AGROKID 210 ->20001
AGROKID 220
->ZKDS2102V0MD20001
AGROKID 220
->ZKDS2902V0MD20001
AGROKID 230
->ZKDS2202V0MD20001
AGROKID 230
->ZKDS3002V0MD20001

WORKSHOP MANUAL

DEUTZ FAHR

40 - WIrINg dIagraMS

40.1 - INTrOduCTION

40.1.1 - Structure of the unit

For easier consultation, this unit has been divided into the following chapters:

- introduction
  - Contains a brief description of the terminology used, the procedures to follow for troubleshooting and repairs, and the instruments required for troubleshooting.
- Indices
  - Contains the indices arranged by connector name, by component code and by component description.
- Components
  - Contains the layouts of the connectors used in the electrical system, descriptions of the components installed on the tractor,the technical data necessary for functional testing and the pinouts of the electronic control units.
- Systems
  - Contains the electrical diagrams of the tractor's systems.
- Wiring looms
  - Contains the layouts, the wiring diagrams and the positioning of connectors on the tractor.

How to consult the unit

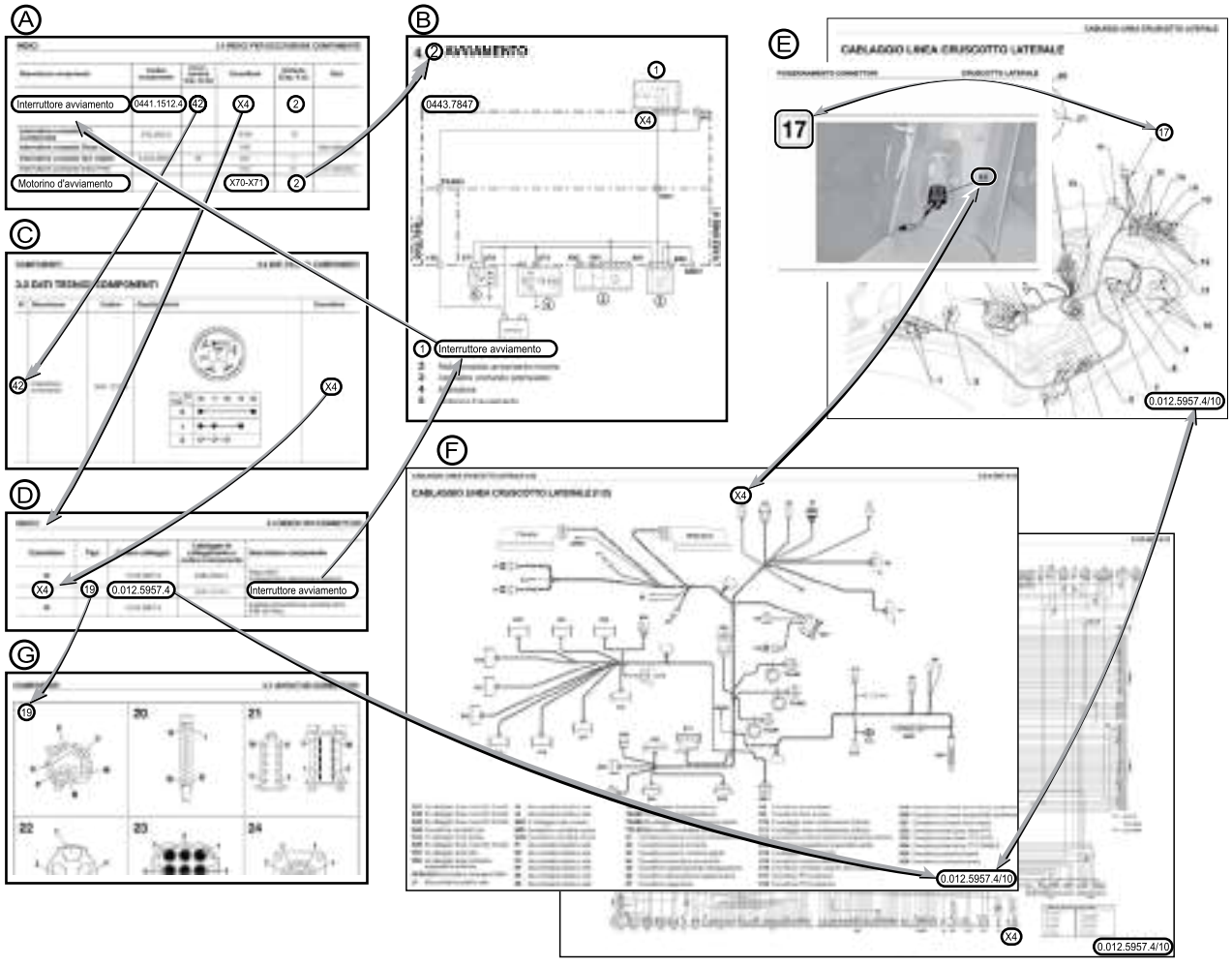


Fig. 1104

How to consult the table

The quickest way to determine the cause of a malfunction of a component (e.g. the starter motor) is to check all the components in the system in which the component is incorporated. In this example, the problem is a malfunction of the starter motor, which fails to start the engine.

- Find the starter motor in heading "Index by part description" and identify the system in which the component is incorporated. The system is indicated in the "System" column and in this case is "2" (figure A).

- Consult heading “Starting” (figure B), where all system components are shown in the electrical diagram; these components are accompanied by numbers that correspond to the key on the same page.
- Check all the components in the system, starting for example with switch “1”.
- In heading “Index by part description” (figure A) find the item “Start switch” and check in the column “Technical Descr’n” to see if there is a technical description of the component (in this case it appears at no. 42 in the heading “component technical data”) (figure C). Take note also of the name of the connector to which the component is connected (in this case “X4”).

Only if the position of the component is not known

Only if the position of the component is not known:

- In heading “Connector index” (figure D) find the name of the connector to which the component is connected (in this case “X4”) and note down the wiring loom in which it is incorporated (in this case “0.012.5957.4”) and the type of connector (in this case “19”).
- Find the wiring loom in chapter “Plans, wiring diagrams, connector positions” using the index at the beginning of the chapter.
- Find the name of the connector in the photos attached to the electrical diagrams and establish its position on the tractor using the drawing (figure E)
- Using the data contained in the paragraph “Component technical data” (figure C) in position no. 42, check the operation of the switch.

daNgEr

In the electrical diagrams (figure F) are indicated the names of the connectors and the descriptions that are used in all the tables of chapter 2.

daNgEr

If the pinout of the connector is not known, look in paragraph “Connector layouts” (figure G) for the number found in the column “Type” of paragraph “Connector index”.

introduction

This section of the workshop manual is intended as a practical guide to troubleshooting the tractor’s electrical and electronic systems. The following pages provide the technician with all the necessary information regarding the tractor’s systems and components. Due to the possible time difference between the introduction of technical modifications (in line with our policy of continuous product improvement) and the corresponding amendment of our printed documentation, we are obliged to state that the data contained in this document are subject to modification and as such are not binding.

Definition of components and symbols

To prevent any misunderstanding or ambiguity, listed below are definitions for some of the key terms used in this unit.

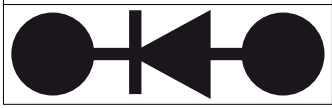
Table 100

TErM	dESCrIPTION
Connector	Element used to connect two components (e.g. wiring-switch, wiring-wiring)
Transmission oil	Electrical component that converts the temperature of a medium (air, water, oil, etc.) into a voltage or resistance
Main clutch	Electrical component that converts the pressure of a medium (air, water, etc.) into a voltage or resistance
accelerator pedal	Electrical component that converts the angular or linear position of an object into a voltage
Pressure switch	Switch that changes state (opens or closes a contact) according to the operating pressure in the circuit in which it is installed
Thermostat	Switch that changes state (opens or closes a contact) according to the temperature of the medium in which it is immersed.
Lights switch	Mechanical component that opens or closes one or more electrical contacts.
hMI control	Valve operated by applying electrical current to a coil (or solenoid)

Chapter “Components” shows the wiring diagrams for certain switches and buttons. The following symbols are used for ease of interpretation:

Table 101

SYMbOl	dESCrIPTION
	Contact between pins CLOSED (stable switch position)

SYMbOl	dESCrIPTION
	Contact between pins CLOSED (unstable switch position)
	Indicator LED
	Indicator lamp
	Diode

general rules

The inspection, maintenance, troubleshooting and repair operations are essential to ensure that the tractor continues to operate correctly over time and to prevent malfunctions and breakdowns. The scope of this paragraph is to describe repair procedures and to help improve the quality of repairs.

Modification of the tractor's electrical/electronic circuits

The manufacturer prohibits any modification or alteration of the electrical wiring for the connection of any non-approved electrical applicances or components. In particular, if it is discovered that the electrical system or a component has been modified without authorisation, the Manufacturer will accept no liability for any damage to the vehicle and the vehicle warranty will be invalidated.

Main wiring faults

Bad contact between connectors

- The main causes of poor contact between connectors are incorrect insertion of the male into the female connector, deformation of one or both connectiors, and corrosion or oxidisation of the pin contact surfaces.

Defective pin soldering or crimping

- The pins of the male and female connectors make good contact in the crimped or soldered area, but the wires are subjected to excessive tension, leading to breakage of the insulation or the wire itself and a poor connection.

Disconnecting wiring

- If components are disconnected by pulling on the wires, or if components are removed with the wires still connected, or if the wiring is subject to a heavy impact this could damage the connections at the pins, breaking strands of wire.

Penetration of water inside connectors

- The connectors are designed to prevent penetration of liquids (water, oil etc.); however, it is possible that when the tractor is cleaned using high-pressure water or steam, water could penetrate or condense in the connectors. As the connectors are designed to prevent liquid penetration, any water that does get in will not be able to drain out, and thus may cause short-circuits across the pins. For this reason it is good practice to dry the connectors with a low pressure jet of compressed air after washing the tractor.

Oil or dirt on connectors

- If the connectors or pin contact surfaces show signs of oil or grease contamination, this will prevent the passage of current (oil and grease are electrical insulators) creating a poor contact. Clean the connectors thoroughly using a dry cloth or a low pressure jet of compressed air and use specific products (deoxidising sprays, etc.) to degrease the contacts.

Important

Take care not to bend the pins when cleaning them. Use dry oil-free compressed air.

Removal, refitting and drying of connectors and wiring

When disconnecting wiring, pull on the connectors rather than on the wires themselves. For connectors that are held in position with screws or levers, fully loosen the screws, then pull on the connector. For connectors that are clipped together, fully depress the

clip then pull the connector apart. After disconnecting connectors, seal them in waterproof material to prevent contamination of the contacts with dirt or moisture.

Connecting the connectors. Check the condition of the connectors:

- Make sure the pin contact surfaces are free of water, dirt or oil.
- Check that the connectors are not deformed and that the pins are not corroded or oxidised.
- Check that the connector casings are not damaged or split.
- If a connector is contaminated with oil or grease, or if moisture has penetrated the casing, clean it thoroughly.
- If a connector is damaged, deformed or broken, replace it with a new one.

When connecting connectors, make sure they are properly aligned before applying force. For connectors with clips, insert the two halves until they clip together.

Cleaning and drying wiring

- When wiring is dirty or contaminated with oil or grease, clean it with a dry cloth, or, if necessary, with water or steam. If the wiring must be cleaned with water, avoid directing the water or steam jet on the connectors; if water penetrates the connector, clean it thoroughly.
- Check that the connector is not short circuited due to the presence of water by testing for continuity across the pins.
- After checking that the connector is good condition, degrease the contacts using a deoxidising product.

Renewal of damaged electrical components.

- When replacing electrical components (fuses, relays, etc.), use only original parts supplied by the manufacturer.
- When replacing fuses, check that the new fuse conforms to DIN 72581 or ISO 8820 standards and in particular:
  - fuse F1 (100A) DIN 72581/2
  - bayonet fuse (F2, F3, etc.) DIN 72581/3C
  - fuse F51 (100A) and F52 (200A) ISO 8820.
- The fitting of replacement fuses that do not comply with these standards will invalidate the warranty with immediate effect and release the manufacturer from any liability.
- When replacing relays, make sure that the new relay conforms to the standards marked on the original relay.

