SECTION 4

Power take-offs

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4.1 General Specifications

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

- the gearbox;
- driveline;
- the front of the engine;
- the rear of the engine.

The characteristics and performances are given in the paragraphs which follow and in the relevant documentation which will be supplied upon request.

For the definition of the power necessary for the apparatus to be controlled, particularly when the values requested are high, the absorbed power should also be considered during the drive transmission phase (5 to 10% for the mechanical transmissions, belts and gears, and greater values for the hydraulic controls).

The choice of transmission ratio for the power take-off should be made so that the absorption of power occurs in a flexible engine operating range. Low r.p.m. (below 1000 r .p.m.) must be avoided to prevent irregular running.

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

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

P = Useable power
M = Torque permitted for the power take-off (Nm)
n = power take-off r.p.m.

Type of use

Both occasional and continuous use should be considered.

For occasional use periods of under 30 minutes are considered.

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

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

To avoid overloading, in some cases (e.g. hydraulic pumps, compressors) it may be necessary to include the application of devices like clutches or safety valves.

PTO transmissions

The kinematic forces of the transmission from the power take-off to the relevant apparatus should be carefully considered (angles, r.p.m., moment) during the design phase and the dynamic behaviour during operation in compliance with the transmission Manufacturer's instructions should be respected. The dimensions should take into consideration the forces which might occur under maximum power and torque conditions.

To obtain a uniformity of kinetic forces angles of equal value, maximum of 7°, should be obtained at the extremities (Figure 4.1). Solution Z is preferred to solution W due to the lower loads on the bearings of the power take-off and the equipment being driven. When it is necessary to obtain different spatial inclinations (φ), the variations in r.p.m. should be compensated for with the arrangement of the forks shown in Figure 4.2.

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

Figure 4.1

Solution Z

Solution W

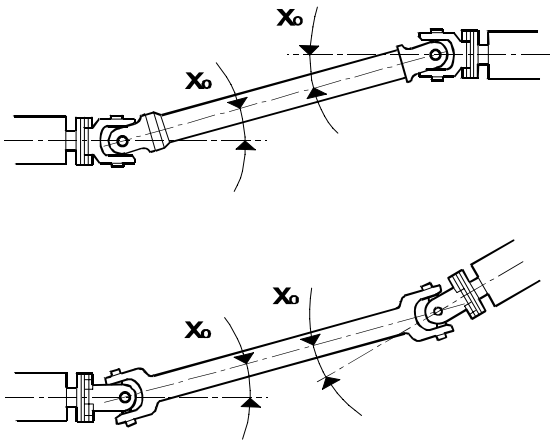

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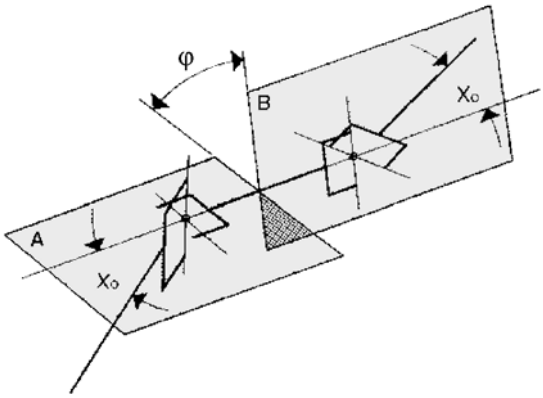
Figure 4.2



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Electrical system

The VCM and EM electrical/electronic system makes available innovative methods and processes for control of power take-offs that can significantly improve safety and reliability. Activation takes place by connecting the power take-off control switch to connector ST14A.
This connector is fitted as standard if the customer has chosen a power take-off as standard. If a later power take-off is installed, please observe the instructions given in Chapter 4.6.

Pneumatic system

See description in Paragraph 2.15.4.

4.2 Power Take-off from Gearbox

Depending on the type of gearbox power can be taken from the layshaft through the flange or spline located on the rear, side or lower part of the gearbox.

The technical characteristics necessary are given in the documentation supplied upon request for the various gearboxes.

The types of power take-off and the torque values obtained with the ratio between the number of output revolutions and engine r.p.m. are shown in Table 4.1.

The values refer to the conditions indicated in the table.

Higher values for occasional use must be agreed upon as each occasion arises depending on the type of use.

Check the vehicle to ascertain whether it is possible to fit a power take-off suitable to its size.

The power take-off applied to the gearbox must only be used when the vehicle is stationary and must be engaged and disengaged when the clutch is disengaged to avoid excessive stress on the synchronisers during gear change. For special situations when the power take-off is used and the vehicle is moving the gear must not be changed.

For gearboxes equipped with a torque converter, the same power take- offs used for normal gearboxes are, as a rule, used. It should be carefully noted that, when the engine r.p.m. is below 60% of the max. value the converter will be in the phase of hydraulic r.p.m.; in this phase, depending on the absorbed power, the r.p.m. of the power take-off is subject to oscillation despite the fact that the engine r.p.m. is constant.

Direct Application of Pumps

When the application of pumps of other equipment (e.g. for tippers or cranes) is carried out directly from the power take-off, without the use of intermediate shafts and after checking that the size of the pump permits margins of safety with chassis and engine unit (cross member, transmission shaft etc.), the static and dynamic torques exerted by the mass of the pump and by the power take-off should be checked for compatibility with the resistance of the walls of the gearbox. By way of an example, the moment due to the additional masses must not have values of over 3% approx. of the maximum engine torque.

In cases where the gearbox is applied in a single unit with the engine, the value of the additional masses must be verified with regard to the inertial effects in order to avoid the induction of resonance conditions in the engine unit within the field of operational engine r.p.m.

When fitting power take-offs the torque values shown in Table 4.1 must not be exceeded.

Transmission oil temperature must not exceed 120°C during prolonged use. Coolant temperature must not exceed 100°C. Not all types of power take-off available on the market are suitable for continuous use. When in use the specifications (working periods, pauses etc.) specific to the power take-off in question should be respected.

Transmission PTO data

The following table shows the types of P.T.O. provided by ZF and by Hydrocar.

The transmission ECU and the Body Computer (BC) will need to be reprogrammed when a PTO is applied after-market. Interventions on the electrical and pneumatic system are required. Read paragraph 4.6 "PTO management" carefully before applying a PTO.

Re-programming of the electronic control units must be carried out in accordance with the instructions in the IVECO technical manual using exclusively the diagnostic instrument (available from IVECO dealers and authorised IVECO service centres), providing the information regardine the specific P.T.O. requirements.

Power Take-off from Gearbox

Table 4.1 - PTO types provided by ZF

Transmission	N. P.T.O.	Type P.T.O.	Assembly side	Ratio Total PTO	Maximum take-off torque (Nm)
9S1310 TO	5202	ZF -NH/1b	center	0.97	800
	5205	ZF -NH/1c	center	0.97	800
	5209	ZF -NH/4b	lower	1.24	430 (1)
	5210	ZF -NH/4c	lower	1.24	430 (1)
	5258	ZF -N109/10b	high	0.97	600
	5255	ZF -N109/10c	high	1.19	630
	5259	ZF -N109/10c	high	0.97	600
16 S 1620 TD 16 S 1920 TD 16 S 2220 TD 16 S 2320 TD	5202	ZF -NH/1b	center	0.91 / 0.77	1000
	5205	ZF -NH/1c	center	0.91 / 0,77	1000
	5209	ZF -NH/4b	right	1.17 / 0.98	430 (1)
	5210	ZF -NH/4c	right	1.17 / 0,98	430(1)
	5258	ZF -N221 10/B	above	1.35 / 1.14	730
	5260	ZF -N221 10/B	above	1.75 / 1.47	560
	5264	ZF -N221 10/B	above	2.00 / 1.68	470
	5255	ZF -N221 10/C	above	1.13 / 0.95	870
	5259	ZF -N221 10/C	above	1.35 / 1.14	730
16 S 2220 TO 16 S 2520 TO	5202	ZF -NH/1b	center	1.09 / 0.91	1000
	5205	ZF -NH/1c	center	1.09 / 0.91	1000
	5209	ZF -NH/4b	right	1.40 / 1.17	430 (1)
	5210	ZF -NH/4c	right	1.40 / 1.17	430 (1)
	5258	ZF -N221 10/B	above	1.62 / 1.35	730
	5260	ZF -N221 10/B	above	2.09 / 1.75	560
	5264	ZF -N221 10/B	above	2.40 / 2.00	470
	5255	ZF -N221 10/C	above	1.35 / 1.13	870
	5259	ZF -N221 10/C	above	1.62 / 1.35	730

1) Limit 1 hour of use

Power Take-off from Gearbox

Table 4.1 - (continued) PTO types provided by ZF

Transmission	N. P.T.O.	Type P.T.O.	Assembly side	Ratio Total PTO	Maximum take-off torque (Nm)
12 AS 1420 TD	5202	ZF -NH/1b	center	0.79	800
	5205	ZF -NH/1C	center	0.79	800
	5209	ZF -NH/4b	lower	1.01	430 (1)
	5210	ZF -NH/4c	lower	1.01	430 (1)
	5260	ZF -Nm AS/10 b	above	1.92	380 (1)
12 AS 1930 TD 12 AS 2330 TD	5202	ZF -NH/1b	center	0.82	1000
	5209	ZF -NH/4b	right	1.05	430 (1)
	5210	ZF -NH/4c	above /H	1.05	430 (1)
	5260	ZF N AS/10b flange	above /H	1.92	400
	6420	ZF -Nm AS/10b double output	above/L/pump lower/H/flange	1.21	670
				1.92	400
12 AS 2530 TD	5202	ZF -NH/1b	center	1.35	1000
	5209	ZF -NH/4b	right	1.22	430 (1)
	5210	ZF -NH/4c	above /H	1.22	430 (1)
	5260	ZF N AS/10b flange	above /H	2.15	400
	6420	ZF -Nm AS/10b double output	above/L/pump lower/H/flange	1.23	670
				1.73	400

1) Limit 1 hour of use

4.3 Power Take-off from Transfer Box

NOTE Not present on Stralis.

4.4 Power Take-off from Drive line

The authorisation for the application of a power take-off on the drive line downstream of the gearbox is issued after examination of the complete documentation presented to the Company.

The various power and torque values will be evaluated as each occasion arises on the basis of the conditions of use.

In general the following should be noted:

- The drive take-off may be operated only when the vehicle is stationary.
- The power take-off r.p.m. is dependent on the gear selected.
- The power take-off must be located immediately downstream of the gearbox. For vehicles with the drive line in two or more sections, the power take-off may also be fitted at the flexible support included between the first and second sections (respect the indications given in point 2.8.2).
- The angles of the drive line on the horizontal plane and vertical plane must be kept as close as possible to the original values.
- Masses and rigidity added to the drive line must not provoke a loss of balance or abnormal vibrations or damage the transmission drive line (from engine to axle) either during vehicle movement or during operation with the motor running.
- The power take-off must be fixed to the chassis with its own suspension.

NOTE As the transmission is an important part for the safety of the vehicle, modification to it must only be carried out by specialist companies approved by the supplier of the transmission.

NOTE The power take-offs on the universal joint line cannot be used in conjunction with EuroTronic transmissions!

4.5 Power Take-off from Engine

In general the use of these power take-offs is planned for apparatus requiring a continuous power supply.

4.5.1 Torque power take off from the front of the engine

The drive take-off from the front part of the crankshaft is obtained, for limited power values to be drawn off (e.g. air conditioning etc.) by drive belt transmission, the use of coupling shafts is normally reserved for take-offs of a greater magnitude (e.g. municipal use).
These uses, when not specifically planned, require precise modifications to the front part of the vehicle, e.g. modifications to the radiator, cab, bumpers etc. Particular attention must therefore be paid:

- To the system comprising additional masses and relative rigidity which must be flexibly disengaged from the crankshaft with regard to the torsional and flexional effects.
- To the additional mass values and relative moments of inertia and to the distance from the centre of gravity of the masses from the centreline of the first main bearing which must be kept to a minimum.
- To avoiding a reduction in the radiator cooling capacity and dead water areas.
- To restoring the rigidity and resistance characteristics of the modified elements (cross member, bumper etc.).
- To avoid exceeding, during extended use, temperatures of the engine cooling fluid of over 100°C and engine oil temperature (measured on the main duct of the pressure switch area) of 110 to 120°C. A margin of approx. 10% should however be left. In other cases include supplementary heat exchangers.

Table 4.2 shows the values to be referred to for the take-off.

Table 4.2 - Power take-off from front of engine

Engine type (power)	Rpm corresp. to full power		Max. rpm admitted (start of red band)		Max. take-off values				
					Max. torque available	Max. moment of inertia	Max. bending moment	Moment multipl. factor	Multipl. factor ang. pos.
(kW/Cv)	rad/s	(rpm)	rad/s	(rpm)	(Nm)	(kgm²)[1]	(Nm)[2]	(-)[3]	(degrees)[4]
Serie Cursor 10 - F3A									
E0681E (287/390)	220	2100	283	2700	500	0.050	150	1	0-180
E0681B (294/400)	220	2100	283	2700	500	0.050	150	2	180-210
E0681D (316/430)	220	2100	283	2700	500	0.050	150	3	210-240
								4	240-300
								3	300-330
								2	330-360
Serie Cursor 13 - F3B									
E0681G (279/380)	199	1900	262	2500	500	0.050	150	1	0-180
E0681C (324/440)	199	1900	262	2500	500	0.050	150	2	180-210
E0681E (353/480)	199	1900	262	2500	500	0.050	150	3	210-240
								4	240-300
								3	300-330
								2	330-360

1) Maximum moment of inertia of rigidly added masses.
2) Max. moment of flexure due to radial forces in relation to the first main support.
3) Amplification factor of the max. permitted flexural moment (depending on the angular position of the additional radial forces)
4) Direction of the additional radial forces. (zero: TDC cylinder axis; rotation: clockwise).

Power Take-off from Engine

4.5.2 Power take off from the rear of the engine

4.5.2.1 Multipower power take-off on flywheel side

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

Some precautions:

- the PTO must be engaged only with the engine at a standstill (a safety device prevents engagement with the engine running in any case);
- the unit may be disengaged with the engine running but only if power is not currently being taken off;

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

- the engine must be started when no torque is being taken from the PTO.

The main dimensional specifications are given in Figure 4.3/4.4 and Figure 4.5, while the technical specifications are given in Table 4.3.

Figure 4.3

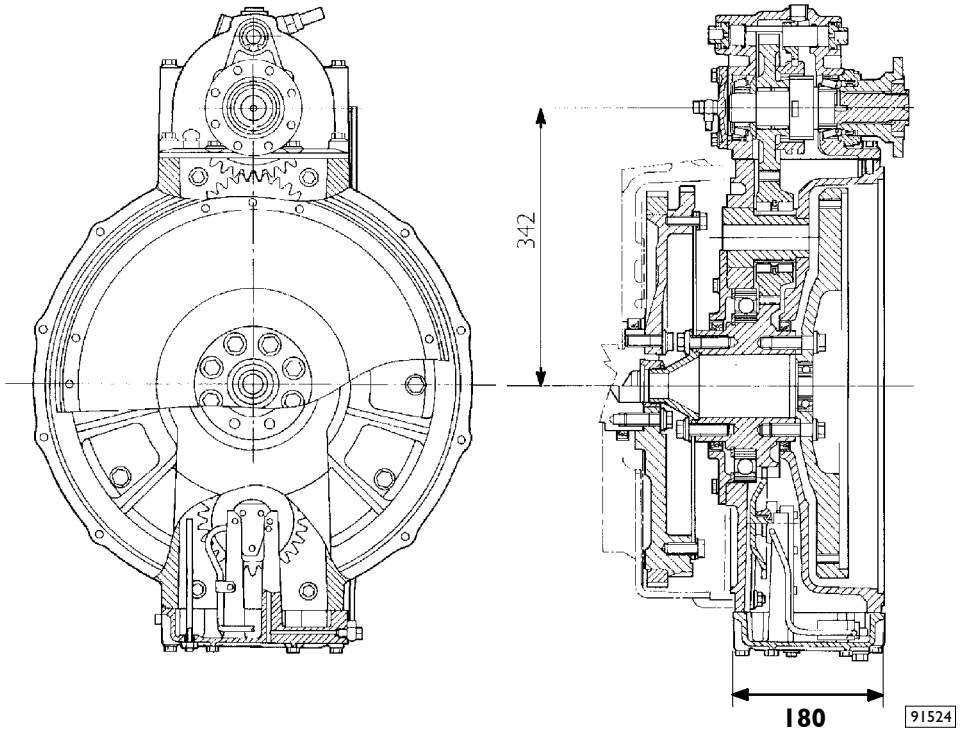


Table 4.3

Output rpm/engine rpm ratio	1.29
Max. torque available	900 Nm
Output flange	ISO 7646-120 X 8 X 10
Control	pneumatic
Direction of rotation	as engine
Installation on engines	Cursor 8-10-13

If turned on during transfers, you must be well aware that depending on the gearing ratio of the power take-off (see tab. 4.3), connected pumps may reach high rotating speeds (e.g.: an engine speed of 1800 rpm corresponds to a pump speed of 2400 rpm).

Consequently, in order to operate FMO FMO (FAST MOVING OBJECTS) equipment with this type of power takeoff, the vehicle control unit must have the three following function modes enabled:

a) Vehicle in motion

With Multipower engaged and the vehicle in motion, the vehicle control unit must receive the PTO engaged signal.

Acceleration of the vehicle is permitted, but it is not allowed to exceed the 1800 rpm threshold, set in the program of the vehicle control unit.

b) Pump engaged with accelerator de-activated

After engagement of the pump, if no part of the equipment is in operation (if no loading and unloading operations are being preformed and the compactor is not engaged), the vehicle control unit receives the pump engaged signal. The rotating speed, set by the vehicle control unit program, is kept to a minimum and accelerations from the operator are not permitted (if the accelerator pedal remains de-activated).

NOTE This condition can be found even when, the movement of the equipment is interrupted during operation because of an alarm.

During emergency movements, for example for the return into the profile of the members, it is advisable to carry out the manoeuvres with a reduced motor rotation speed.

Remember that with these enabled pump without accelerator request conditions during normal operation may not be frequent: in fact the compactor is always on during normal equipment operation and this implies the accelerator enabling request.

c) Pumps engaged with accelerator activated

After engauging the PTO pump and with the equipment in operation (loading, unloading and compacting operations), the vehicle control unit receives the accelerator request signal.

The rotating speed set by means of the vehicle control unit, is carried to the optimal value required to obtain the oil flow capacity required for equipment operation.

Even in this stage the operator cannot accelerate.

Therefore, three different vehicle rotating speeds and thresholds are required and must be obtained by means of three different signals that are to be sent by the equipment to the vehicle control unit.

FMO equipment without Multipower operate only on function b and c.

4.5.2.2 Power take-off from the timing gears at rear of engine

Models equipped with engines of the Cursor 8 and Cursor 13 series are supplied with friction clutch power takeoff which picks motion from the distribution gears, independently from the vehicle's clutch.

The power takeoff is available in the direct pump mount version, or with a flange for Cardan shaft.

The installation of this power takeoff must be requested when ordering the vehicle; subsequent applications require the replacement of the whole engine.

Figure 4.4 shows diagrams with dimensions and position of the PTO in relation to the engine and vehicle.

Table 4.4 gives the main data.

To take off a max. torque of 600 Nm (CURSOR 8) and 800 Nm (CURSOR 10/13) the moment of inertia of the rotating masses, movement after the power take-off (including the coupling shaft), must be no greater than: **0.03 Kgm^2.**

In no case must the max. available torque of 600 Nm (CURSOR 8) and 800 Nm (CURSOR 10/13) be exceeded.

Direct pump application

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

Connection with coupling shaft

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

Power Take-off from Engine

Figure 4.4

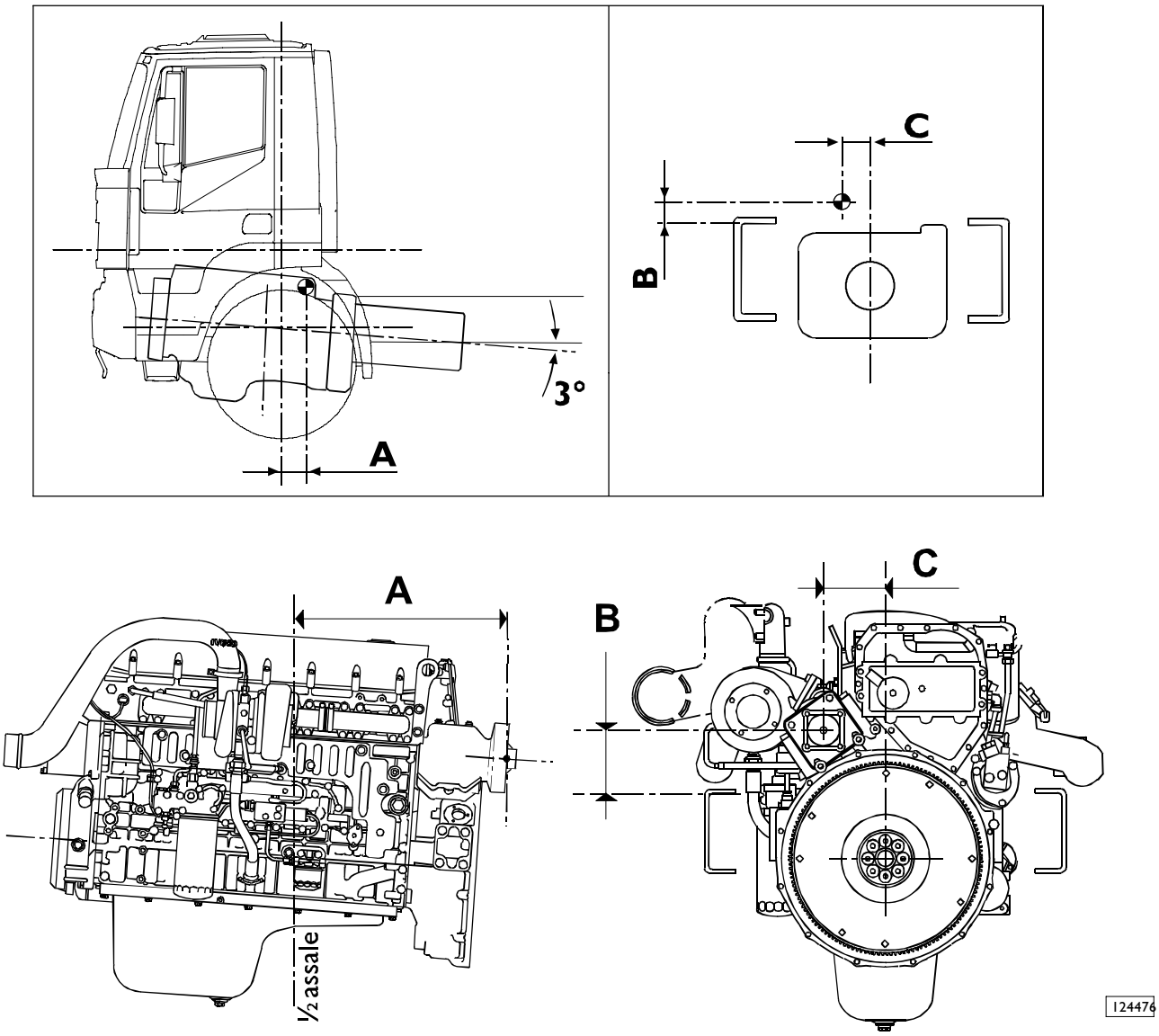
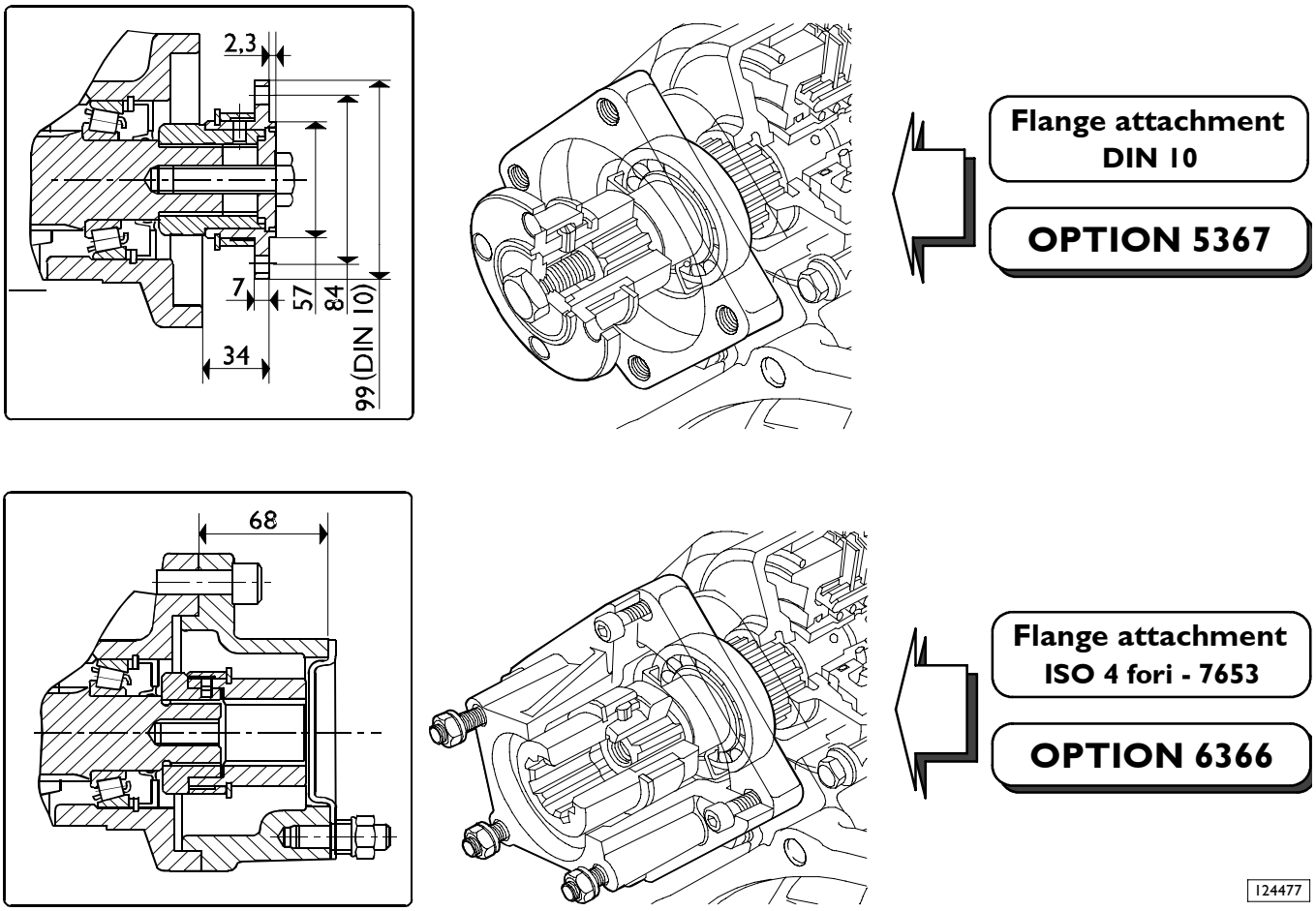


Table 4.4 - (Illustrative examples of possible configurations)

Type engine	PTO Type Hydrocar	A / Flange	A / Pump	B	C
Cursor 8	F210	555 mm	589 mm	73 mm	154 mm
Cursor 10	F211	542 mm	576 mm	119 mm	167 mm
Cursor 13	F211	542 mm	576 mm	119 mm	167 mm

Power take-off from timing gears for Eurotronic 2 transmissions

Figure 4.5



NOTE **It is, however, necessary to check compatibility between the pump to be applied and the fitting case by case.**

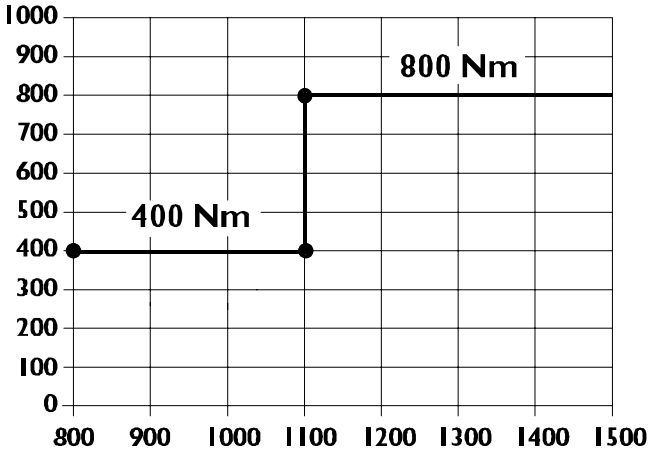
Table 4.5 - PTO Specifications

Engine	Power take-off				
	Max. torque available for drawing Nm	Out rpm/engine rpm ratio	Output type		Direction of rotation
			Pump conn.	Flange conn.	
CURSOR 10/13	800	1.12	ISO 4 holes (7653)	DIN 10	Opposite to engine
CURSOR 8	600	1.14	ISO 4 holes (7653)	DIN 10	Opposite to engine

NOTE **PTO can be equipped with a pneumatic disc clutch in oil bath system.**

Torque limits available from PTO according to engine speed

Figure 4.6



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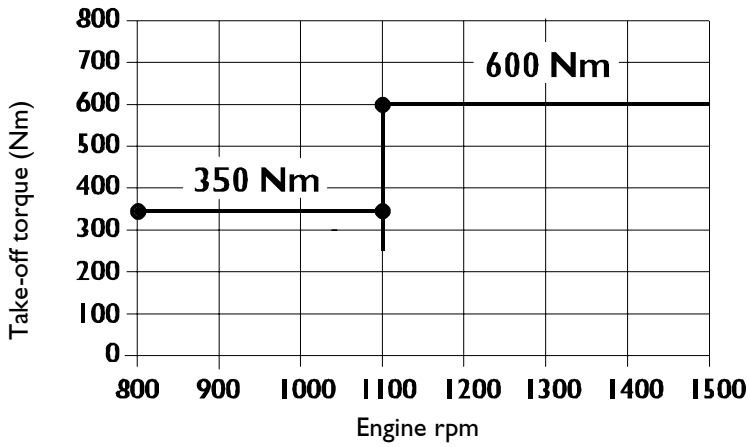
A. Take-off torque - B. Engine rpm

CURSOR 10/13

Vehicle programming

- Vehicle stopped - PTO mode ON
  Take-off of up to 800 Nm of torque is permitted at engine speeds of over 1100 rpm.
- Vehicle running - PTO mode ON
  - no limit to the torque obtainable from the power takeoff according to engine revs;
  - engine idle running set to 700 r.p.m.;
  - the air supply system pressure fot PTO clutch coupling must be above 8.5 bars.

