn control
			Ground = horn ON. Open circuit = horn OFF.
8	Emergency handle lock	max Output 10 mA (interface with uncoupling diode)	Extension of central locking to the emergency handle
			Ground = handle locked Open circuit = handle open
9	Turn and slide door operation	max Output 10 mA (interface with uncoupling diode)	Indicates out-swinging door malfunctioning
			Ground = door closing failed. Open circuit = normal condition.
10	Engine revs (r.p.m.)	**See specification 2 - Section 5**	
11	Not used		
12	Not used		

A.7 Road tests

a) The following checks must be performed, with the vehicle stationary, prior to beginning functional testing:
- tyre pressure;
- oil level in the engine, gearbox and axle, brakes and steering, water in the cooling tank, state of the batteries and level of battery fluid;
- operation of the parking brake;
- operation of the doors, sensitivity of the emergency buttons, control lights, windscreen wipers, windscreen washers, horn, outside lights, switching off engine from the cab;
- alignment of the bodywork with respect to the chassis and suspension heights;
- absence of interference in the steering controls, in the whole path of the rotations of the steering wheel and of the wheels;
- visibility and correct operation of the indicating lights and acoustic warnings.

b) The following parameters must be verified during a 50 km drive over various roads (level ground, curves, uphill, downhill and uneven surface):
- absence of vibrations or unusual noises due to gearbox, axle, transmission or other assemblies of the chassis or bodywork;
- correct operation of the mechanical gearbox;
- gradual braking and absence of excessive force on the pedal;
- gradual clutch operation;
- gradual steering without resistance or jolts, maintaining the direction of the vehicle without continuous corrections.

With regard to "system" function, it should be verified that:
- no fault message appears on the instrument panel and no danger or warning signal remains lit which should not be present;
- the electric retarder has a short reply time and determines a gradual action in each point of operation;
- the speed limiter does not cause jolts;
- the operation of the emergency button stops the engine, activates the warning and deactivates the batteries;
- the speedometer is sealed;
- the heating and air conditioning are efficient;
- internal and external noise levels comply with the regulations;
- there are no infiltrations during and after passing through an arch simulating rainwater/washing with a pressurised jet.

With regard to ergonomics, the following should be verified:
- travel, stiffness, any interference of the gear levers with the dashboard and seat;
- position, adjustment of leg distance and backrest of the driver's seat;
- any visual interference of the steering wheel with the instrument panel and the brightness and lighting of the instrument panel.

c) On completion of the route, it is necessary:
- check for any leaks of water, oil, fuel and brak, steering and clutch fluid;
- Check and retighten the wheel nuts to 290-350 Nm.

APPENDIX B

Daily CNG and CNG with Recovery Mode

NOTE Keep to what is prescribed in the previous sections for everything not specified in this appendix.

B.1 General Information

Natural gas is a mixture that consists essentially of methane (main component), ethane, propane, carbon dioxide and nitrogen. To make it more recognisable, an odorising agent (THT) is added to give it its characteristic smell of sulphur.
Natural gas composition may vary considerably and its chemical and physical properties may also differ significantly.
Natural gas is compressed in cylinders for transport and use on the vehicle; hence its name of CNG, Compressed Natural Gas.
In the Daily vehicle range, CNG and CNG with Recovery Mode positions represent IVECO's contribution to a transport system that is as eco-friendly as possible.
These versions differ from the others due to specific solutions applied to certain engine components, due to their specific electronic management system and due to the presence of the gas cylinders and their piping on the frame.
On versions with recovery mode, a small petrol tank is also present that is activated automatically to enable the vehicle to cover short distances if the gas runs out.
The greater technical complexity must therefore be taken into consideration by the Bodybuilder during the design of the conversion and above all during its implementation.

The highly flammable properties of compressed gas mean that authorisation cannot be given for vehicles to be outfitted or converted for firefighting applications or for applications in potentially critical environments (e.g. airports, refineries etc.)

NOTE IVECO designs, type-approves and builds CNG vehicles in accordance with ECE Regulation110 currently in force.

Operations on the engine fuel system that:

a) use components other than those approved by IVECO (even if approved as Independent Technical Units)
b) modify the original architecture (for example: movement or addition of cylinders, type of cylinder fixation)

involving reapproval of the vehicle.

For this reason, the Authority responsible may request all the documentation (calculations, diagrams, test reports) attesting compliance with ECE Regulation 110 for all modifications made to the original system.

Vehicle reapproval costs are to be met by the Bodybuilder.

B.2 Safety Rules

B.2.1 During refuelling

- The gas is usually compressed to 200 bar during refuelling. Small amounts of natural gas may be released during this operation. The cooling that follows its rapid decompression may cause frostbite symptoms if it comes into contact with the skin. Wear protective gloves during refuelling.
- Do not smoke, handle open flames or flammable lights.
- Before filling the pressurized gas system, check that it has no visible defects.
- Vehicles to be refuelled must be blocked to prevent them from moving. The engine must be off and the ignition key must be extracted from the switch.
- Keep fire extinguishers of suitable class (class A, B, C) with other fire extinguishing devices at hand. Class C fire extinguishers are particularly suitable for methane.
- Avoid releasing the content of cylinders or pressurized gas pipes into the atmosphere.