Diagnostic instruments

For the correct diagnosis of any faults in the tractor's electrical system, the following instruments are required:

- Digital multimeter with the following minimum characteristics:
  - AC VOLT 0-600
  - DC VOLT 0-600
  - OHM 0-32M
  - AC AMP 0-10
  - DC AMP 0-10
- All Round Tester or computer with "PCTESTER" software installed

Wire colour codes

Table 102

COlOur COdES	
a	Light blue
b	White
C	Orange
g	Yellow
h	Grey
l	Dark blue
M	Brown
N	black
r	Red
S	Pink
v	green
Z	Purple

40.1.2 - Wiring and components index

List of wiring harnesses

Table 103

dESCrIPTION	COdE	WIrING dIagraM	CONNECTOr POSITIONS
Aereo cab	0.014.7593.4	**40-89**	**40-90**
Front	0.012.6951.4	**40-57**	**40-58**
Front with cab	0.015.0032.4	**40-66**	**40-68**
Cab power supply	0.014.7594.4	**40-92**	**40-93**
Compressor wiring	0.014.7601.4	**40-65**	**40-65**
Remote valve wiring	0.012.6955.4	**40-86**	-
Solenoid valve wiring	0.014.1482.4	**40-80**	**40-81**
Rear lights wiring	0.014.7602.4	**40-86**	**40-87**
Flashing light wiring	0.014.7597.4	**40-100**	**40-101**
Cab earth wiring	0.015.0031.4	**40-96**	**40-96**
Radio wiring	0.014.7600.4	**40-104**	**40-104**
Central wiring	0.012.6949.4	**40-71**	**40-74**
Front lights	.014.7599.4	**40-62**	**40-63**
Rear	0.013.1452.4/10	**40-82**	**40-84**

Index by part description

Table 104

COMPONENT dESCrIPTION	COMPONENT COdE	CONNECTOr	SYSTEM
Check panel	2.8339.230.0	A18	**40-71**
	2.8339.230.40	A20	**40-71**
Sol. valve control unit	2.8519.035.4	U1	**40-80**
Steering column switch	0.013.3337.3	A25	**40-71**
Ex rotating beacon wire	0.013.9053.2	N1	**40-100**
RH light	2.8039.293.0	P2	**40-62**
	2.8039.293.0	P3	**40-62**
LH light	2.8039.294.0	P5	**40-62**
		P6	**40-62**
Front lights	2.8039.230.0	Z5	**40-66**
		Z8	**40-66**
Worklights d. 80	2.8039.001.0	G14	**40-89**
Rear lights	2.8059.230.0 (LH)	S2	**40-86**
		S3	**40-86**
		S4	**40-86**
	2.8059.240.0 (RH)	S6	**40-86**
		S7	**40-86**
		S8	**40-86**
Receiver-dryer	0.008.9604.0	M3	**40-94**
		M4	**40-94**
Flasher	0.009.6758.4/10	A26	**40-71**
Bosch emergency pushbutton	2.7659.110.0	A7	**40-71**
PTO switch	2.7659.262.0	V4	**40-61**
Windscreen wiper timer relay	2.8639.008.0	G9	**40-89**
Windscreen wiper	2.9019.200.0	G19	**40-89**
Rear wiper	2.9019.190.0	L4	**40-98**
Air conditioning fan	0.010.0618.4	M5	**40-94**

40.1.3 - Introduction

For easier consultation, this unit has been divided into the following chapters:

- Introduction
  - Contains a brief description of the terminology used, the procedures to follow for troubleshooting and repairs, and the instruments required for fault diagnosis.
- Components list
  - Contains the components of the electrical systems, organised by type.
  - Indicates the system code, the component code and description, the technical data required for functional testing and a description of the pin-outs of the ECUs.

- Systems
  - Contains the wiring diagrams of the tractor's systems.
- Wiring harnesses
  - Contains the layouts, the wiring diagrams and the positions of connectors on the tractor.

Introduction

This section of the workshop manual is intended as a practical guide to fault diagnosis of the tractor's electrical and electronic systems. The following pages provide the technician with all the necessary information regarding the tractor's systems and components. Due to the possible time difference between the introduction of technical modifications (in line with our policy of continuous product improvement) and the corresponding amendment of our printed documentation, the data contained in this document are subject to modification and as such are not binding.

Definition of components and symbols

To prevent any misunderstanding or ambiguity, definitions for some of the key terms used in this unit are listed below.

Table 105

TErM	dESCrIPTION
Connector	Element used to connect two components (e.g. wiring-switch, wiring-wiring)
Temperature sensor	Electrical component that converts the temperature of a medium (air, water, oil, etc.) into a voltage or resistance
Pressure sensor	Electrical component that converts the pressure of a medium (air, water, etc.) into a voltage or resistance
Position sensor	Electrical component that converts an angular or linear position into a voltage
Pressure switch	Switch that changes state (opens or closes a contact) according to the operating pressure in the circuit in which it is installed
Thermostat	Switch that changes state (opens or closes a contact) according to the temperature of the medium (air, water, etc.) in which it is immersed.
Switch	Mechanical component that opens or closes one or more electrical contacts.
Solenoid valve	Valve operated by applying electrical current to a coil (or solenoid)

Chapter "Components" shows the wiring diagrams for certain switches and buttons. The following symbols are used for ease of interpretation:


Contact between pins CLOSED (stable switch position)


Contact between pins CLOSED (unstable switch position)


Indicator LED


Indicator light


Diode

general rules

The inspection, maintenance, fault diagnosis and repair operations are essential to ensure that the tractor continues to operate correctly over time and to prevent malfunctions and breakdowns. This paragraph describes repair procedures and aims to help improve the quality of repairs.

Modification of the tractor's electrical/electronic circuits

The manufacturer prohibits any modification or alteration of the electrical wiring for the connection of any non-approved electrical appliances or components. In particular, if the electrical system or a component is altered without the Manufacturer's authorisation, the Manufacturer will accept no liability for any damage to the vehicle and the vehicle warranty will be invalidated.

Main wiring faults

Bad contact between connectors

- The main causes of poor contact between connectors are incorrect insertion of the male into the female connector, deformation of one or both connectors, and corrosion or oxidisation of the pin contact surfaces.

Defective pin soldering or crimping

- The pins of the male and female connectors make good contact in the crimped or soldered area, but the wires are subjected to excessive strain, leading to breakage of the insulation and a poor connection or breakage of the wire.

Disconnecting wiring

- If connectors are disconnected by pulling on the cables, or if components are removed with the wires still connected, or if the wiring is subject to impact by a heavy object this could damage the soldering or crimping of wires on the pins and some wires may break.

Penetration of water inside connectors

- The connectors are designed to prevent penetration of liquids (water, oil etc.); however, when cleaning the tractor with pressure washers or steam washers water could penetrate or condense in the connectors. As the connectors are designed to prevent liquid penetration, any water that does get in will be unable to drain out, and thus may cause short circuits across the pins. It is therefore good practice to dry the connectors with a low pressure jet of compressed air after washing the tractor.

Oil or dirt on connectors

- If the connectors or pin contact surfaces show signs of oil or grease contamination, this will prevent the passage of current (oil and grease are electrical insulators) creating a poor contact. Clean the connectors thoroughly using a dry cloth or a low pressure jet of compressed air and use specific products (deoxidising sprays, etc.) to degrease the contacts.

Important

Take care not to bend the pins when cleaning them. Use dry oil-free compressed air.

Removal, refitting and drying of connectors and wiring

When disconnecting wiring, pull on the connectors rather than on the wires themselves. For connectors that are held in position with screws or levers, fully loosen the screws, then pull on the connector. For connectors that are clipped together, fully depress the clip then pull the connector apart. After disconnecting connectors, apply water proof covers to prevent contamination of the contacts with dirt or moisture.

Connecting the connectors. Check the condition of the connectors:

- Make sure the pin contact surfaces are free of water, dirt or oil.
- Check that the connectors are not deformed and that the pins are not corroded or oxidised.
- Check that the connector casings are not damaged or split.
- If a connector is contaminated with oil or grease, or if moisture has penetrated the casing, clean it thoroughly.
- If a connector is damaged, deformed or broken, replace it with a new one.

When connecting connectors, make sure they are properly aligned before applying force. For connectors with clips, insert the two halves until they clip together.

Cleaning and drying wiring

- When wiring is dirty or contaminated with oil or grease, clean it with a dry cloth, or, if necessary, with water or steam. If the wiring must be cleaned with water, avoid directing the water or steam jet on the connectors; if water penetrates the connector, clean it thoroughly.
- Check that the connector is not short circuited due to the presence of water by testing for continuity across the pins.
- After checking that the connector is good condition, degrease the contacts using a deoxidising product.

Renewal of damaged electrical components.

- When replacing electrical components (fuses, relays, etc.), use only original parts supplied by the manufacturer.
- When replacing fuses, check that the new fuse conforms to DIN 72581 or ISO 8820 standards, and in particular:
  - fuse F1 (100A) DIN 72581/2
  - bayonet fuse (F2, F3, etc.) DIN 72581/3C
  - fuse F51 (100A) and F52 (200A) ISO 8820.

- The fitting of replacement fuses that do not comply with these standards will invalidate the warranty with immediate effect and release the manufacturer from all liability.
- When replacing relays, make sure that the new relay conforms to the standards marked on the original relay.

Diagnostic instruments

For the correct diagnosis of any faults in the tractor's electrical system, the following instruments are required:

- Digital multimeter with the following minimum characteristics:
  - AC VOLT 0-600
  - DC VOLT 0-600
  - OHM 0-32M
  - AC AMP 0-10
  - DC AMP 0-10
- All Round Tester or computer with "PCTESTER" software installed
- SDF Analyzer

Wire colour codes

Table 106

COlOur COdES	
a	Light blue
b	White
S	Orange
g	Yellow
h	Grey
l	Blue
M	Brown
N	Black
r	Red
S	Pink
v	Green
Z	Purple

40.1.4 - Basic electronics for mechanics (1/2)

What is electronics?

The name of this branch of electrical science is derived from the word "ELECTRON", the name given to a small electrically charged particle.

The movement of electrons produces electrical current, which we know more about for its effects - heat, light, magnetism, electrolysis, etc. - than for its actual nature.

While electrical engineering is concerned with these external effects of electrical current, electronics deals with way materials react to the gain or loss of electrons.

Electrons in fact move from (-) to (+), but according to a convention that was established before the emergence of modern atomic theory, electric current flows in the opposite direction from (+) to (-).

Using electronics it is possible to program complex logical processes, which could not be achieved in other ways.

The various applications of electronics on our tractors can be divided into two groups:

- Invisible electronics, which operate without requiring any intervention of the driver, (voltage regulation, rectification of the current produced by the alternator, timing, etc.);
- Visible electronics, ranging from the visible and audible information to made available to the driver via the vehicle's instruments and signalling systems, to the control systems that serve to optimise work processes (Performance Monitor, SBA System, I-Monitor, etc.).

Logical development of the electronics

As mentioned previously, electronics is generally viewed as a branch of electrical science, even though in certain aspects they are quite independent.

Whereas electrical engineering generally deals with large amounts of current, electronics is more concerned with very low levels of current.

Electronic applications are based on the movement of electrons and thus exploit the different degrees to which different materials conduct electrical current:

- Conductors,
- Insulators,
- Semiconductors

We therefore need to know what happens “electrically” inside the material.

All matter is composed of tiny particles called atoms.

The atom can be likened to a planetary system which has at its core a nucleus, comprised of protons and neutrons, around which rotate the electrons in different orbits, or shells.

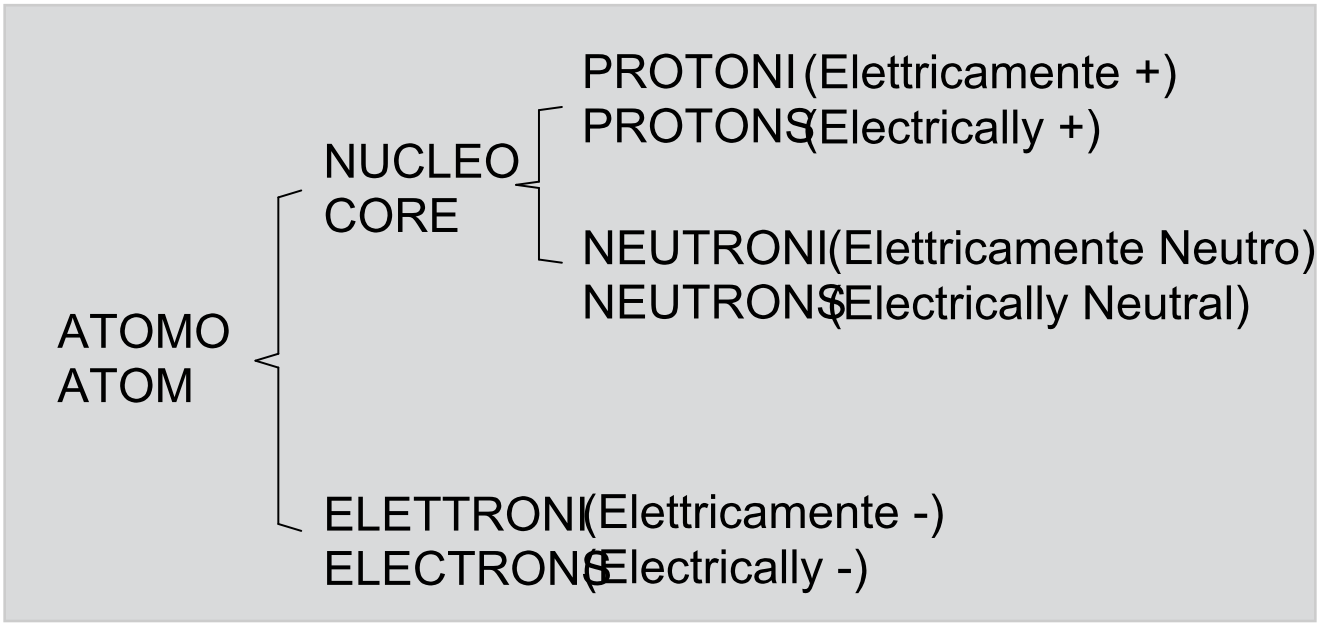


Fig. 1105

Under certain conditions, electrons can move from one atom to another.

If the number of electrons in an atom is the same as the number of protons, the atom is neutral (it has no charge).