Figure 4.7



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CURSOR 8

Vehicle programming

- Vehicle stopped - PTO mode ON
  Torque drawing of 600 Nm is permitted over 1100 r.p.m.
- Vehicle running - PTO mode ON
  - no limit to the torque obtainable from the power takeoff according to engine revs;
  - engine idle running set to 800 r.p.m.;
  - the air supply system pressure for PTO clutch coupling must be above 8.5 bars.

4.6 PTO management

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

4.6.1 General Specifications

PTOs are activated electrically by means of a solenoid and their use always involves the programming of 2 control units: Expansion module (EM) and Vehicle Control Module (VCM).
The EM is able to drive up to three PTOs and controls their activation and the activation independently.
PTO management also makes it possible to considerably simplify conversion because it incorporates a set of safety and control functions such as, for example, engagement under certain limit conditions and control during operation.

4.6.1.1 Definitions

The most important aspects of PTO Management are described in detail in the following paragraphs. Firstly, however, some definitions must be given for a better understanding of the explanations given below.

MUX

The term MUX describes a set of two control units: Body Computer (BC) and MET (frame electronic module).
This network is connected to other electronic systems such as the EDC, EBL, EuroTronic 2, Instrument Cluster, etc Information and messages are exchanged by means of Bus CAN lines.

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

Switch located in the middle of the dashboard (control panel). This is used to request an action relating to a given PTO (e.g. PTO engagement, PTO disengagement, intermediate speed activation etc.).
Because the EM and VCM are able to control up to three PTOs, this number may be installed on the switches (from PTOsw1 to PTOsw3).
Each switch is connected to a given pin on connector ST14A.

Connector ST14A

Connector ST14A provided specifically for body builders is located on the passenger side below the electric control unit in the footwell. More detailed information is given in Chapter 5.

PTO Mode x (x=1,2,3)

Following a request from a PTO switch on the dashboard, a PTO mode makes available a set of parameters that allow regular PTO operation. A PTO mode includes:

- a PTO configuration (described below)
- a fast mode (option, described below)

It is possible to activate up to three PTO modes simultaneously.

PTO Configuration

The PTO configuration is an integral part of a PTO Mode. This includes a set of parameters for mechanical engagement of a PTO. Various parameter sets are available for the different PTOs (depending on the engine and transmission). These guarantee PTO engagement is compliant with requirements. The PTO configuration may be customised by Iveco Service upon the specific request of customers. The PTO configuration is stored in the EM, VCM control units.

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

A speed mode may be activated as part of a PTO mode (option). This makes available a set of parameters that defines the engine reaction in the event of activation (intermediate speed, min speed, max speed, accelerator deactivation etc.). This configuration is stored in the Vehicle Control Module (VCM).

NOTE Because the engine only acts on the basis of a set of parameters, a choice must be made if more speed modes are requested at a certain point. This takes place on the basis of a scale of priorities. It is absolutely necessary to consider these priorities in management of the conversion!

4.6.1.2 Diagram functions

Two conditions must be met in order for a power take-off to operate:

1) Mechanical engagement of a power take-off

2) Allocation of a speed mode to this power take-off (option). The definition of a speed mode is explained in this Chapter.

The expression "active power take-off" means that the power take-off engaged (active end-travel switch) and a speed mode have been activated.

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

Only management of the power take-offs through the EM control unit ensures comprehensive, reliable and safe PTO management.
Only in this way is it possible to guarantee the connection with other vehicle functions.
Operating the power take-off without connection to the EM control unit may cause damage to the vehicle.
Connection to the EM control unit presupposes activation and electrical control of the power take-offs (by means of electromagnetic valves). Air-activated power take-off and/or without connection to the EM control unit are not therefore recommended by IVECO.

NOTE The electromagnetic valve used to activate a power take-off is connected in the chassis to the relevant ST91 connector (PTO1) / ST92 (PTO2) / ST93 (PTO3).
An electromagnetic valve is allocated to each power take-off via a PTO mode.

If the power take-offs are used without connection to the EM control unit, a logical connection to the status signals, namely 'parking brake applied', 'vehicle parked,' 'reverse not engaged' is absolutely necessary to ensure safe operation of the power take-off and prevent damage.
These signals must be detected by the ST14A interface connector in the cab.
With ADR vehicles, the use of a PTO without connection to the EM control unit is not permitted!

4.6.1.3 PTO switch

The following photograph shows the installation position of a PTO switch (PTOsw 1, right). As already mentioned, up to three PTO switches may be fitted in the dashboard.

PTO switch	Connected to ST14A	Description	IVECO Part Number
PTOsw1	18	PTO1	50409 6567
PTOsw2	19	PTO2	50409 6566
PTOsw3	20	PTO3	50409 6565

NOTE The command may be also given on vehicles with a Eurotronic transmission directly on ST14A.
The PTO switches may be purchased directly through IVECO. The table summarises the part numbers.

4.6.2 PTO modes

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

1) PTO configuration

2) Speed mode

The terms PTO configuration (4.6.2.1) and speed mode (4.6.3) are explained below.

4.6.2.1 EM - PTO 1, 2, 3 configurable

Depending on the planned use of the vehicle, body builders are bound to contact IVECO Service in order to carry out the necessary programming of the controls involved (EM, VCM, EuroTronic Transmissions) in the operation of a power take-off.
Body builders may examine the following tables to organise the configuration of a system in advance (described as PTO configuration below).
A PTO unit may then be selected.
If the body builder needs custom settings, these may be programmed via IVECO Service for each individual power take-off.

As already mentioned, the body builder is bound to scrupulously observe mode priority in conversion management and in the event of reprogramming in order to avoid extra expense for subsequent changes to the wiring or reprogramming.

4.6.2.2 EM - PTO 1, 2, 3 Programming

PTO programming includes the following function groups:

1) PTO switch functionIdle running actuation

Possibility of choosing between:

- physical activation of PTO only
- physical activation of PTO and activation of speed mode
- activation of speed mode only.

2) PTO hardware

For the selection of:

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

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

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

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

The selection determines the conditions and the limit values that must not be exceeded or that must at least be reached, respectively. If the set values are not respected, the speed mode will be deactivated with consequent mechanical deactivation of the PTO. At the same time, a message will be displayed on the IC (instrument cluster).

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

- dynamic behaviour relating to PTO activation/deactivation.

The adjustments within the five function groups may be defined separately for each PTO mode x 1,2,3 .

1) PTO switch function

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

Table 4.6

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

Each switch is allocated to a PTO, in other words two switches are required if two PTOs are fitted.
Activation of a PTO by the EM is always connected to a switch operation. Switch operation should not, however, necessary lead to engagement of a PTO (see table above).
Each switch may be allocated its own PTO configuration. A switch operation also activates fast mode, a selection must be made in the case of simultaneous operation of various switches. The following priority must be observed:

- PTO 3 configuration (PTOsw 3): Maximum priority (PTOsw 1 and 2 status is ignored)
- PTO 2 configuration (PTOsw 2): Medium priority (PTOsw 1 status is ignored)
- PTO 1 configuration (PTOsw 1): Minimum priority

As mentioned previously, the bodybuilder is bound to scrupulously observe mode priority in the management of the conversion and in the case of reprogramming in order to avoid additional expenses for subsequent wiring changes or re-programming.

PTO management

2) PTO hardware. The following PTOs may be installed and activated

Table 4.7

Definition
Predisposition, no PTO installed
PTO dependant on engine (PTO engines), controlled via the EM
PTO on manual gearbox, controlled via the EM
Switchable multi-power, controlled by the EM
PTO on Allison transmission, controlled via the EM
PTO n1 on EuroTronic transmission, controlled via the EM
PTO n2 on EuroTronic transmission, controlled via the EM
PTO on distributor gear, controlled via the EM
ZF NMV, controlled via the EM

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

3) Selection of conditions for engagement of a PTO

Table 4.8

Parameter	Option 1	Option 2	Option 3
Service brake	Operated	Not operated	Not controlled
Handbrake	Operated	Not operated	Not controlled
Clutch status	Operated	Not operated	Not controlled
Clutch timeout	secs		
Connector ST 91/92/93 Pin 3	Open	Earthed	Not controlled
Coolant temperature	40 -100°C		Not controlled
Clutch slip limit			Not controlled
Expansion module press switch (not active)			
Min rpm for engagement	650- rpm		Not controlled
Max rpm for engagement	700- rpm		Not controlled
Minimum vehicle speed	0 Km/h		Not controlled
Maximum vehicle speed	1 Km/h		Not controlled
Lowest speed engaged			Not controlled
Highest speed engaged			Not controlled
Gear in neutral	In neutral	Gear engaged	Not controlled
Reverse	Engage	Not engaged	Not controlled

The power take-off is engaged only if all conditions are met. If one of the conditions is not met, the EAM displays a warning message within a short space of time (10 seconds standard) and stops the engagement procedure. PTO engagement must be requested again (deactivation and reactivation of the PTO switch).

4) Selection of conditions for deactivation of a PTO

Table 4.9

Parameter	Option 1	Option 2	Option 3
Service brake	Operated	Not operated	Not controlled
Handbrake	Engage	Not engaged	Not controlled
Clutch status	Operated	Not operated	Not controlled
Clutch timeout	secs		
Connector ST 91/92/93 Pin 3	Open	Earthed	Not controlled
Coolant temperature	40 -100°C		Not controlled
Clutch slip limit			Not controlled
Expansion module press switch (not active)			
Min rpm for engagement	650- rpm		Not controlled
Max rpm for engagement	700- rpm		Not controlled
Minimum vehicle speed	0 Km/h		Not controlled
Maximum vehicle speed	1 Km/h		Not controlled
Lowest speed engaged			Not controlled
Highest speed engaged			Not controlled
Gear in neutral	In neutral	Gear engaged	Not controlled
Reverse	Engage	Not engaged	Not controlled

The PTO is engaged as soon as one of the set conditions is not met, i.e. the speed is reduced and the PTO is mechanically deactivated. At the same time, a message will be displayed on the IC (instrument cluster)

When selecting the activation/deactivation parameter, care must be taken to ensure no plausibility is violated (for example, activation condition: Brake pedal operated and simultaneously condition for deactivation: Brake pedal operated).
Full function in this case too is possible only with the power take-offs operated electrically. If the power take-offs are operated pneumatically, the control unit is not able to control a power take-off in any way.

5) Extended functions (see the following Table 4.10)

Dynamic behaviour in relation to PTO conditions

The EAM control unit expects certain conditions to be met within a certain time period (standard 10 seconds) after the PTO request. Once this period has elapsed, the PTO request is rejected and an error is displayed.
The time interval is programmable (0 - 10s). The PTO switch must then be operated again.

Dynamic behaviour for PTO engagement

Establishes the interval after which a PTO must be mechanically engaged after the request. If the set interval is exceeded, the request is rejected and an error is displayed.

Dynamic behaviour in relation to PTO deactivation conditions

If a deactivation condition arises once a set time interval has elapsed (10 seconds standard), actions are taken for deactivation and an error is displayed. The time interval is programmable (0 - 10s).

PTO management

Dynamic behaviour on PTO deactivation

Establishes the interval after which a PTO must be mechanically disengaged after the request has been made. If the time interval is exceeded, an error message is displayed.

Dynamic behaviour in relation to the clutch and PTO engagement

Establishes a minimum time interval within which the clutch must be operated before PTO engagement is permitted and carried out (to be used only with manual transmission).

Dynamic behaviour in relation to error identification

Time that elapses before an error activates Degraded Mode

Dynamic behaviour in relation to Degraded Mode activation (see information below for more details)

If no confirmation is received from the driver within a certain time interval after Degraded Mode activation, PTO operation is discontinued and an error message is displayed on the IC (Instruments Cluster). If the timeout is set to 0, PTO operation is immediately suspended.

Table 4.10

Parameter	Condition 1	Condition 2
Timeout at activation	1 - 10 secs.	Not controlled
Time out at PTO activation conditions	1 - 10 secs.	Not controlled
Timeout at activation via switch	1 - 10 secs.	Not controlled
Time out at PTO deactivation conditions	1 - 10 secs.	Not controlled
Timeout for error identification	1 - 10 secs.	Not controlled

NOTE In general, all the activation and deactivation and Timeout control condition parameters must be set as to "is not controlled" as far as possible in order to rule out unnecessary sources of error.

4.6.3 RPM Mode (to be set in the VCM control unit)

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

4.6.3.1 RPM 0 mode (driving mode)

When the vehicle speed is below 25 km/h, example, an intermediate engine RPM may be activated.
Activation of an intermediate speed may take place by activating the Resume function, from SET+ or SET- on the control lever either or by means of the respective inputs of bodybuilder's connector ST14A.
The intermediate engine rpm on a standard vehicle is set to 900 rpm and may be altered on the basis of the following procedure:

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

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

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

Table 4.11

Parameter	Function
Resume/OFF	Activation/deactivation of the intermediate speed
SET+/SET-	Increase/reduction of the intermediate speed
Conditions leading to deactivation of the intermediate speed	- Brake or clutch pedal depression - Operation of CC Off on the control lever on ST14A - Activation of the engine brake/Intarder
Accelerator	Active
Maximum engine speed with SET+	NLL - 1800 rpm
Maximum engine speed with the accelerator pedal	NLL - 2700 rpm (Cursor 8) NLL - 2340 rpm (Cursor 13)
Engine torque	Maximum torque according to the engine

4.6.3.2 Configurable rpm mode 1, 2, 3

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

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

- speed mode 3: Maximum priority (speed modes 1 and 2 are ignored)
- speed mode 2: Average priority (speed mode 1 is ignored)
- speed mode 1: Minimum priority

The bodybuilder must observe these priorities during management of the conversion and the conversion interface. This is to avoid additional expenses for subsequent changes to the wiring or reprogramming.
The following table provides an overview of parameters that must be determined individually for each mode (programming by IVECO Service).

Table 4.12

Parameter	Option 1	Option 2
Engine speed adjustable by means of Set+ 1)	550- 1800 rpm	
Engine speed adjustable by means of Set- 2)		
Maximum torque 3)	According to the engine	
Theoretical speed in neutral 4)		
Angular coefficient of torque curve NM/rpm		
Speed threshold for PTO/CC activation (km/h) 5)	1 Km/h	
Speed deactivation with handbrake not engaged	Yes	No
Activation of parameters for maximum PTO speed 6)	Yes, by selection	No
Maximum PTO speed (kms/h) 7)	1 Km/h	
Speed deactivation by operating brake pedal 8)	Yes	No
Speed deactivation by driver operating brake pedal 9)	Yes	No
Speed deactivation by driver operating Intarder 10)	Yes	No
Speed deactivation by operation of engine brake by means of CAN	Yes	No
Speed deactivation by operation of Intarder by means of CAN	Yes	No
Speed deactivation by operation of clutch 11)	Yes	No
Speed deactivation if this is lower than that set as minimum speed 12)	Yes	No
Speed deactivation if this is higher than that set as maximum speed 13)	Yes	No
Speed the activation due to an error in the CC module 14)	Yes	No

Table 4.13

Parameter	Option 1	Option 2
Speed deactivation in the event of communication of service brake and parking brake switch error 15)	Yes	No
Deactivation of the accelerator pedal.	Yes	No
Resume function on start-up	Yes	No
Maintenance by key of Resume function of other PTO operating modes 16)	Yes	No
Speed deactivation in the case of a speed sensor error 17)	Yes	No
Speed deactivation in the case of exceeding coolant temperature 18)	Yes, by selection	No
Coolant temperature (°C)	80°C- 110°C	
Speed deactivation with gear engaged 19)	Yes	No
Speed deactivation with reverse engaged 20)	Yes	No
Activation for control of the lowest speed for PTO engagement/disengagement 21)	Yes, by selection	No
Lower speed for speed activation/deactivation	1st-5th gear	
Activation for control of the highest speed for PTO engagement/disengagement 22)	Yes, by selection	No
Highest speed for speed activation/deactivation	1st-5th gear	
CC regulation and memo function 23)	See description	Voir la description
Engine speed via memo 24)	Final speed 550-LL	
Maximum speed by means of Set+ 25)	1 Km/h	
Temporary activation of engine speed increase from another control device 26)	Yes	No
Temporary activation of speed increased by driver 27)	Yes	No

4.6.3.3 Custom settings

Table 4.14

Parameter	Option 1	Option 2
Activation for a reserve speed	Yes, by selection	Not controlled
Reserve speed value (km/h) 28)		
Limitation of torque according to engine speed (rpm)		
Limitation of torque according to torque momentum (Nm)		

PTO management

4.6.3.4 Setting for special functions

Table 4.15

Parameter	Option 1
Increase/reduce speed by operating Set+/Set- (rpm) 29)	
Time required to reach selected speed 30)	
Speed deactivation by means of an external torque momentum request (Nm)	

4.6.3.5 Footnotes on 4.6.3.2/4.6.3.3/4.6.3.4

1. Maximum rpm may not be exceeded using Set+ .
2. Minimum rpm may not be exceeded using Set-.
3. To avoid damage to the PTO and transmission, engine torque should be adapted to the PTO
4. Maximum variable rpm of engine with no load Warning: This speed (rpm) differs from the PTO speed according to the PTO transmission ratio!
5. Up to this setting, the intermediate speed regulator is active in the following PTO modes (it regulates engine speed independently of the gear) If the set value is exceeded by pressing Set+ again, automatic switching takes place to CC mode (Cruise Control: speed is suggested independently of the gear).
6. If this value is exceeded, the intermediate speed will be deactivated and the speed will return to the value indicated in NOTE 25.
7. If the set speed is exceeded, the set intermediate speed will return to the value indicated in NOTE 25. Despite possible speed fluctuations, the value is always 5 km/h lower than the set value. If the value is changed, the value indicated in NOTE 25 is also automatically changed.
8. The intermediate speed is deactivated and returns to the value indicated in NOTE 2
9. The intermediate speed is deactivated and returns to the value indicated in NOTE 2
10. The intermediate speed is deactivated and returns to the value indicated in NOTE 2
11. The intermediate speed is deactivated and returns to the value indicated in NOTE 2
12. The intermediate speed is deactivated and returns to the value indicated in NOTE 2
13. The intermediate speed is deactivated and returns to the value indicated in NOTE 2
14. The intermediate speed is deactivated and returns to the value indicated in NOTE 2
15. The intermediate speed is deactivated and returns to the value indicated in NOTE 2
16. If the setting is on "Yes", these speed of the previously engaged mode is maintained, despite switching between the individual speed modes. If the setting is "No", the speed is adjusted to that of the corresponding selected mode (considering priority).
17. The intermediate speed is deactivated and returns to the value indicated in NOTE 2
18. The intermediate speed is deactivated and returns to the value indicated in NOTE 2
19. If the setting is " Yes", fields 20, 21 and 22 are active. If the setting is "No", no input is possible in these fields.
20. -22 becomes an unsatisfied condition. The intermediate speed setting returns to the value in NOTE 2.

23. Three adjustment options are available in this case
    Option 1:
    No possibility of calibration! The speed set at point 19 is fixed and cannot be altered by the driver by means of SET+ SET- .
    Option 2:
    Calibration is possible: The speed set at point 24 is fixed and may be adjusted by the driver using SET +/Set - on the basis of the adjustment range shown in Point 1 and 2.
    Option 3:
    With calibration and possibility of storage: The speed set at point 24 is fixed and may be adjusted by the driver using SET +/Set - on the basis of the adjustment range shown in Point 1 and 2 and stored as a new speed.
24. If a speed is already stored, this will be automatically activated at the time of engagement. This speed may be altered, as described under Point 23
25. Speed that may be achieved at maximum with SET+
26. Must be set to "No"! With the programming on "YES" intermediate speed may be imposed by the EuroTronic transmission switching procedure! One consequence of this could be a PTO over speed.
27. Must always be set to "No" to ensure that the Kickdown function is excluded. If set to "Yes", the driver could exceed the set speed limit by operating the kickdown function.
28 If a power take-off is used on the universal shaft (N90 - Omsi - etc.), it is possible to engage a speed higher than 90km/h in this case in order to allow it to work in the highest gear with high engine RPM without the speed limit cutting in.
29. Possibility of adjustments to alter rpm each time Set+/-is pressed
30 The speed control activates after a correction time (time during which the modified signal remains uninterrupted in order to be accepted as valid) in the new selected speed mode (pin connector ST14 pin 18,19,20). This correction time may be shortened in relation to the factory setting (500 ms), down to 100 ms.

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

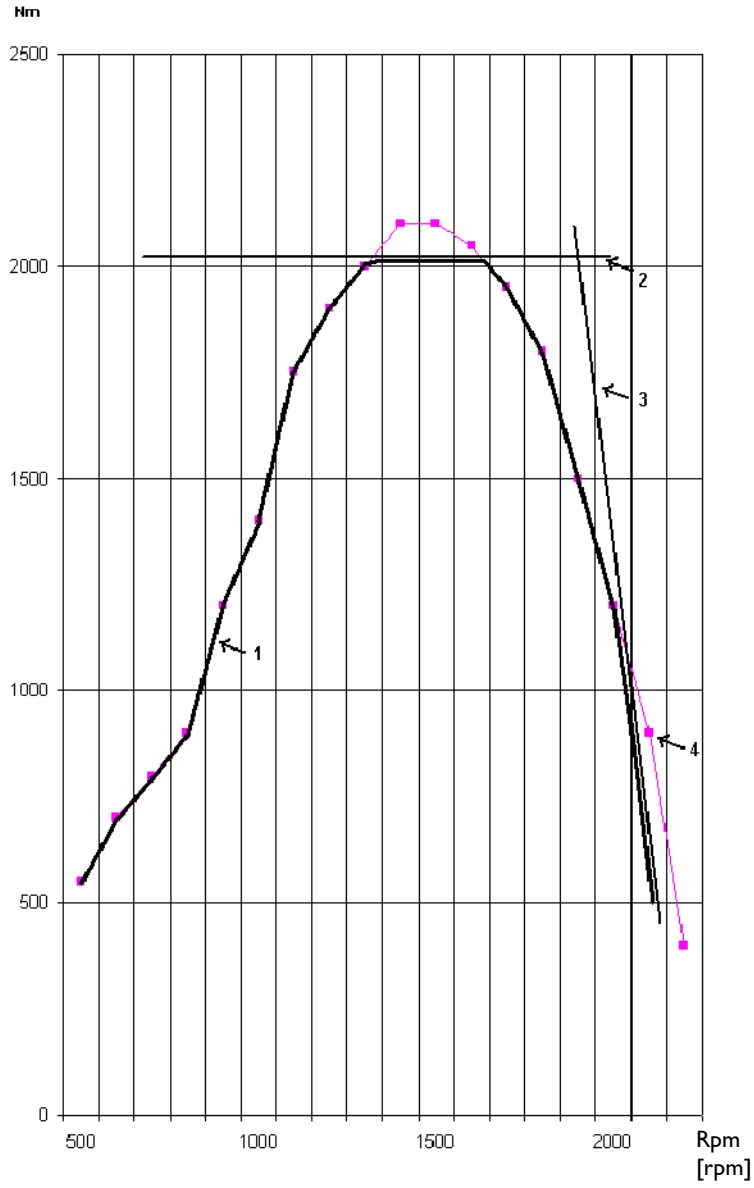
For mechanical power take-off protection, it is possible to limit:

a) engine torque delivery as a protection against overload

b) engine rpm, as a protection against over-speed

The diagram in fig. 4.8 shows this qualitatively by means of a toque/engine RPM curve (defined by 16 points), a horizontal section (representing torque limitation) and a sloping section (representing over-rev adjustment).

Figure 4.8



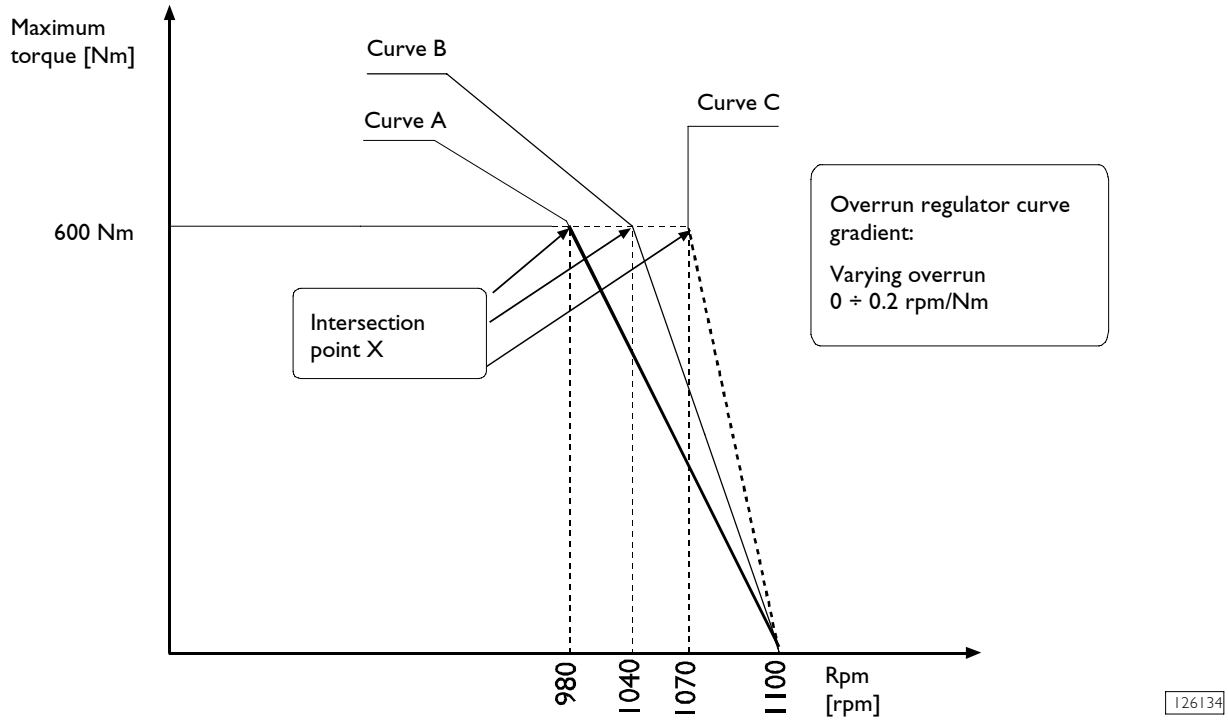
1. Resultant curve - 2. Maximum torque straight limitation line - 3. Out of rev curve - 4. Curve points

After setting a maximum for engine RPM and a variation mode (slope 3), we obtain a point of intersection X with the straight line of the set torque and therefore the maximum RPM compatible with this torque on the x-axis.
In other words: As the engine RPM increases, the control unit uses the lowest torque value between those on curve 1 and those on straight line 2 and then, for speeds greater than that determined by point X, causes the over-revving adjustment device to cut in and thus reduce the torque.

Please note that:

- The bodybuilder chooses the engine speed up to which the selected torque must available according to the use planned for the PTO
- The speed referred to is that of the crankshaft and not that of the PTO, for which the RPM must be calculated taking into account the reduction ratio (tab. 4.3 on page 4-11)
- These limitations (maximum torque, intersection point and curve gradient) may be selected independently of one another. It is, however, advisable to set a combination
- These parameters may only be activated by IVECO.

Figure 4.9



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

- Max engine torque 600 Nm
- Standard power take-off operation is specified at 900 rpm.
- The engine rpm must not exceed 1100 rpm
- The rpm must be calculated for all overrevving rpm regulator gradients

The corresponding power at 1100 rpm and a torque of 600 Nm gives (see equations on page 4-3)

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

The overrevving regulator curve gradient depends on the specific application.
With stationary operation, a steep overrevving rpm adjustment curve is therefore generally sufficient, while in driving mode this may give rise to rapid load changes (which could be a problem).

Therefore:

- with regulator at 0.05 rpm/Nm (curve C in figure), a torque of 600 Nm is available up to 1100 - (0.05 x 600) = 1070 rpm;
- with regulator at 0.1 rpm/Nm (curve B), the torque is available up to 1040 rpm;
- with regulator at 0.2 rpm/Nm (curve A), the torque is available up to 980 rpm;

4.7 PTO management

4.7.1 No PTO installed or provisions for PTO:

Default configuration

PTO-Option 5194, 6368, 1483, 1484.

Only the programming of the engine revolutions by the VCM is required.
The switches select the three rpm modes:

Table 4.16

PTO 1	PTO mode 1	900 [tr/min]
PTO 2	PTO mode 2	1100 [tr/min]
PTO 3	PTO mode 3	1300 [tr/min]

4.7.2 PTO Multipower

Default configuration

PTO option: 2395 for all gearboxes.

Only the programming of the engine revolutions by the VCM is required.
The switches select the three rpm modes:

NOTE These conditions can be modified in Customer Service.

Table 4.17 - Activation conditions

State of engine	OFF
Pressure switch	closed
State of vehicle	stationary
Coolant temperature	< 120 [°C]

Table 4.18 - Deactivation conditions

Coolant temperature	> 120 [°C]

4.7.3 PTO manual gearbox with electric engagement

Default configuration

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

NOTE These conditions can be modified in Customer Service.