B.2.2 In the event of leaks

If there are leaks, there is the DANGER OF EXPLOSION so it is important to not only follow all the rules set out by the law and competent authorities, to but also observe the following safety rules.

- Close the shut-off taps on the gas cylinders, the refuelling pump and the refuelling station tank.
- Switch off the main switch of the electric system of the building or refuelling area.
- Block access to the hazardous area and have unauthorized people move away from the area.
- Promptly notify the competent authorities and ask for a restoration operation.
- Ventilate the entire surrounding environment thoroughly.

B.2.3 In case of fire

- Do not extinguish the flame; if possible, cool the object that has caught fire.
- Close the cylinder cocks and the cocks on the filling risers and tanks.

BURNING GAS = GAS UNDER CONTROL

- If the flames spread to the surrounding environment, proceed in the usual manner with fire extinguishers to extinguish the fire. Immediately remove the vehicles from the immediate surroundings from the danger zone.
- In the case of fire, promptly inform the local FIRE BRIGADE and proceeding with the fire extinguishing operations.
- Rescue the injured immediately. Rescue operation come before fire extinguishing.
- Switch off the main switch of the electric system of the building or refuelling area.

B.3 Operations on the system

B.3.1 General warnings

NOTE It is essential to repeat the type approval if any change is made to the system layout.

Observe the following warnings when carrying out operations that involve fuel system components.

- Before any operation, close the taps on the solenoids of each gas cylinder, then start the engine and leave running until all the gas in the lines has been used up and the engine stalls. For versions with an additional fuel tank, the engine must be left running until the vehicle switches to recovery mode, i.e. begins to run on petrol.
- Make sure the parts are cleaned, ensuring that no sludge or foreign bodies enter during handling and installation. For this purpose, the protective covers on parts and sensors must not be removed until immediately prior to positioning.
- Observe the direction of installation for all electrical connections.
- All threaded connections must be tightened to the specified torque (see point B.3.3)

Fuel system components cannot be serviced and must be replaced if they are not efficient.

Washers, tapered washers, self-locking nuts and seals deform to improve tightening and they are also of a special type. They must therefore be replaced whenever refitted.

New minor components must be systematically restored to their original positions in accordance with the original installation sequence.

After valve replacement or any repair to the high pressure system, a HYDRAULIC LEAK TEST (300 bar) must be carried out by an IVECO DEALERSHIP able to issue a test certificate if the outcome is positive.

B.3.2 Repainting of outfitted frames

The paintwork must be protected:

- stainless steel pipes of the methane fuel system;
- pipe connection fittings;
- hose from pressure reduction unit to rail on engine;
- solenoids and coils on gas cylinders;
- gas system pressure reduction unit;
- identification plates.

B.3.3 Tightening torques

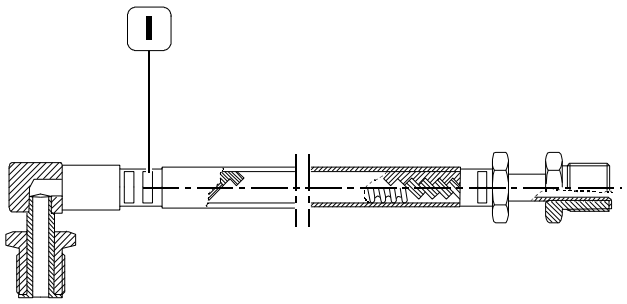
PART	TORQUE	
	Nm	kgm
Methane gas system		
High-pressure hose connection (M12x1) to refuelling filler (Italy) - Figure B.2	24 ÷ 26	2.4 ÷ 2.6
High-pressure hose connection (M12x1) to refuelling filler (CEE) - Figure B.2	33 ÷ 37	3.3 ÷ 3.7
High-pressure hose connection (M12x1) to VBE 498 solenoid check valve - Figure B.2	33 ÷ 37	3.3 ÷ 3.7
High-pressure hose fittings - Figure B.3	38 ÷ 42	3.8 ÷ 4.2
Medium-pressure hose connection (M18x1.5) to pressure reducer Figure B.1	67 ÷ 73	6.7 ÷ 7.3
Medium-pressure hose connection (M18x1.5) to fitting on cylinder head Figure B.1	67 ÷ 73	6.7 ÷ 7.3
Stainless steel stiff pipe connection (M12x1) to pressure reducer	33 ÷ 37	3.3 ÷ 3.7
Stainless steel stiff pipe connection (M12x1) to VBE solenoid valve (side opposite check valve)	24 ÷ 26	2.4 ÷ 2.6
Stainless steel stiff pipe connection (M12x1) to VBE solenoid valves	24 ÷ 26	2.4 ÷ 2.6
Blank plug (M12x1) on solenoid valve	33 ÷ 37	3.3 ÷ 3.7
Fittings (M14x1.5) connecting pipe to T fittings and cross-fittings - Figures: B.4 - B.5 - B.6	74 ÷ 82	7.4 ÷ 8.2
Fittings (M 14x1.5) fastening cross fitting to chassis	67 ÷ 70	6.7 ÷ 7.0
Refuelling filler fastening to support (M24x1)	60 ÷ 70	6.0 ÷ 7.0
Solenoid valve fastening to cylinders (W28.8x1/14")	260 ÷ 280	26.0 ÷ 28.0
Cylinder support bracket and rear crossmember fastening (M14x2)	151 ÷ 184	15.1 ÷ 1.84
Cylinder support strip fastening (M10x1.5)	33 ÷ 35	3.3 ÷ 3.5
Bracket fastening to cylinder support rear crossmember (M12x1.75)	74 ÷ 90	7.4 ÷ 9.0
Cylinder support rear crossmember fastening (M10x1.5)	42 ÷ 51	4.2 ÷ 5.1
Cylinder shelf fastening (M8x1.25)	21 ÷ 26	2.1 ÷ 2.6