If the number of electrons exceeds the number of protons, the atom is negatively charged, while if it loses electrons it will become positively charged.

atomic structure of matter

The atom is the smallest particle of a simple element that can combine with other atoms to form molecules.

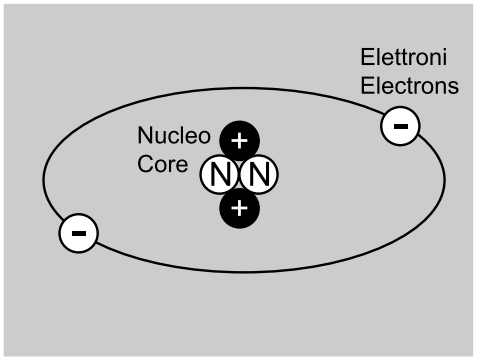


Fig. 1106

The composition of the nucleus and the number of electrons present in an atom determine which element it belongs to.

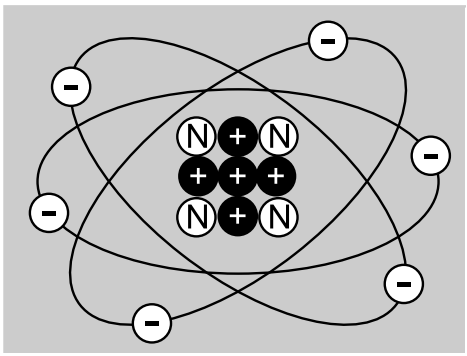


Fig. 1107

The structure of an atom can be compared to that of the solar system:

1. Electron (Planet)
2. Nucleus (Sun)

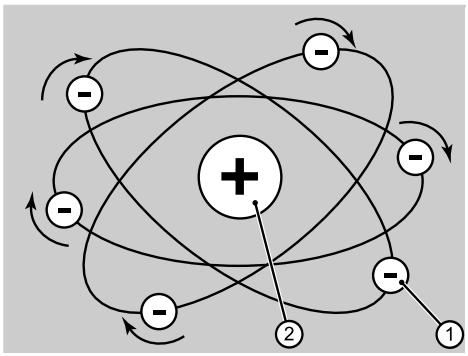


Fig. 1108

Electrical charges of the same sign (1) repel each other while charges of opposite signs (2) attract.

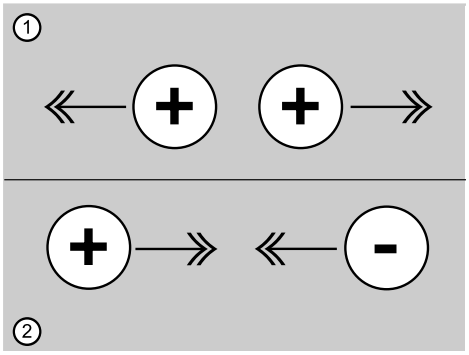


Fig. 1109

40.1.5 - Basic electronics for mechanics (2/2)

Conductors, Insulators and Semiconductors

The behaviour exhibited by different materials in response to electricity derives from their atomic structure:

1. In conductors (generally metals), electrons are able to move freely from one atom to another;
2. In insulators (generally metalloids) electron movement is restricted to varying degrees, depending on the type of material. Their atoms are not able to acquire electrons.
3. Semiconductors (germanium, silicon, selenium, etc.), are materials which in their pure state may act as insulators, but with the addition of precisely calibrated amounts certain impurities, they can become conductors. Their electrical properties thus lie somewhere in the range between insulators and conductors. If these materials in their pure state are subjected to a technical process known as “doping” (the addition of impurities with a certain number of atoms with free electrical charges), they become positively or negatively charged, depending on the specific process.

Electrical voltage

We have talked about “external causes” that can provoke the movement of electrons in atoms.

One of these external causes is “voltage” or “potential difference”, which exerts a “force” on electrical charges, causing them to start moving.

This force is known as electromotive force; the force supplied by electrical sources (battery, dynamo, alternator).

The concept of voltage or potential difference is illustrated by the example shown here.

- The levels in A and B are equal if the valve is open.

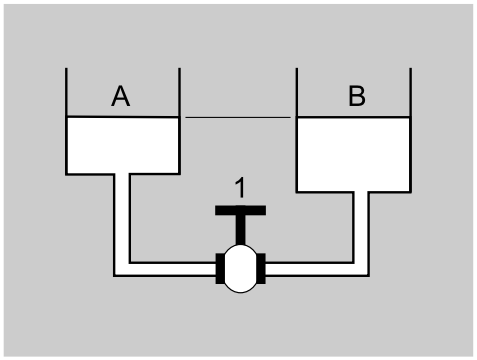


Fig. 1110

The concept of voltage or potential difference is illustrated by the example shown here.

- For water to flow from A to B, there must a difference in level “h” when the valve closed.
- The difference between the height of water in A and that in B creates a difference in pressure.

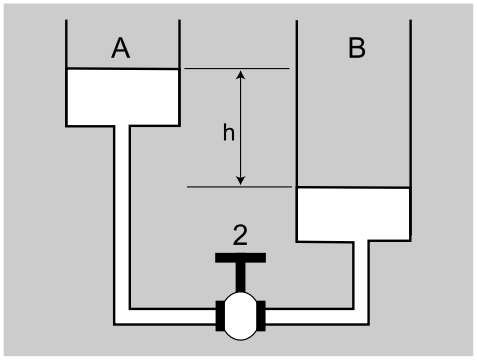


Fig. 1111

When the valve is opened, water flows from A to B until the point where the two pressures are equalised.
The same happens with electrical current:

- to obtain current flow, there has to be potential difference at one of the conductor (caused by the presence of electrical charge).

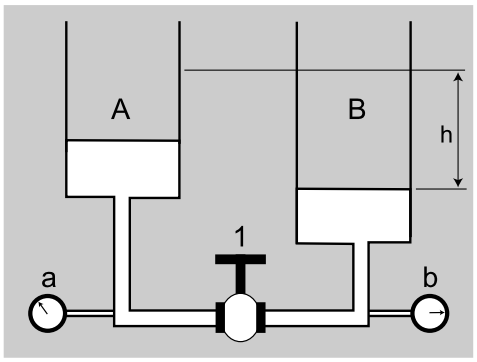


Fig. 1112

resistance

The water model can also be used to explain the concept of electrical resistance. If water encounters obstacles when flowing through a pipe the the flow rate will slow or the direction of flow will change .

The same applies to electrical current; obstacles of an electrical nature reduce the flow of electrons. Every material offers some degree resistance to the flow of electrons; the level of this resistance will depend on its atomic structure and its dimensions. Obstacles in a water course will slow down or change the direction of the water flow.

Electrical resistance can be compared to a restriction in the conductor or scaling on the inside of a water pipe.

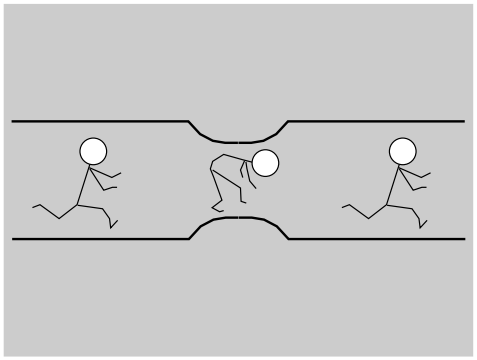


Fig. 1113

The electrical resistance of a material can be defined as the opposition it presents to the flow of electrons and varies according to the nature of the material and its dimensions.

Electrical continuity

Staying with the water analogy, let's examine how to obtain a continuous flow of water in a circuit. 424For the flow to be continuous, the water must be returned to basin 1.

In this hydraulic circuit, the function of the pump (2) is to return the water to basin or tank (1).

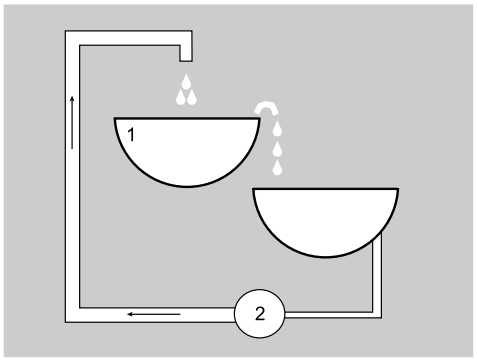


Fig. 1114

Similarly, for current to flow continuously in an electrical circuit, the electrons must return from the positively charged terminal to the negatively charged terminal, in order to maintain a potential difference between the two terminals. This is the job of the electrical power source.

Electrical power supply

An electrical power source can be defined as a system capable of separating and initiating the motion of a number of electrons.

A battery, for example, has two metal terminals, one positive and one negative.

Inside the battery, a chemical process causes free electrons to flow to the negative terminal to create a negative charge and a corresponding positive charge to build at the positive terminal.

This process will continue inside the battery until the actions which caused it are balanced by the forces of attraction between the electrons and the positive charges.

If the electrons could flow to the positive terminal, the initial neutral status could be restored, but as there is internal connection between the two terminals, this can only be achieved if there is an external connection between B and A.

We can therefore state that a difference in potential, or voltage, has been created between the two terminals A and B.

If we now connect an external load between B and A, the electrons concentrated at terminal A (+) will starting moving towards terminal B, thereby pushing along the free electrons present in the connecting conductor.

An electrical current is thus created, (which by convention is deemed as flowing from A to B), and this current will continue to flow as long as there remains a difference in potential between the two terminals.

Schematic representation of a electrical power source
A = Positive terminal
B = Negative terminal
G = Generator

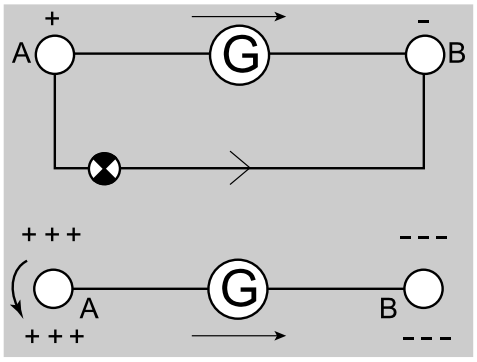


Fig. 1115

Electromotive force (e.m.f.)

Taking a simple electrical circuit , let's see what happens to the voltage at the terminals of the power source when the circuit is closed (in this example, the power source is a battery, but the same result would be obtained with a different source of power, such as an alternator).

Simple circuit with switch "I "open: no current flow.
The same situation occurs if we replace the battery with an alternator in rotation. A voltage (e.g. 12V) is present at the terminals of the power source, which can be measured with a voltmeter. This no-load voltage is known as the electromotive force.
R = resistance of a load.

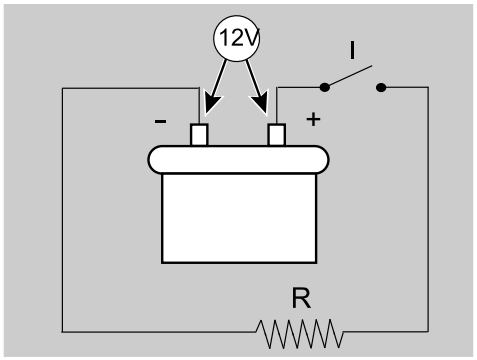


Fig. 1116

Simple circuit with switch "I" closed. The battery powers the resistance R. A voltage drop occurs between the terminals of the power source, caused by the circulation of current in the source itself, which has its own internal resistance.

vd = r × a

r = internal resistance of the power source in series with the other elements of the circuit
A = current flowing through the circuit

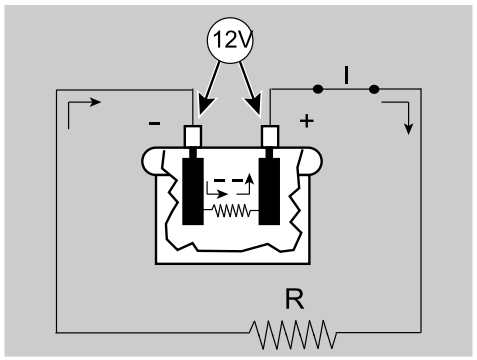


Fig. 1117

The following relationship is therefore true for every power source:

Available voltage = Electromotive force - Internal resistance x Current

v = E - (r × I)

Direct Current (DC) and Alternating Current (AC)

Electrical current can be either direct or variable: with direct current, the electrons always flow only one direction; with variable current, the direction and intensity of electron flow varies over time in accordance with the laws of trigonometry.

If this change in direction is regular over time, the current is described as "alternating". Alternating current changes cyclically from positive values to zero and from zero to negative values and so on.

On a tractor, the battery supplies direct current voltage, and therefore direct current flows through the connected circuits.

The alternator produces alternating current, which, as we shall see, must be converted into direct current by a bridge rectifier before it can be used.

The graph below illustrates the behaviour of a sinusoidal alternating current. The voltage increases from zero volts up to the maximum positive value and then decreases to zero volts . The polarity is then inverted and the the voltage rises to the maximum negative value before returning once again to zero. This complete sequence is referred to as one "cycle".

If a cycle is performed once every second, then the frequency of the alternating current is said to be 1 Hertz. In domestic electrical supplies, the frequency of the supply is 50 Hz.

Frequency is thus the number of complete cycles performed in one second.

A period is defined as the time required for an alternating sine wave to complete one cycle, i.e. from zero to a positive peak to zero to a negative peak and back to zero.

This time period is expressed in seconds and is denoted by the letter T.