Table 4.19 - Activation conditions

State of engine	ON
Coolant temperature	< 120 [°C]

Table 4.20 - Deactivation conditions

State of engine	OFF
Coolant temperature	> 120 [°C]

4.7.4 Allison gearbox PTO

Default configuration

Allison automatic gearbox option: 8292 (PTO included)

NOTE These conditions can be modified in Customer Service.

Table 4.21 - Activation conditions

State of engine	ON
State of gearbox	neutral
State of vehicle	stationary
Coolant temperature	< 120 [°C]

Table 4.22 - Deactivation conditions

State of engine	OFF
Coolant temperature	> 120 [°C]

4.7.5 PTO FOCSA

Default configuration

PTO option: 5151

NOTE These conditions can be modified in Customer Service.

Table 4.23 - Activation conditions

State of engine	ON (always enabled)

Table 4.24 - Deactivation conditions

State of engine	OFF

4.7.6 PTO engine

Default configuration

PTO options: 5367

NOTE These conditions can be modified in Customer Service.

Table 4.25 - Activation conditions

State of engine	ON
State of vehicle	stationary
Coolant temperature	< 120 [°C]

Table 4.26 - Deactivation conditions

State of vehicle	OFF
Coolant temperature	> 120 [°C]

4.7.7 PTO Eurotronic 2 transmission

Default configuration

NOTE These conditions can be modified in Customer Service.

Table 4.27 - Activation conditions

State of gearbox	enabled
State of engine	ON
State of vehicle	stationary
Coolant temperature	< 120 [°C]

Table 4.28 - Deactivation conditions

State of vehicle	OFF
Coolant temperature	> 120 [°C]

4.8 EM (Expansion Module)

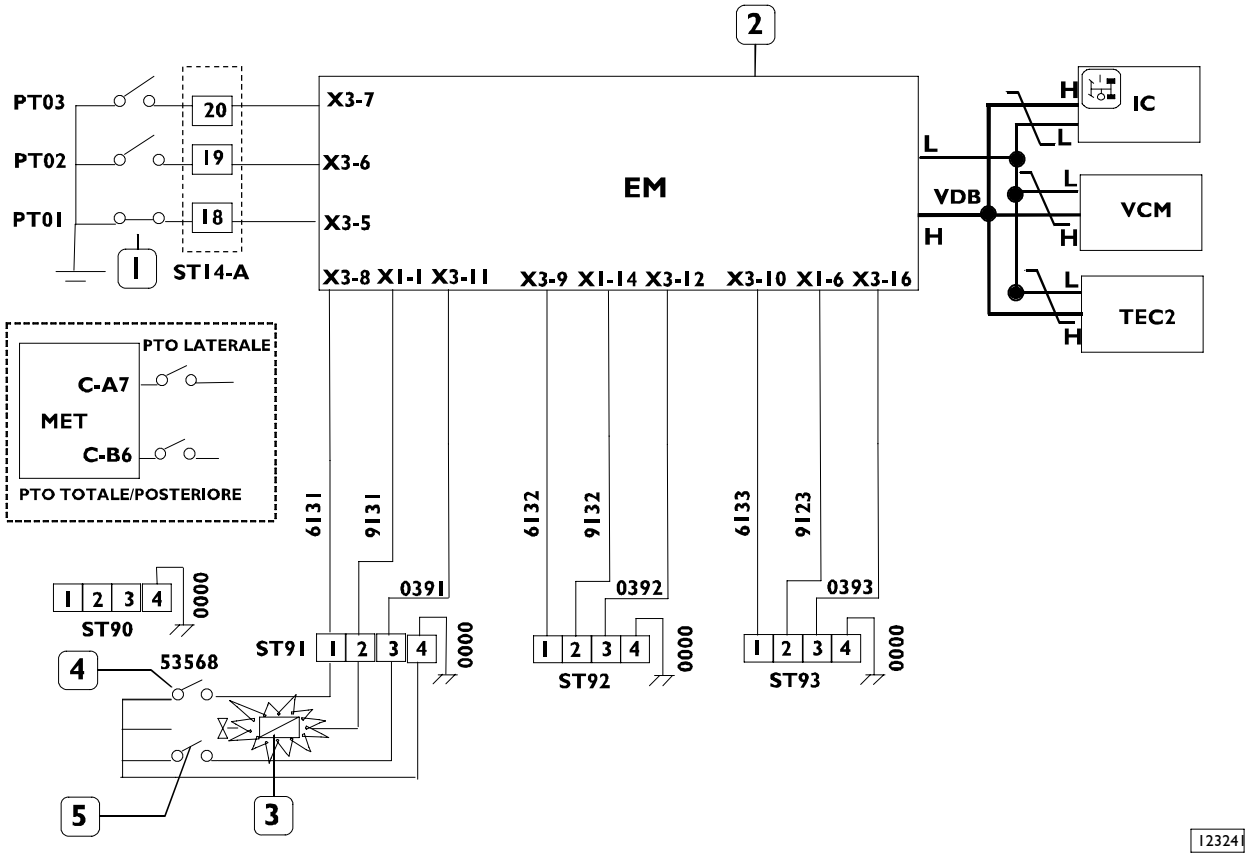
The optional 4572, EM (Expansion Module), is available on all the new Stralis.

The EM control unit can be used for electrical management of the PTO and for special applications. Also provides special gateways such as: trailer interface ISO11992-3 (TT) and CAN OPEN interface (BB in development phase).

Diagnostics is possible via CAN line and K line.

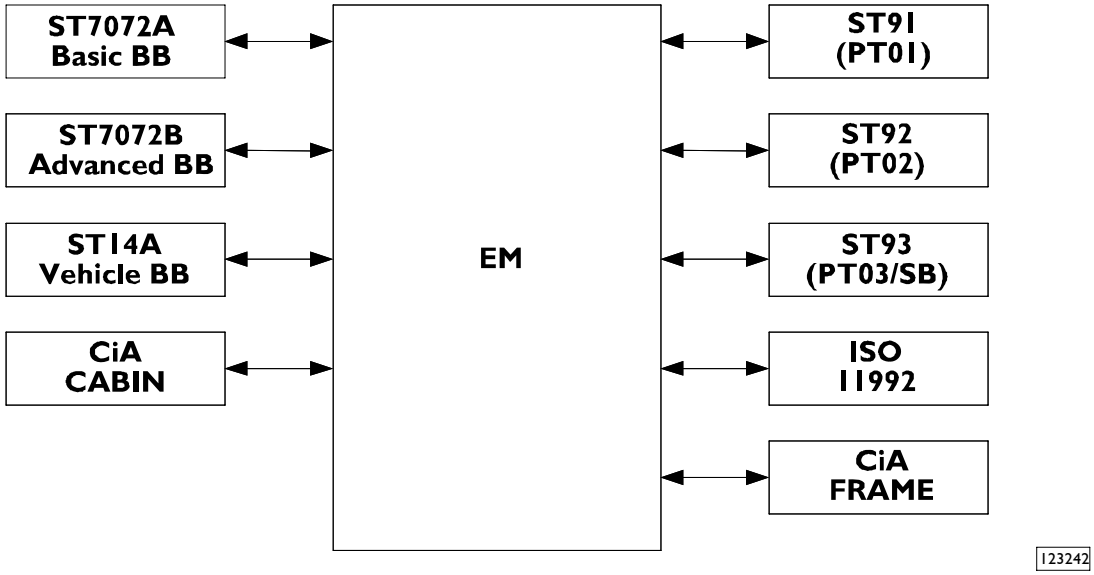
The wiring diagram for the Expansion Module hardware is shown in Figure 4.10, and the block diagram of the hardware structure is shown in Figure 4.11.

Figure 4.10



1. PTO switch - 2. EM ECU - 3. PTO solenoid valve - 4. PTO on - 5. Configurable PTO enablement.

Figure 4.11



The EM control unit allows the PTO activation and deactivation conditions to be set.

The connections on ST91, ST92 and ST93 must be carried out by the fitter so as to activate and display on IC the activation of the PTO.

The predefined set conditions for Stralis Euro 4-5 are:

4.8.1 Connections

Table 4.29 - PTO mode request: ST14A

PTO 1	pin 18
PTO 2	pin 19
PTO 3	pin 20

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

Table 4.30 - PTO IN/OUT: ST91 PTO1, ST92 PTO2, ST93 PTO3

pin 1	PTO feed-back
pin 2	PTO actuator (solenoid valve control)
pin 3	PTO enabling
pin 4	Ground

EM (Expansion Module)

SECTION 5

Special instructions for electronic subsystems

Index

5.1 Electronic systems

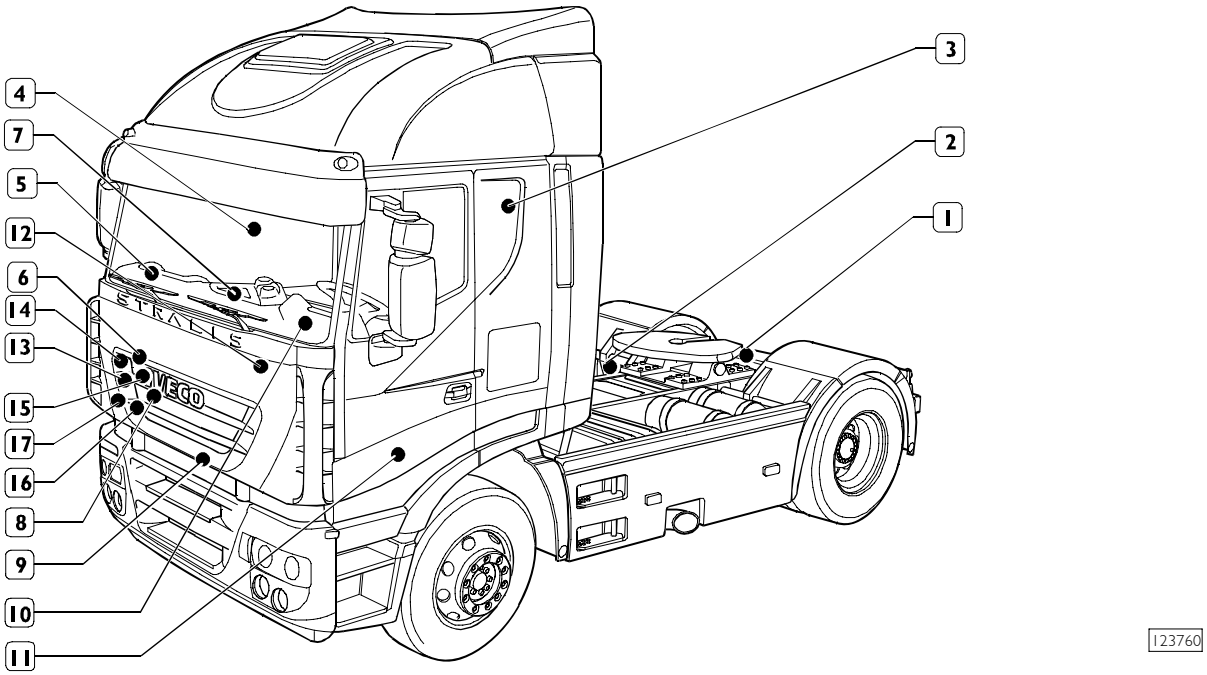
Stralis is equipped with an innovative electronic system, called Multiplex (MUX). The system electronically manages and controls the vehicle subsystems on CAN lines. The most important characteristics of devices are shown in the paragraphs that follow.

5.1.1 Description of ECUs

The location (Figure 5.1) and functions of the ECUs (electronic control units) installed in the vehicle are illustrated below for a better understanding of the Multiplex system.

Devices or electrical circuits cannot be directly connected to the ECUs described below. Always only use the connectors and special interfaces listed in the following paragraphs (bodybuilder connectors 5.2)!

Figure 5.1

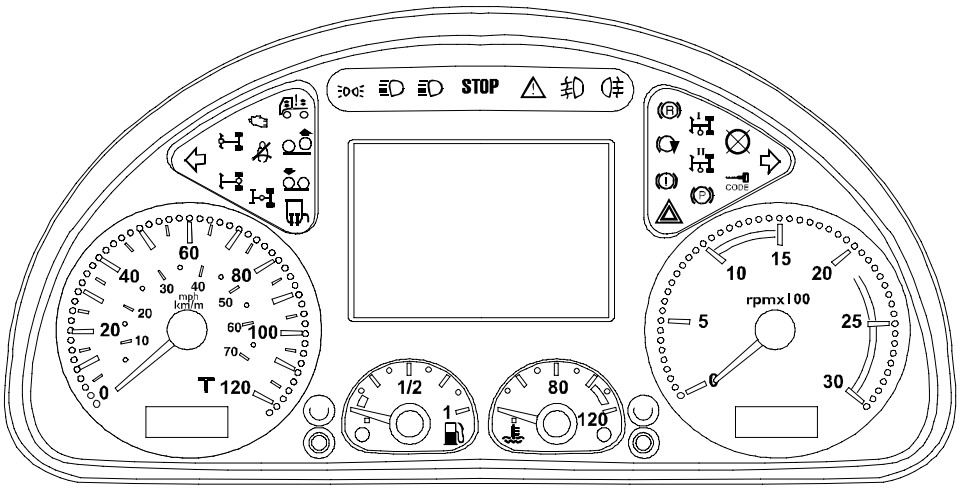


1. RFC on trucks - 2. RFC on tractors - 3. BM Bed Module - 4. AHT.A (additional heater) - 5. BC Body Computer - 6. Terminal board - 7. CC Climate Control - 8. AHT.W (additional coolant heater) - 9. FFC Front Frame Computer - 10. IC Instrument Cluster - 11. DDM Drive Door Module - 12. PDM Passenger Door Module - 13. Cab Module (Ordenador bastidor) - 14 Vehicle Control Module (VCM) - 15. Central locking - 16. Electronically-controlled air suspension (ECAS) - 17. EM (Expansion Module)

5.1.1.1 Instrument Cluster (IC)

The Instrument Cluster (IC) control panel forms the interface between driver and vehicle.
All vehicle statuses such as vehicle speed, engine rpm, coolant temperature and fault reports are indicated via the driver's control panel. It is not possible to select or take individual displays directly (e.g. control warning lights). This is possible only using the appropriate planned connection points.

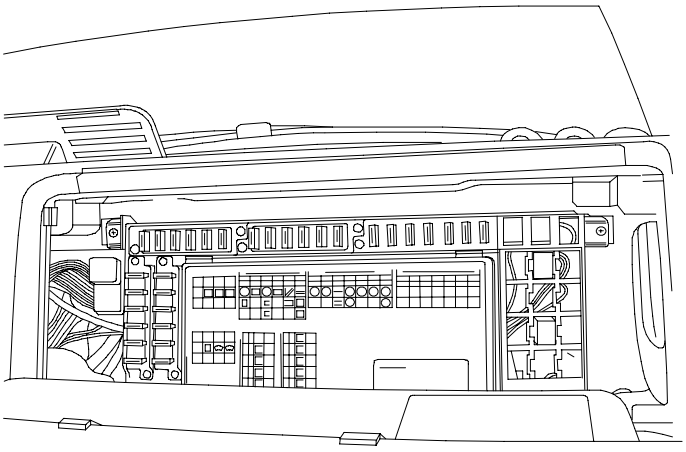
Figure 5.2



5.1.1.2 Body Computer (BC) and Cab Module (CM)

Illustration 5.3 shows the vehicle's central control unit, the Body Computer. All the input and output signals that are important for interaction with individual vehicle systems are processed here.
When non-permitted vehicle states arise, the information is sent from the Body Computer to the Instrument Cluster so that the driver can be informed via the fault warning lights. The fuses and relays are also housed in this sector.

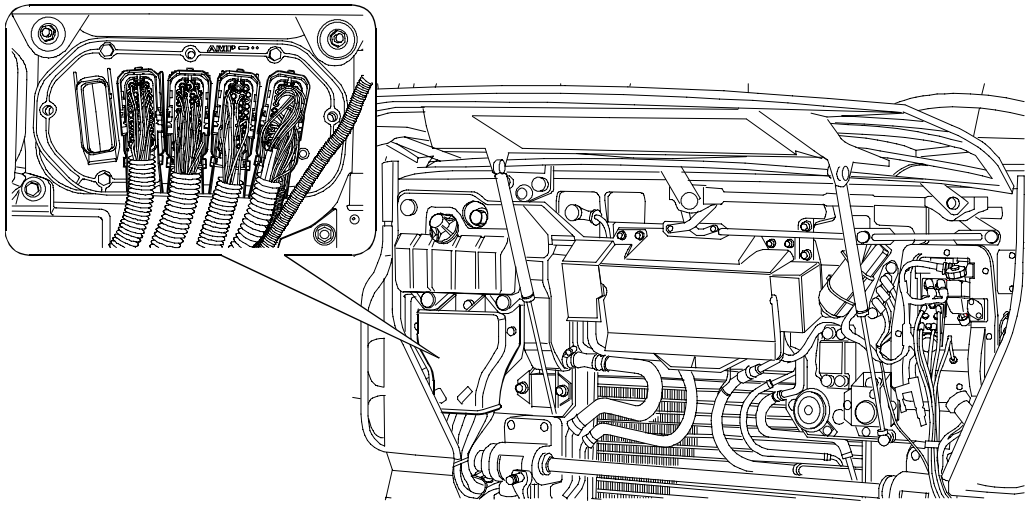
Figure 5.3



5.1.1.3 Bulkhead coupling (passage of electrical wiring)

The subsystems fitted on the body are connected to the ECUs in the cab via the terminal board which is the interface for connectors on body and cab side. It is located under the hood.

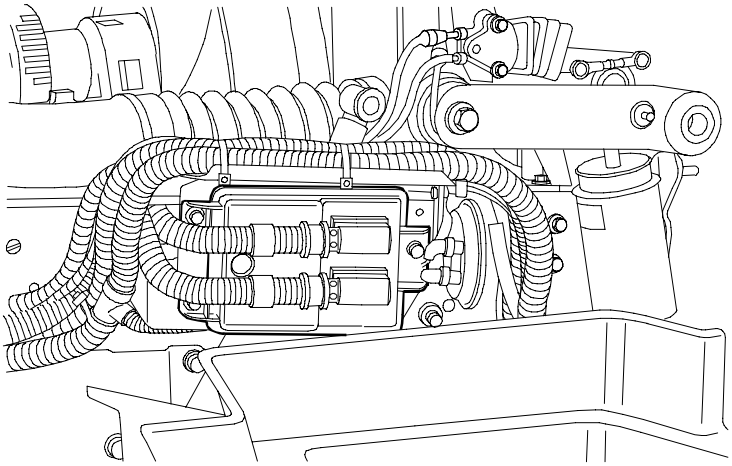
Figure 5.4



5.1.1.4 Front Frame Computer (FFC)

The Front Frame Computer sends and receives information on all components that are arranged in the front part of the vehicle, for example the front lighting system or the brake and engine system sensors.
Information is forwarded by means of the Body Computer to those vehicle systems to which this information is relevant.

Figure 5.5



5.1.1.5 Rear Frame Computer (RFC)

The RFC processes the information from the subsystems and the bodybuilder connectors in the rear part of the body and the signals from the trailer.

In the truck, the RFC is located behind the rear axle, as shown in Figure 5.6, whereas in the on-road tractor unit for half-trailer it is located in the centre of the frame, see Figure 5.7.

Figure 5.6

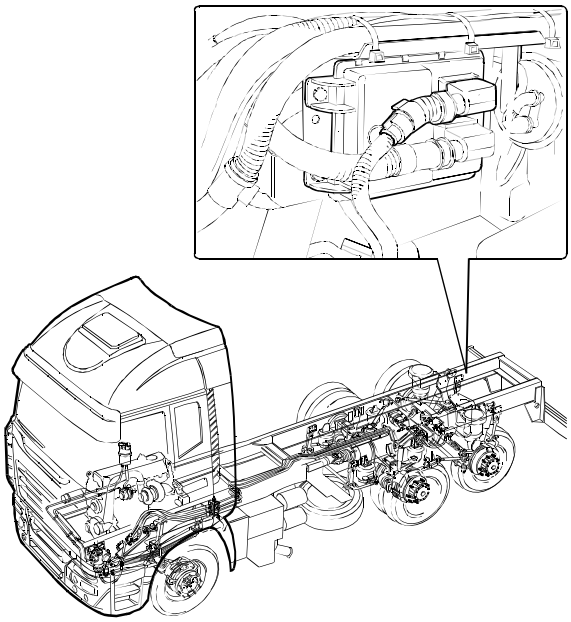
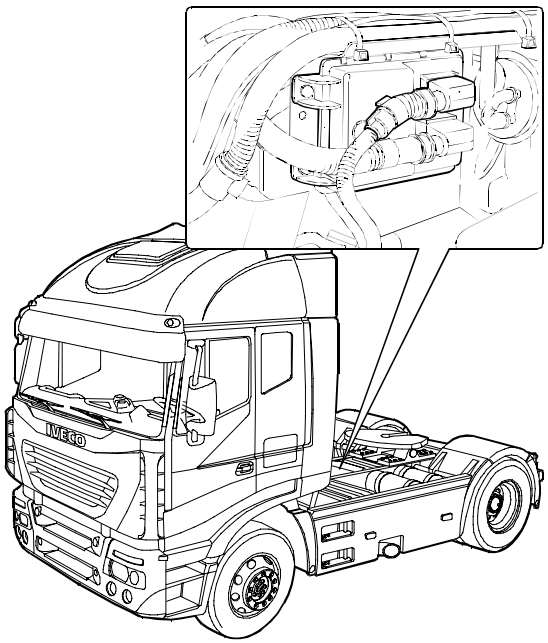


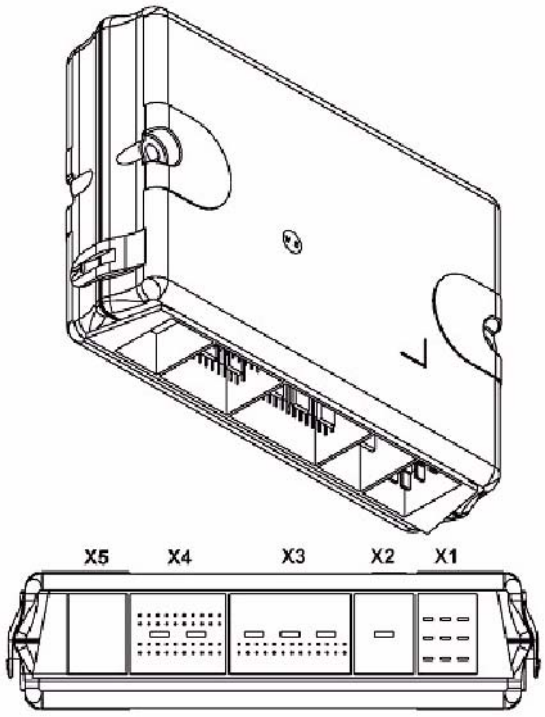
Figure 5.7



5.1.1.6 Expansion module (EM)

The EM (2) replaces the DMI control device used so far with the Trakker and is located in the passenger footwell. This is connected to the request switches, the electromagnetic valves and the PTO feedback switches. All PTO engagement/disengagement functions are now programmed in the EM control not and no longer in the Body Computer. The EM is already equipped with a cable and connectors for future applications that are currently not yet active.

Figure 5.8



0051469t

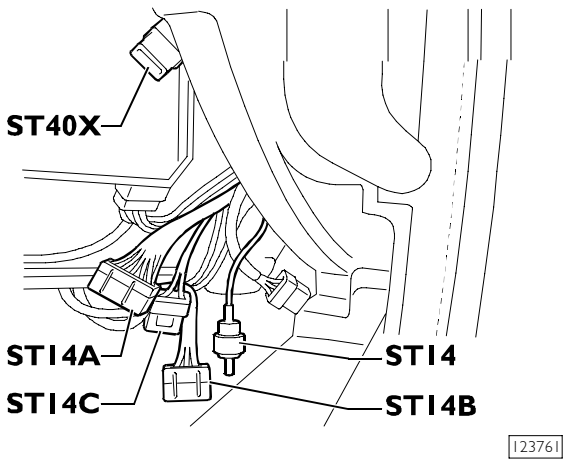
5.2 Bodybuilder connectors

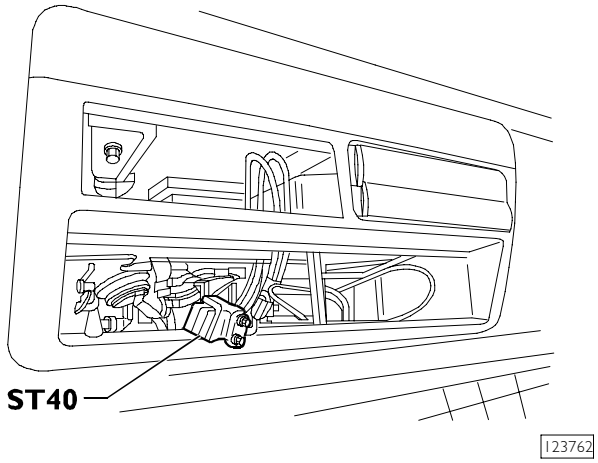
The various connectors for bodybuilders are described in detail in the following paragraphs.

5.2.1 In the cab

The connectors important for bodybuilders are the ST14 outputs. These are divided as follows: ST14, ST14A, ST14B, ST14C, and they are installed in accordance with specific requirements. They are housed behind a cover in the passenger footwell.
The ST40 output (FMS output) is housed above the driver in one of the removable DIN cassettes. Parallel to this in the passenger footwell, a ST40X output is available. Both outputs contain the same CAN communications.