NOTE The tightening torques indicated only refer to special original equipment components.

B.3.4 Parts list

Medium-pressure gas line

Figure B.1



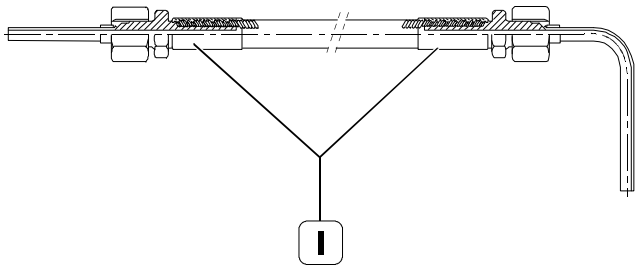
117679

1. Tublex-product code - Manufacturing date - Lot.

The gas hose connecting the reducer to the rail is a flexible AISI 321 stainless steel helical structure, internal diameter of 6.5 mm, protected by a AISI 304 stainless steel braid in turn coated when a shrink-wrap sheath and AISI 303 stainless steel fittings.

Refuelling high-pressure gas lines

Figure B.2



117680

1. Manufacturing date

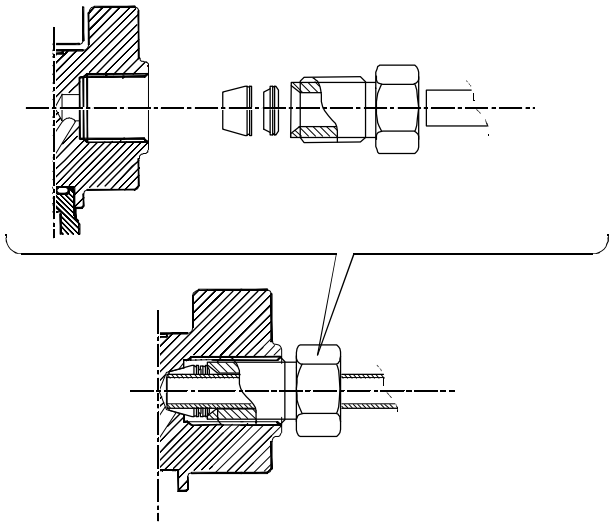
The gas hose connecting the VBE refuelling solenoid valve of the first cylinder is of the type. It is made of ISO 84342 stainless steel, diameter 6.4x11.8 mm, with high-tech polymer coating and reinforced with two aramid fibre braids. ISO 84342 stainless steel fittings.

VBE solenoid valve connection lines

The VBE solenoid connection pipes are in AISI 304 steel without welded joints, with outer diameter of 6 mm and bore of 4 mm.

Fittings

Figure B.3

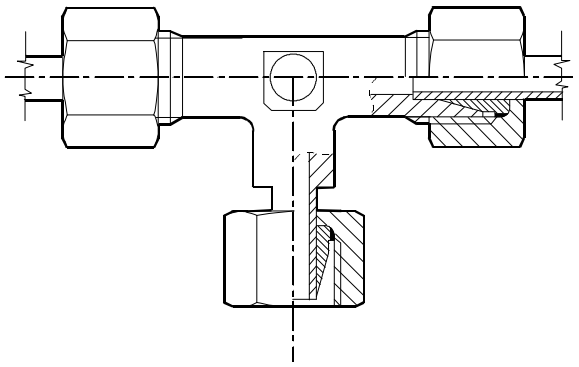


117681

AISI 303 stainless steel front tipped fitting.
For installation instructions refer to point B.3.7 - Figure B.18.

For safety reasons, both during bodybuilding and servicing, IT IS FORBIDDEN to use gas pipes as brackets for other pipes.
In specific cases where space is restricted, it is acceptable to fasten only electrical cables to the gas pipes (by means of PVC collars) provided that the pipes only serve as a guide and do not act as a support.
During maintenance operations, make sure that the tubes are not damaged and do not present scratches, rubbing, cuts or deformation visible to the naked eye.
If necessary, pipes must be properly protected.