The alternating current wave form illustrated in the graph is called sinusoidal.

T = 1 period

a = amplitude

B = Positive voltage

C = Negative voltage

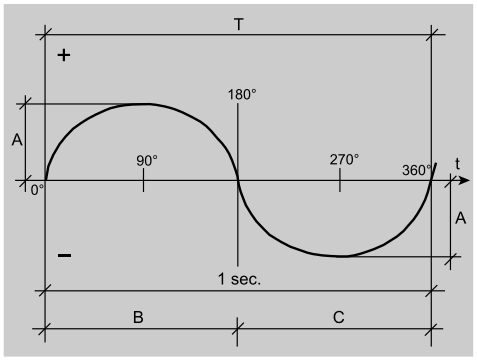


Fig. 1118

The number of cycles per second is the FREQUENCY and is expressed in Hertz and denoted with the letter “f”.

f = 1 ÷ T

T = 1 ÷ f

An AC current with a frequency of 50 Hertz therefore has a period of 1 ÷ 50 = 0.02 seconds.

Electrical values: Current and Voltage

CurrENT Symbol a

Value: Amount of electrical charge that passes through a conductor in a given unit of time.

Units: amperes.

Instrument: ammeter.

Connection to circuit: In series.

Basic electrical circuit incorporating a voltmeter and an ammeter.
Resistance is present in the conductors (R), in the loads (Ri1) and in the power source (Ri2).
The inclusion of an ammeter (unlike a voltmeter) requires a modification to the circuit, in that the circuit must be opened at some point by cutting a conductor and the instrument must be then connected between the open ends of the conductor.

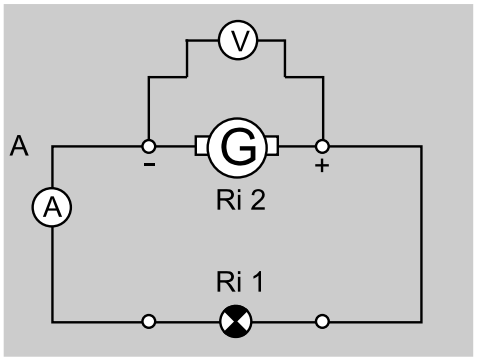


Fig. 1119

The inclusion of an ammeter (unlike a voltmeter) requires a modification to the circuit, in that the circuit must be opened at some point by cutting a conductor and the instrument must be then connected between the open ends of the conductor.

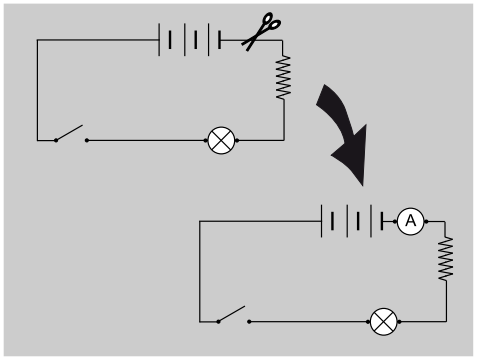


Fig. 1120

vOl TagE Symbol v

Voltage: Difference in potential; (emf); force that causes electrons to flow

Units: Volts

Measuring instrument: Voltmeter.

Connection to circuit: in parallel.

resistance

In an electrical circuit, voltage and current are both dependent on RESISTANCE, i.e. the opposition to the flow of electrons in a material.

We have already mentioned how the motion of electrons occurs as a result of forces produced by the collision of these minute particles.

This phenomenon generates heat and is this reason why materials heat up when current passes through them.

The greater the current (the greater the number of electrons in motion) the more heat is produced.

As the temperature increases, the movement of the electrons also increases, and the electrons find it more difficult to move under the influence of the voltage.

In some materials, this resistance is minimal; these materials are good conductors of current (conductors: copper, aluminium, silver, etc.). In others, the resistance is so high that it is difficult for electrons to move (insulators: mica, porcelain, glass, paper, etc.)

In addition to the nature of the material, resistance is also affected by its dimensions:

- LENGTH: the greater the length of the conductor the greater the number of collisions between atoms and free electrons.
- CROSS-SECTIONAL AREA; the greater the cross-sectional area, the greater the number of free electrons. Resistance is inversely proportional to cross-sectional area.
- TEMPERATURE, the motion of atoms and consequently the probability of collision with free atoms increases proportionally with the temperature, thus increasing also the resistance.

The electrical circuits on the tractor are generally comprised of wire conductors with a cross-sectional area that is negligible in comparison with their length.

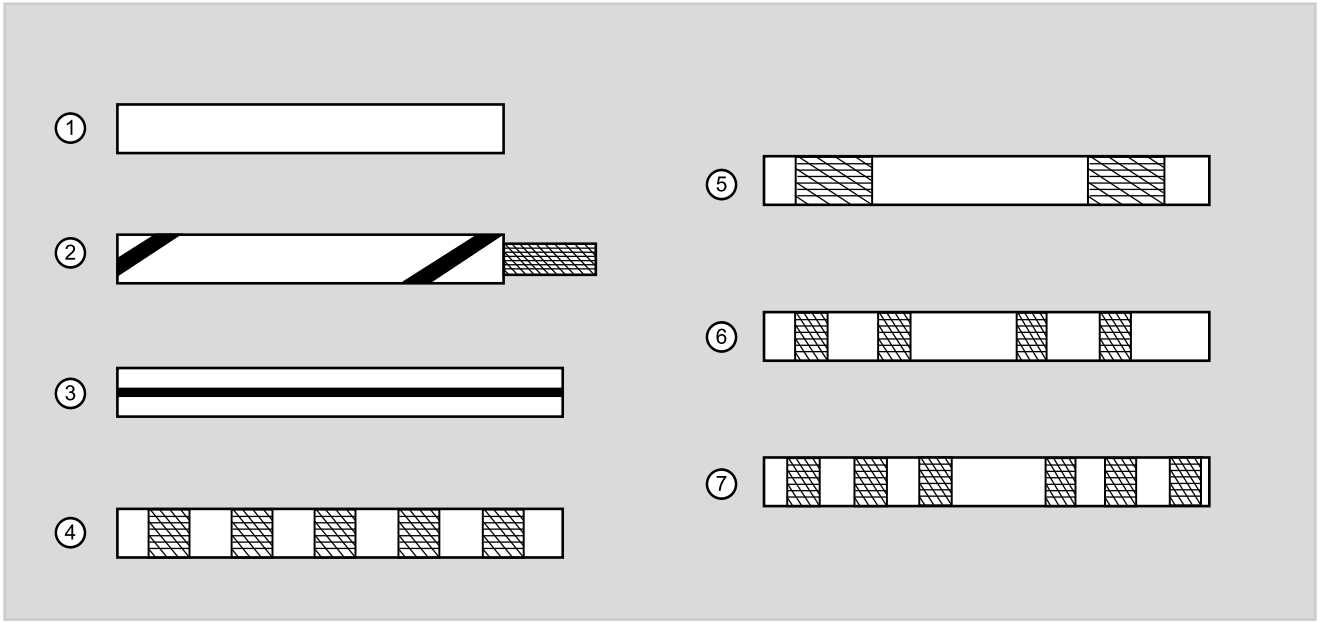


Fig. 1121 - Load connection cables

1. Single colour.
2. Spiral striping with max. pitch 50 mm
3. Horizontal striping.
4. With narrow-spaced coloured rings.
5. With wide spaced rings.
6. With rings in groups of 2 of same or different colours, depending on use.
7. With coloured rings in groups of 3

RESISTANCE Symbol R (Omega)

Resistance: Opposition to the flow of electrons.

Units: Ohm (Omega).

Measuring instrument: Ohmmeter (tester), or voltmeter and ammeter when in presence of voltage.

The resistance of different materials - Resistivity

It has been determined experimentally that the resistance of a wire conductor is given by:

R = p × (l ÷ S) = ohms

in which:

p = (Greek letter pronounced “rho”) is a proportional coefficient that varies according to the nature of the material and is known as “resistivity” or “specific resistance”.

l = length, expressed in metres

S = sectional area, expressed in mm²

This formula can also be written:

p = (r × S) ÷ l

so we can state that the unit of measurement of resistivity (p) represents a resistance of 1 ohm of a conductor of the material in question, with a length 1 metre, and sectional area of 1 mm², at a temperature of 0°C.

While for conductors resistivity is measured in ohms per mm²/m, for insulators it is almost always expressed in mega ohms/mm, which is the resistance in millions of ohms of a cube with a side length of 1 m.

Variation of resistance with temperature (temperature coefficient)

For most metals, resistivity increases with the temperature (positive temperature coefficient); this is why when talking about resistivity there must always be a reference to temperature.

There are exceptions to this rule, such as, for example, chromium and carbon, in which resistivity decreases with the temperature (negative temperature coefficient) and some alloys in which resistivity does not vary, which have temperature coefficient of 0.

This increase or decrease in the resistance per degree of temperature and per ohm of resistance is termed the “temperature coefficient” , and is denoted with the Greek letter a (alpha).

If the initial resistance is R0, at a temperature t0 (ambient temperature), and the temperature difference is t = t1 - t0, the variation in resistance will be:

r × t × a

and the final resistance is:

rt = r0 + r0 × t × a

rt = r0 (1 + a × t0)

This formula is of great practical importance as it allows us to calculate the final temperature of a coil or resistor using the resistance variation method.

The temperature coefficient is used (positive or negative) to characterise thermistors (PTC = Positive Temperature Coefficient and NTC = Negative Temperature Coefficient)

The interdependence of electrical values

In an electrical circuit, the relationship between current, voltage and resistance is given by the formula:

v = I x r

Volts = ohms x amps

If any of these values is unknown, it can be calculated, providing the other two values are known, simply by applying one of the following formulae:

r = v ÷ I

I = v ÷ r

v = I x r

Power

The power developed or dissipated is given by the formula:

Power = Voltage x Current

Watt (W) = volts x amps

In mechanical engineering, power is still commonly expressed in terms of horsepower: hp

The relationship between horsepower and Watts is given in the following equation:

1 hp = 736 W = 0.736 kW

1 kW = 1.36 hp

Dissipated power, in electrical terms, is power transformed into heat and is given by:

Power = Voltage x Current = Resistance x Current x Current

given that:

W = v × I

v = r × I

then:

W = r × I × I = r × I²

Multiples and submultiples of electrical values

Table 107

MuI TIPIES aNd SubMuI TIPIES Of uNITS Of MEaSurEMENT			
PrEfIx		MuI TIPI Y bY	dIvIdE bY
NaME	SYMbOI		
mega-	M	1,000,000	-
kilo-	k	1000	-
hecto-	h	100	-
deca-	da	10	-
deci-	D	-	10
centi-	S	-	100
milli-	M	-	1.000
micro-	µ	-	1,000,000
nano-	N	-	1,000,000,000
pico-	P	-	1,000,000,000,000

40.1.6 - Electrical and electronic components (1/2)

Electrical and electronic components

Electronic components are used in circuits to modulate (vary, modify), control and regulate electrical values or to protect other devices.

In particular, electronic semiconductor components exploit the various reactions of electrons to heat, magnetism, and light in order to generate small electrical signals. These electrical signals, when suitably modified, can be used by signalling devices or to control other components.

Components can be classified on the basis of the functions they perform; components used to control or amplify power signals are deemed ACTIVE; components which neither control nor amplify power are deemed PASSIVE.

resistors*

Components of various design comprised of a conductor with a known resistivity that when included in a circuit causes a voltage drop.

They are therefore used to change voltage and current; they come in different shapes and sizes, depending on their type, ohmic resistance value, tolerance and heat dispersion characteristics.

Table 108

TYPES Of rESISTOrS			
fIxEd	varIablE	ThErMaII Y SENSITIvE rESISTOrS	IIghT SENSITIvE rESISTOrS
wirewound	wirewound	Thermistors:	LDR
film	film	NTC	-
-	Linear or non-linear variation	PTC	-

All resistors are defined by their dimensions and characteristics: ohmic value, and maximum operating temperature.

* N.B. To avoid confusion, in this manual the term RESISTANCE is used for the value expressed in ohms which represents the opposition to the flow of electrical current.

The term RESISTOR is used for the component used to introduce “resistance” into an electrical circuit.

Resistors are of two types: fixed or variable.