Figure 5.9





21 pin connector (blue): ST14A

Table 5.1 - ST14A Interface connector basic functions

Pin	Description	Wire code	Max. load	Connected to	Remarks
1	Engine Start	8892	10mA	VCM X3-27	Engine cranking; earth = cranks engine (signal must be permanently on until the engine starts); wire open = no action.
2	Engine stop	0151	10mA	VCM X3-26	Engine stopping; Earth = stops engine (short activation sufficient to stop engine); wire open = no action.
3	Service brake	1165	200mA	VCM X1-13	Signal indicating that the service brake is applied. 0 V = service brake not applied +24 V = service brake applied
4	Vehicle standstill	5515	200mA	BC2 J5-1	Vehicle stationary signal 0 V = vehicle stationary +24 V = vehicle moving

Table 5.1 - (Continued) ST14A Interface connector basic functions

Terminal	Description	Wire number	Max. load	Connected to	Remarks
5	Parking brake	6656	200mA	VCM - X1-10	Signal indicating that the parking brake is applied 0 V = disengaged +24V = engaged
6	Reserved				
7	Vehicle speed	5540	10 mA	M/DTCO B7	Pulse signal
8	Engine status	7778	150 mA	BC2 J7-4	+24V at engine running
9	Gearbox neutral	8050	200 mA	VCM X1-7	+24V at neutral engaged
10	Reverse gear	2268	150 mA	BC2 J5-5	+24V at reverse gear engaged
11	K15	8871	3A	BC2 J3-3	K15 (ignition-operated power point)
12	CC Set+	8156	10 mA	VCM X3-33	CC Set+ input Open wire = Set + not activated Close to Ground = Set + activated
13	CC Set-	8157	10 mA	VCM X3-32	CC Set- input Open wire = Set - not activated Close to Ground = Set - activated
14	CC OFF	8154	10 mA	VCM X3-30	CC OFF input Open wire = Off not activated Close to Ground = OFF activated
15	CC Resume	8155	10 mA	VCM X3-31	CC RES input signal Circuit open = RES not activated Connection to ground = RES activated
16	CC driver/BB	0152	10 mA	VCM X3-49	Selection of CC activation by driver or BB Open wire = CC controlled by driver Close to Ground = CC controlled by BB
17	Ground	0000	10A	Wiring	Ground
18	PTO 1 sw	0131	10 mA	VCM X3-47 EM X3-5	PTO mode 1 Open wire = PTO mode 1 not activated Close to Ground = PTO mode 1 activated
19	PTO 2 sw	0132	10 mA	VCM X3-46 EM X3-6	PTO mode 2 Open wire = PTO mode 2 not activated Close to Ground = PTO mode 2 activated
20	PTO 3 sw	0123	10 mA	VCM X3-45 EM X3-7	PTO mode 3 Open wire = PTO mode 3 not activated Close to Ground = PTO mode 3 activated
21	K30	7772	Fusible 10 A	70401-6	K30 (positive from TGC)

9 pin connector (blue): ST14B

Table 5.2 - ST14B Interface connector basic functions

Pin	Description	Wire code	Max. load	Connected to	Remarks
1	2nd Speed Limiter	8223	10 mA	VCM X3 - 13	2nd speed limiter activation open wire = 2nd SL not activated + 24V = 2nd SL activated
2	Economy Power	0166	10 mA	VCM X3 - 11	Activation Economy Power (EP) open wire = EP not activated close to Ground = EP activated
3	Clutch status	9963	200 mA	VCM X1 - 12	To ground = clutch activated
4	PTS	5542	200 mA	VCM X1 - 14	Programmable threshold = rpm or vehicle speed +24 V = limit exceeded
5	Emergency Lights	1113	10 mA	BC2 J4 - 4	Close to ground = Emergency lights on Open wire = no action
6	Reserved				
7	Reserved				
8	Engine speed signal	5587	10mA	ECM 33	Pulse Signal
9	K58 external lights	3333	5A	BC2 J1 - 9	+24V at vehicle lights on

NOTE The pinout for connectors ST14A and ST14B indicated in tables 5.1 and 5.2 are specifically for OBD1 Step 2 vehicles.
The eighth digit of the PIC (Product Identification Code) indicates STEP 2 of the vehicle:
3 - 4 - C - B Stralis AS
3 - 4 - C Stralis AT/AD

12 pin connector: ST14C

Table 5.3 - ST14C Interface connector basic functions (Allison Gearbox for Refuse Vehicles)

Pin	Description	Connections				Remarks
		Type	Wire code	Max. load	Connected to	
1	Neutral Indicator for Extra Pto	OUTPUT High Side	"145"	0,5A	ALL 45	Gearbox in neutral: Ground for neutral engaged
2	Refuse Stepper Switch	INPUT	"123"	15mA	ALL 23	1st gear limitation and inhibit reverse Open wire = function activated + 24V = function not activated
3	-		"142"		ALL 42	
4	Pto Enable	INPUT	"143"	15mA	ALL 43	Input from PTO switch Open wire = PTO not requested + 24V = PTO requested
5	Pto Command	OUTPUT High Side	"130"	0,5A	ALL 30	PTO enable: +24 Output for solenoid valve
6	Reserved					
7	Reserved					
8	Automatic Neutral Dual Input	INPUT	"117"	5mA	ALL 17	Automatic Neutral. Logic "and" mode with pin 9 Open wire = function not activated Close to Digital Ground = function activated
9	Automatic Neutral Dual Input	INPUT	"101"	5mA	ALL 1	Automatic Neutral. Logic "and" mode with pin 8 Open wire = function not activated Close to Digital Ground = function activated
10	Digital Ground	POWER	"103"		ALL 3	Digital Ground. Must be used as return for inputs "Close to Digital Ground". Do not connect to -Battery or other grounds
11	Range indicator	OUTPUT Low Side	"113"	0,5A	ALL 13	Gearbox: Ground for neutral not engaged
12	Reserved					

12 pin connector: ST14C

Table 5.4 - ST14C Interface connector basic functions (Allison Gearbox for Fire Fighting Vehicles)

Pin	Description	Connections				Remarks
		Type	Wire code	Max. load	Connected to	
1	Neutral Indicator for Extra Pto	OUTPUT Low Side	"145"	0,5A	ALL 45	Gearbox in neutral: Ground for neutral engaged
2	-		"123"		ALL 23	
3	Auxiliary function Range Inhibit	INPUT	"142	5mA	ALL 42	Hold transmission in Neutral. Logic "and" mode with pin 2. Open wire = function not activated Close to Digital Ground = function activated
4	Pto Enable	INPUT	"143"	15mA	ALL 43	Input from PTO switch Open wire = PTO not requested + 24V = PTO requested
5	Pto Command	OUTPUT High Side	"130"	0,5A	ALL 30	+24 Output to activate PTO by solenoid valve
6	Reserved					
7	Reserved					
8	-		"117"		ALL 17	
9	Auxiliary function Range Inhibit	INPUT	"101"	5mA	ALL 1	Hold transmission in Neutral. Logic "and" mode with pin 3. open wire = function not activated Close to Digital Ground = function activated
10	Digital Ground	POWER	"103"		ALL 3	Digital Ground. Must be used as return for inputs "Close Digital Ground". Do not connect to -Battery or other grounds
11	Range indicator	OUTPUT Low Side	"113"	0,5A	ALL 13	Gearbox: Ground for neutral not engaged
12	Reserved					

9 pin connector: ST40

Table 5.5 - ST40 Interface connector basic functions

Pin	Description	Connections				Remarks
		Type	Wire code	Max. load	Connected to	
1	K30	POWER	7772	5A		K30
2	K15	POWER	8871	5A		K15
3	Vehicle speed	OUTPUT	5541	10 mA	IC 20	Vehicle speed
4	+12	POWER	7712	5A		+12
5	CAN H	Bus	WS/Bi	10 mA	VCM X3-37	CAN H
6	CAN L	Bus	GN/Ve	10 mA	VCM X3-38	CAN L
7	Dashboard light	OUTPUT High Side	4442	1A	BC2 J7-19	Dashboard light
8	Reverse gear	OUTPUT High Side	2268	200mA	BC2 J5-5	+24V at reverse gear engaged
9	Ground	POWER	0000	5A		Ground

6 pin connector: ST 72072A

Table 5.6 - ST 72072A Interface connector basic functions

Pin	Description	Connections				Remarks
		Type	Wire code	Max. load	Connected to	
1	Stopping brake	OUTPUT	Tbd	EM X4-4	6981	Tbd
2	Gearbox neutral	OUTPUT	Tbd	EM X4-5	6983	Tbd
3	Dig Input 11	INPUT	Tbd	EM X3-17	0991	Digital Input
4	External Clutch	OUTPUT	Tbd	EM X1-7	9995	Tbd
5	Reserved					
6	Reserved					

20 pin connector: ST 72072B

Table 5.7 - ST 72072B Interface connector basic functions

Pin	Description	Connections				Remarks
		Type	Max. load	Con-nected to	Wire code	
1	Dig Input 12	INPUT	Tbd	EM X3-18	0992	Digital Input
2	Dig Input 13	INPUT	Tbd	EM X3-19	0993	Digital Input
3	Dig Input 14	INPUT	Tbd	EM X3-20	0994	Digital Input
4	Dig Input 15	INPUT	Tbd	EM X3-21	0995	Digital Input
5	Dig Input 16	INPUT	Tbd	EM X4-6	0996	Digital Input
6	HS Output 5	OUTPUT	Tbd	EM X1-3	6985	High side Output
7	HS Output 6	OUTPUT	Tbd	EM X1-8	6986	High side Output
8	HS Output 7	OUTPUT	Tbd	EM X4-1	6987	High side Output
9	HS Output 8	OUTPUT	Tbd	EM X4-2	6988	High side Output
10	HS Output 9	OUTPUT	Tbd	EM X4-3	6989	High side Output
11	HS Output 10	OUTPUT	Tbd	EM X4-21	6990	High side Output
12	HS Output 11	OUTPUT	Tbd	EM X4-22	6991	High side Output
13	HS Output 12	OUTPUT	Tbd	EM X4-23	6992	High side Output
14	HS Output 13	OUTPUT	Tbd	EM X4-31	6993	High side Output
15	HS Output 14	OUTPUT	Tbd	EM X4-32	6994	High side Output
16	AN IN 1	INPUT	Tbd	EM X4-14	5981	Analog input
17	AN IN 2	INPUT	Tbd	EM X4-15	5982	Analog input
18	AN IN 3	INPUT	Tbd	EM X4-29	5983	Analog input
19	Freq IN 1	INPUT	Tbd	EM X4-16	5991	Frequency input
20	Freq IN 1	INPUT	Tbd	EM X4-38	5992	Frequency input

5.2.2 On frame

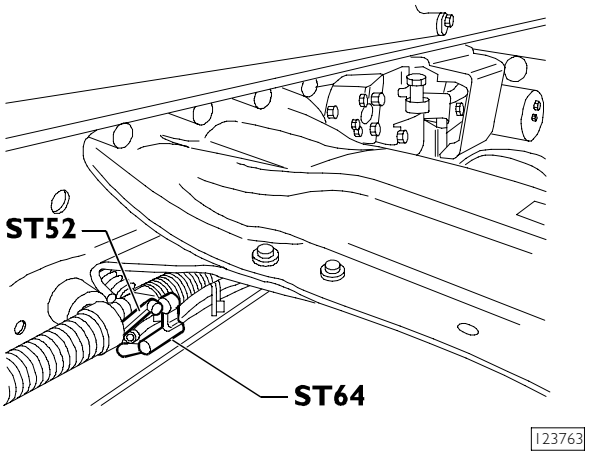
The following plug connections are located in the frame area:

- ST52 (for customer-specific solutions)
- ST64 (for customer-specific solutions)
- ST91 PTO output 1
- ST91 PTO output 2
- ST91 PTO output 3

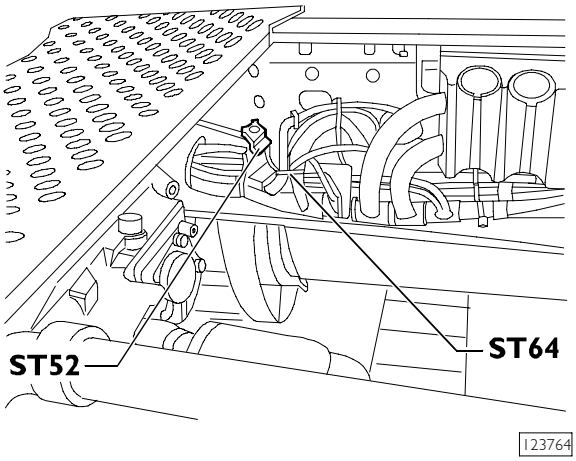
NOTE Output ST 90 (in the case of a manual gearbox), that was introduced with the Stralis construction series is still used, but is no longer supported and may no longer be used for applications! Output St 67 is no longer available!

Figure 5.10

Tractors:



Cabinati:



4 pin connector: ST52

Figure 5.11

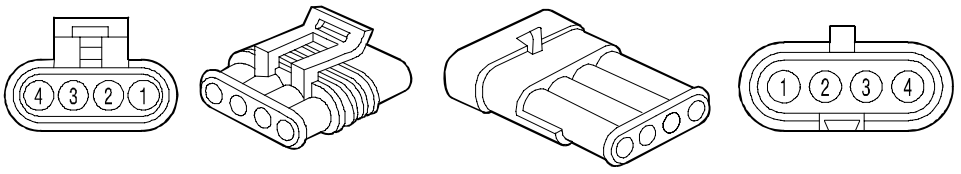


Table 5.8 - ST52 Interface connector basic functions

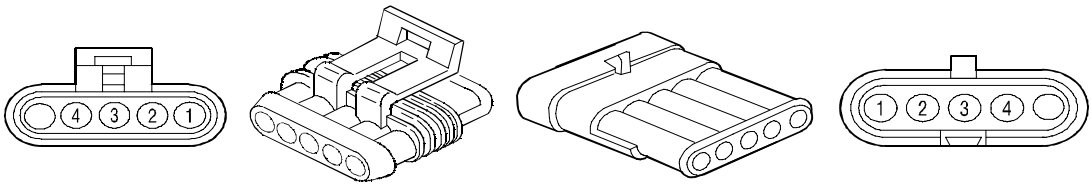
Pin	Function	Cable color code
1	Plus + 15 for special body makers	8871
2	Ground	0000
3 [1)]	Position lights	3333
4	Negative from secondary speed limiter switch	0172

1) +24 V when:

- K15 OFF and side markers on
- K15 ON and side markers on
- K15 ON and lights on (dipped beam and main beam)

5 pin connector: ST64

Figure 5.12



For general use by bodybuilders: four terminals in the 15-pole connector can be used for the trailer.

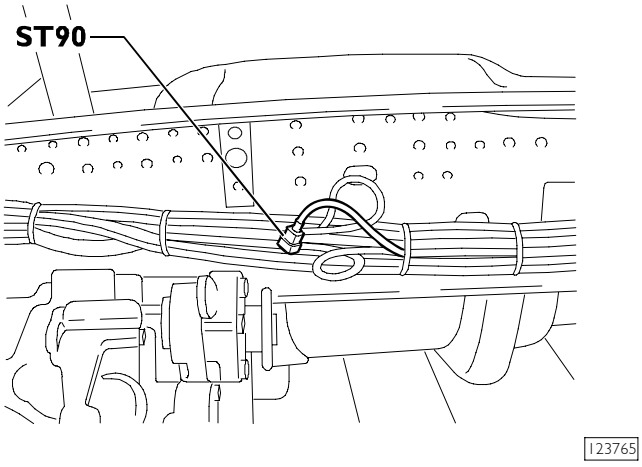
Table 5.9 - ST64 Interface connector basic functions

Pin	Function	Cable color code
1	Current socket supply	8021
2	Current socket supply	7021
3	Connected to trailer output Pin 10	6621
4	Terminal 15 also connected to output ST52 Pin 1	8075
5	Connected to trailer output Pin 11	8075

NOTE ST90 DO NOT use for PTO management.

4 pin connector: ST91 / 92 / 93

Figure 5.13



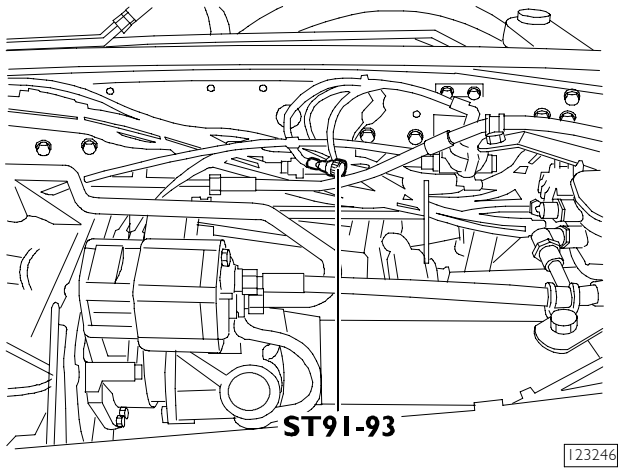


Table 5.10 - ST91 / 92 / 93 Interface connector basic functions

Pin	Description	Wire number	Max. load	Connected to	Remarks
1	PTO feedback signal	6131 (ST91) 6132 (ST92) 6133 (ST93)	-	EM X3-8 EM X3-9 EM X3-10	Connection open = PTO not engaged Earth = PTO engaged
2	PTO activation by means of electromagnetic valve	9131 (ST91) 9132 (ST92) 9133 (ST93)	1,6 A	EM X1-1 EM X1-3 EM X1-6	0 V = Electromagnetic valve not activated +24 V = Electromagnetic valve activated
3	Press switch/digital input	0391 (ST91) 0392 (ST92) 0393 (ST93)	-	EM X3-11 EM X3-12 EM X3-16	The input may be factory programmed 1)
4	Ground	0000	11 A		Ground

1) Two input situations may occur:
A to ground = PTO enabled
B connection open = PTO not enabled
Active condition programmed using Easy programming device
Acquistion of pressure switch installed in the factory with the use of Multipower and engine operation power take-offs (engine PTO)
The input may be freely used for other applications in order to connect a required function in the PTO control

5.2.3 Truck/trailer connectors

Two connectors are provided for connecting the trailer:

- 15-pin for electrical devices in general
- 7-pin for vehicles with EBS, or 5-pin for vehicles with ABS + EBL.

Table 5.11 - 15-pin plug for connecting the trailer

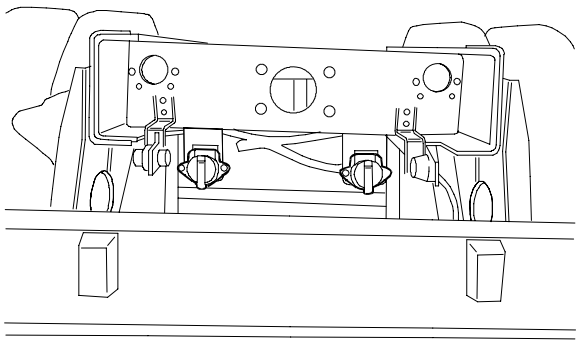
Pin	Code	Maximum load	Transversal cross-section	Use
		A	mm^2	
1	1180	6	0.75	Left trailer indicator
2	1185	6	0.75	Right trailer indicator
3	2283	6	0.75	Rear foglight
4	0000	11	2.5	Ground
5	3339	6	0.75	Right rear marker/left trailer light
6	3330	6	0.75	Left rear marker/right trailer light
7	1179	6	0.75	Trailer brake light
8	2226	6	0.75	Tail-light
9	7790	11	2.5	ADR, terminal 30
10	6021	11	1.0	To ST64
11	8075	11	1.0	ST64 Pin 15
12	6642	11	1.0	Lifting axle signal for trailer in raised position. For bulkhead coupling B Pin 19
13	0000	11	1.0	Ground
14	8081	11	1.0	To ST64 Pin 2
15	9021	11	1.0	To ST64

Remarks

Use connector ST64 described in paragraph 5.2.3 for connecting to terminals 10, 12, 14, 15.

Figure 5.14 shows truck connectors. The arrangement is similar and located behind the cab on tractors.

Figure 5.14



Bodybuilder connectors

Table 5.12 - Component codes

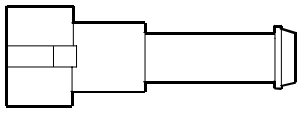
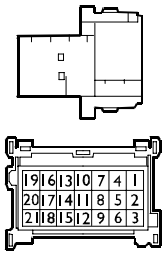
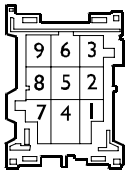
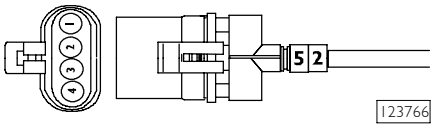
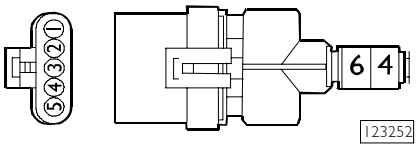
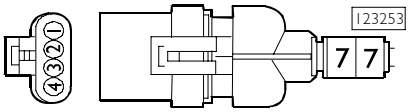
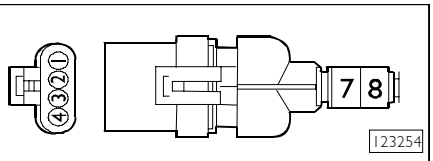
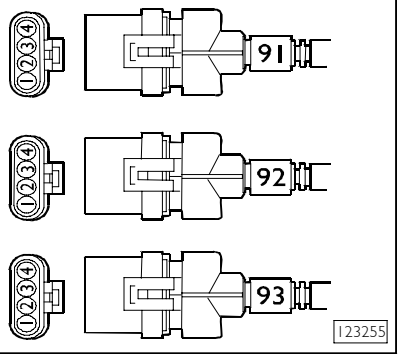
ST14	Connector body component code: 98435333 Connector contact component code: 98457375	 123249
ST14A	Connector body component code: 500314817 Connector contact component code: 500314823 (0.35-0.5 mm^2) 500314824 (0.75-1.5 mm^2)	 123250
ST40X ST14B	Connector body component code: 41118303 Connector contact component code: 41200695	 123251
ST52	Connector body component code: 9843 5337 Connector contact component code: 98457375 (0.35-0.5 mm^2) 9845 5370 (0.75-1.5 mm^2) Gasket TN 486 1936	 123766
ST64	Connector body component code: 9843 5338 Connector contact component code: 98457375 (0.35-0.5 mm^2) 9845 5370 (0.75-1.5 mm^2) Gasket TN 486 1936	 123252
ST77	Connector body component code: 9843 5337 Connector contact component code: 98457375 (0.35-0.5 mm^2) 9845 5370 (0.75-1.5 mm^2) Gasket TN 486 1936	 123253

Table 5.12 - (Continued)

ST78	Connector body component code: 9843 5337 Connector contact component code: 98457375 (0.35-0.5 mm^2) 9845 5370 (0.75-1.5 mm^2) Gasket TN 486 1936	
ST91-93	Connector body component code: 9843 5337 Connector contact component code: 98457375 (0.35-0.5 mm^2) 98455370 (0.75-1.5 mm^2) Gasket TN 486 1936	

5.3 Electrical circuit modifications

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

IVECO recommends not to change the other electrical circuits and wiring harnesses either.

Any modifications on the system will reduce quality and safety characteristics.

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

IVECO cannot be liable for system malfunctioning following the instructions contained in this chapter.

5.3.1 Introduction

The instructions provided by IVECO in paragraph 2.1.1 also refer to Multiplex system wiring harnesses.
IVECO connectors and the respective terminals cannot be modified. Avoid connecting and disconnecting the chassis ECU connectors for more than three times to prevent damaging the gel which ensures tightness of the connections.

5.3.2 Wiring harness length

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

The wire length (CAN line + electrical wires) may not be correct when repositioning ECUs connected to the Multiplex system.

- excessive
- not sufficient

If the length is excessive, fold the wires without forming rings (this could cause undesired electromagnetic effects). Preferably use figures of 8. The wire which connects the ECUs is very stiff. For this reason, it must be replaced when it cannot be folded.

Replace the wiring if the length is not sufficient. Use genuine IVECO spare parts (contact the IVECO service network).

The wire length depends on three factors: wheelbase, overhang and crossmember position. Select one of the variants in the table for replacing the wiring if the modification involves a wheelbase/overhang which already exists in the IVECO range or, conversely, choose the closest variant for the solution (the table only shows the currently produced wheelbase/overhang combinations).

In all cases, the CAN wiring itself cannot be changed. All modifications are expressly forbidden by IVECO.

Table 5.13

Vehicle	Variant	Wheelbase	Overhang
4x2 truck	1	4500	1803
	2	5100	2388
	3	5700	2208
	4	6300	2793
6x2P truck	1	4200	2118
	2	4500	2073
	3	4800	2073
	4	5100	1803
	5	5700	2433
	6	6050	2658
6x4 trucks	1	3800	1488
	2	4200	1848
	3	4500	1982
4x2 tractors	1	3650	1048
	2	3800	1048
6x2C tractors	2	3800	1048

This does not refer to modifications which do not involve the Multiplex wiring (CAN line + electrical wires). For example, when extending the overhang without changing the position of the RFC, simply replace the electrical wires leading from the RFC to the respective utilities.

IVECO recommends replacing traditional electrical wires with genuine components instead of modifying them.

Contact IVECO for particularly difficult cases. Send a diagram with the chassis dimensions and the new ECU positions.

5.3.3 Repositioning ECUs

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

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

5.3.4 Disconnecting ECUs

Operations which do not comply with the instructions specified by IVECO or made by non qualified personnel can cause severe damage to on-board systems, effect driving safety and correct operation of the vehicle and cause considerable damage which is not covered by warranty.

Follow the instructions below carefully before disconnecting an ECU:

- turn the ignition key to off, if it is inserted;
- switch off the additional heaters and wait for the end of the cooling down cycle (the warning light in the button will go out);
- open the TGC;
- isolate the battery by disconnecting the battery cables: disconnect the negative terminal first followed by the positive terminal;
- disconnect the ECU.

5.4 FMS

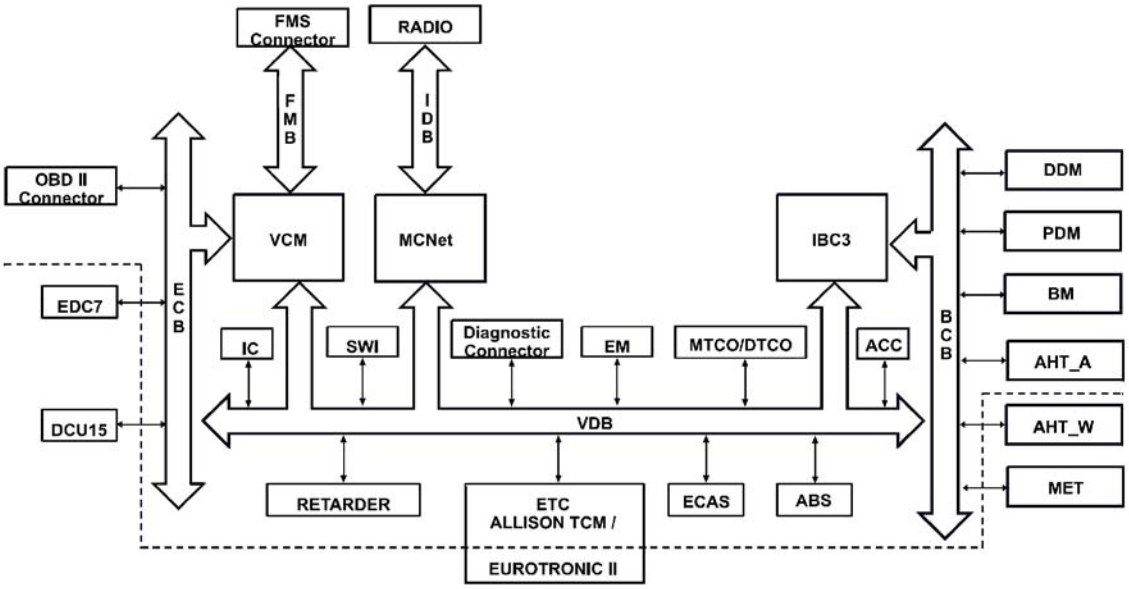
SVDI Vehicle Data Interface, (FMS interface) option 14569

Specific data is made available through the CAN line for vehicles fitted with option 14569. Information is available on:

- Engine speed
- Engine oil temperature
- Engine torque
- Speedometer data
- Current fuel consumption
- Current fuel reserve
- Display of axle load (if option 7306 present, display of axle load)

The exact composition of the data complies with the vehicle equipment (equipment with electronic control devices).
Data may be recalled in real time by installing a PC on board (option). The data format corresponds to FMS standard. The details of this standard may be consulted on the internet at the address www.fms-standard.com.

Figure 5.15 MULTIPLEX SYSTEM ASSEMBLY (OPTION 6873)



117540

MTCO/DTCO. Tachograph - VCM. Vehicle Control Module - I.C. Cluster - B.C. Body Computer - DIAGNOSTIC CONNECTOR. 30-pin diagnostic connector - EBS II. EBS II control unit - INTARDER. Intarder control unit - ECAS. Air suspension control unit - EU II. Eurotronic II automatic transmission control unit - ACC. Adaptive Cruise Control control unit - ECM. Engine management unit - UDS. Control unit for SCR - OBD supply module. 16 pin coupling for OBD (on board diagnosis) - DDM. Driver Door Module - PDM. Passenger Door Module - BM. Bed Module - CC. Climate Control - FFC. Front Frame Computer - RFC. Rear Frame Computer - HWH. Water heater - AAH. Air heater - CM. Cabin Module - SWI. Steering Wheel Interface - EM (Expansion Module) - Radio. Radio - FMS. FMS (Fire Wall) connector - P.C. Personal Computer

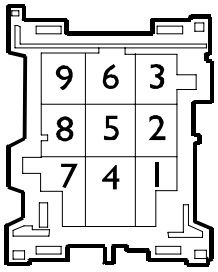
The following analyses may be carried out for subsequent processing of the data on a PC:

- checking of vehicle service data (trip duration, road sections, fuel consumption and speed)
- engine service data (rpm, load conditions)
- estimated oil consumption
- data for analysing brake use by the driver
- breakdown of road sections travelled, speed, breaks in the trip and resumption of trip.

To call up the data through a VDI interface, the onboard PC must be connected to connector ST40.

CAN connection between VDI interface and PC

Figure 5.16



Pin for connector PN 41200695

Table 5.14 - Characteristics of the CAN line

Physical level	Unshielded twisted pair cable compliant with ISO 11898 (SAE J1929/11). Termination of internal bus to cable with 120 Ω resistor.
Data link level	CAN 2.0B, 250 Kbit/sec. Format identifier and multi-packet message management compliant with SAE J1929/21.
Application level	Messages and parameters compliant with SAE J1939/71

The body builder is responsible for installation of the on-board PC, wiring for the ST40, hardware and software for subsequent processing of data.

The information that may be called up via the VDI interface contains an "FMS Standard Interface" message and identifies the version that is supported by the VDI interface installed.

This message is not present if an interface that does not yet support the FMS standard is installed. The vehicle-related data quoted in this paragraph are nevertheless still available in this case.

5.5 Electrical System: Modifications and Drawing-Off Power

5.5.1 General Specifications

The vehicles operate on a 24v electric system for normal requirements and the chassis is an earth return. This acts as a current return wire between relevant components, such as battery and alternator. All component negative terminals are connected through the chassis in the absence of an insulated return wire.

Installation of auxiliary equipment or circuits added by the bodybuilder must take into account the instructions given below. Depending on the complexity of the modification, suitable documentation (e.g. electrical diagram) must be provided for inclusion with that relating to the vehicle.

Use colours and/or codes for wires and connectors equal to those used on the original vehicle makes the installation more consistent and facilitates repair work.

NOTE For greater details on the vehicle's electrical system, see the specific Workshop Manual, publication no. 603.93.521 (Stralis AT/AD) - publication no. 603.93.531 (Stralis AS).

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

Precautions

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

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

It is absolutely prohibited to make any changes or connections to the line linking the ECU's (CAN line), which cannot be tampered with, under any circumstances. Any fault diagnosis or maintenance work can only be done by authorized personnel with IVECO approved equipment.

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

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

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

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

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

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

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

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

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

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

Additional equipment should be connected to the system earth with the utmost care (see point 2.1.1). The relative wiring must not be fitted alongside the existing electronic circuits in order to avoid electromagnetic interference.

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

5.5.2 Electromagnetic compatibility

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

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

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

The maximum admissible variation in transient voltage for units powered with 24 V is +80V, as measured at the terminals of the artificial network (L.I.S.N.) during bench tests; otherwise, if the measurements are made on the vehicle, the variation must be determined at the most accessible point in the proximity of the device generating the disturbance.

NOTE The 24 V supplied devices:

- **must be free from immune from negative noises, such as -600V spikes, positive +100V spikes, +/-200V burst.**
- **they must operate correctly during voltage lowering phases to 8V for 40 mS and to 0V for 2 mS.**
- **moreover, they must resist the load dump phenomena up to 58V.**

Max levels measured on bench for radiated and driven emissions generated by 24V devices are shown in Table 5.15.