Figure B.4

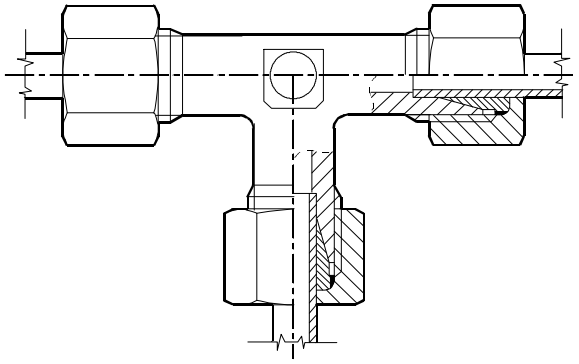


117682

ADJUSTABLE "T"-FITTING

Front tipped, AISI 3 16 TJ stainless steel

Figure B.5

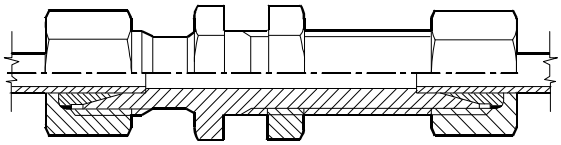


117683

INTERMEDIATE "T"-FITTING

AISI 316 TJ stainless steel front tipped fitting.

Figure B.6



117714

STAIGHT FITTING

AISI 316 TJ stainless steel front tipped fitting.

B.3.5 Emptying the gas system

Before performing significant operations (such as welding) or servicing the engine, the gas circuit must be completely ventilated with air.

It is usually sufficient to partially empty the system (i.e. to empty the pipes and leaving the cylinders as are) but the entire system (pipes and cylinders) may need to be emptied in some cases.

Decide which procedure is required on a case-by-case basis according to the severity and type of intervention to be performed. If in doubt, choose the safest solution (complete emptying).

If the engine conditions so allow (e.g. no leakages), it is advisable to use up all the gas by running the engine.

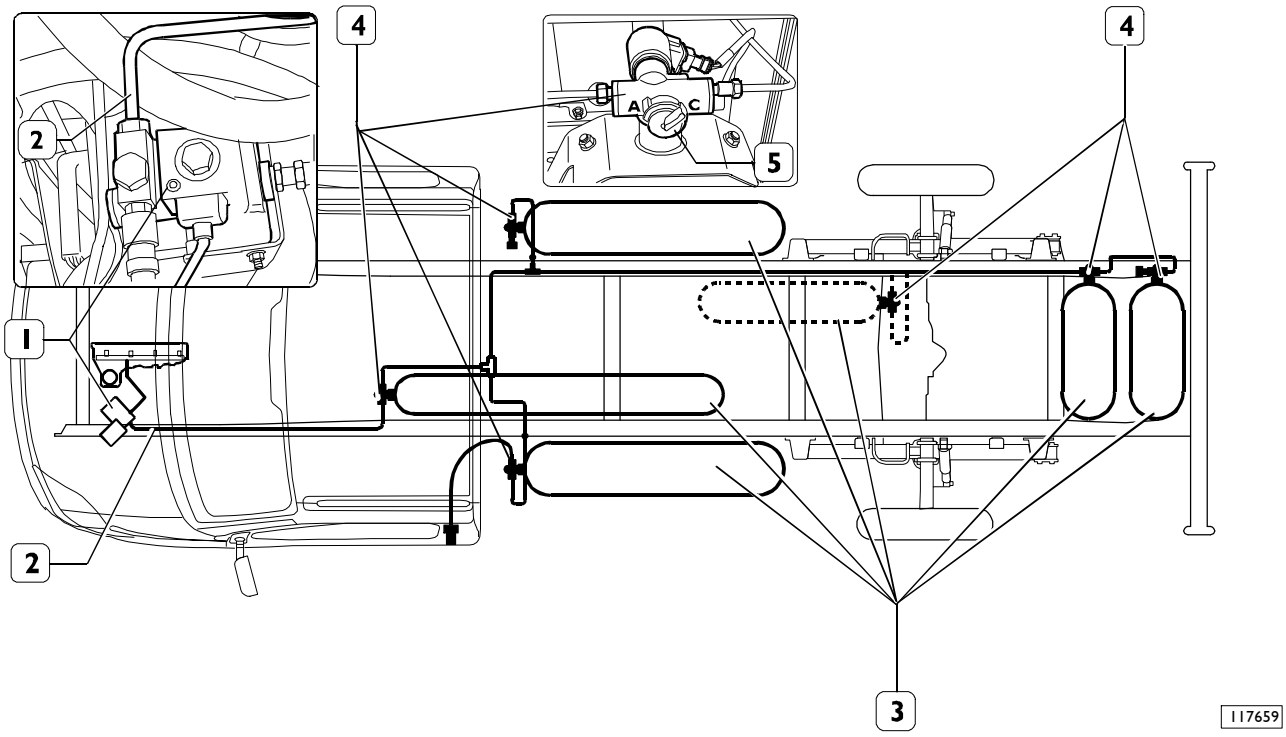
Running the engine with system pressure under 20 bar does not ensure the correct fuel metering.

NOTE **Below 20 bar, the engine must be run at idle speed only to prevent damage to the catalytic converter.**

Perform the emptying operations described below with the engine off and in the open-air. Maintain a spark-free area of at least 5 meters around the vehicle.

Partial emptying procedure

Figure B.7



1. Pressure reducer - 2. High-pressure gas pipe - 3. Cylinder - 4. VBE solenoid valve - 5. Manual valve
A. Open valve - C. Closed valve.