(the term “resistance” is also often used for the component).

fixed resistors

How to determine the ohmic value of a resistor
In wirewound resistors, the value is printed with decimal point (or comma) and the omega symbol.
If the value of the resistor is 10.5 ohms, the marking will be: 10.5 ohms
sometimes the letter R is used in place of the decimal separator (point or comma): 10 R5
On resistors with values measured in thousand of ohms, the printed value will include the letter “k”, which stands for thousand (1000): 10.5 kohms (10,500 ohms)

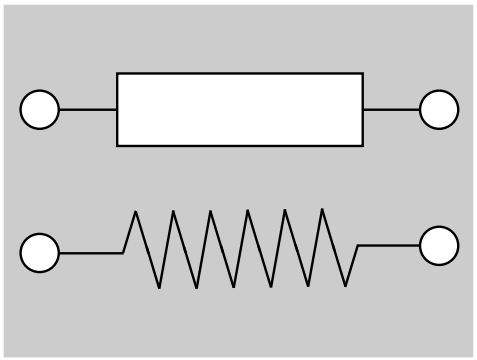


Fig. 1122

Potentiometers (variable resistors)

This a resistor with a sliding contact that varies the resistance as it is moved along the resistor.
The symbols used in schematics for a variable resistor or potentiometer are shown in the figure on the right:

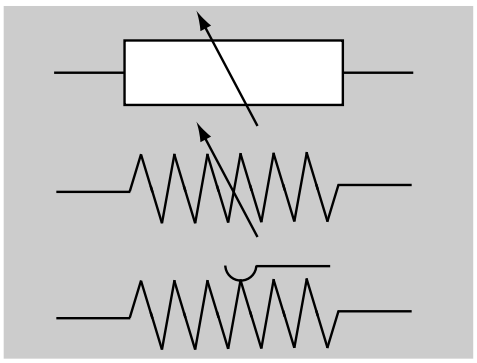


Fig. 1123

Use of a variable resistor as a voltage divider

Divides the voltage into two or three parts in a specific ratio.
V1 = Applied voltage,
P = Potentiometer,
U = Load,
V2 = Required voltage (obtained by moving the sliding contact) < V1

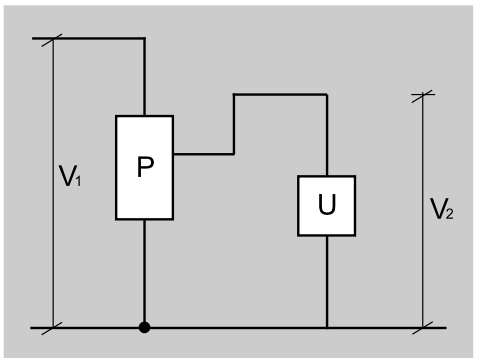


Fig. 1124

use of a variable resistor as an electrical resistance of absolute value

All the current flows through the sliding contact.
This means that the sliding contact must be held securely in place, otherwise the voltage V2 will change.

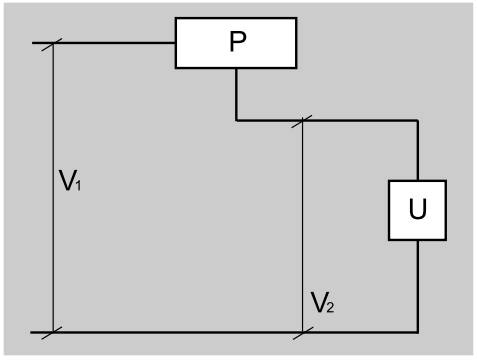


Fig. 1125

Preventing arcing between the resistor and sliding contact.

The figure shows a way to prevent the arcing between the resistor and the sliding contact that may occur in the case of poor contact.
This connection allows some of the current to flow through the full length of the resistor. The voltage drop between the sliding contact and the resistor is less than V1, thus reducing the possibility of arcing.
The resistor of the rheostat can be sized so that the resistance can be varied in both a linear and a non-linear way.

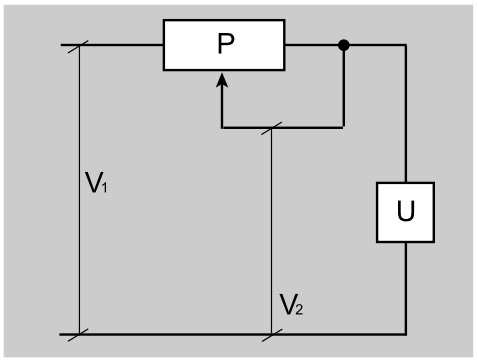


Fig. 1126

Voltage divider

Voltage dividers with fixed resistors or potentiometers are used whenever circuits require electrical power below the standard voltages available on the tractor (12 Volts with engine off and 14.5 Volts with engine running).

Voltage dividers are found in the voltage regulator of the alternator and in the electronic control units.

Thermistors (Thermally Sensitive Resistors)

These are semiconductor resistors in which the resistance decreases as the temperature rises, ranging from just a few ohms at 0 °C to tens of thousands of ohms at 100 °C; they are used to detect changes in temperature.

They may be either self-heating, if the heat is produced by the current flowing through them, or externally heated, if sensitive to the temperature of the environment or the component on which they are mounted.

There are two types: PTC (Positive Temperature Coefficient) and NTC (Negative Temperature Coefficient)

With PTC thermistors, resistance increases with the temperature, while with the NTC type, resistance decreases as the temperature rises.

NTC types are available with resistance values ranging from just a few ohms to several hundred kohms.

Operating characteristics of NTC thermistors

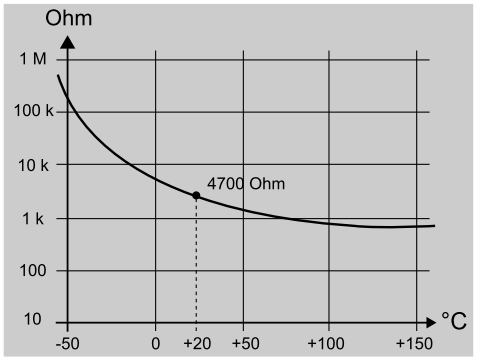


Fig. 1127

Operating characteristics of PTC thermistors

Note the linearity of the variation.

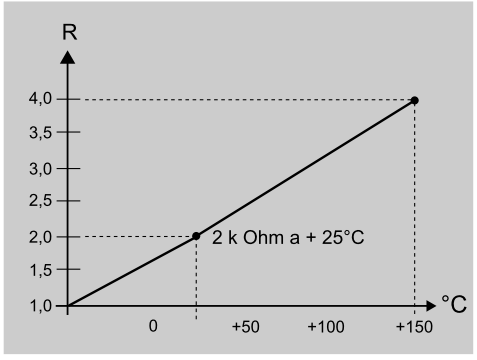


Fig. 1128

Thermistors are used in cab heating and climate control systems.

Capacitor

This component consists of a pair of conductors, generally in the form of flat plates, separated by an insulator (dielectric). Its function to store electrical charge from a power supply.

This charge can then be given as and when required.

Symbol

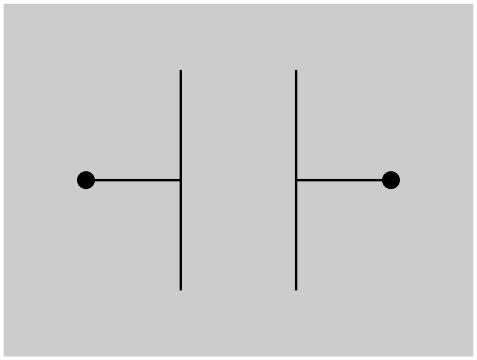


Fig. 1129

Capacitor in a circuit with a generator.

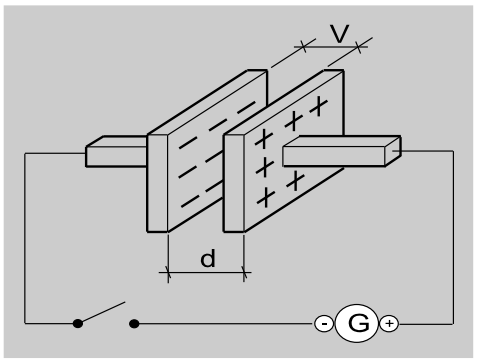


Fig. 1130

The amount of electrical charge that a capacitor can store is referred to as its “capacitance” (C), and is measured in farads (F). In practice, however, the farad is too large for general use so the following units are used instead:

mF = millifarad = 1/1,000 F

µF = microfarad = 1/1,000,000 F

nF = nanofarad = 1/1,000,000,000 F

On closing the switch, the electrons start moving but their flow is impeded by the dielectric. Electrons will therefore accumulate in the plate connected to the negative terminal (-) of the generator, causing negative charge to build up. In the meantime the positive plate loses electrons, thereby becoming positively charged. A potential difference is thus created across the plates of the capacitor, and this increases until it equals the potential difference of the generator.

The capacitance of the capacitor is therefore proportional to the applied voltage and to the surface area of the plates and is inversely proportional to the distance “d” between the plates. It also depends on the type of dielectric used.

The process described above is known as charging the capacitor, and is complete when the capacitor is fully charged. If a resistor or a load of another type is connected to the capacitor, the latter discharges as electrons flow in opposite direction and the potential difference between the plates decreases to zero.

diodes

A diode can be defined simply as a junction between two semiconductors, one made of P-type material and the other made of N-type material.

A diode is a junction between two semiconductors, one made of P type material and the other made of N type material.

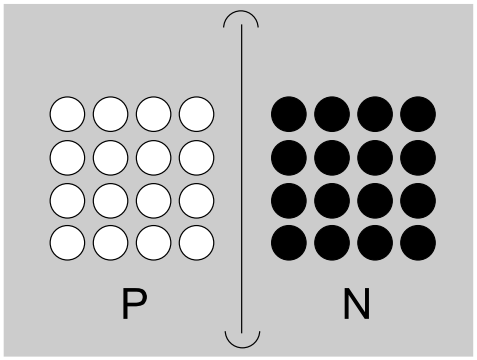


Fig. 1131

The contact between the two semiconductors in different situations of electrical charge forms a barrier to electrical current flow at the junction.

This barrier prevents the current from flowing through the diode.

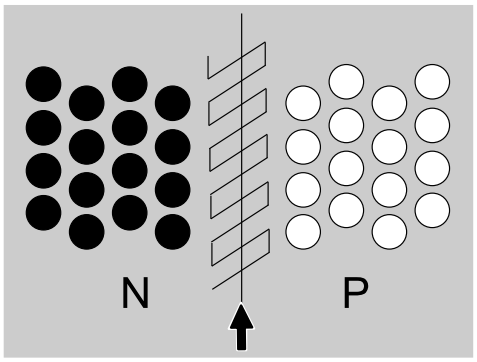


Fig. 1132

Rectification, isolation, (switch), discharge and protection.

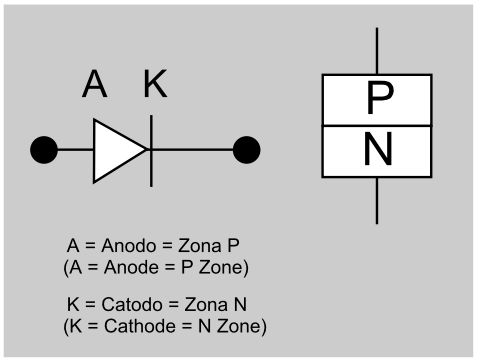


Fig. 1133

The diode symbol and the designations of its terminals.

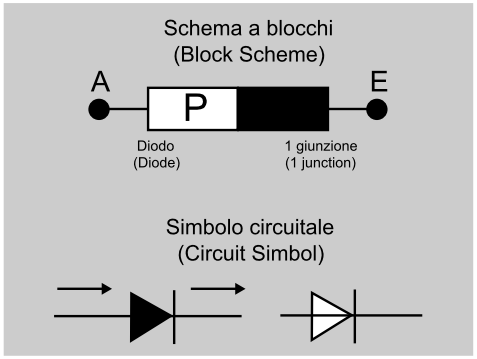


Fig. 1134

The situation at the junction between the two semiconductors changes when a voltage is applied across the anode and cathode; the diode is polarised, as shown in the figure.

When a voltage is applied to the diode, it polarises in the two ways indicated.

(A) = Direct polarisation (forward biasing)
(-) = Cathode
(+) = Anode

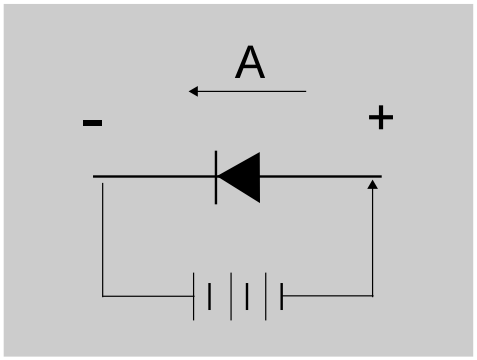


Fig. 1135

(B) = Reverse polarisation (reverse biasing)
(-) = Cathode
(+) = Anode

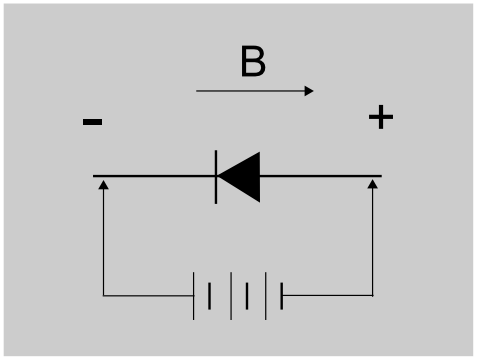


Fig. 1136

With forward biasing (positive connected to the anode and negative to the cathode) the resistance to current flow is significantly reduced and the diode allows current to flow, providing that the applied voltage exceeds the threshold value, i.e. the voltage required to initiate the process by which the barrier is reduced.

If the polarity of the diode is reversed, there is no electron flow except for the very weak current that crosses the junction. If the reverse voltage applied to the diode exceeds a certain value (thousand of Volts) the reverse current flowing through the diode will increase rapidly to the point where the junction is damaged.

The function of the diode is therefore to allow current flow in one direction only, from the anode (+) to the cathode (-).

It this way it acts as an electrical one-way valve.