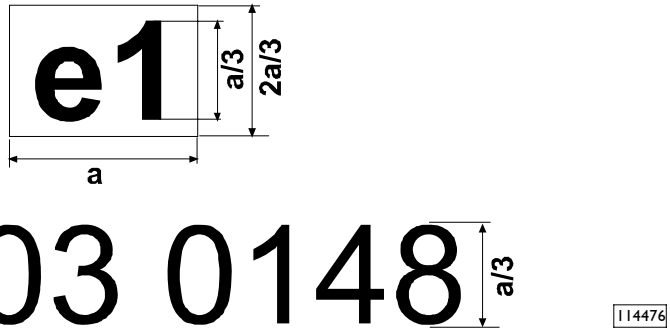
Table 5.15

Type of emission	Type of transducer	Type of disturbance	Type of detector	Frequency range and limits acceptable by noise in dBuV/m									Unit of measure
				150KHZ 300KHZ	530KHZ 2 MHZ	5.9MHZ 6.2MHZ	30 -54 MHZ	68-87 MHzmobile services only	76-108 MHzbroadcast only	142-175 MHZ	380-512 MHZ	820-960 MHZ	
radiated	Aerial at a distance of 1 metre	Broad-band	Nearly peak	63	54	35	35	24	24	24	31	37	dBuV/m
radiated		Broad-band	Peak	76	67	48	48	37	37	37	44	50	
radiated		Narrow-band	Peak	41	34	34	34	24	30	24	31	37	
conducted	LISN d 50 ohm/ 5 mH / 0, 1 mF	Broad-band	Nearly peak	80	66	52	52	36	36	Not applicable			dBuV
conducted		Broad-band	Peak	93	79	65	65	49	49				
conducted		Narrow-band	Peak	70	50	45	40	30	36				

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

Fine below an example of brand as required by the current European directive 2004/104EC applicable for electromagnetic compatibility in the automotive sector:

Figure 5.17



a ≥ 6 mm

If in any doubt, call the IVECO Service Network.

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

In case of systems which use the primary or secondary civil electric network (220V AC) as a supply source, the relevant characteristics have to comply with the IEC regulations.

Two-way radio systems

The most common applications include:

- amateur two-way radio equipment for CB and 2 metre bands.
- two-way radio equipment for mobile phones.
- GPS satellite reception and navigation equipment.

The selection of the aerial to be installed is very important to ensure max performance to receiver and transmitter equipment. It shall be of very good quality and installed with utmost care, even the mount position is of essential importance, as it determines the aerial efficiency, therefore its transmission range.

Therefore, the ROS (Stationary Wave Ratio), gain and generated electromagnetic field characteristics must be ensured within predefined limits, while impedance, efficient height, efficiency, orientability parameters are contained in manufacturer's technical card.

The installation of 2m amateur CB sets, mobile phones (GSM) and satellite navigation systems (GPS) must use the power system already present on the vehicle. The connection is made directly to terminal 30 of connector ST40 (and 15, where necessary).

Such devices must be legally type-approved and fixed (not portable). The use of two-way radio sets that are not type approved or the application of extra amplifiers could seriously impair the efficient operation of the electric/electronic devices normally fitted to the vehicle, to the detriment of vehicle and/or driver safety.

Amateur equipment for CB and 2m band

The installation of C.B. equipment (27 MHz), 1 m (144 MHz) shall require use of the supply system already installed on vehicle, with connection to terminal 30 of ST40 connector.

These units must be type-approved according to the applicable legal requirements and must be of the fixed type (non portable) type. The use of non type-approved receiver-transmitter units or supplementary amplifiers might affect the correct operation of standard on-board electrical/electronic devices, with adverse effects on vehicle and/or driver safety.

The antenna must be installed outside the vehicle, possibly on a large metallic base as vertically as possible with the connection wire leading downwards. Follow the instructions and the manufacturer's warnings for assembly (see Figure 5.18).

- The ROS value must be as close as possible to the unit, the recommended value is 1.5 while max acceptable value must never be greater than 2.
- The **AERIAL GAIN** values must be as high as possible and ensure sufficient spatial uniformity, normally with deviations from the average value in the order of 1.5dB in the typical CB radio band (26.965-27.405 MHz).
- The **IRRADIATED FIELD IN CABIN** value must be as low as possible , < 1V/m is recommended as a quality target. In any case, limits set by the applicable European legislations must never be exceeded.
- **For this reason**, the aerial must always be placed out of cabin.

In order to determine the good operation of radio-cable-aerial system and to check whether aerial is properly adjusted, we recommend that following indications be followed:

1) If ROS is greater on low channels than on high channels, the aerial should be extended

2) If ROS is greater on higher channels than on low channels, the aerial should be shortened

After aerial adjustment, it is recommended to check ROS value again on al channels.

Installation at roof center is to be considered the best one as the ground plane is proportional in all directions, while mount on a side or on any other vehicle part makes the ground plane proportional to its mass.

Cables involved in the installations should be connected and positioned taking care to:

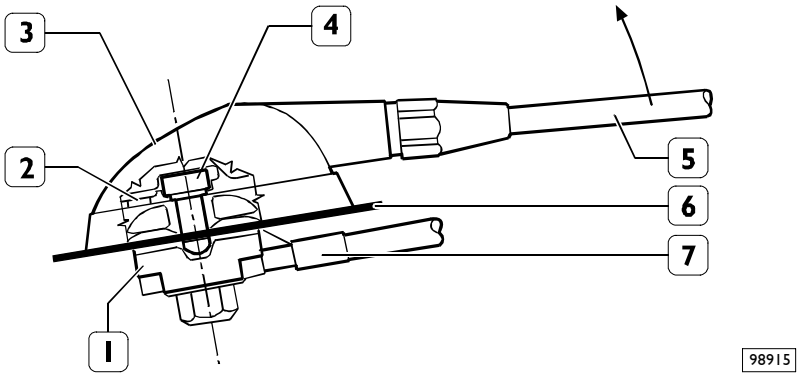
- Use a top-quality, low-loss coaxial antenna cable with the same impedance as the transmitter and the antenna (see Figure 5.19).
- The coaxial cable run must be at a suitable distance (minimum 50 mm) from pre-existing wiring (TV, radio, telephone, amplifiers and other electronic devices) to prevent interference and malfunctioning. Ensure the minimum distance from the metallic structure of the cab. Cable installation on the left or right-hand side is preferable.
- Clean the lower part of the hole made in the body for installing the antenna in fixed position so that the antenna support is perfectly connected to the vehicle earth.
- The coaxial cable connecting the antenna to the radio must be fitted with the utmost care. Avoid curves or bends which can pinch or distort the cable. Avoid tangling. Shorten the wire as much as possible.
  Remember that any imperfections in the coaxial cable will cause severe interference for the radio transmitter.

- Use existing holes for routing the cable. Take all the necessary precautions for protecting the body if additional hole have to be drilled (use anti-rust paint, sheath, etc.).
- Ensure a good connection with the vehicle earth both at the base of the antenna and at the device fixing to ensure maximum power transfer.

Radio transmitters are typically fitted on the dashboard in the gear lever area or in the header rail above the driver (see Figure 5.20).

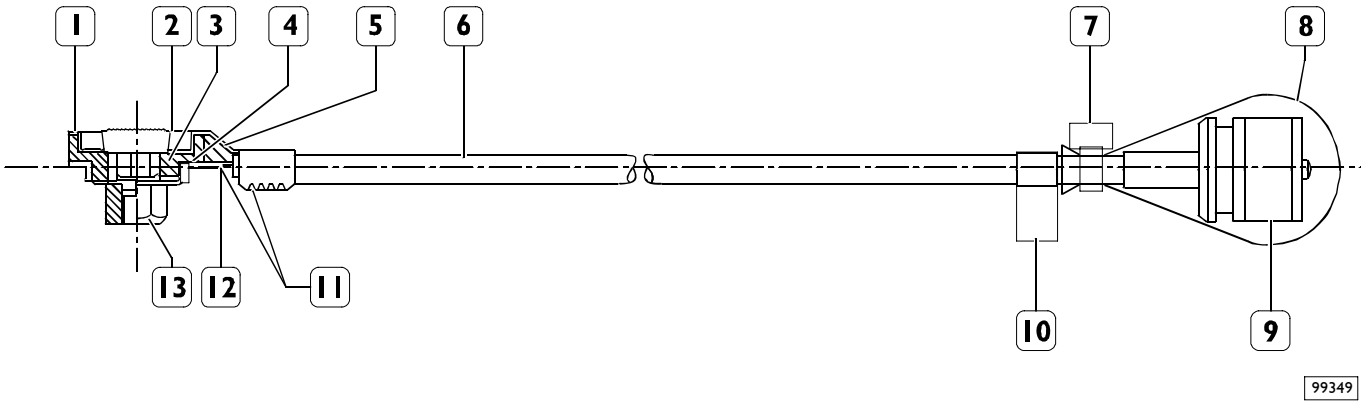
If the equipment uses a 12v power supply, a suitable 24-12V DC/DC converter will have to be fitted (if not already provided). The power cables for the converter must be as short as possible with no coils and maintaining the minimum distance from the reference plane.

Figure 5.18



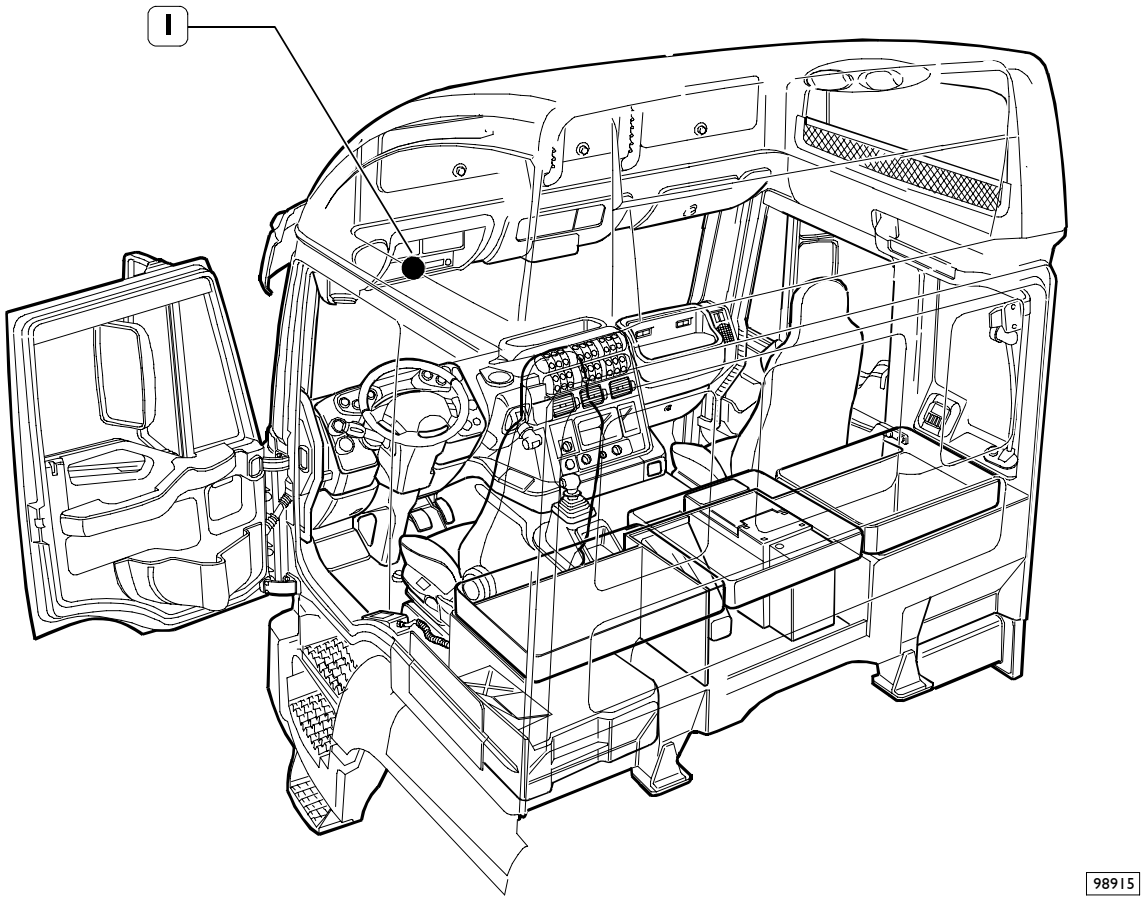
1. Antenna support - 2. Gasket (P/N for spares 244614) - 3. Fixed joint cover (P/N for spares 217522) - 4. Fixing screw M6x8.5 (torque to 2 Nm) - 5. Antenna (spare P/N for complete rod 675120) - 6. Roof - 7. Antenna extension lead

Figure 5.19



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

Figure 5.20



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

Two-way systems for GSM/PCS/UMTS mobile phones

Cellular telephone systems must be installed using the power system provided in the vehicle. Connect to terminal 30 via a supplementary fuse.

The devices must be legally type-approved and fixed (not portable). Install the transmitting part in a flat, dry area separate from the electronic components of the vehicle, away from humidity and vibrations.

- The ROS value must be as close as possible to the unit, the recommended value is 1.5 while max acceptable value must never be greater than 2.
- The **AERIAL GAIN** values must be as high as possible and ensure sufficient space uniformity, featured by 1,5 dB deviations as to average value in 870-960 MHz band and 2dB in the 1710-1880 MHz band.
- The **IRRADIATED FIELD IN CABIN** value must be as low as possible , < 1V/m is recommended as a quality target. In any case, limits set by the applicable European legislations must never be exceeded.
- **For this reason**, the aerial must always be placed out of cabin, possibly on a metallic base with a large surface, installed as vertical as possible, with connection cable turned downward, in compliance with Manufacturer's installation instructions and warnings.

The antenna must be installed outside the vehicle, possibly on a large metallic base as vertically as possible with the connection cable facing down. Follow the instructions and the manufacturer's warnings for assembly.

The ideal location of the antenna is on the front of the cab roof at a distance no less than 30 cm from other antennas.

Follow the precautions below when connecting and arranging the wires:

- Use a top quality cable particularly as concerned to the protective shielding.
- The cable route must be at a suitable distance (minimum 50 mm) from pre-existing wiring. Ensure the minimum distance from the metallic structure of the cab. Avoid excessively pulling or pinching the cable. Installation on the left or right-hand side is preferable.
- Never shorten or extend the coaxial antenna cable.
- Use existing holes for routing the cable. Take all the necessary precautions for protecting the body if additional hole have to be drilled (use anti-rust paint, sheath, etc.).
- Ensure a good connection with the vehicle earth both on the base of the antenna and at the device fixing to ensure maximum power transfer.

Cellular telephones are typically fitted on the dashboard in gear lever area or in the header rail above the driver.

If the equipment uses a 12v power supply, a suitable 24-12V DC/DC converter will have to be fitted (if not already provided). The power cables for the converter must be as short as possible with no coils and maintaining the minimum distance from the reference plane.

GPS antenna cable and navigation system installation

Correct and careful assembly of GPS antennas in the vehicle is extremely important for correct operation and maximum performance.

The antennas should if possible be fitted in a concealed position where they cannot be seen.

Arranging the GPS antenna is a delicate matter. The power of the signal received from the satellite is very weak (approximately 136dBm), so any obstacle can effect quality and performance of the receiver.

- The ROS value must be as close as possible to the unit, the recommended value is 1.5 while max acceptable value must never be greater than 2 in the GPS frequency range (1575,42 +1,023 MHz).
- The **AERIAL GAIN** values must be as high as possible and ensure sufficient space uniformity, featured by 1,5 dB deviations as to average value in 1575,41±1,023 MHz band.

The GPS antenna must be installed in a position ensuring maximum visibility of the sky.

The minimum angle of visibility must be 90°. Sky visibility must not be obscured by objects or metallic structures. The installation position must be horizontal.

The ideal location for the GPS antenna is under the plastic dashboard in the middle and at the base of the vehicle windscreen.

Do not install the antenna under any type of metallic structure in the cab.

Position the GPS antenna at a distance which is not less than 30 cm from another antenna.

Follow the precautions below when connecting and arranging the wires:

- Use a top quality cable particularly concerning the protective shielding.
- The wire course must be at a suitable distance (minimum 50 mm) from pre-existing wiring. Ensure the minimum distance from the metallic structure of the cab. Avoid excessively pulling or pinching the cable. Installation on the left or right-hand side is preferable.
- Never shorted or extend the coaxial antenna cable.
- Use existing holes for routing the cable. Take all the necessary precautions for protecting the body if additional holes have to be drilled (use anti-rust paint, sheath, etc.).
- Ensure a good connection with the vehicle earth both on the base of the antenna and at the device fixing to ensure maximum power transfer.

Navigation systems must be installed using the power system provided in the vehicle. Connect to terminal 30 via a supplementary fuse.

The devices must be legally type-approved and fixed (not portable). Install the transmitting part in a flat, dry area separate from the electronic components of the vehicle, away from humidity and vibrations.

If the equipment uses a 12v power supply, a suitable 24-12V DC/DC converter will have to be fitted (if not already provided). The power cables for the converter must be as short as possible with no coils and maintaining the minimum distance from the reference plane.

When installing devices that could interact with other electronic systems, namely: Retarders, Extra heaters, Power take-offs, Air conditioners, Automatic transmissions, Telematics and Speed limiters - contact IVECO to for efficient application.

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

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

5.5.3 Additional equipment

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

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

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

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

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

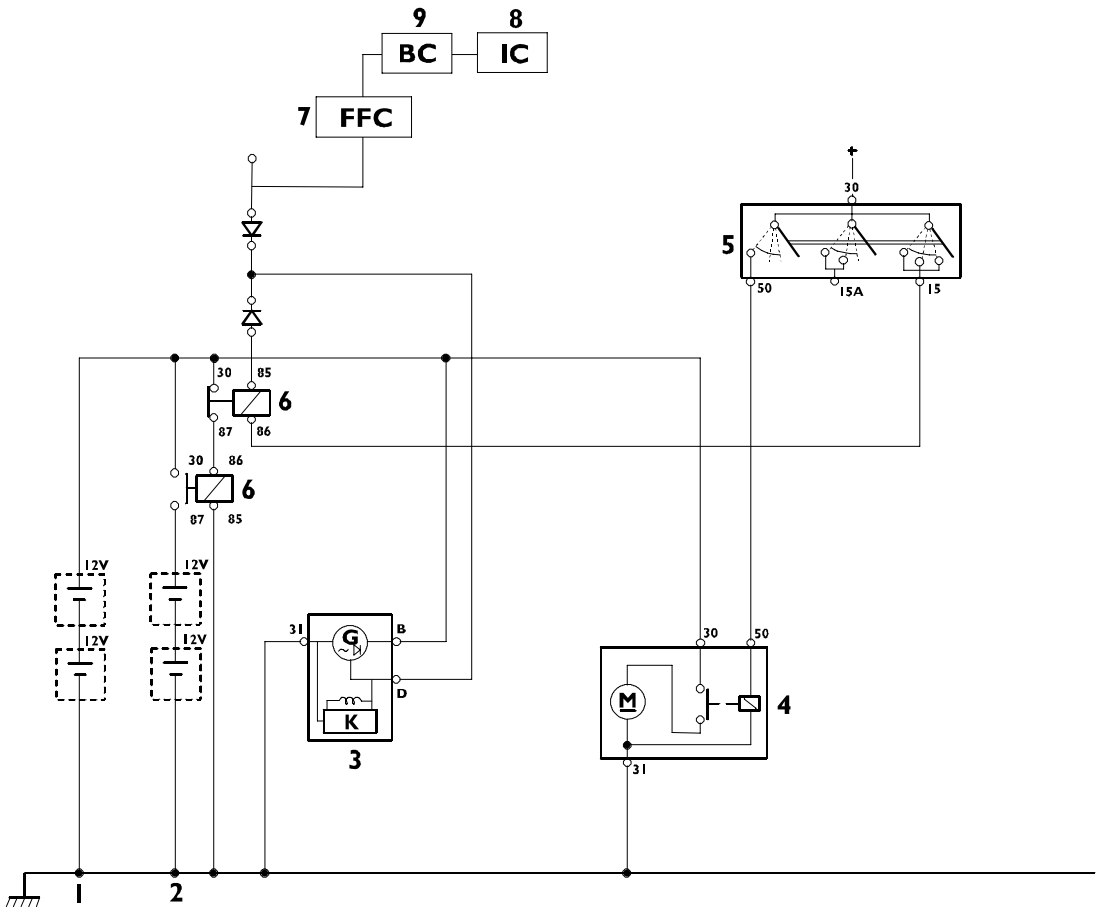
Additional Batteries and Alternators

Installing high power-consumption electric equipment (e.g. electrical motors frequently used or for a long time while the vehicle engine is not running, such as tail lifts) or a great deal of additional electrical equipment, may require power which the vehicle's standard system is unable to deliver. In such cases additional batteries of the appropriate capacity must be used.

Their insertion into the vehicle's circuits must include a separate recharging system (see Figure 5.21) integrated with that of the vehicle. In this case it is advisable to provide supplementary batteries with the same capacity as the batteries originally installed in order to ensure correct recharging of all batteries.

Figure 5.21

Installing additional batteries



1. Standard batteries - 2. Supplementary batteries - 3. Alternator with built-in regulator - 4. Starter motor - 5. Starter key - 6. Relays - 7. Front Frame Computer - 8. Instrument Cluster

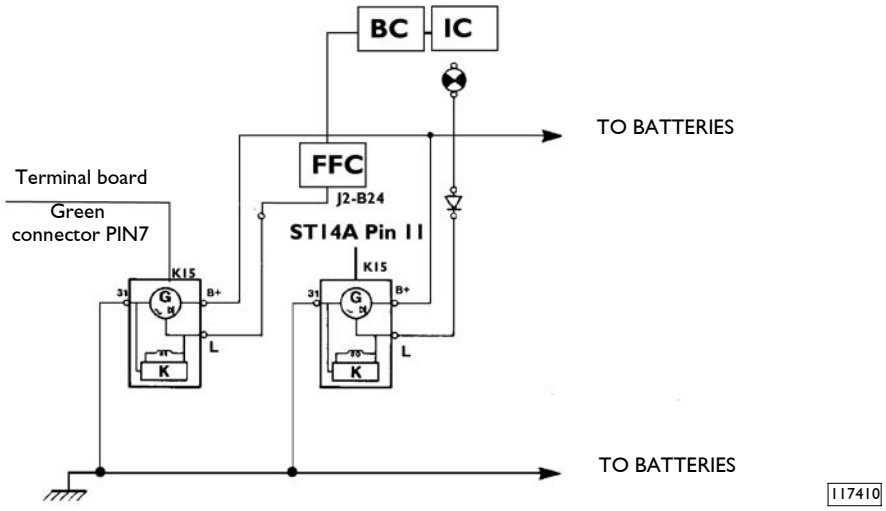
Installing additional batteries involves checking that the alternator is of a sufficient capacity to recharge. If necessary, an alternator with larger power or an additional one must be used. In this case connect up as shown in Figure 5.22.

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

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

Figure 5.22

Installing an additional alternator



Auxiliary Electric Systems

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

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

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

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

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

An error message will appear on the on-board panel in the event of standard alternator failure (e.g. low voltage, no signal).

An additional alternator cannot be connected and programmed to the MUX. Consequently, the MUX will not be capable of detecting which alternator is not working correctly.

5.5.4 Taking current

From TGC (OPT)

For the Stralis, it is forbidden to connect additional electric systems directly on the battery positive pole. In fact, the positive pole is engaged by the cables to the fuse-holder box placed on battery box side (for the ADR vehicles, the fuse-holder box, usually placed on battery box side, is connected on the specific TGC pin).

The fusebox cannot be modified or moved.

Current can be taken from the specific TGC pin (TGC = general current relay, see Figure 5.23). Remove the plastic protection from the free pin and connect the terminal directly to the threaded screw (positive pole). Fasten it with a suitable nut. The earth return is via the chassis. For two or more connections, arrange a suitable shim between the terminals. Always use a suitable corrugated tube to protect the wires. Always refit the plastic protection.

Read paragraph 5.3 on bodybuilders connectors before taking current in the cab. Current consumption must not exceed the maximum load value shown in the paragraph below.

5.5.5 General battery switch

It is normally located on battery box and operated manually. It is a two-pole switch disconnecting battery from underframe letting tachograph (for law requirements), body computer, refrigerator, bed module and instrument cluster operate.

For special changes (e.g. fuel transport, dangerous substance transport) it might be necessary to use a safety switch fully insulating batteries and alternator from the remaining system. Specific solutions for a given market are available on request.

NOTE the parallel connection to diverter output is permitted (max 100 A).

On chassis

Current cannot be taken from the terminal board under the hood. The terminals must neither be disconnected nor modified.

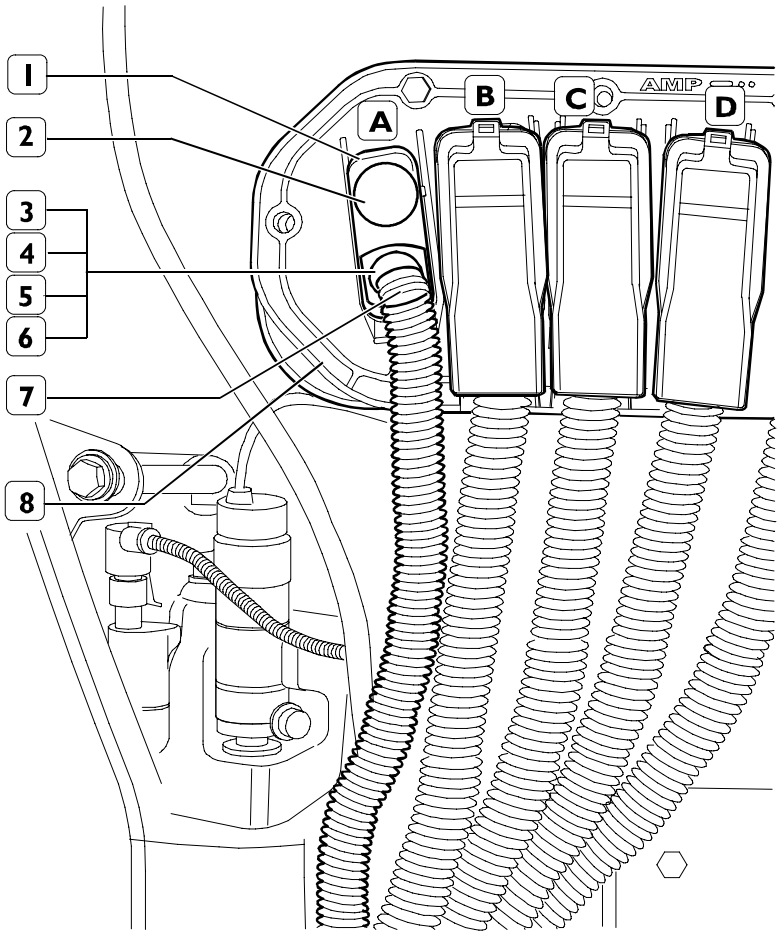
Operations which do not comply with the instructions specified by IVECO or made by non qualified personnel can cause severe damage to on-board systems, effect driving safety and correct operation of the vehicle and cause considerable damage which is not covered by warranty.

Wire passage

The terminal board (component 8 in Figure 5.23) consists of a plate with five housings, four of which are occupied by connectors (B, C, D and E) and one by a plate (A). The four connectors cannot be changed. The plate (component 1 in Figure 5.23) in housing A is provided with two wire passages from the cab outwards and vice versa. A corrugated pipe (7) is fitted on the lower hole of the plate (7) and can be used for passing the wires.

For bodybuilders requiring a second crossing point, disconnect the plate, remove the plug (2) from the plate, insert the specific threaded fitting (3), pass the corrugated pipe containing the electrical wires through (diameter 13 mm) and fasten it to the plate using the specific nut and the two sealed washers (4, 5, 6). Only use genuine IVECO components (contact IVECO Aftersales).

Figure 5.23



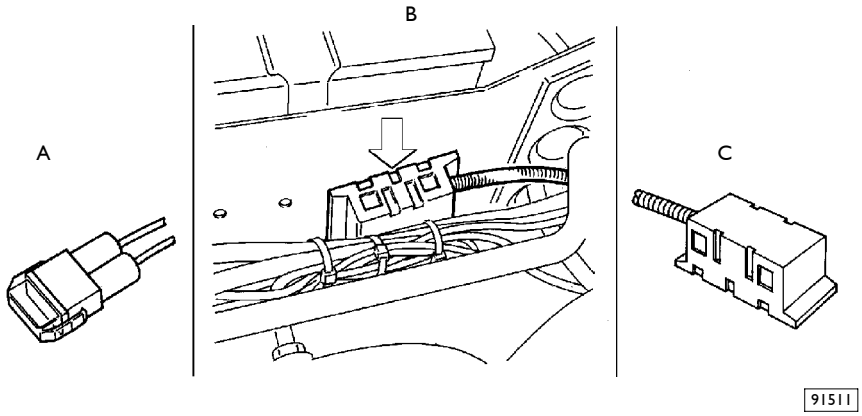
Do not drill the plastic plug to pass the wires. Do not remove the plate. Genuine components ensure water and humidity tightness and must always be used. Operations which do not comply with the instructions specified by IVECO or made by non-qualified personnel can cause severe damage to on-board systems and effect safety and reliability.

Maxifuse and Megafuse fuses

IVECO Shop offers a series of five fuseholder kits to protect high power draw power taps.

The positioning of the fuses (always as close as possible to the output terminal on the battery) must be decided by the bodybuilder in accordance with the space available on the vehicle.

Figure 5.24



A. Maxifuse - B. Battery case - C. Megafuse

Table 5.16 - Maxifuse

Capacity	Reference number of IVECO kit electrical accessories	Body drawing number Fuseholder	Cable cross-section
KIT 40A	4104 0110 KZ	500317518	10 mm^2
KIT 60A	4104 0111 KZ	500317518	10 mm^2

The fuseholder (Part number 500317518) suitable for installation on a production line, must be secured to the chassis with a tightening torque of 2 ± 0.2 Nm.

Table 5.17 - Megafuse

Capacity	Reference number of IVECO kit electrical accessories	Body drawing number Fuseholder	Cable cross-section
KIT 100A	4104 0112 KZ	500315861	25 mm^2
KIT 125A	4104 0113 KZ	500315861	35 mm^2
KIT 150A	4104 0114 KZ	500315861	50 mm^2

The current take-off from the battery positive terminal is to be considered as an alternative to a take-off from the battery isolator switch when this latter is installed on the vehicle.