This operation only ensures ventilation of the system downstream of the cylinders. It is therefore essential to ensure that work is carried out at a distance of under 5 m from the cylinders that could generate sparks (welding, cutting, grinding, drilling) or that involves the use of electric equipment or naked flames.

- Disconnect power from the electrical system by operating the master switch (where fitted).
- Disconnect cables from the battery.
- Connect the vehicle to earth.
- Check that the cocks (5) of the solenoid valves (4) on all cylinders (3) are closed: cock (5) on position **C**.
- Disconnect gas delivery pipe (2) from pressure reducing valve (1) by slowly undoing it and paying attention to the effects caused by the gas pressure in the pipes.
- Connect a rubber pipe (methane-compatible) with the gas deliver pipe (2) to dispose of the gas: the free end of the tube must be at least 5 metres away from sparks.
  During this operation, the cooling subsequent to rapid decompression may cause freezing. Be careful.
- Check that the pressure in the system is equal to zero.

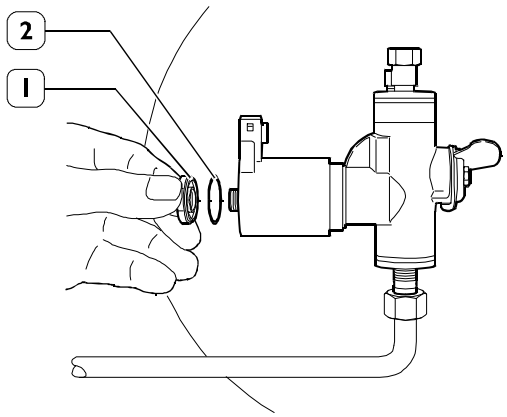
Complete emptying procedure

When the system is fully drained down, the cylinders must also be ventilated. To allow the gas to be evacuated in safety, remove the VBE valve plungers and the system must be ventilated downstream of the manual cylinder taps.

- Proceed with the partial emptying procedure described in the paragraph above.
- Check that the taps (5) on the solenoid valves (4) on all the cylinders (3) are closed: valve (5) turned to position C and proceed as described below.

Removing solenoid mobile equipment and/or cylinder replacement

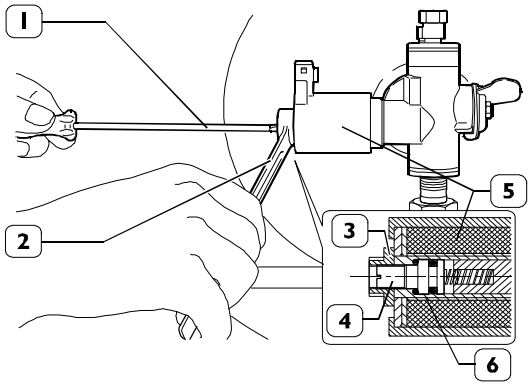
Figure B.8



117660

- Disconnect the electrical connection from the coil.
- Unscrew the outer nut of coil (1) with its O-Ring (2).

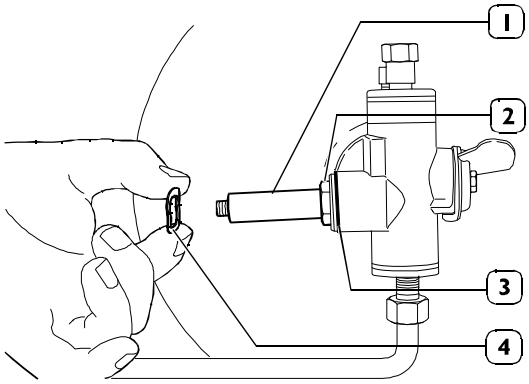
Figure B.9



117661

- With a screwdriver (1), stop rotation of the threaded pin (4) and use tool (2) to remove the nut (3) fastening the coil (5). Remove the coil (5) from the sleeve (6).

Figure B.10



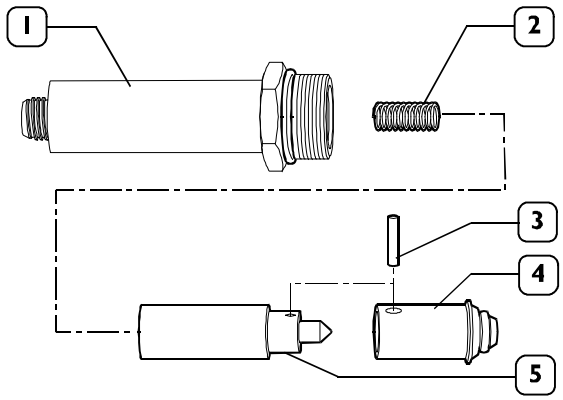
117662

- Remove the washer (4).

A small amount of high-pressure gas will remain in the valve. To prevent damage to the operator, it is advisable to decrease the pressure by slowly unscrewing ring nut (2) from the coil sleeve (1).

- With no residual pressure, proceed with the disassembly procedure and remove the coil holder sleeve (1) with its O-Ring (3).

Figure B.11



- Remove the piston (5) with shutter (4) and the spring (2) from the coil holder sleeve (1) being very careful not to misplace the pin (3) fastening the shutter to the piston.
- If the VBE valves do not need to be replaced, check the conditions of the removed parts, including the o-rings. Replace them if needed during assembly.
- Fasten the empty coil holder sleeve with its o-ring and fasten the ring nut at a torque of 28 Nm.
- Repeat the operations on all the VBE valves of the cylinders.