Forward biased diode allows current flow.
The lamp illuminates,

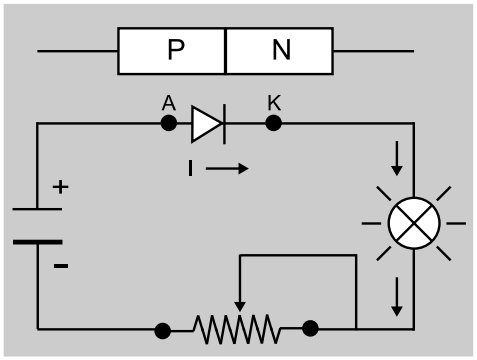


Fig. 1137

Reverse biased diode blocks current flow.
The lamp does not illuminate.

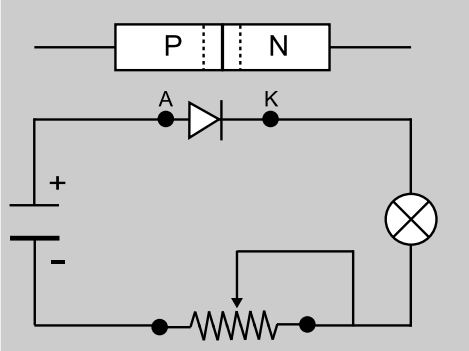


Fig. 1138

The main function of the diode is to act as an electrical one-way valve.

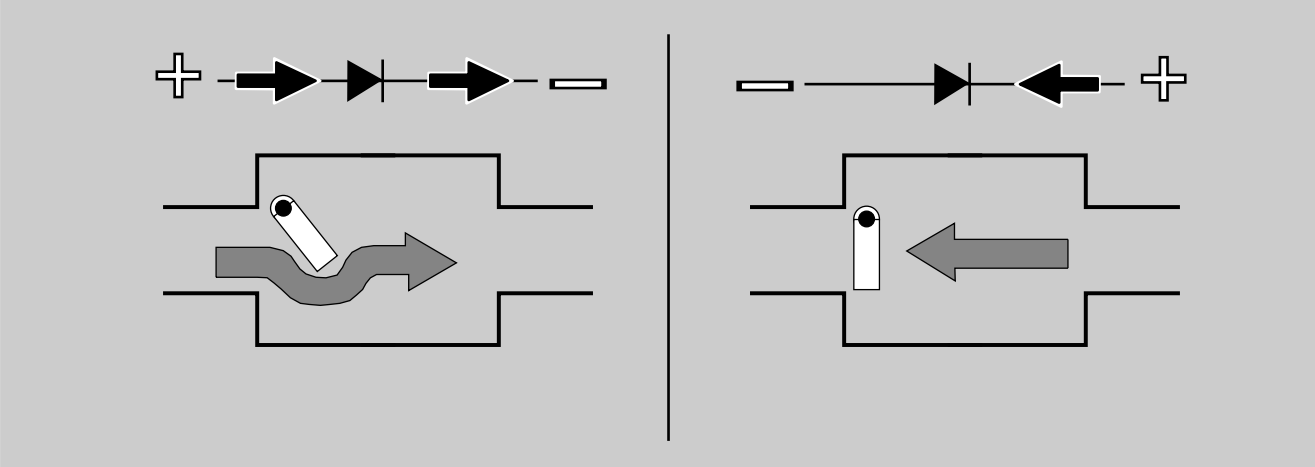


Fig. 1139

Zener diode

We have already mentioned how diodes do not tolerate reverse voltage, as when this reaches a certain level, the reverse current flow will increase significantly to the point where the diode itself is damaged.

The Zener diode is specifically designed to allow a certain amount of reverse current flow without damage to the junction.

It is also possible to make this reverse current flow occurs at a certain reverse voltage, known as “zener voltage”.

A zener diode can therefore be defined as semiconductor with a special PN junction with controlled reverse bias properties.

If forward biased, the Zener diode behaves just like a normal diode, while if reverse biased, it prevents current flow until the voltage reaches the critical level, which is defined as the “Zener point”.

At this point the current increases rapidly.

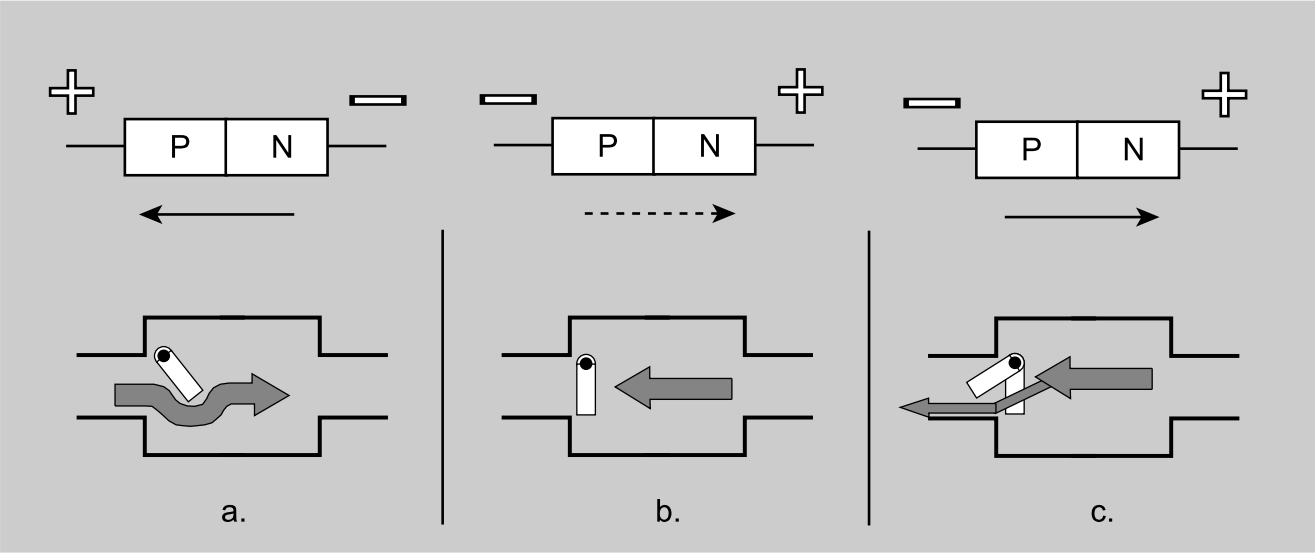


Fig. 1140

The behaviour of the Zener diode can thus be compared to that of a pressure relief valve in a hydraulic circuit.

a) current and water flow

b) no current or water flow,

c) the water flows when it overcomes the opposing force of the valve spring. Likewise, the current flows when the voltage reaches the zener point.

LED (light emitting diode)

A LED is a special diode with two terminals; it allows current flow in one direction only and emits light when low-voltage current passes through it.

The polarity of the terminals is very important, and the cathode is marked to facilitate identification.

The light emitted is monochromatic; the colours red, yellow, green and orange are available.

Operating characteristics of a LED and its symbol.

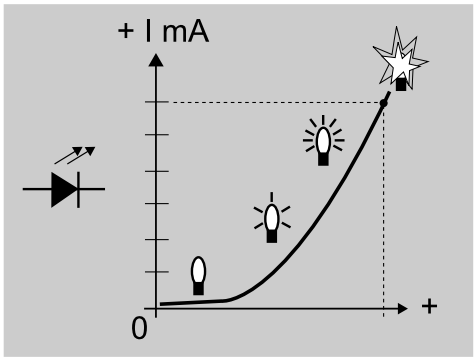


Fig. 1141

LED

1. Light beam emitted
2. Diode
3. Transparent plastic cap
4. PIN terminals

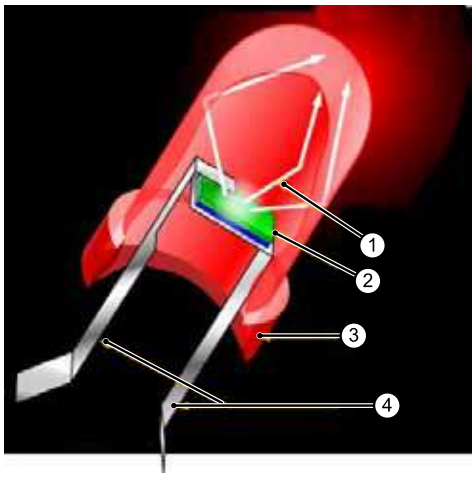


Fig. 1142

LEDs are often used for signal lamps as their power consumption is very low, they require only low levels of reverse current and they are impact resistant.

A typical application is as an indicator lamp, which, unlike a conventional bulb, can be flashed on and off repeatedly without failing.

They are also used to display segmented symbols and alphanumeric digits.

40.1.7 - Electrical and electronic components (2/2)

Transistors

A transistor is semiconductor which has three junctions.

It can be distinguished from a diode by its three leads, whereas a diode only has two.

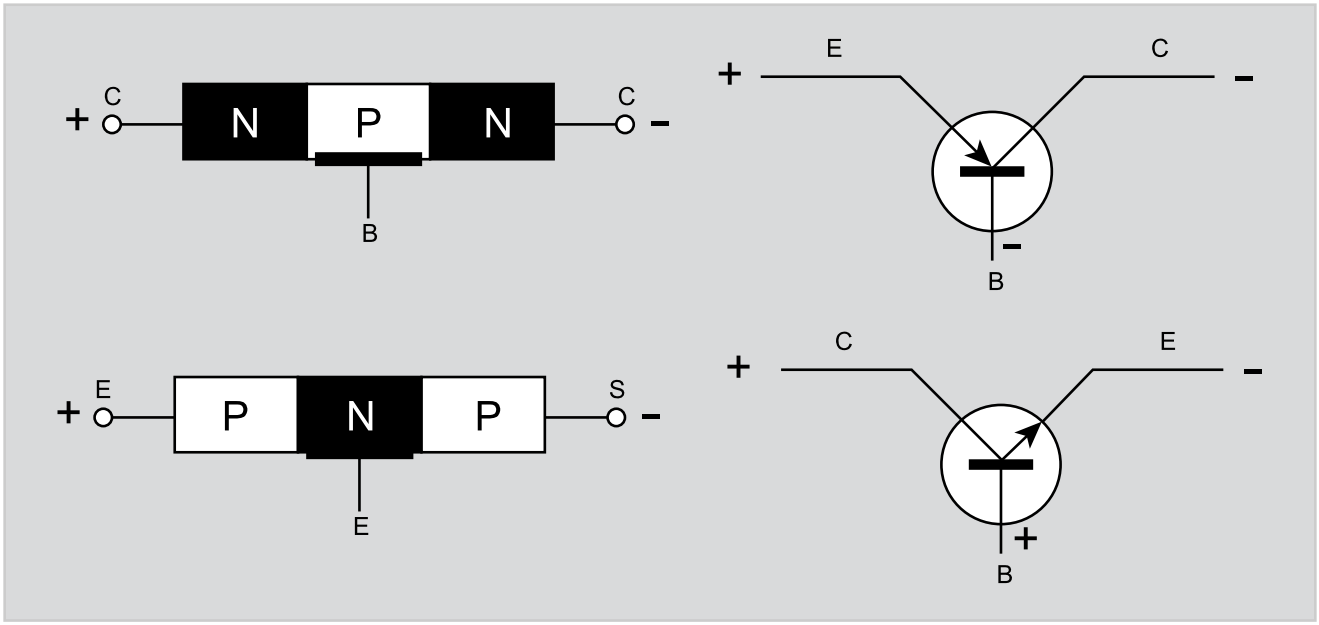


Fig. 1143 - Schematic diagram and symbol of the transistor.

As you can see from the schematic, there two possible configurations: PNP (with a N semiconductor in the centre) or NPN (with a P semiconductor in the centre). The central part is known as the “base”.

The lateral parts are doped with impurities and are termed the “collector” and the “emitter”. On the symbol, note that the emitter is marked with an arrow, which indicates the direction of current flow between the base and the emitter.

Inside the transistor, there are two opposing barriers to current flow: if voltage is applied at one end of the semiconductor (E-C), one if the barriers is eliminated while the other is strengthened and consequently no current flows; the same result is obtained if the polarity of the applied voltage is reversed.

When voltage is applied across terminals (E) and (C), no current flows through the transistor.

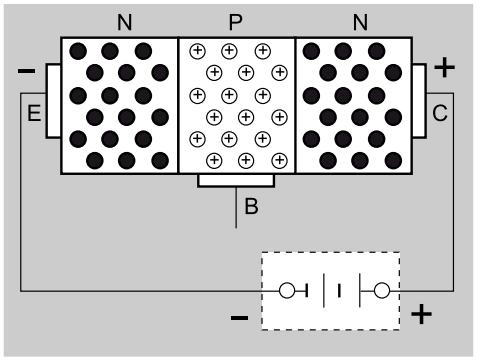


Fig. 1144

If a weak voltage is applied simultaneously to the base terminal, the transistor becomes a conductor and current flows between the emitter and collector.

When voltage is also applied to the base terminal, the transistor allows current flow.