5.5.6 Additional circuits (fuses and conductor cross-section)

Additional circuits must be segregated and protected form the main vehicle circuit by means of fuses.
The cables utilised must be of a size that is suitable for the relative functions and must be well insulated. They must also be suitable protected in sheaths (not PVC) or routed though flexible conduits in the case of a plurality of functions (we recommended the use of polyamide type 6 plastic for flexible conduits) and they must be correctly installed **in a place where they are protected from impact and heat sources. Take care to avoid any chaffing with other components, particularly with live edges of the bodywork.**
The transit of these cables through structural components (cross members, profiles, etc.) must be executed using suitable cable glands or protections; firstly the cables must be secured separately with insulated cable clamps (e.g. made of nylon) at adequate intervals (approx. 350 mm).
In case of external panels, use a specific sealant both on cable and on panel to avoid water, dust and fume ingress.
Establish suitable distance between electrical wiring harnesses and other components as follows:
- 10 mm from static components;
- 50 mm from moving components (minimum distance = 20 mm);
- 150 mm from components that generate heat (e.g. engine exhaust).

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

Table 5.18

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

1) For uses of more than 30 seconds.

2) Depending on the position and hence the temperature that may be reached in the housing, choose fuses that can be loaded to up to 70%- 80% of their maximum capacity.

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

Precautions

- Avoid coupling with signal transmission cables (e.g. ABS), for which a preferential path has been defined for electromagnetic requirements (EMI).It should be noted that when grouping several cables together, in order to compensate for the lower heat dispersal capacity current intensity must be reduced with respect to the nominal value of a single cable.
- In vehicles subject to frequent engine starts, in the presence of power draws with limited engine running times (e.g. vehicles with refrigerated bodies) periodic battery charges are required to maintain optimal efficiency.

5.5.7 Harness Modifications due to Changes to Wheelbase or Overhang

Should it be necessary to lengthen the wires on the chassis owing to the new dimensions of wheelbase and overhang, a watertight junction box must be used which has the same characteristics as those used on the standard vehicle. The components used such as wires, connectors, terminal blocks, conduits etc. must be of the same type as those used originally and be correctly fitted.
See the instructions given in paragraph 2.15.3 for electronic brake control device functionality.

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

The vehicle electrical system is arranged for powering devices at 12V. A connection with voltage reducer (from 24V to 12V) is fitted in the cab. Do not power devices directly by taking 12V from the battery.

The voltage reducer (supplied by IVECO) is arranged for a maximum current consumption of 20 A at 30°C measured in the device compartment in the header rail above the windscreen.

(Maximum consumption is 10A at 60°C).

Other devices with higher consumption must not be used.

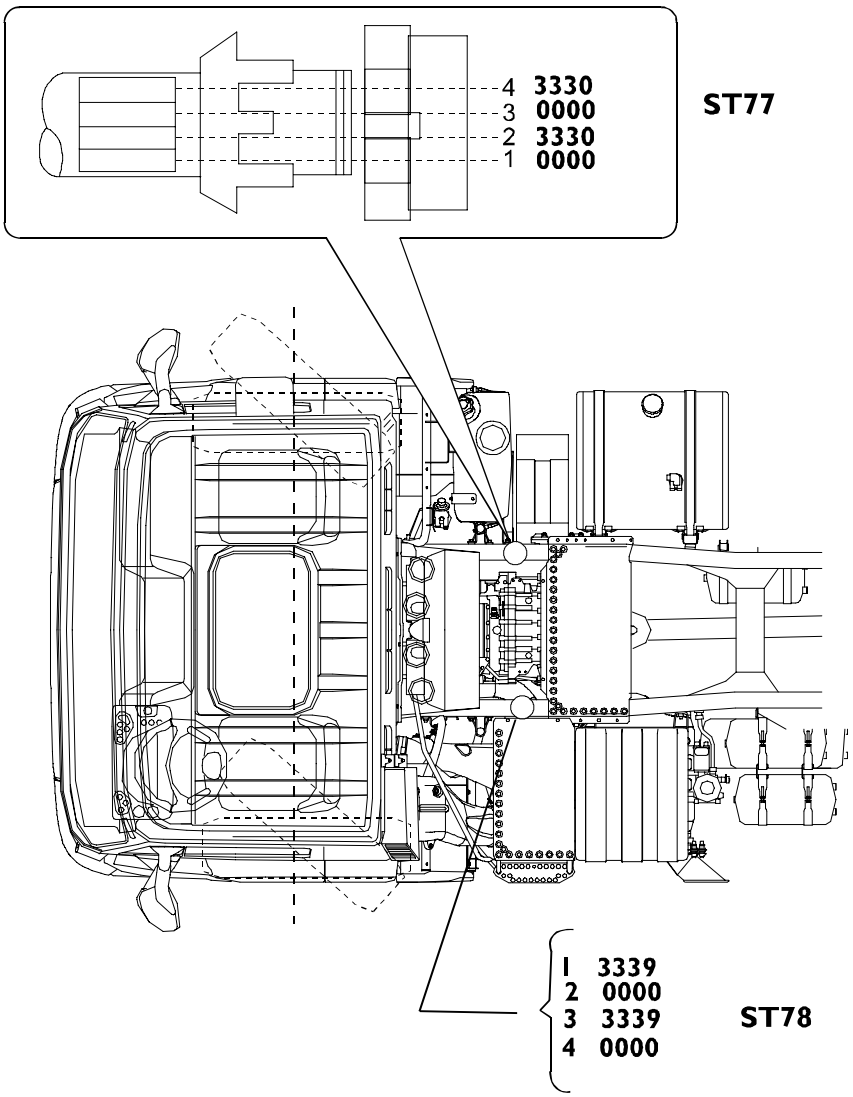
5.5.9 Side Marker Lamps

Some national or EC regulations require that vehicle be equipped with side parking light, as a function of its overall length.
The Stralis range vehicles are equipped with specific terminals for the side light power supply connection.
Bodybuilders must fit the lights on the relevant structures and connect to the dedicated terminals (platform, box bodies, etc.).
The position of these terminals is shown below.

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

Two special connectors are used to install side markers lights and are located behind the vehicle cab: ST77 on the right-hand side and ST78 on the left-hand side (Figure 5.25).

Figure 5.25



ST77. Terminal 4 poles per side marker lamp RH side - ST78. Terminal 4 poles per side marker lamp LH side

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

SECTION 6

Special instructions for -SCR- exhaust system

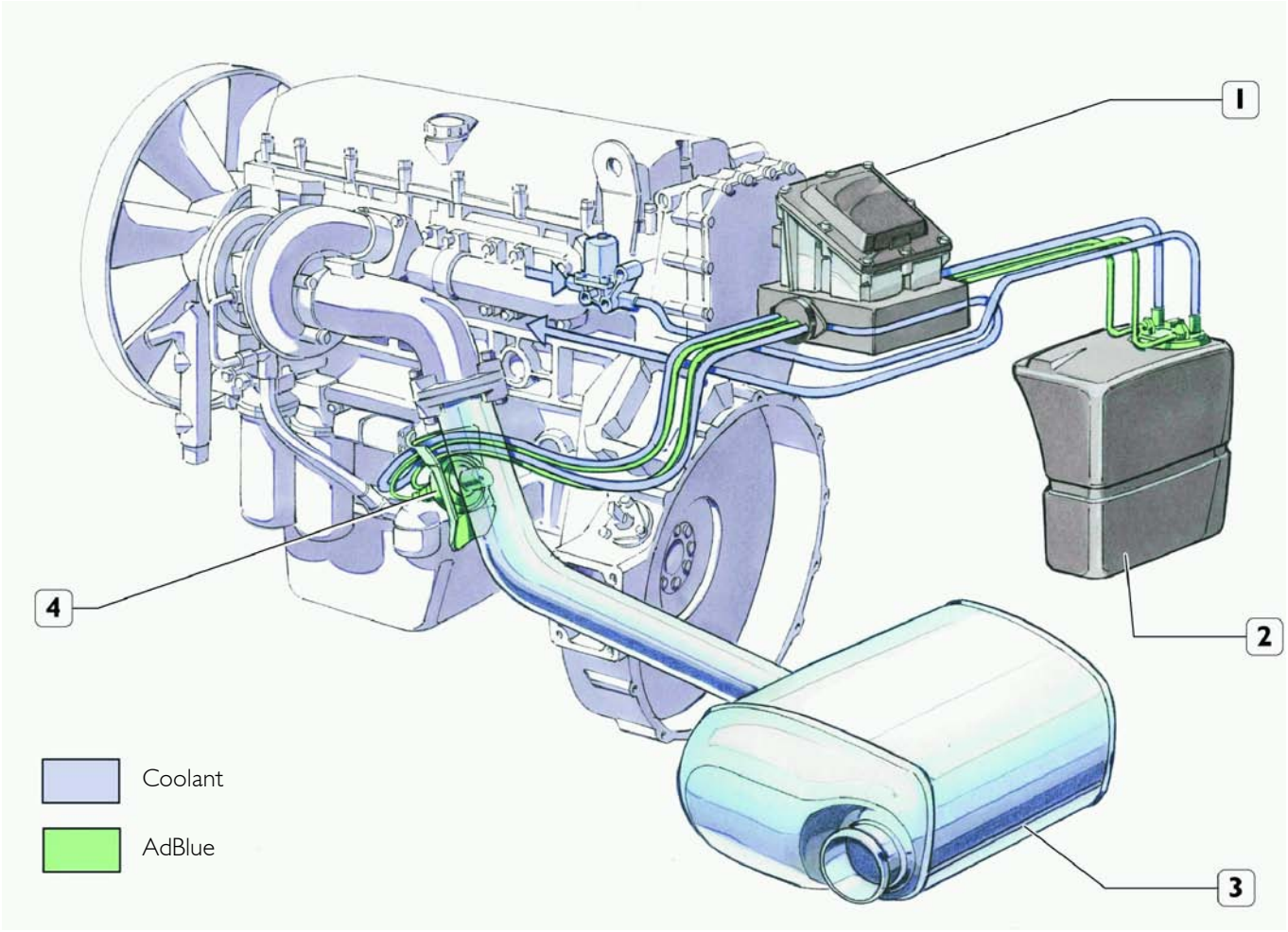
6.1 General specifications

This chapter contains important information on the **-SCR- exhaust systems** fitted on the IVECO series (EuroCargo - Stralis - Trakker).

In order to comply with Euro4 Euro5 standards, IVECO has chosen the SCR (selective catalyst reduction) system to reduce the nitrogen oxide (NOx) emissions produced by exhaust gas.

SCR is an exhaust gas post-treatment system that uses a catalyzer which, by means of a chemical reaction, transforms NOx nitrogen oxyde into nitrogen and water. This chemical reaction is produced by an additive called AdBlue (a solution of urea + water).

Figure 6.1



1. Pumping module - 2. Urea tank - 3. Catalyzer - 4. Dosing module

6.2 The nitrogen oxide catalytic reduction principle. AdBlue

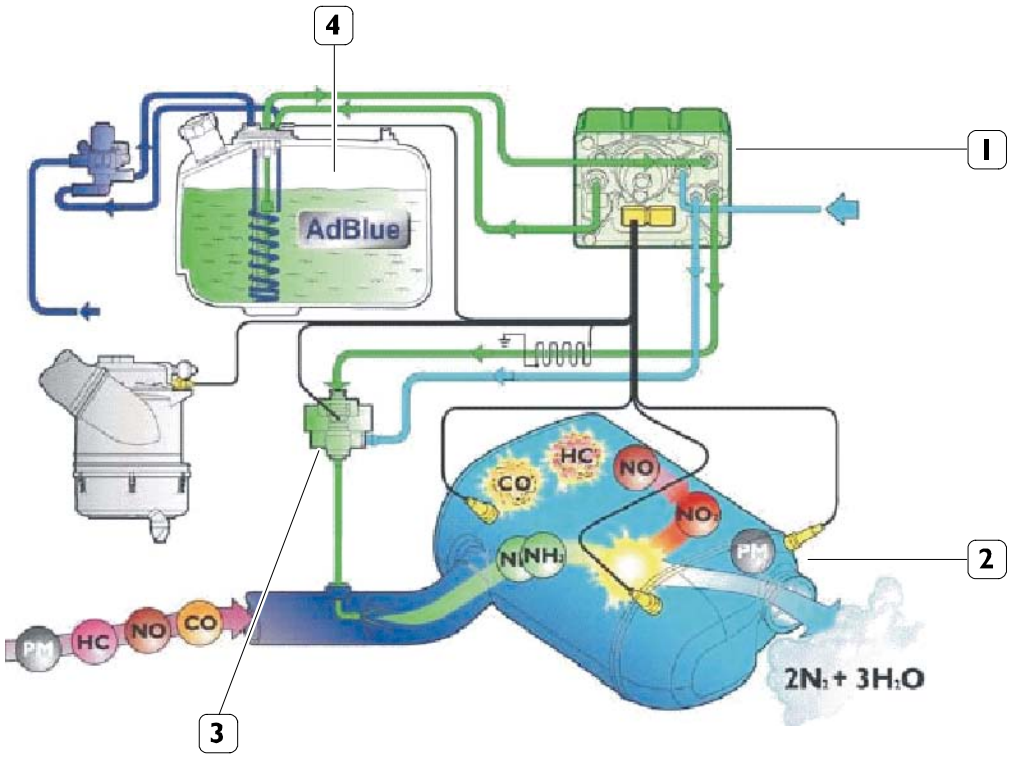
The additive is sent from a dedicated reservoir by means of supply module (1) to dosing module (3), which injects AdBlue into the exhaust pipe.

The mixture thus obtained is then fed to the SCR catalyzer that transforms the NOx into nitrogen and water.

Post-treatment is based on a simple principle: the chemical reaction of ammonia NH_3 with nitrogen oxides NO and NO_2 produces two harmless substances: water vapour H_2O and nitrogen N_2.

The whole system is managed by an electronic control unit.

Figure 6.2

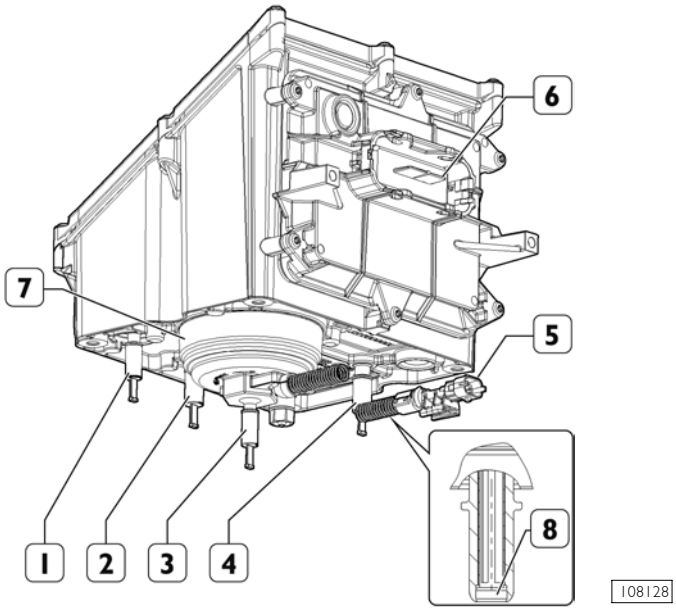


1. Pumping module - 2. Catalyzer - 3. Dosing module - 4. AdBlue reservoir

Main system components

Pump module

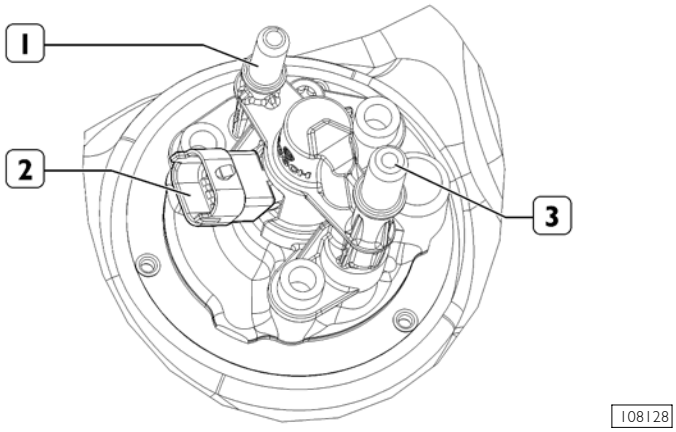
Figure 6.3



1. Ad Blue return Pipe to the tank - 2. Ad Blue return Pipe from Dosing module - 3. Ad Blue solution outlet - 4. Ad Blue solution inlet - 5. Electrical connection - 6. DCU control unit - 7. Filter - 8. Pre-filter.

Dosing module

Figure 6.4

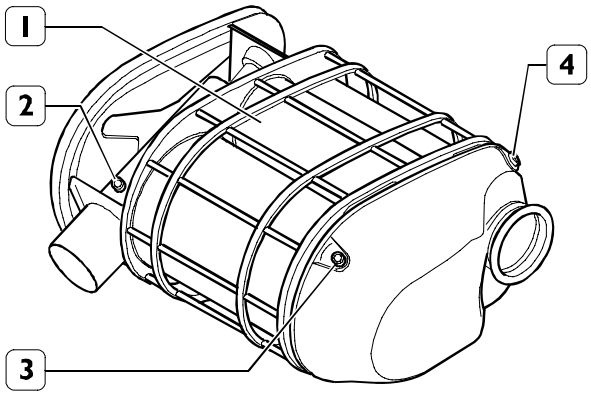


1. Ad Blue inlet - 2. Electrical connection - 3. Ad Blue outlet

Its task is to meter the Ad Blue solution sent to the exhaust pipe upstream of catalyst.

Catalyzer

Figure 6.5



Catalyst (1), equipped with sound-proofing material, replaces the exhaust silencer.
Inside the catalyst, the exhaust gas nitric oxides are, by reacting with ammonia, converted into free nitrogen and water vapour.
Temperature sensors (2 and 3) and nitric oxide detecting sensor (4) are fitted onto catalyst (1).

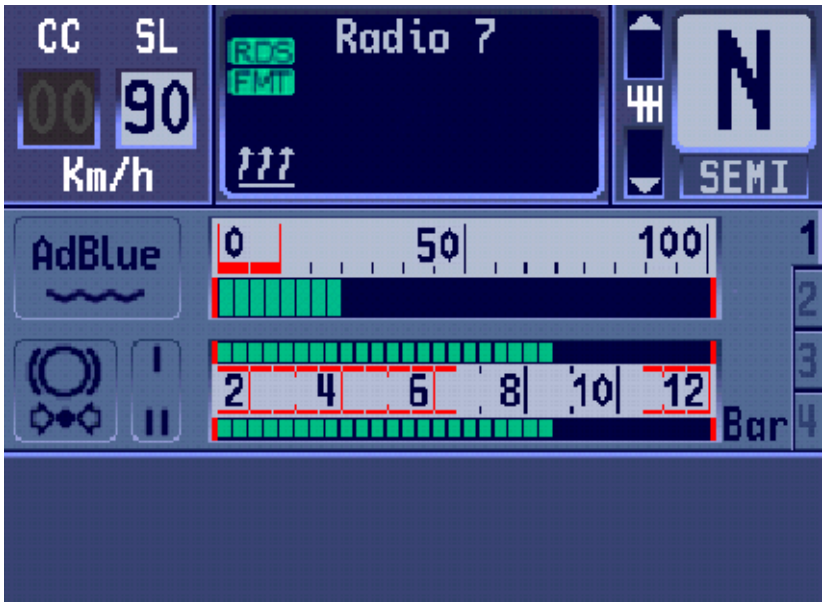
AdBlue reservoir

Figure 6.6

6.3 On-board instruments

The on board diagnostic system checks the tank level continuously and informs the driver on the current AdBlue quantity.

Figure 6.7



6.4 Distribution of the ecological additive AdBlue

The 'AdBlue' denomination is recognized internationally; it is an aqueous solution consisting of high purity urea according to the DIN 70070 standard.

It is absolutely safe, non-toxic and non-flammable.

AdBlue manufacturers can assure the product direct distribution to the transporters with huge vehicle fleets, and the oil companies are also planning to install AdBlue pumps close to diesel fuel pumps within a short time.

In this case it will also be available in tanks. A detailed list of sales outlets throughout Europe is available on the internet site: www.findadblue. com

Figure 6.8

114735

Figure 6.9

114736

Figure 6.10

114737

6.5 Specifications for installation and removal

The instructions that follow are intended for the AdBlue injection system of the Bosch DENOX2 type, within the SCR system.

If Bodybuilders make changes to the frame, the following procedures must be followed under all circumstances:

- disassembly: disconnect the hydraulic connectors first and then the electric connectors;
- assembly: connect the electric connectors first and then the hydraulic connectors.

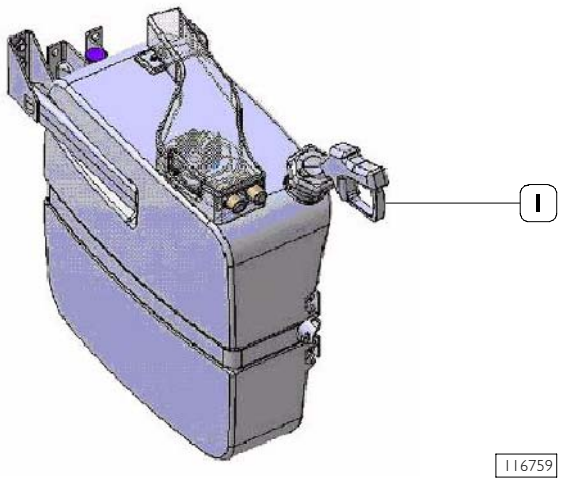
Compliance with this assembly/disassembly procedure will ensure that AdBlue does not come into contact with the electric connectors.

6.5.1 Operations for positioning the AdBlue tank

As regards the AdBlue tank, ensure that:

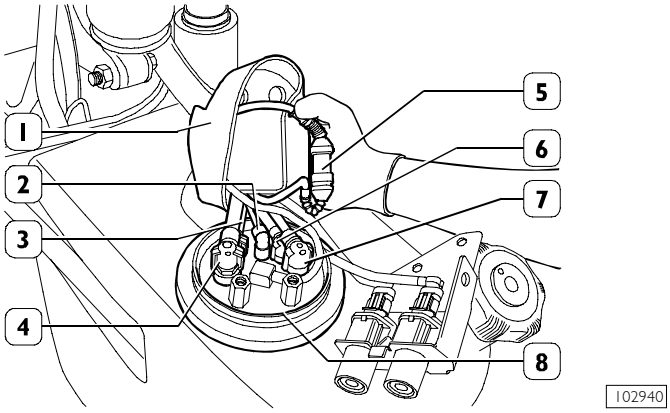
- the tank ventilation pipe is never closed;
- the reservoir must contain at least 5 l of AdBlue at the end of each operation to ensure the dosing module is cooled;
- after each operation, the tank does not contain more than 85% of AdBlue (corresponding to the max reading of the level sensor) with respect to the tank total volume, so as to guarantee enough room for AdBlue to expand during freezing at temperatures below -11 °C;
- the tank and the float are combined and cannot be modified. It is advisable to use a standard tank from the Stralis, Trakker or Eurocargo construction series. 45, 60 and 120 litre tanks are available on the right side of the vehicle and 60 litre tanks on the left. If a smaller tank is required, a 27 litre model is available in the Eurocargo construction series. In this case, note that a specific data adaptation is required due to the shorter float;
- if specific-shaped tanks are available, these must be made out of polyethylene or stainless steel 1.4301, 1.43, in each case the tank height must be respected.
- when fitting equipment onto the chassis, there is enough room for the AdBlue fill gun (1, Figure 6.11) to fit completely and correctly into the tank filler.

Figure 6.11



Removal and refitting of the AdBlue tank

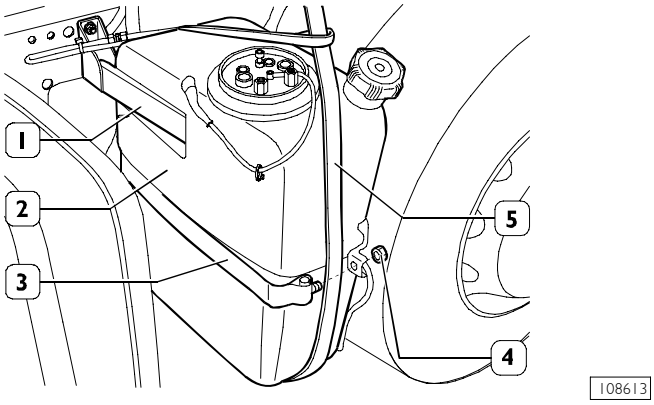
Figure 6.12



1. Cover - 2. Breather pipe - 3. AdBlue outlet pipes - 4. AdBlue heating fluid outlet pipes - 6. AdBlue inlet pipe - 7. AdBlue heating fluid inlet pipe - 8. Level gauge

Remove cover (1) and remove the water/AdBlue pipes shown in the figure.

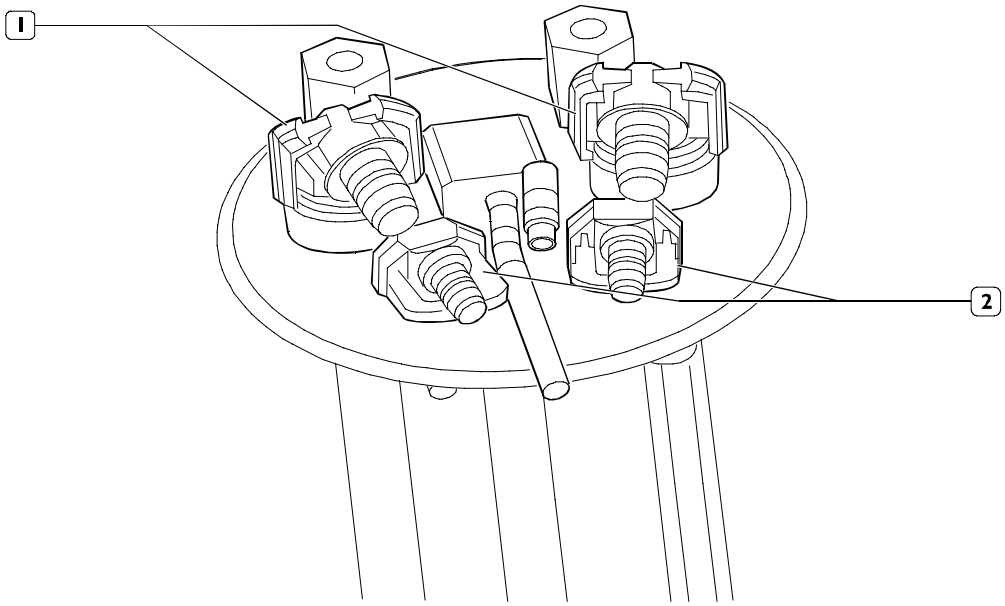
Figure 6.13



Remove nut (4) and dismantle elastic strap (3) securing tank (2). Sling tank (2) with appropriate cable (5) and hook it to the hoister. Remove tank from brackets (1).

Water/AdBlue connectors

Figure 6.14



1. H_2O infeed/outfeed connectors for AdBlue heater - 2. AdBlue infeed/outfeed connectors

The temperature and level sensors are connected to the DCU (Dosing Control Unit); the level sensor is specific to each type of tank, therefore its dimensions cannot be modified.

6.5.2 Operations on AdBlue pipes and heating water

After turning off the engine, the outlet ducts (PL/UPL) and the inlet ducts (IL/UIL) must be drained to prevent the AdBlue freezing in the ducts and components if temperatures are low. The time that elapses is approximately 2 minute and must not be interrupted by premature disconnection or the battery or disconnector. The process may clearly be heard because the AdBlue pump keeps working even after the engine has been turned off.

As far as the pipes connecting reservoir, supply module and dosing module are concerned, ensure that:

- the connection pipes between the AdBlue reservoir and the supply module (delivery or inlet line or return or return line) must be 5 m;
- the connection pipes between the supply module and the dosing module (delivery or pressure line and return or cooling line) must be 3 m.

The pipes may only be modified using the "Voss" fittings described in Table 6.1.