Emptying

- Open the manual valves half way (5) (Figure B.7).

This operation ensures that pressurised gas enters the pipes: for this reason, exercise maximum care.

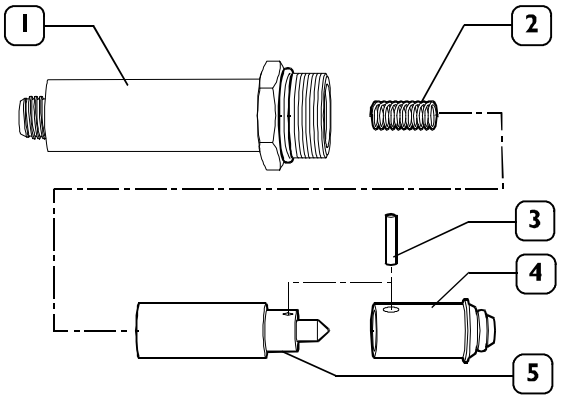
After emptying operations, check that the engine cannot stop.

If the VBE valves are not replaced after the complete emptying procedure, refit the previously removed parts (which were either carefully put aside or replaced) as shown in the following paragraph.

Introduction to solenoid valve plunger

Remove the empty coil sleeve (1) with the o-ring.

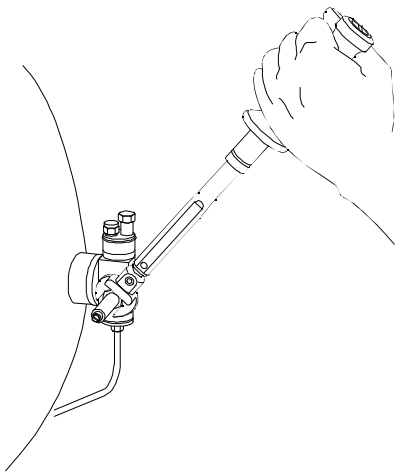
Figure B.12



87391

- Insert the piston (5) in the shutter (4) and lock it with the pin (3).
- Insert the spring (2) and push well into the specific seat in the piston (5).
- Fit the resulting assembly into coil sleeve (1) with the tapered part of plunger (4) turned toward the outside of the coil carrier sleeve.
- Check the presence and conditions of the o-ring on the sleeve (1).

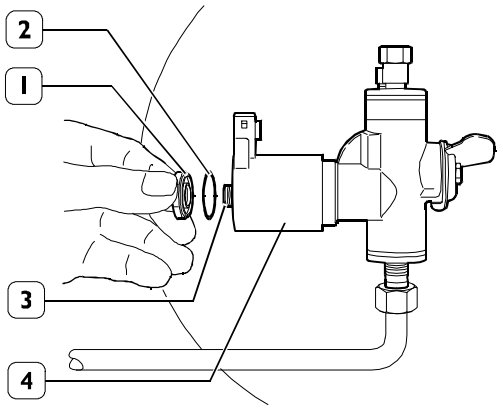
Figure B.13



87392

- Fasten the coil holder sleeve ring nut and tighten at a torque of 28 Nm.

Figure B.14



117663

- Check that coil (4) does not present signs of damage. Replace the coil if necessary.
- Fit the washer (4, Figure B.10) and the coil (4, Figure B.14) on the sleeve (1, Figure B.10).
- Screw in inner nut (3) securing coil (4) and tighten to 8 Nm.
- Screw in nut (1) with o-ring (2) and tighten and tighten to a torque of 7 Nm.
- Connect the electrical connection to the coil (4).
- Repeat the previous operations on all VBE valves of the cylinders.

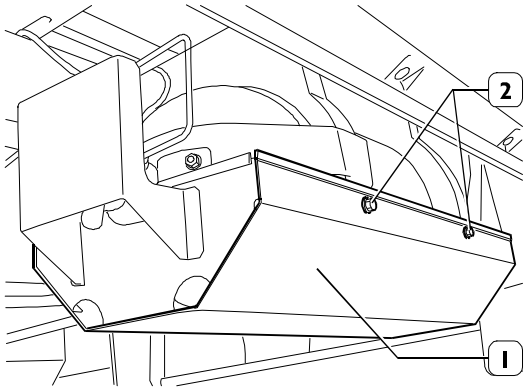
B.3.6 VBE solenoid valve replacement

Removal

NOTE VBE solenoids may be removed as a result of a fault or during periodic overhaul of the cylinders. Because removed solenoids cannot be reused, they must always be replaced whatever the reason for their removal. It is advisable to scrap them immediately after removal.

Before disconnecting the solenoid valves, empty the system completely following the procedure described in the "Emptying the gas system" chapter.