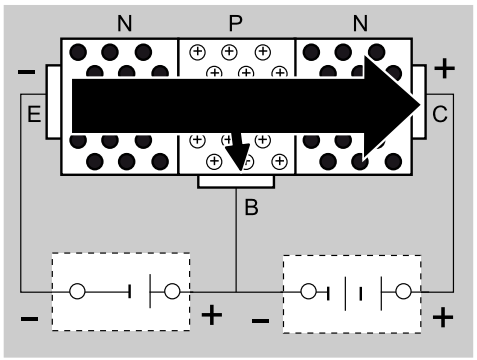


Fig. 1145

When the voltage applied to the base terminal is modified, the current flow between the emitter and collector will also vary proportionally. From this behaviour are derived the two main characteristics of the transistor:

1. Current does not flow through the transistor if the circuit between the emitter and collector is interrupted, i.e. no voltage applied.
2. The current flowing through the transistor is directly proportional to current that flows through the emitter-base circuit, within the operating limits of the transistor. This means that the base current (the current that flows between the emitter and base) is proportional to the collector current (the current flow between the emitter and the collector) and therefore the latter increases.

Given these two characteristics, a transistor can function as a switch (by removing the voltage at the base) or as an amplifier.

With a transistor, a weak current flowing from the emitter E to the base B (PNP transistor) or from the base to the emitter (NPN transistor), can be used to control a strong current flow from the emitter to the collector (PNP) or from the collector to emitter (NPN).

This is the most useful characteristic of the transistor, which can be summarised in the equation:

a = (Ic) ÷ (Ib)

This parameter, however, varies according to the collector current and voltage, as well as the temperature of the transistor.

The difference between NPN-type and PNP-type transistors lies solely in the direction of the current flow. The operating limits of transistors are:

- the maximum collector current,
- maximum voltage from collector to emitter.

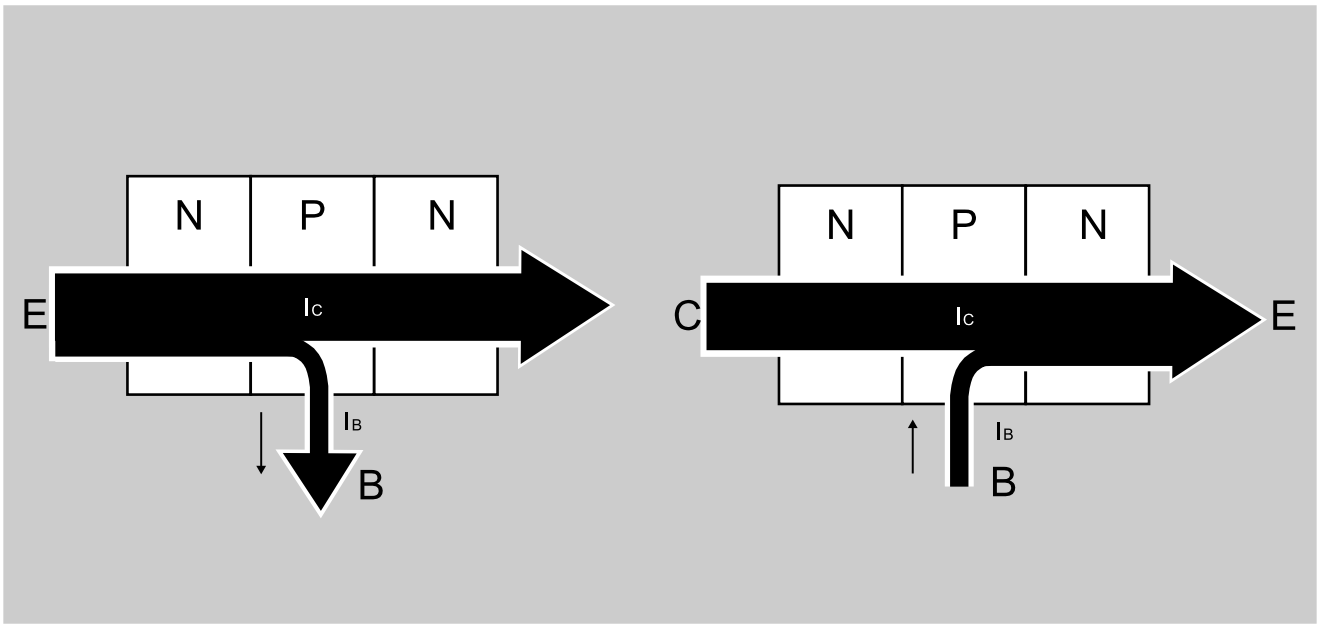


Fig. 1146 - Operation schematic

Schematic showing operation of a PNP transistor and an NPN transistor when voltage is applied at the base.
The current Ic can flow from E to C only if it flows from E to B (1) or from B to E (2). Ic is amplified relative to Ib.

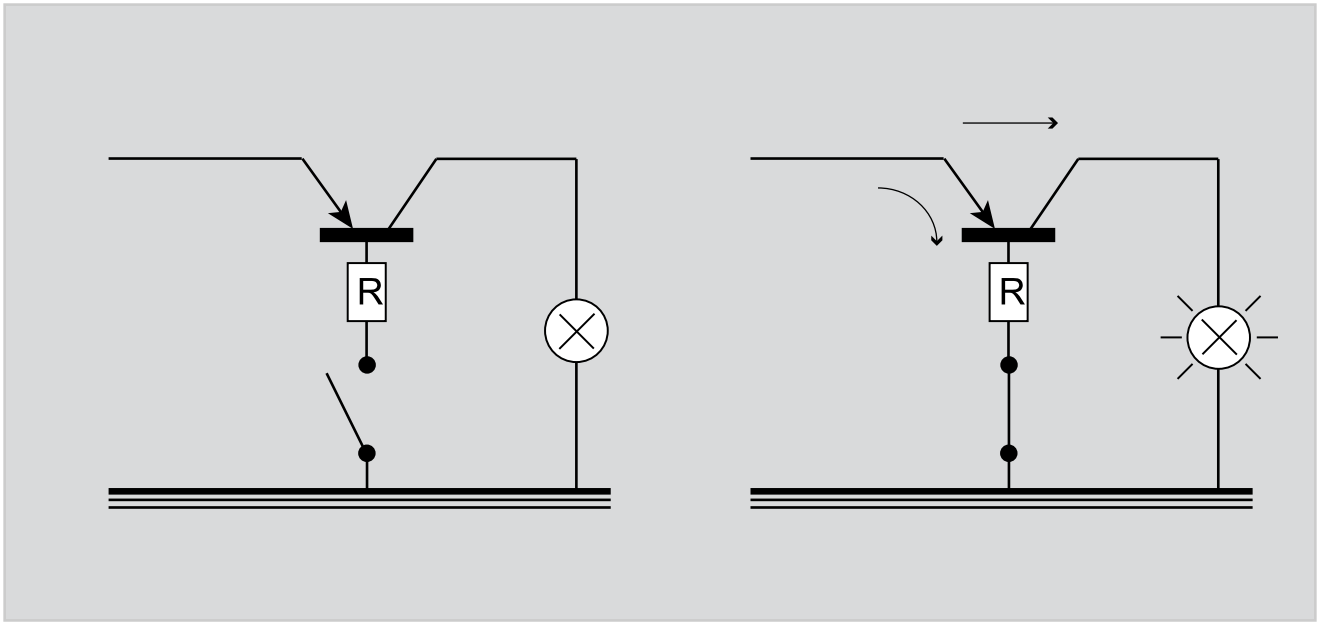


Fig. 1147

Typical connection of a transistor. The resistor R limits the current and protects the transistor.

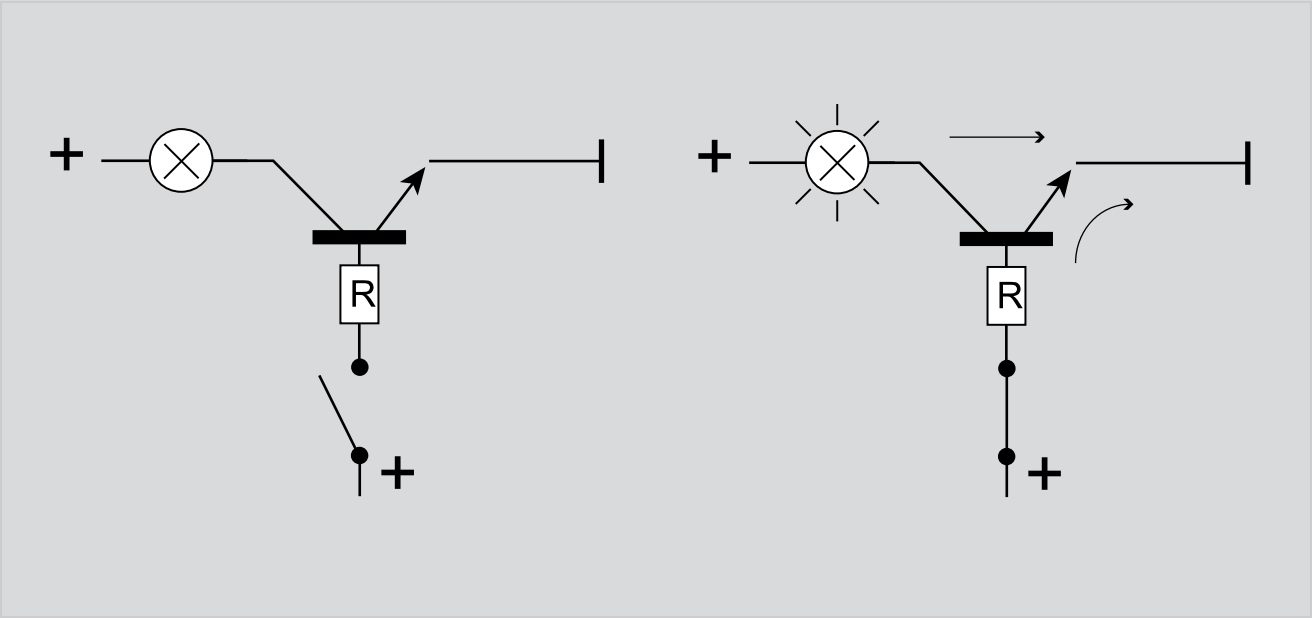


Fig. 1148

Typical connection of a transistor. The resistor R limits the current and protects the transistor.

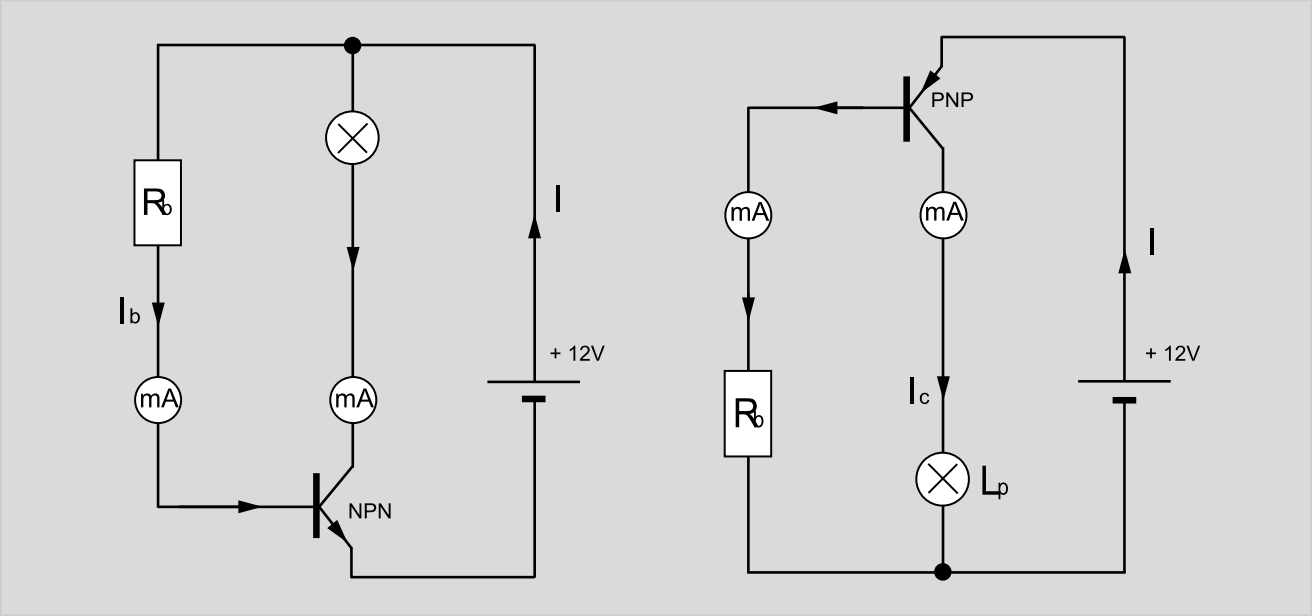


Fig. 1149

The transistor as a current amplifier

Use of a transistor as a switch or relay

Thanks to their amplifying properties, transistors can be used in place of relays (electromagnetic switches) as they can perform the same function, but with the advantage that they use static components rather than moving parts.

The figure shows two electrical circuits, one controlled by a relay and the other by a transistor.

In the relay circuit, when the switch is closed in the relay control circuit, the contacts close the main circuit (drawn with the thick black line); i.e. a relatively small current (0.2 A) can be used to control a much larger working current (8A).

The transistor circuit works in exactly the same way. When the switch in the control circuit is closed, the current flows from the positive pole of the battery through the emitter; the base terminal of the transistor is polarised and the transistor allows current flow (EC) thus allowing current to flow in the main circuit.