Table 6.1 - AdBlue

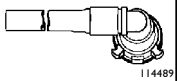
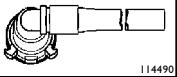
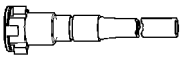
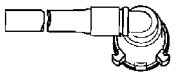
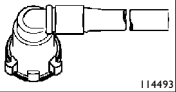
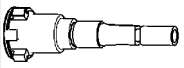
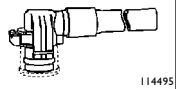
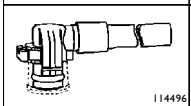
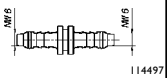
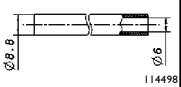
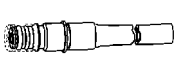
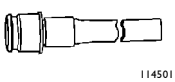
	VOSS/IVECO Teil -Nr: Part -No: Codice:	**Benennung**	**Itemname**	**Descrizione**	**Description**	**Descripción**
 114489	5 4 62 07 00 00 4128 3733 EZ 50-7499	Winkelkupplung SV241 5/16" Ausführung links; mit MLT 8.8x1.4 PA 0.2 Länge 3m und Quetschhülse	ELBOW CONNECTOR SV241 5/16" VERSION LEFT; WITH MLT 8.8x1.4 PA0.2 LENGTH 3m AND COMPRESSED SLEEVE	RACCORDO ANGOLO SV241 5/16" VERSIONE SINISTRA; CON MLT 8.8x1.4 PA0.2 LUNGHEZZA 3m E BOCCOLA PRESSATA	RACCORD ANGLE SV241 5/16" VERSION GAUCHE, AVEC MLT 8.8x1.4 PA0.2 LONGUEUR 3 m ET BAGUE PRESSEE	CONEXION EN ANGULO SV241 5/16" VERSION IZQUIERDA; CON MLT 8.8x1.4 PA0.2 LONGITUD 3 m Y BOQUILLA PRENSADA
 114490	5 4 62 07 56 00 4128 3734 EZ 50-7499	Winkelkupplung SV241 5/16" Ausführung rechts; mit MLT 8.8x1.4 PA 0.2 Länge 3m und Quetschhülse	ELBOW CONNECTOR SV241 5/16" VERSION RIGHT; WITH MLT 8.8x1.4 PA0.2 LENGTH 3m AND COMPRESSED SLEEVE	RACCORDO ANGOLO SV241 5/16" VERSIONE DESTRA; CON MLT 8.8x1.4 PA0.2 LUNGHEZZA 3m E BOCCOLA PRESSATA	RACCORD ANGLE SV241 5/16" VERSION DROITE, AVEC MLT 8.8x1.4 PA0.2 LONGUEUR 3 m ET BAGUE PRESSEE	CONEXION EN ANGULO SV241 5/16" VERSION DERECHA; CON MLT 8.8x1.4 PA0.2 LONGITUD 3 m Y BOQUILLA PRENSADA
 114490	5 4 62 08 89 00 4128 3735 EZ 50-7499	Geradekupplung SV241 5/16"; mit MLT 8.8x1.4 PA 0.2 Länge 3m und Quetschhülse	CONNECTOR SV241 5/16"; WITH MLT 8.8x1.4 PA0.2 LENGTH 3m AND COMPRESSED SLEEVE	RACCORDO SV241 5/16"; CON MLT 8.8x1.4 PA0.2 LUNGHEZZA 3m E BOCCOLA PRESSATA	RACCORD SV241 5/16", AVEC MLT 8.8x1.4 PA0.2 LONGUEUR 3 m ET BAGUE PRESSEE	CONEXION SV241 5/16"; CON MLT 8.8x1.4 PA0.2 LONGITUD 3 m Y BOQUILLA PRENSADA
 114492	5 4 62 23 26 00 4128 3736 EZ 50-7499	Winkelkupplung SV241 3/8" Ausführung links; mit MLT 8.8x1.4 PA 0.2 Länge 3m und Quetschhülse	ELBOW CONNECTOR SV241 3/8" VERSION LEFT; WITH MLT 8.8x1.4 PA0.2 LENGTH 3m AND COMPRESSED SLEEVE	RACCORDO ANGOLO SV241 3/8" VERSIONE SINISTRA; CON MLT 8.8x1.4 PA0.2 LUNGHEZZA 3m E BOCCOLA PRESSATA	RACCORD ANGLE SV241 3/8" VERSION GAUCHE, AVEC MLT 8.8x1.4 PA0.2 LONGUEUR 3 m ET BAGUE PRESSEE	CONEXION EN ANGULO SV241 3/8" VERSION IZQUIERDA; CON MLT 8.8x1.4 PA0.2 LONGITUD 3 m Y BOQUILLA PRENSADA
 114493	5 4 62 23 49 00 4128 3737 EZ 50-7499	Winkelkupplung SV241 3/8" Ausführung rechts; mit MLT 8.8x1.4 PA 0.2 Länge 3m und Quetschhülse	ELBOW CONNECTOR SV241 3/8" VERSION RIGHT; WITH MLT 8.8x1.4 PA0.2 LENGTH 3m AND COMPRESSED SLEEVE	RACCORDO ANGOLO SV241 3/8" VERSIONE DESTRA; CON MLT 8.8x1.4 PA0.2 LUNGHEZZA 3m E BOCCOLA PRESSATA	RACCORD ANGLE SV241 3/8" VERSION DROITE, AVEC MLT 8.8x1.4 PA0.2 LONGUEUR 3 m ET BAGUE PRESSEE	CONEXION EN ANGULO SV241 3/8" VERSION DERECHA; CON MLT 8.8x1.4 PA0.2 LONGITUD 3 m Y BOQUILLA PRENSADA
 114494	5 4 62 23 50 00 4128 3738 EZ 50-7499	Geradekupplung SV241 3/8"; mit MLT 8.8x1.4 PA 0.2 Länge 3m und Quetschhülse	CONNECTOR SV241 3/8"; WITH MLT 8.8x1.4 PA0.2 LENGTH 3m AND COMPRESSED SLEEVE	RACCORDO SV241 3/8"; CON MLT 8.8x1.4 PA0.2 LUNGHEZZA 3m E BOCCOLA PRESSATA	RACCORD SV241 3/8", AVEC MLT 8.8x1.4 PA0.2 LONGUEUR 3 m ET BAGUE PRESSEE	CONEXION SV241 3/8"; CON MLT 8.8x1.4 PA0.2 LONGITUD 3 m Y BOQUILLA PRENSADA
 114495	5 4 62 24 70 00 4128 3739 EZ 50-7499	Winkelstecker SV246 NG 8 Öffnungselement weiss; mit MLT 8.8x1.4 PA 0.2 Länge 3m und Quetschhülse	ELBOW CONNECTOR SV246 NG 8 RELEASE CLIP WHITE; WITH MLT 8.8x1.4 PA0.2 LENGTH 3m AND COMPRESSED SLEEVE	RACCORDO ANGOLO SV246 NG 8 ELEMENTO DI APERTURA BIANCO; CON MLT 8.8x1.4 PA0.2 LUNGHEZZA 3m E BOCCOLA PRESSATA	RACCORD ANGLE SV241 8/16" ELEMENT D'OUVERTURE BLANC, AVEC MLT 8.8x1.4 PA0.2 LONGUEUR 3 m ET BAGUE PRESSEE	CONEXION EN ANGULO SV246 NG 8 ELEMENTO DE APERTURA BLANCO; CON MLT 8.8x1.4 PA0.2 LONGITUD 3 m Y BOQUILLA PRENSADA
 114496	5 4 62 27 60 00 4128 370 EZ 50-7499	Winkelstecker SV246 NG 8 Öffnungselement schwarz; mit MLT 8.8x1.4 PA 0.2 Länge 3m und Quetschhülse	ELBOW CONNECTOR SV246 NG 8 RELEASE CLIP BLACK; WITH MLT 8.8x1.4 PA0.2 LENGTH 3m AND COMPRESSED SLEEVE	RACCORDO ANGOLO SV246 NG 8 ELEMENTO DI APERTURA NERO; CON MLT 8.8x1.4 PA0.2 LUNGHEZZA 3m E BOCCOLA PRESSATA	RACCORD ANGLE SV241 8/16" ELEMENT D'OUVERTURE NOIR, AVEC MLT 8.8x1.4 PA0.2 LONGUEUR 3 m ET BAGUE PRESSEE	CONEXION EN ANGULO SV246 NG 8 ELEMENTO DE APERTURA NEGRO; CON MLT 8.8x1.4 PA0.2 LONGITUD 3 m Y BOQUILLA PRENSADA
 114497	5 4 66 12 06 49 4128 3741 EZ 50-7499	Set Verbinder MLT; 1 Verbinder NW6 2 1-Ohr Schellen 1 Montageanleitung ACHTUNG Montageanleitung 9 1 77 00 02 20 beachten	SET CONNECTOR MLT; 1 CONNECTOR NW6 2 RETAINING CLIP 1 ASSEMBLY INSTRUCTION ATTENTION TAKE NOTICE OF ASSEMBLY INSTRUCTION 9 1 77 00 02 20	SET DI RACCORDO; 1 RACCORDO NW6 2 FASCETTA 1 ISTRUZIONE DI MONTAGGIO PRESTARE ATTENZIONE A L'ISTRUZIONE DI MONTAGGIO 9 1 77 00 02 20	SET DE RACCORD ; 1 RACCORD NVV6 2 COLLIER 1 INSTRUCTION DE MONTAGE RESPECTER LES INSTRUCTIONS DE MONTAGE 9 1 77 00 02 20	JUEGO DE CONEXION; 1 RACOR NW6 2 ABRAZADERAS 1 INSTRUCCIONES DE MONTAJE PRESTAR ATENCION A LAS INSTRUCCIONES DE MONTAJE 9 1 77 00 02 20
 114498	5 4 64 11 16 00 4128 3742 EZ 50-7499	Rohr MLT 8.8x1.4 PA0.2 Länge 10m	TUBE MLT 8.8x1.4 PA0.2 LENGTH 10m	TUBO MLT 8.8x1.4 PA0.2 LUNGHEZZA 10m	TUBE MLT 8.8x1.4 PA0.2 LONGUEUR 10m	TUBO MLT 8.8x1.4 PA0.2 LONGITUD 10 m
 114500	5 4 62 35 74 00 4128 3743 EZ 50-7499	Stecker Trennstelle; mit MLT 8.8x1.4 PA 0.2 Länge 3m und Quetschhülse	CONNECTOR SECTION POINT; WITH MLT 8.8x1.4 PA0.2 LENGTH 3m AND COMPRESSED SLEEVE	RACCORDO PIASTRA DI SEZIONAMENTO; CON MLT 8.8x1.4 PA0.2 LUNGHEZZA 3m E BOCCOLA PRESSATA	RACCORD PLAQUE DE SECTIONNEMENT, AVEC MLT 8.8x1.4 PA0.2 LONGUEUR 3 m ET BAGUE PRESSEE	CONEXION CHAPA DE SEPARACION; CON MLT 8.8x1.4 PA0.2 LONGITUD 3 m Y BOQUILLA PRENSADA
 114501	5 4 62 35 75 00 4128 3744 EZ 50-7499	Kupplung Trennstelle; mit MLT 8.8x1.4 PA 0.2 Länge 3m und Quetschhülse	CONNECTOR SECTION POINT; WITH MLT 8.8x1.4 PA0.2 LENGTH 3m AND COMPRESSED SLEEVE	RACCORDO PIASTRA DI SEZIONAMENTO; CON MLT 8.8x1.4 PA0.2 LUNGHEZZA 3m E BOCCOLA PRESSATA	RACCORD PLAQUE DE SECTIONNEMENT, AVEC MLT 8.8x1.4 PA0.2 LONGUEUR 3 m ET BAGUE PRESSEE	CONEXION CHAPA DE SEPARACION; CON MLT 8.8x1.4 PA0.2 LONGITUD 3 m Y BOQUILLA PRENSADA

Table 6.1 - (cont.) Cooling water

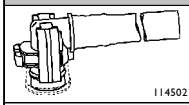
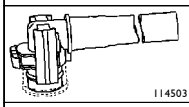
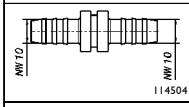
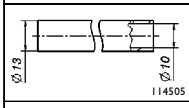
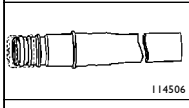
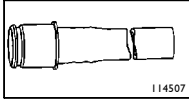
	VOSS/IVECO Teil -Nr: Part -No: Codice:	Benennung	Itemname	Descrizione	Description	Descripción
 114502	5 4 62 28 42 00 4128 3745 EZ 50-7499	Winkelstecker SV246 NG 12 Öffnungselement weiss; mit Rohr Grilamicl 13x1.5 Länge 3m	ELBOW CONNECTOR SV246 NG 12 RELEASE CLIP WHITE; WITH GRILAMID TUBE 13x1.5 LENGTH 3m	RACCORDO ANGOLO SV246 NG 12 ELEMENTO DI APERTURA BIANCO; CON TUBO GRILAMID 13x1.5 LUNGHEZZA 3m	RACCORD ANGLE SV246 NG 12 ELEMENT D'OUVERTURE BLANC, AVEC TUBE GRILAMID 13x1.5 LONGUEUR 3m	CONEXION EN ANGULO SV246 NG 12 ELEMENTO DE APERTURA BLANCO; CON TUBO GRILAMID 13x1.5 LONGITUD 3 m
 114503	5 4 62 29 49 00 4128 3746 EZ 50-7499	Winkelstecker SV246 NG 12 Öffnungselement blau; mit Rohr Grilamid 13x1,5 Länge 3m	ELBOW CONNECTOR SV246 NG 12 RELEASE CLIP BLUE; WITH TUBE GRILAMID 13x1.5 LENGTH 3m	RACCORDO ANGOLO SV246 NG 12 ELEMENTO DI APERTURA BLU; CON TUBO GRILAMID 13x1.5 LUNGHEZZA 3m	RACCORD ANGLE SV246 NG 12 ELEMENT D'OUVERTURE BLEU, AVEC TUBE GRILAMID 13x1.5 LONGUEUR 3m	CONEXION EN ANGULO SV246 NG 12 ELEMENTO DE APERTURA AZUL; CON TUBO GRILAMID 13x1.5 LONGITUD 3 m
 114504	0 0 26 11 50 00 4128 3747 EZ 50-7499	Verbinder NW 10	CONNECTOR NW 10	RACCORDO NW 10	RACCORD NW 10	CONEXION NW 10
 114505	5 4 64 19 08 00 4128 3748 EZ 50-7499	Rohr GRILAMID 13x1.5 Länge 10m	TUBE GRILAMID 13x1.5 LENGTH 10m	TUBO GRILAMID 13x1.5 LUNGHEZZA 10m	TUBE GRILAMID 13x1.5 LONGUEUR 10m	TUBO GRILAMID 13x1.5 LONGITUD 10 m
 114506	5 4 62 35 76 00 4128 3749 EZ 50-7499	Stecker Trennstelle; mit Rohr Grilamid 13x1,5 Länge 3m	CONNECTOR SECTION POINT; WITH TUBE GRILAMID 13x1.5 LENGTH 3m	RACCORDO PIASTRA DI SEZIONAMENTO; CON TUBO GRILAMID 13x1,5 LUNGHEZZA 3m	RACCORD PLAQUE DE SECTIONNEMENT AVEC TUBE GRILAMID 13x1,5 LONGUEUR 3m	CONEXION CHAPA DE SEPARACION; CON TUBO GRILAMID 13x1,5 LONGITUD 3 m
 114507	5 4 62 35 77 00 4128 3750 EZ 50-7499	Kupplung Trennstelle; mit Rohr Grilamid 13x1,5 Länge 3m	CONNECTOR SECTION POINT; WITH TUBE GRILAMID 13x1.5 LENGTH 3m	RACCORDO PIASTRA DI SEZIONAMENTO; CON TUBO GRILAMID 13x1,5 LUNGHEZZA 3m	RACCORD PLAQUE DE SECTIONNEMENT AVEC TUBE GRILAMID 13x1,5 LONGUEUR 3m	CONEXION CHAPA DE SEPARACION; CON TUBO GRILAMID 13x1,5 LONGITUD 3 m

Table 6.1 - (cont.) Corrugated pipe

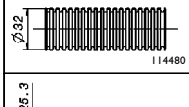
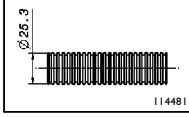
	VOSS/IVECO Teil -Nr: Part -No: Codice:	Benennung	Itemname	Descrizione	Description	Descripción
 114479	5 4 66 11 37 00 4128 3751 EZ 50-7499	Wellrohr NW37 Länge 3m	CORRUGATED HOSE NW37 LENGTH 3m	TUBO CORRUGATO NW37 LUNGHEZZA 3m	TUBE ANNELE NW37 LONGUEUR 3m	TUBO CORRUGADO NW37 LONGITUD 3 m
 114480	5 4 66 12 10 00 4128 3752 EZ 50-7499	Wellrohr NW26 Länge 3m	CORRUGATED HOSE NW26 LENGTH 3m	TUBO CORRUGATO NW26 LUNGHEZZA 3m	TUBE ANNELE NW26 LONGUEUR 3m	TUBO CORRUGADO NW26 LONGITUD 3 m
 114481	5 4 66 12 09 00 4128 3753 EZ 50-7499	Wellrohr NW22 Länge 3m	CORRUGATED HOSE NW22 LENGTH 3m	TUBO CORRUGATO NW22 LUNGHEZZA 3m	TUBE ANNELE NW22 LONGUEUR 3m	TUBO CORRUGADO NW22 LONGITUD 3 m

Table 6.1 - (cont.) Breather pipe

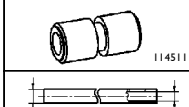
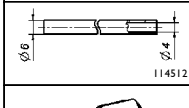
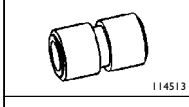
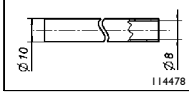
	VOSS/IVECO Teil -Nr: Part -No: Codice:	Benennung	Itemname	Descrizione	Description	Descripción
 114511	5 4 66 09 65 00 4128 3757 EZ 50-7499	Verbinder NW 6	CONNECTOR NW 6	RACCORDO NW6	RACCORD NW6	CONEXION NW6
 114512	5 4 64 19 09 00 4128 3758 EZ 50-7499	Rohr 6x1 PA12PHLY Länge 10m	TUBE 6x1 PA12PHLY LENGTH 10m	TUBO 6x1 PA12PHLY LUNGHEZZA 10m	TUBE 6x1 PA12PHLY LONGUEUR 10m	TUBO 6x1 PA12PHLY LONGITUD 10 m
 114513	5 4 66 10 21 00 4128 3759 EZ 50-7499	Verbinder NW 10	CONNECTOR NW 10	RACCORDO NW10	RACCORD NW10	CONEXION NW10
 114478	5 4 64 19 10 00 4128 3760 EZ 50-7499	Rohr 10x1 PA12PHLY Länge 10m	TUBE 10x1 PA12PHLY LENGTH 10m	TUBO 10x1 PA12PHLY LUNGHEZZA 10m	TUBE 10x1 PA12PHLY LONGUEUR 10m	TUBO 10x1 PA12PHLY LONGITUD 10 m

Table 6.1 - (cont.) Components

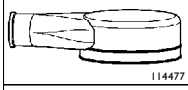
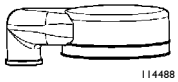
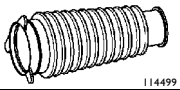
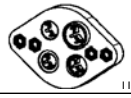
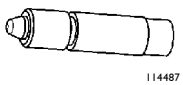
	VOSS/IVECO Teil -Nr: Part -No: Codice:	Benennung	Itemname	Descrizione	Description	Descripción
 114477	5 0 99 11 64 00 4128 3761 EZ 50-7499	Schutzkappe Tank 0°	PROTECTION CAP TANK 0°	CAPPA DI PROTEZIONE SERBATOIO 0°	CAPUCHON DE PROTECTION RESERVOIR 0°	COBERTURA DE PROTECCION DEPOSITO 0°
 114488	5 0 99 11 71 00 4128 3762 EZ 50-7499	Schutzkappe Tank 90°	PROTECTION CAP TANK 90°	CAPPA DI PROTEZIONE SERBATOIO 90°	CAPUCHON DE PROTECTION RESERVOIR 90°	COBERTURA DE PROTECCION DEPOSITO 90°
 114499	5 4 66 09 30 00 4128 3763 EZ 50-7499	Faltenbalg	CONVOLUTED RUBBER GAITER	SOFFIETTO	SOUFFLET	RESPIRADERO
 114508	5 4 66 09 64 00 4128 3764 EZ 50-7499	T-Stück für Wellrohr NW37	T-CONNECTOR FOR CORRUGATED HOSE NW37	DISTRIBUTORE A T PER TUBO CORRUGATO NW37	DISTRIBUTEUR EN T POUR TUBE ANNELE NW37	DISTRIBUIDOR EN T PARA TUBO CORRUGADO NW37
 114509	5 3 49 03 21 00 4128 3765 EZ 50-7499	Deckplatte Trennstelle	COVERPLATE SECTION POINT	PIASTRA DI COPERTURA PUNTO DI SEZIONAMENTO	PLAQUE DE COUVERTURE POINT DE SECTIONNEMENT	CHAPA DE COBERTURA PUNTO DE SEPARACION
 114510	5 3 49 03 20 49 4128 3766 EZ 50-7499	Grundplatte Trennstelle	BASE PLATE SECTION POINT	PIASTRA DI BASE PUNTO DI SEZIONAMENTO	PLAQUE DE BASE POINT DE SECTIONNEMENT	CHAPA DE BASE PUNTO DE SEPARACION

Table 6.1 - (cont.) Tools

	VOSS/IVECO Teil -Nr: Part -No: Codice:	Benennung	Itemname	Descrizione	Description	Descripción
 114482	5 9 94 52 14 00 Iveco: 99387101 50-7499	Kunststoffrohr Montagezange	NYLON TUBE MOUNTING PLIERS	PINZA DI MONTAGGIO PER TUBO PLASTICA	PINCE DE MONTAGE POUR TUBE PLASTIQUE	ALICATES DE MONTAJE PARA TUBO DE PLASTICO
	5 9 94 71 53 49 Iveco: 99387102 50-7499	Spannbacken für Rohr MLT 8.8x1.4	CLAMPING JAWS FOR TUBE MLT 8.8x1.4	MORSA PER TUBO MLT 8.8x1.4	GRIFFE DE SERRAGE POUR TUBE MLT 8.8x1.4	MORDAZA PARA TUBO MLT 8.8x1.4
 114484	5 9 94 65 41 00 Iveco: 99387103 50-7499	Spannbacken für Rohr GRILAMID 13x1.5 (08/ 010/ 012/ 013)	CLAMPING JAWS FOR TUBE GRILAMID 13x1.5 (08/ 010/ 012/ 013)	MORSA PER TUBO GRILAMID 13x1.5 (08/ 010/ 012/ 013)	GRIFFE DE SERRAGE POUR TUBE GRILAMID 13x1.5 (08/ 010/ 012/ 013)	MORDAZA PARA TUBO GRILAMID 13x1.5 (08/ 010/ 012/ 013)
 114485	5 9 94 71 55 00 Iveco: 99387104 50-7499	Werkzeugeinsatz Aufnahme für Verbinder NW6 (Harnstoff)	TOOLING INSERT COLLET FOR CONNECTOR NW 6 (AD-BLUE)	INSERTO STAMPO ALLOGIAMENTO PER CONNETTORI NW6 (UREA)	EMPREINTE MOULE LOGEMENT CONNECTEURS NVV6 (UREE)	UTIL ESTAMPACION ALOJAMIENTO PARA CONEXIONES NW6 (UREA)
 114486	5 9 94 69 16 49 Iveco: 99387105 50-7499	Werkzeugeinsatz Aufnahme für Verbinder NW10 (Kühlwasser)	TOOLING INSERT COLLET FOR CONNECTOR NW 10 (COOLING WATER)	INSERTO STAMPO ALLOGIAMENTO PER CONNETTORI NW10 (AQUA DI RAFFREDDAMENTO)	EMPREINTE MOULE LOGEMENT CONNECTEURS NW10 (EAU DE REFROIDISSEMENT)	UTIL ESTAMPACION ALOJAMIENTO PARA CONEXIONES NW10 (AGUA DE REFRIGERACION)
 114487	5 9 94 71 56 00 Iveco: 99387106 50-7499	Aufweitdorn für Rohr MLT 8.8x1.4	WIDENING SPIKE FOR TUBE MLT 8.8x1.4	MANDRINO ALLARGATUBI MLT 8.8x1.4	MANDRIN A DUDGEONNER MLT 8.8x1.4	MANDRIL PARA AVELLANAR TUBOS MLT 8.8x1.4
	9 7 51 00 00 08	Klemmzange für Einohrschelle	CLAMPING PLIERS FOR CLIP RETAINER	MORSETTO PER FASCETTA	CLIP POUR COLLIER DE SERRAGE	UTIL PARA ABRAZADERAS
	5 9 94 84 72 00	Kunstoffrohr-Schneidezange	NYLON TUBE SCISSORS	TRONCHESE PER TUBO IN PLASTICA	TRICOISES POUR TUBE EN PLASTIQUE	CORTADOR DE TUBO DE PLASTICO
	5 9 94 84 74 00	Ersatzklinge für Kunstoffrohr-Schneidezange (2 Stück)	SPARE BLADE FOR NYLON TUBE SCISSORS	LAMA DI RICAMBIO PER TRONCHESE PER TUBO IN PLASTICA	LAME DE RECHANGE DE TRICOISES POUR TUBE EN PLASTIQUE	CUCHILLA DE RECAMBIO PARA CORTADOR DE TUBO DE PLASTICO

- When working on the pipes, it is compulsory to work in a completely dust-free environment to prevent dust reaching the injector.
- Restore all the pipe insulation (water and Urea pipes) to prevent freezing.

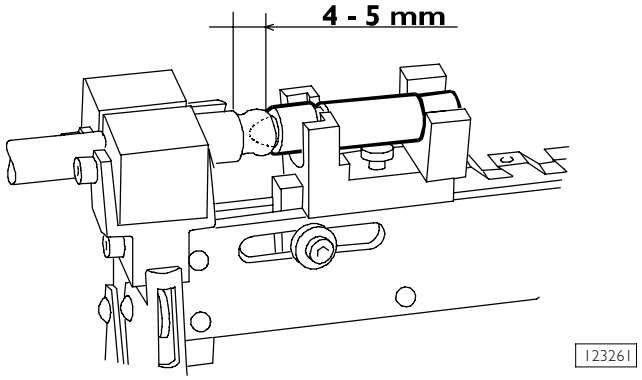
Specifications for installation and removal

6.5.2.1 Instructions for lengthening and shortening the AdBlue ducts on the vehicle

1) Mark the delivery and returns ducts before separating them to ensure that they are correctly positioned during subsequent assembly. The maximum permitted length for ducts must not exceed 5 m from the reservoir to the supply module and 3 m from the supply module to the dosing module.

2) Cut the AdBlue duct (MLT Rehau - VOSS HWL 8.8 x 1.4 PA wall thickness 0.2 mm and 0.4 mm PA/PUR) with the appropriate pipe cutting clippers in order to ensure an accurate cutting area. For reasons of space, it is advisable to divide the AdBlue delivery and return ducts along the length of the line.

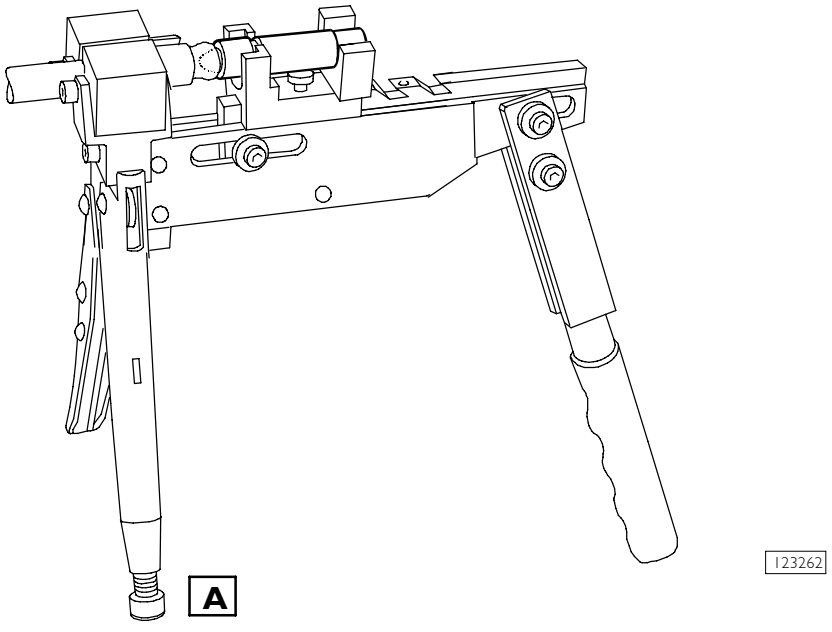
Figure 6.15



3) The special band is pushed by the fitting toward the end of the pipe.

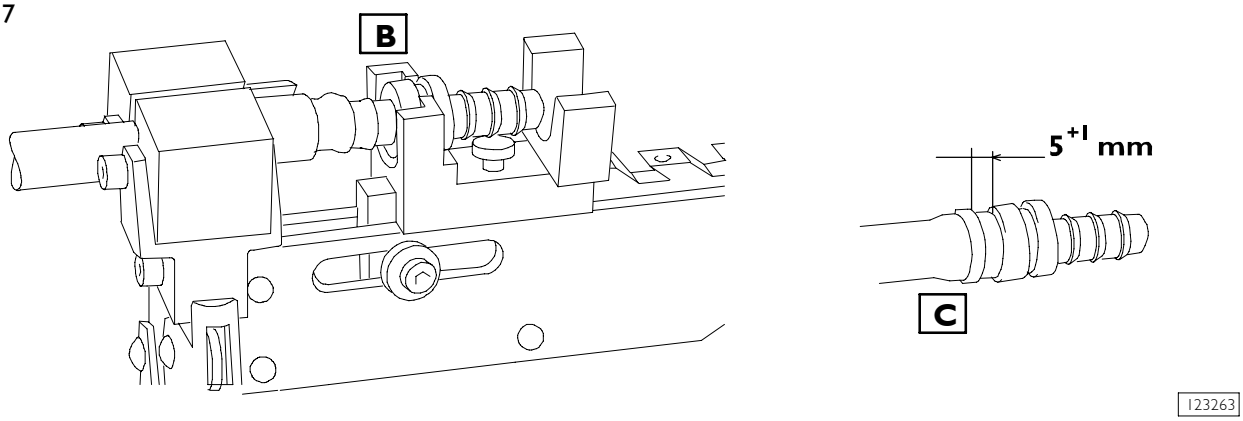
4) The pipe is inserted in the pipe jaws and secured by clips. The end of the duct should extend 4-5 mm from the clips. The tightening force must be adjusted using adjustment screw (A) (the distance of the jaws without the pipe must be approximately 1-2 mm).

Figure 6.16



5) Fit expanding pin (B) in the tool element and push the transport bar mechanically toward the pipe until the pin cone fits fully into the pipe. Then pull the bar back and remove the expansion plug.

Figure 6.17



6) The expanded side of the joint on the duct to be fitted must be moistened with water to above the O-Ring and fitted into the tool insert. The connector must be pressed toward pipe by hand through the transport bar until the profile of the pipe expander is centred within the inner diameter of the pipe.