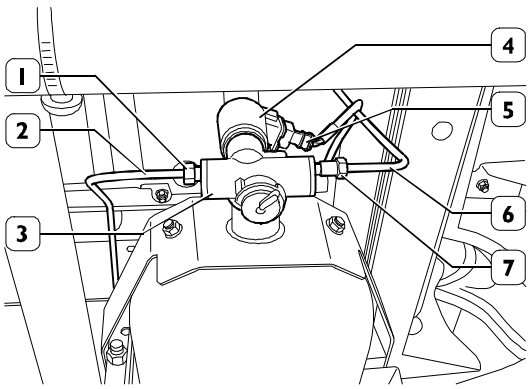
Figure B.15



117664

- Remove the screws (2) and remove the cover (1).

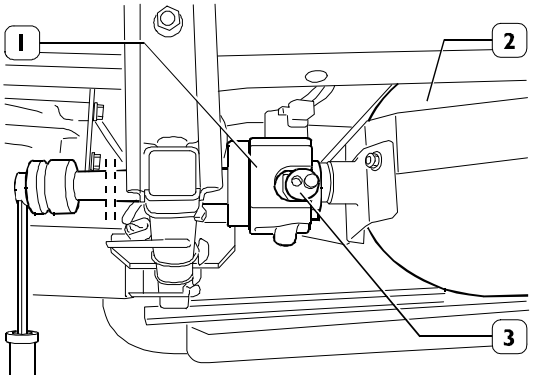
Figure B.16



117665

- Loosen the fittings (1 and 7) and disconnect the pipes (2 and 6) from the VBE valve fittings (3). Disconnect the electrical connection (5) from the coil (4).

Figure B.17



117666

- Use tool 99355018 (1) to loosen and remove the VBE valve (3) from the cylinder (2).

Refitting

Reverse the removal sequence to refit and observe the following precautions:

- the VBE valve protective caps must not be removed to avoid damage to the valve during assembly. The use of percussion pneumatic screw runners or of any other tool which could deform the valve body and compromise functionality must be avoided.
- if the cylinder is off-vehicle, secure the cylinder preferably in vertical position with the collar facing upwards.
- fasten the threading of the valve seat with 2-3 layers of Teflon.
- tighten the valve by hand through a few turns. Then use specific wrench 99355018 (1) with a torque wrench to tighten to a torque of 270 ±10 Nm.

NOTE In this operation, make sure that tool 99355018 (1), does not damage the VBE valve thermal fuse device.

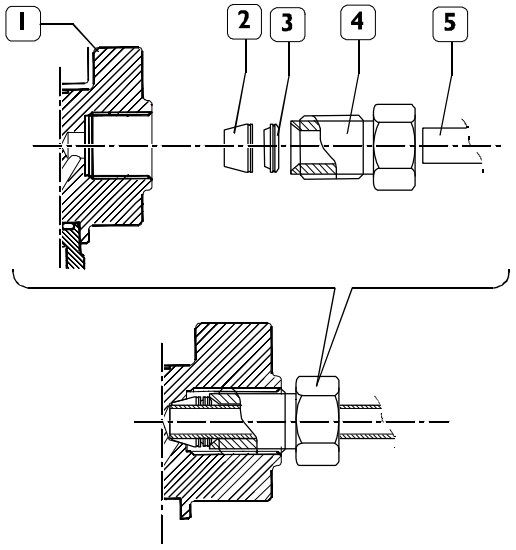
B.3.7 Repair interventions on fittings and pipes

If gas leaks occur from the pipe or fittings, replace the pipe assembly. The pipe is not provided with the fittings and these must be obtained separately.

- Remove the pipe to be replaced together with its end fittings.
- Check the condition of the new pipe that is pre-formed into the same configuration as the pipe to be replaced and fit new fittings and o-rings at its ends.
- Fit the pipe by fitting its ends into the seats of the components to be connected and ensure that they are fitted fully home.
- Check the pipe end centre line is aligned with the centre line of the fitting to which it is to be connected to prevent pretensioning.
- Pre-tighten the fitting nuts by and then tighten to the specified torque. For EMER fittings, follow the procedure described in the relevant chapter.
- Apply the fastening brackets checking that the tube is not subjected to excessive tension.
- Restore system operation by carrying out a hydraulic seal test following the procedure described in the warnings at the beginning of the chapter.

Fitting assembly

Figure B.18

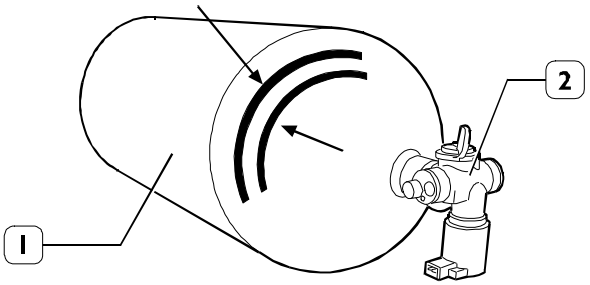


- Fit the seals (2 and 3) on the pipe.
- Insert the pipe (5) in the valve seat (1), appropriately orienting the cylinder to avoid pulling the pipe.
- Keeping the pipe in the seat, fasten the fitting (4) at the specified torque.
- Loosen the fitting (4) and check fastening of the seal on the pipe.
- Fasten the fitting at the specified torque.
- Have the system hydraulically tested as indicated in the warnings at beginning of the chapter.

NOTE In case of subsequent disassembly, replace the seals with new parts.