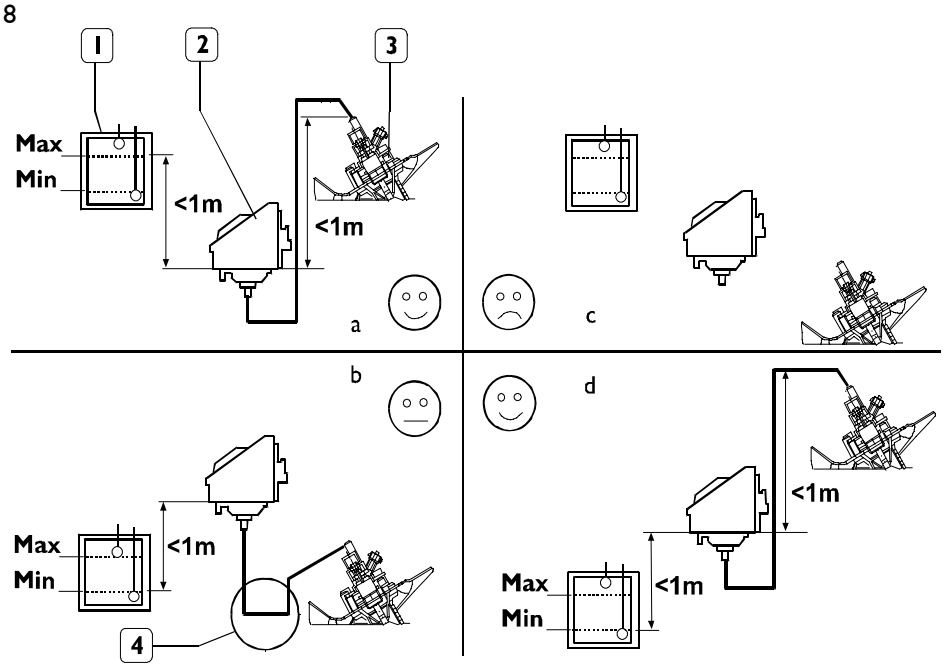
7) Use the appropriate lever to push the connector into the pipe to the end of the expansion pin. It is advisable to exercise continuous pressure while doing this.

8) Release the locking jaws, position the special bands up to 5+ 1 mm from the collar and press using the manual pliers (C.)

6.5.3 Altering the supply module position

On some body models or for some types of service, it is necessary for components of the AdBlue system such as the AdBlue tank, the dosing module or the supply module to be fitted in another part of the vehicle.
When moving the AdBlue components, take particular care over the height differences between them. Relevant examples are shown in the following figures.

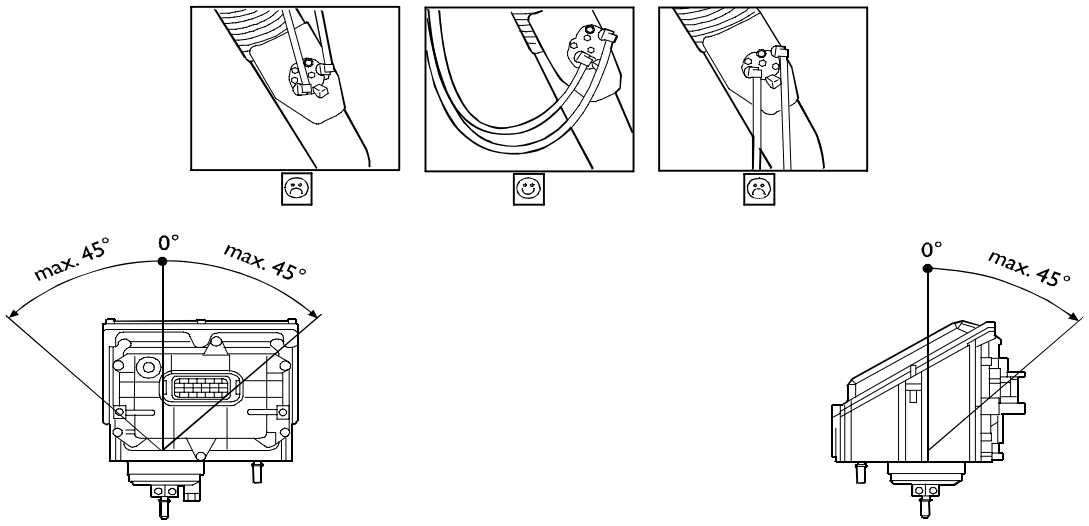
Figure 6.18



1. AdBlue reservoir - 2. Pumping module - 3. Dosing module - 4. Siphon compulsory

The supply module must be fitted on a fixed base. The preferred fitting position of the supply module is vertical with the attachments facing down. A different position is possible within the measurements shown below. The fitting position on Stralis vehicles corresponds to layout in version b. When connecting the AdBlue pipe to the DM, ensure that the pipe is fitted leading upwards just before the DM (illustration below).

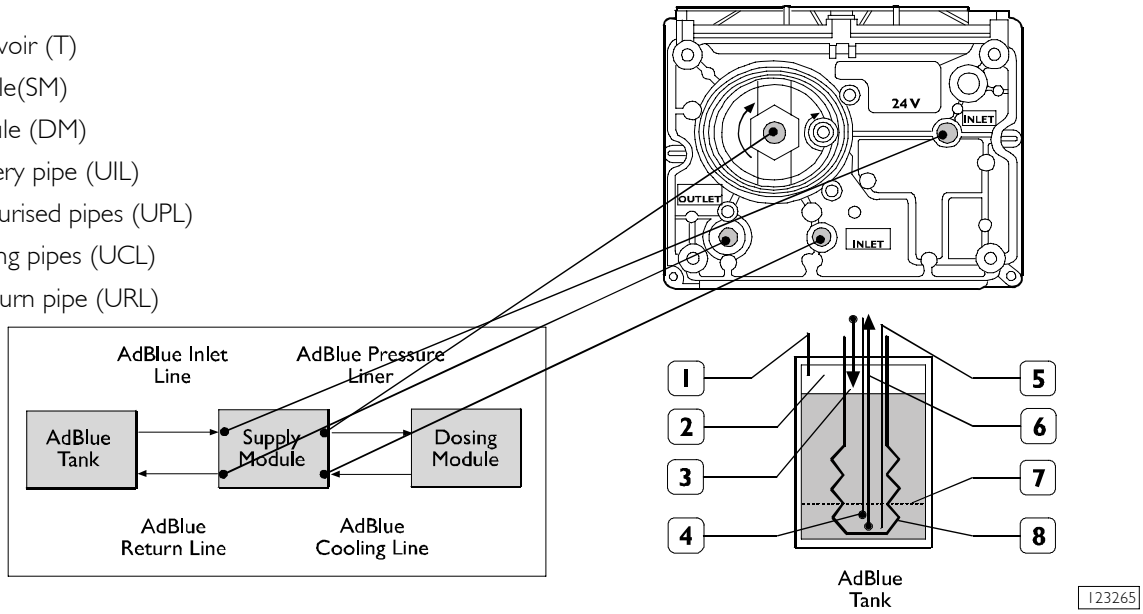
Figure 6.19



If the position of the supply module (SM) is altered, a check must be carried out to ensure that the environmental temperature corresponds
to that of the original installation. In case of doubt, it is advisable to re-check the temperatures.
The following abbreviations may be used in the description of the component position:

Figure 6.20

- AdBlue reservoir (T)
- Supply module(SM)
- Dosing module (DM)
- AdBlue delivery pipe (UIL)
- AdBlue pressurised pipes (UPL)
- AdBlue cooling pipes (UCL)
- A AdBlue return pipe (URL)

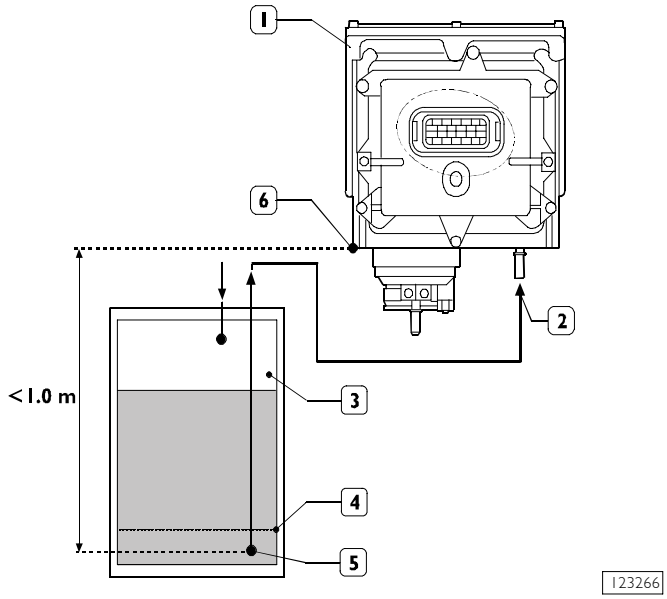


1. Reservoir ventilation - 2. Residual air - 3. Return line - 4. Temperature sensor - 5. AdBlue level sensor - 6. Delivery line - 7. Reservoir minimum level - 8. Reservoir heater.

The AdBlue reservoir is lower than the supply module(SM):

The maximum intake height corresponds to the difference between reference point (6) = lower edge of the supply module and the lower edge of the intake duct (5). The intake height must not exceed 1 m.

Figure 6.21

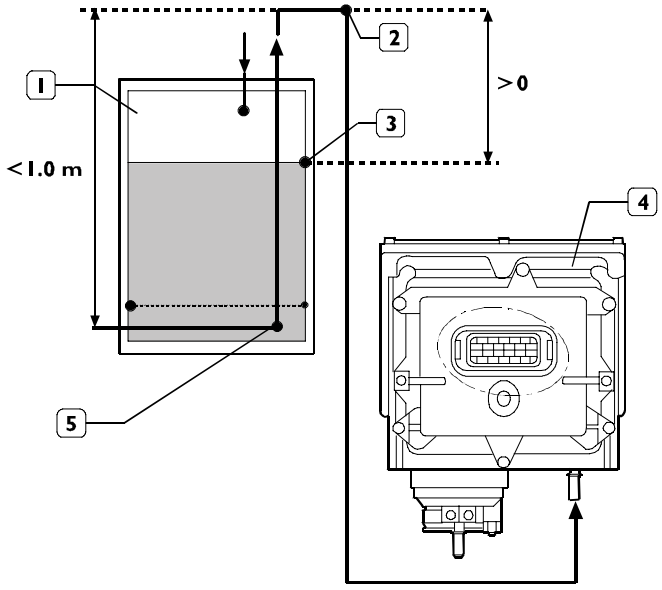


1. Supply module (SM) - 2. Supply line - 3. AdBlue reservoir - 4. AdBlue minimum level - 5. Intake duct lower edge - 6. Lower edge of supply module.

The AdBlue reservoir is higher than the supply module(SM):

The maximum intake height corresponds to the difference between the lower edge of intake pipe (5) and the highest point of intake duct (2). This height must not exceed 1 m.

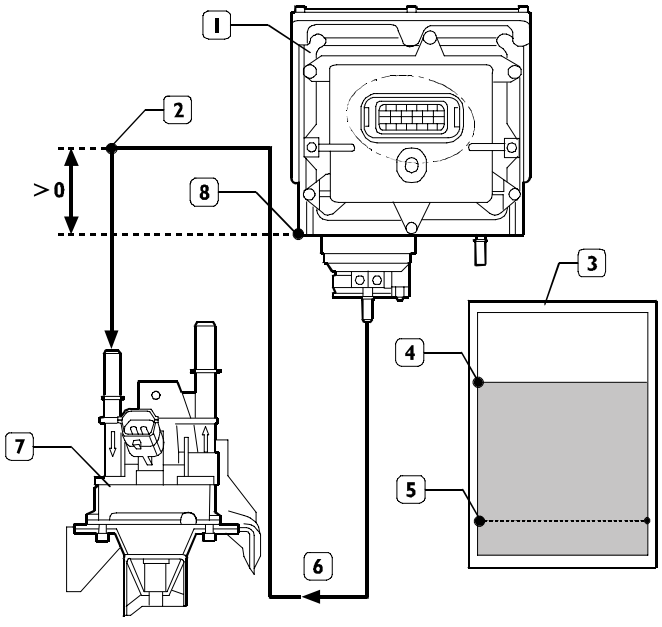
Figure 6.22



1. AdBlue reservoir - 2. Upper edge of intake pipe - 3. Level of AdBlue in reservoir - 4. Supply module - 5. Lower edge of intake pipe.

Dosing module (DM) is lower than supply module (SM):

The upper edge of delivery duct (2) must be located above reference point (8).

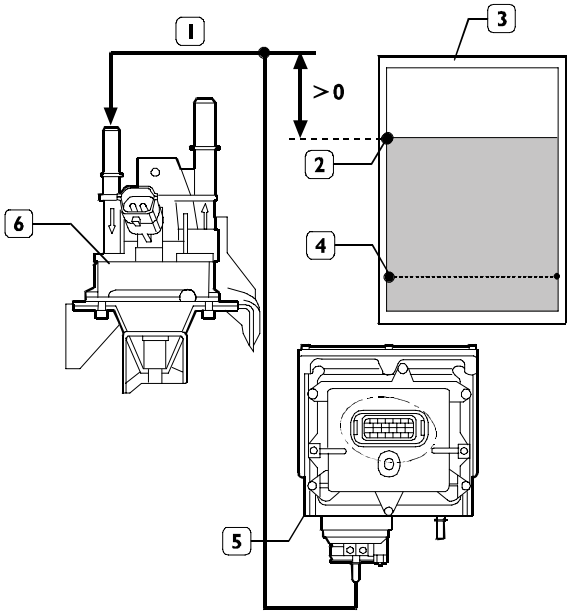


1. Supply module - 2. Upper edge of intake duct - 3. AdBlue reservoir - 4. Level of AdBlue in reservoir - 5. AdBlue minimum level - 6. Siphon - 7. Dosing module (DM) - 8. Lower edge of supply module.

The AdBlue reservoir is higher than the supply module (SM):

The upper edge of delivery duct (1) must be located above reference point (5).

Figure 6.23

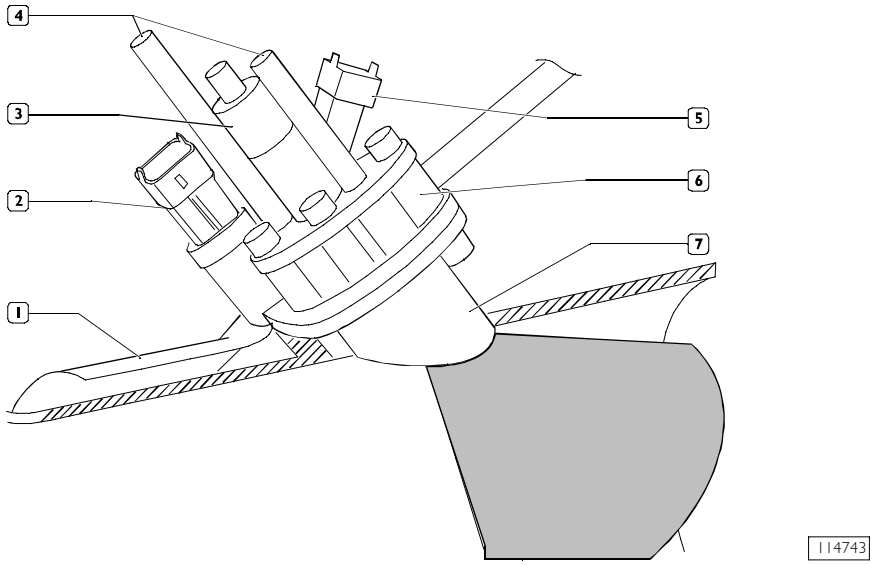


1. Pressurised pipe - 2 AdBlue level - 3. AdBlue reservoir - 4. Minimum level of AdBlue - 5. Lower edge of supply module.

6.5.4 Operations on the dosing module

When the dosing module requires repositioning, note some important precautions.

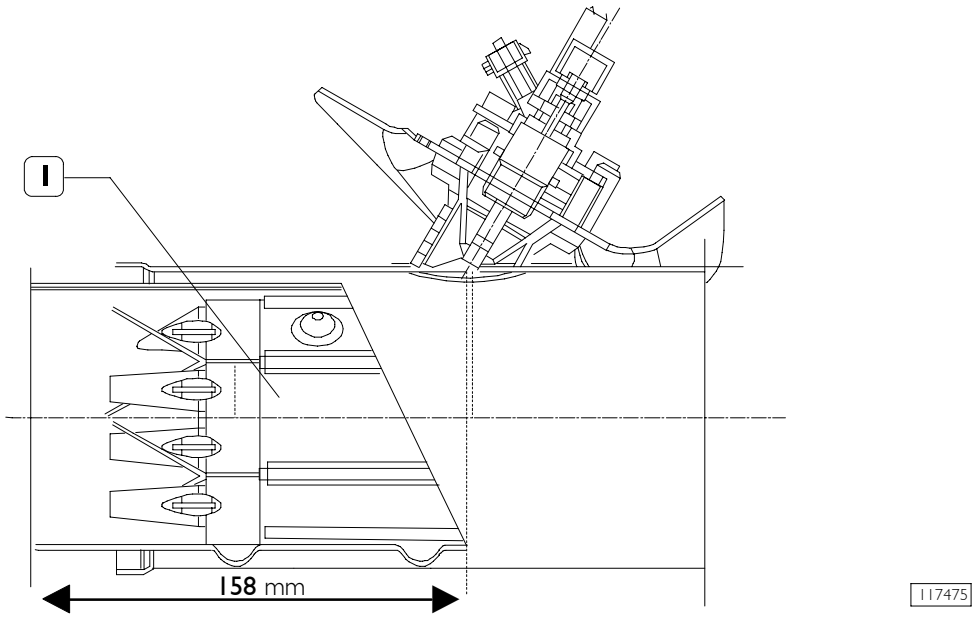
Figure 6.24



STRUCTURE OF THE MEASURING MODULE

1. Heatshield - 2. Temperature sensor - 3. Valve holder - 4. AdBlue connectors - 5. Dosing valve - 6. Cooling adapter - 7. Insulation

Figure 6.25

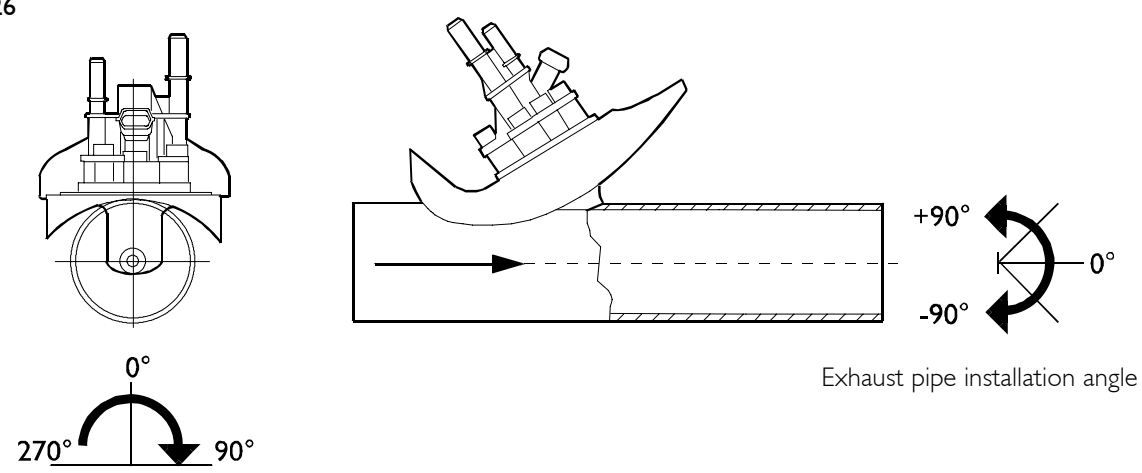


- Inside the exhaust gas pipe is placed a diffuser (1) therefore the pipe interested cannot be modified.

Orientation of dosing module (DM) in the exhaust pipe:

When positioning the DM, a distinction is drawn between the positioning rotation angle in the exhaust pipe and the exhaust pipe installation angle (see following figure).

Figure 6.26



Exhaust pipe installation angle

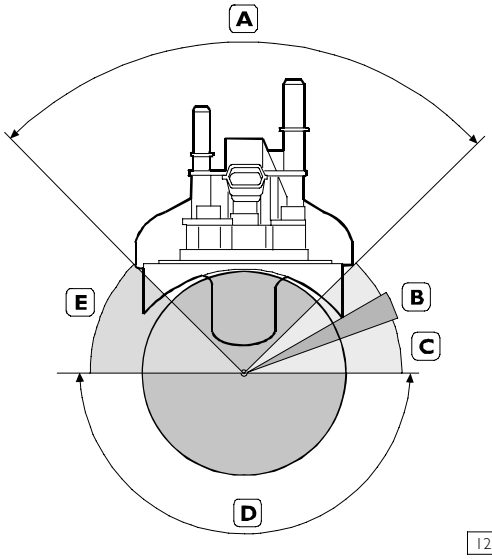
Angle of rotation of DM in exhaust pipe

123270

Orientation of dosing module (DM) in relation to angle of rotation in exhaust pipe:

To prevent operating errors and damage to the DM, the following positions must be respected during installation:

- 315° - 45° (A)
  The increasing heat in the exhaust pipe may damage the DM or cause it to malfunction. In this case, a heat shield must be installed under all circumstances.
- 90° - 270° (D)
  The AdBlue fluid contained in the dosing module. In If temperatures are very low, this may freeze and damage the module.
- 45° - 90° and from 270° to 315° (C - E)
  In this position installation is possible, a minimum quantity of AdBlue remains in the module.
- 60° - 70° (B)
  This is the idea position for installing the DM and must be absolutely preferred if conditions permit.



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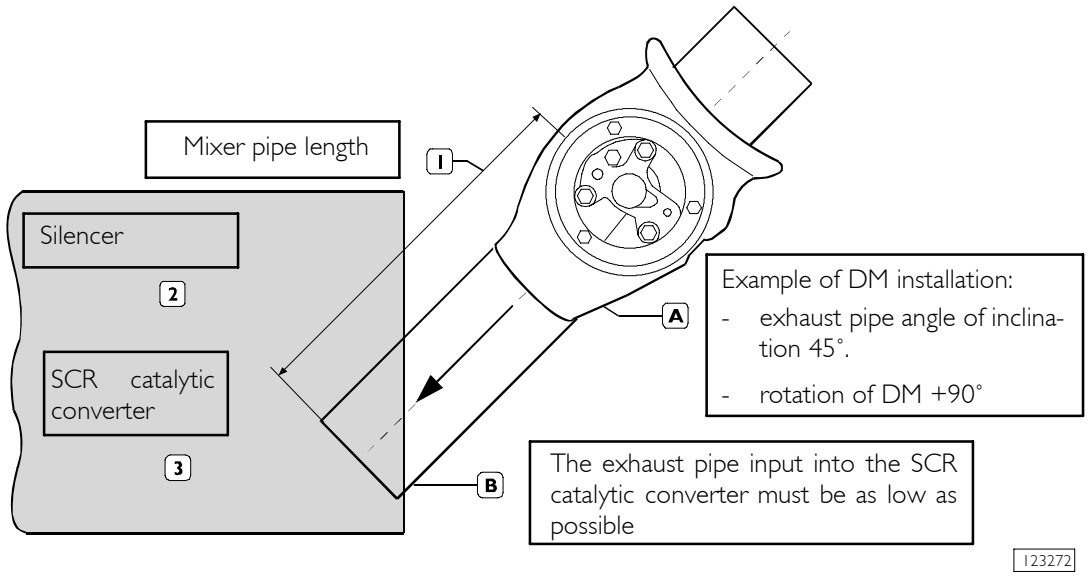
Exhaust gas pipe installation angle:

The installation angle must be between +45° and -90°.

Installation of the form of dosing in relationship to the catalyst SCR:

Figure 6.27



NOTE The exhaust pipe input into the SCR catalytic converter must be located as low as possible. If the catalytic converter is turned so that the exhaust pipe input is located in the upper part, there is a danger of the hot exhaust gases going back into the dosing module if the engine stalls, with a consequent risk of damage.

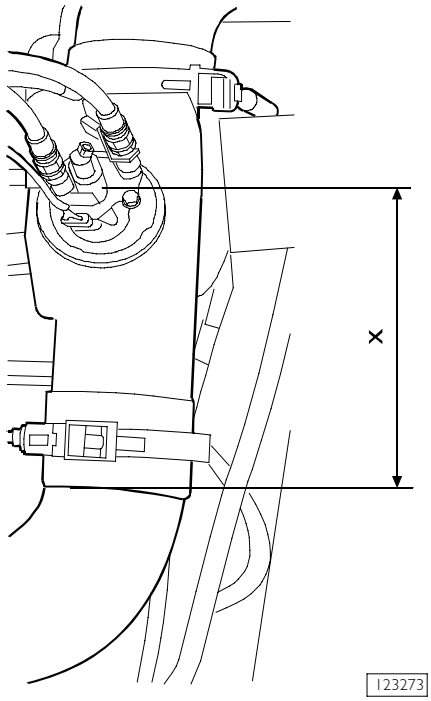
Distance of the DM from the SCR catalytic converter:

On IVECO Cursor engines, the distance of the DM from the SCR catalytic converter must not be less than 1200 mm. Lower distances must be checked and authorised in each individual case.
In some conversions, it may be necessary to locate the SCR catalytic converter in a new position on the vehicle. Taking into consideration the above conditions, the exhaust gas (start or mixer pipe to the inlet of the SCR plug) may be extended up to 3 m.
A further extension of the exhaust gas pipe makes it absolutely necessary to insulate the pipe to avoid excessive heat dispersion with a possible consequent malfunction of the SCR system SCR.

An overall exhaust pipe length of 6 m must not be exceeded under any circumstances.
The distance (X) between the DM and the next bend depends on the angle and the following distances must be complied with:

- 30° bend > distance 150 mm
- 45 bend > distance 200 mm
- 90° bend > distance 300 mm

If an adaptation should be necessary due to the tubomixer, the following requirements must be observed:
To prevent the formation of sediment in the exhaust pipe behind the mixer due to sharp edges or welds, a connection to the mixer must be created at least 10 mm before the end of its internal duct.



NOTE If the dosing module is moved, the pipes and electrical wiring must be modified.

6.5.5 Operations on exhaust pipes

NOTE The exhaust pipe layout cannot be changed without the approval of IVECO.

The exhaust pipe can be modified paying attention to the following warnings:

- Type approved (homologated) counter-pressures must be respected when determining the exhaust pipe route. Form bends with angles greater than 90° and radius of curvature greater than 2.5 times the pipe diameter. Keep the exhaust pipe far enough away from rubber or plastic parts and fit heat shields if necessary.
- It is not permitted to use pipes with diameters, thicknesses and materials other than those used for the original equipment.
- It is permitted to use hoses with limited lengths.
- In some conversions, it may be necessary to locate the SCR catalytic converter in a new position on the vehicle. Taking into consideration the above conditions, exhaust gas pipe (start of mixer pipe to the SCR plug intake) may be extended up to 3 m.
- A further extension of the exhaust gas pipe makes it absolutely necessary to insulate the pipe to avoid excessive heat dispersion with a possible consequent malfunction of the SCR system.

An overall exhaust pipe length of 6 m must not be exceeded under any circumstances.

Electrical wiring:

- It is only possible to lengthen cables for the temperature sensors.
- It is not possible to alter the length of the Nox sensor cable.

6.6 Wiring for positioning of SCR system components

If the SCR system components are moved (e.g. total or partial movement of the rails and lengthening of wheelbase), Iveco makes available replacement material and wiring to ensure final product quality.

Table 6.2 - Replacement of cables for repositioning of SCR system components

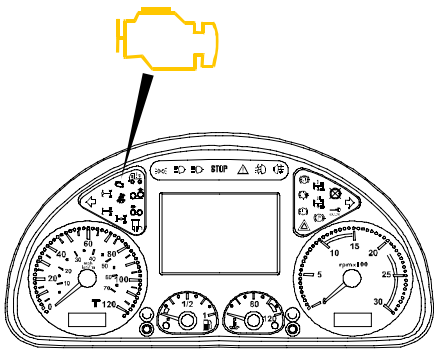
Basic pump module cable (for movement of the SCR Supply Module within the frame, on the left side).	dis. n° 41244952
2 m pump module movement cable. (To be added to the basic cable, in longer wheelbases and in cases where the wheelbase is lengthened)	dis. n° 41244954
P/N 4 m pump module movement cable. (To be added to the basic cable, in longer wheelbases and in cases where the wheelbase is lengthened)	dis. n° 41244955
Electrical cable for heated pre-filter (For movement of the heated prefilter to the left side of the frame	dis. n° 41245115
Fuel tank electrical cable (For movement of the tank to the left side of the frame)	dis. n° 41245116

6.7 OBD 1 - Stage 2

The Emissions Directive introduced on 1 October 2007 obliges industrial vehicle manufacturers to reduce engine performance if Nox emissions do not meet requirements laid down by the regulation during use of the vehicle.
When driving with the AdBlue reservoir empty (AdBlue level below the minimum operating level for the dosing unit) or with other causes that do not permit the vehicle to respect the NOx emission levels specified in the regulations, the engine will undergo a reduction in performance (derating) indicated in advance by the yellow OBD warning light coming on the instrument panel (see Figure 6.28).

This drop in performance is activated on the first occasion that vehicle speed is reduced to zero and persists until the emission control devices are restored to normal operating conditions, allowing the vehicle to comply with an NOx emissions again (e.g.: If the AdBlue reservoir is empty, it should simply be refilled) and has no effect on vehicle reliability.
Note also that the on-board control unit is legally bound to record such events so that they may be made available during any future police checks.

Figure 6.28

CONDITION	CONSEQUENCE	SYMBOL
AdBlue remains approximately 10% below the tank capacity	Driver notified (warning light flashes)	YELLOW warning light  125201
Non-compliance with Nox values established in standards: • AdBlue tank empty • Dosing stopped • Any deviation greater than 50% of average AdBlue consumption	AdBlue warning light comes on with continuous light, reduction in engine performance and fault code stored for 400 days or 9600 hours of engine operation	