B.4 Cylinders

Figure B.19



1. Cylinder - 2. Solenoid valve.

The methane (CNG) is stored in compressed form at a pressure of 200 bars in a certain number of cylinders positioned in the chassis and protected by metal guards.
The cylinders are connected in series to each other and are filled by a refuelling valve provided with check valve. A second check valve is inserted in the solenoid valve fitted on the first cylinder and connected to the refuelling filler. The check valves are used to prevent the release of gas into the outside environment when the valve is extracted after the refuelling operation.

NOTE A faulty flow valve or solenoid valve may lead to incorrect indications regarding the cylinder contents. Refer to the solenoid valve inspection and replacement procedures in the corresponding paragraph B.3.6.

Important information concerning the cylinders is punched into their upper surface (→).

CNG ONLY - DO NOT USE AFTER □□ (1) □□□ (2)

FABER 01/1234/123 □□ (3) L □□ (4) KG □□□ (5) 15°C/ □□□ (6) MPaE □ (7) 110R-
□□□□□□ (8)

CNG-I USE TESTED FABER CYLINDERS ONLY
□□ (9) □□□ (10)

01/1234/ 123 = FABER serial numbers

(1) = expiration month,
(2) = expiration year, after 20 years
(3) = nominal capacity
(4) = cylinder weight
(5) = working pressure in MPa
(6) = test pressure in MPa
(7) = country where the cylinder was approved
(8) = ECE/ECE type approval number
(9) = test month/year
(10) = inspector punch

B.4.1 Cylinder scheduled overhauling according to ECE/ONU R 110 standards

Methane gas cylinders for road vehicles must be inspected EVERY FOUR YEARS by competent authorities responsible for certifying their validity.

NOTE The due date is shown on the cylinders and in the documents supplied with the vehicle.

ECE/ONU R 110 specify the following procedure to be followed in the event of an accident:

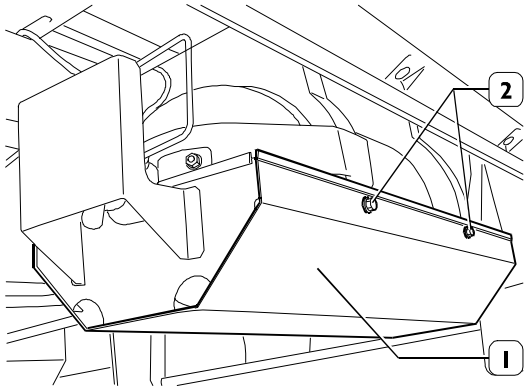
- cylinders that have been involved in a vehicle collision (frame) must be inspected by an agency authorised by the manufacturer unless the competent authorities decide otherwise. A cylinder that has not suffered any damage following the collision impact can be returned to service; otherwise the cylinder must be sent back to the manufacturer for examination;
- cylinders that have been subject to the effects of a fire must be inspected by an agency authorised by the manufacturer or scrapped and removed from service.

B.4.2 Cylinder replacement

Removal

Before disconnecting the cylinders, empty the system completely following the procedure described in the "Emptying the gas system" chapter.

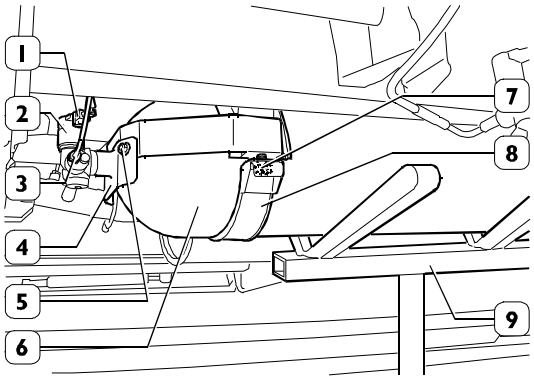
Figure B.20



117664

- Remove the screws (2) and remove the cover (1).

Figure B.21



117715

- Remove the nuts (5) and remove the cover (4).
- Disconnect the electrical connection (1) from the coil (2) of VBE solenoid valve.
- Disconnect the gas pipes (3) from the solenoid valve (2).
- Support the cylinder (6) with an appropriate support (9).
- Remove the screws (7), turn the brackets (8) and remove the cylinder (6) from the chassis.
- Disconnect the VBE valves (2) from the cylinder (6) as described in the corresponding chapter.

Refitting

Reverse the removal sequence to refit and observe the following precautions:

- Position the cylinders in the basket directing the VBE valves so as to be able to connect the pipes.
- "Fasten the VBE valves (2) and pipe fittings to the specified torque observing the precautions shown in the "Repair interventions on fittings and pipes" chapter.
- After refitting, check hydraulic tightness of the system as described in the corresponding chapter.

B.5 Fuses and relays

B.5.1 Fuse box and CNG relay under dashboard

See specific section 5.4.

B.6 Bodybuilder connectors

NOTE For information on Bodybuilders' connectors, see Section 5 - Paragraph 5.2.

B.7 Power takeoff

The PTO engagement and disengagement procedures are analogous to those described in Section 4 for diesel engine vehicles, except for the need (during engagement) to run the engine at 1200 rpm prior to pressing the button in Figure 4.6 on the PTO control panel.