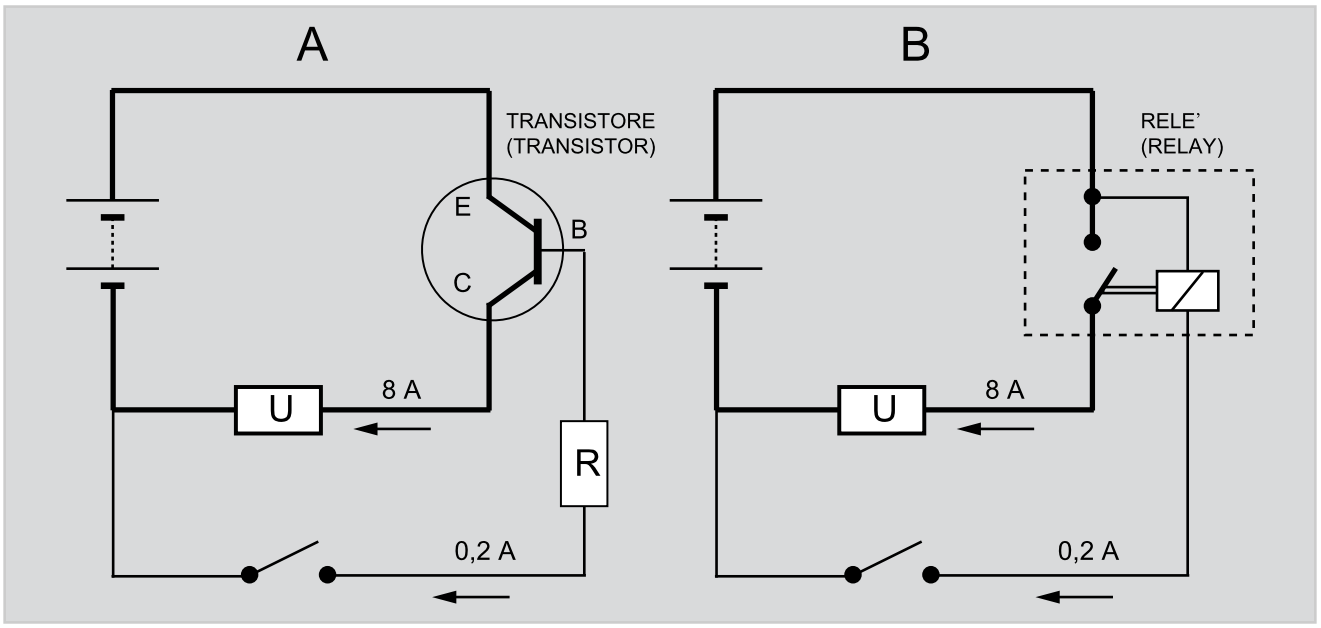


Fig. 1150

Circuit diagrams show use of an electromagnetic relay (B) and use of a transistor as a relay (A). U = Load in main circuit.

40.2 - COMPONENTS

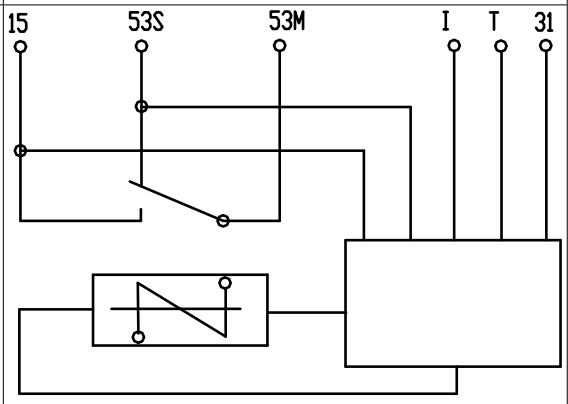
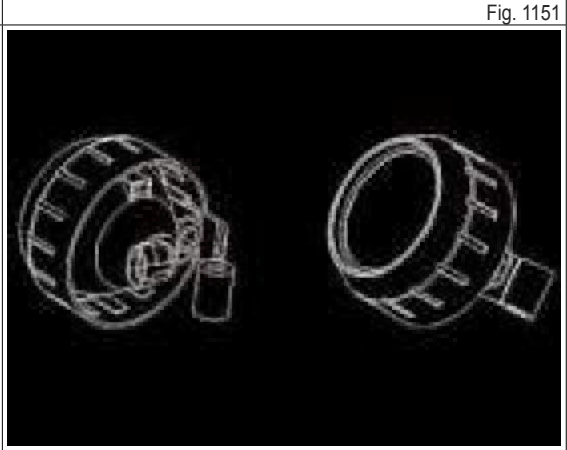
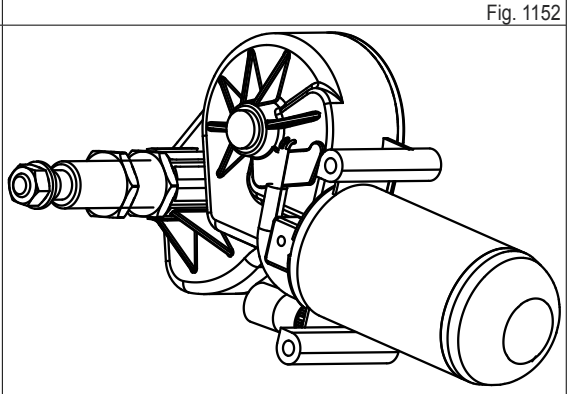
40.2.1 - Components

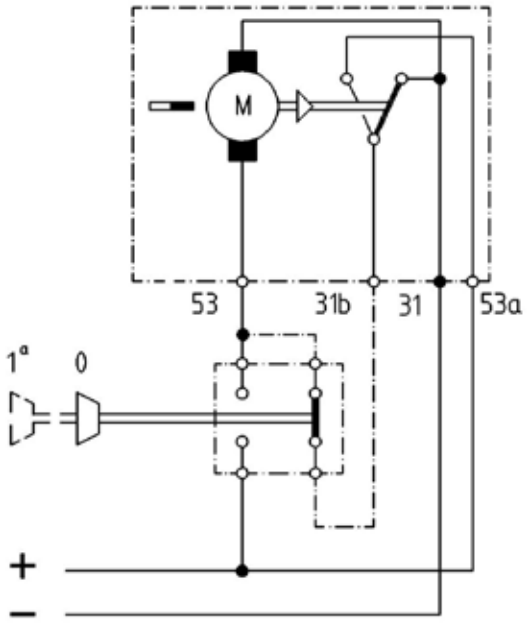
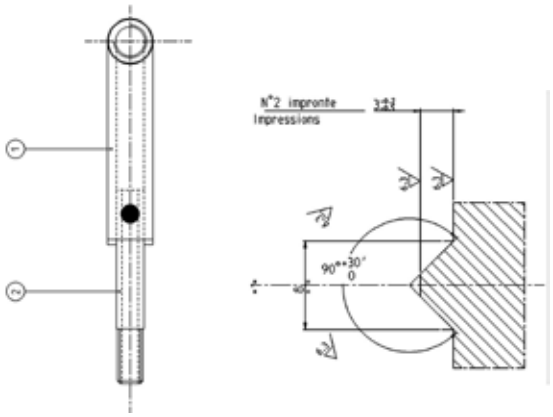
This chapter contains:

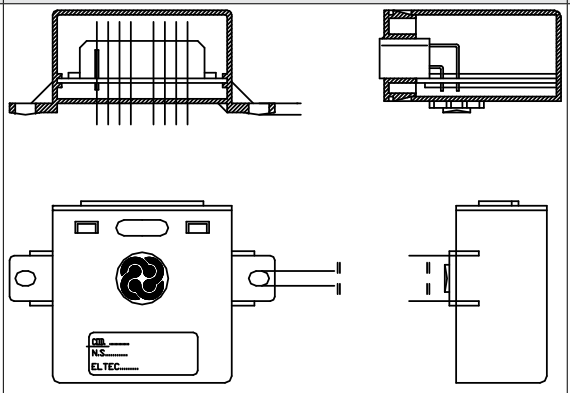
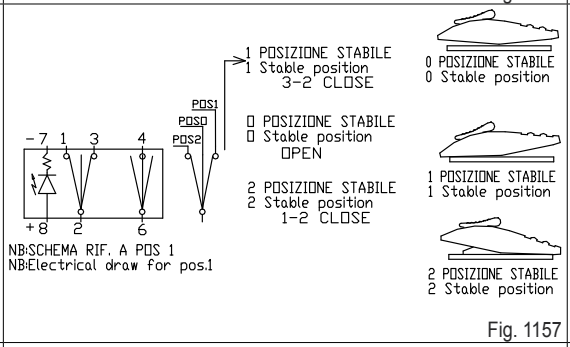
- Components table: technical and functional description of the components
- Pinouts of the electronic control units

Component technical data

Table 109

dESCrIPTION	COdE	CharaCTErISTICS	CONNECTOr
Bosch emergency pushbutton	2.7659.110.0	-	A7
Check panel	2.8339.230.0	-	A18
	2.8339.230.4		A20
Steering column switch	0.013.3337.3	-	A25
Flasher	0.009.6758.4/10	-	A26
Windscreen wiper timer relay	2.8639.008.0	 Fig. 1151	G9
Worklights d.80	2.8039.001.0	 Fig. 1152	G14
Windscreen wiper	2.9019.200.0	 Fig. 1153	G19

dESCrIPTION	COdE	CharaCTErISTICS	CONNECTOr
Rear wiper	2.9019.200.0	 Fig. 1154	L4
Receiver-dryer	0.008.9604.0	-	M3
			M4
Air conditioning fan	0.010.0618.4	-	M5
Ex rotating beacon wire	0.013.9053.2	 Fig. 1155	N1
RH light	2.8039.293.0	-	P2
	2.8039.293.0		P3
LH light	2.8039.294.0	-	P5
	2.8039.294.0		P6
Rear lights	2.8059.230.0 (LH)	-	S2
			S3
			S4
Rear lights	2.8059.240.0 (RH)	-	S6
			S7
			S8

dESCrIPTION	COdE	CharaCTErISTICS	CONNECTOr
Fan control unit	2.8519.035.4	 Fig. 1156	U1
PTO switch	2.7659.262.0	 Fig. 1157	V4
Front lights	2.8039.230.0	-	Z5 Z8

PINOuTS aNd dESCrIPTIONS Of ThE ElECTrONIC CONTrOl uNITS

fan control unit (COdE 0.014.1482.4) - u1

Table 110

PIN	vOl TS	SYMbOl	-
1	+12V	-	Positive (+12V)
2	-	-	N.C.
3	-	-	Triangle warning light
4	-	-	N.C.
5	-	-	N.C.
6	-	-	N.C.
7	-	-	N.C.
8	-	-	N.C.
9	-	-	N.C.
10	-	GND	Earth
11	-	-	Sensor on/off
12	-	-	Temperature sensor
13	-	-	N.C.
14	-	-	N.C.
15	-	-	Fan control
16	-	-	N.C.
17	-	-	N.C.

Instrument panel (CODE 2.8339.230.0/70) - Connector A18

Table 111

PIN	vOl TS	SYMbOl	dESCrIPTION
1	-	B	External buzzer output
2	-	L1A	Air cleaner warning light (red)
3	-	L2A	Glowplugs warning light (amber)
4	-	L2A	Glowplugs indicator light (amber)
5	-	L3A	Battery charging warning light (red)
6	-	L4A	Convert. oil filter warning light (red)
7	-	L5A	Engine oil pressure warning light (red)
8	-	L6A	PTO engaged warning light (amber)

PIN	vOl TS	SYMbOl	dESCrIPTION
9	-	L7A	Handbrake on warning light (red)
10	-	L8A	Conv. oil pressure warning light (red)
11	-	L9A	Alarm warning light (red)
12	+12V	+	Positive (+12V)

Instrument panel (CODE 2.8339.230.0/70) - A19

Table 112

PIN	vOl TS	SYMbOl	dESCrIPTION
1	+12V	+	Positive (+12V)
2	-	-	N.C.
3	-	-	N.C.
4	-	S	ILC instrument signal
5	-	+L	Lighting (+lights)
6	-	GND	Earth

Instrument panel (CODE 2.8339.230.0/70) - A20

Table 113

PIN	vOl TS	SYMbOl	dESCrIPTION
1	-	GND	Earth
2	-	L1B	Differential lock indicator light (amber)
3	-	L2B	Front wheel drive engaged (yellow)
4	-	L3B	Low fuel warning light (yellow)
5	-	L4B	Trailer brakes alarm warning light (red)
6	-	L5B	Direction indicators warning light (green)
7	-	L6B	Trailer direction indicators warning light (green)
8	-	L7B	Sidelights warning light (green)
9	-	L8B	Full beam headlights warning light (blue)
10	-	L9B	PTO clutch indicator light (red)
11	-	L1B	N.C.
12	+12V	+	Positive (+12V)

Instrument panel (CODE 2.8339.230.0/70) - A21

Table 114

PIN	vOl TS	SYMbOl	dESCrIPTION
1	-	GND	Earth
2	-	+L	Lighting (+lights)
3	-	S2	TA instrument signal
4	+12V	+12	Positive (+12V)
5	-	+24	N.C.

Instrument panel (CODE 28993.230.0/70) - A22

Table 115

PIN	vOl TS	SYMbOl	dESCrIPTION
1	-	GND	Earth
2	-	+L	Lighting (+lights)
3	-	5	Temperature gauge signal
4	-	-	N.C,
5	-	-	N.C.
6	+12V	+	Positive (+12V)

40.3 - SYSTEMS

40.3.1 - Earthing points

Radar earthing points

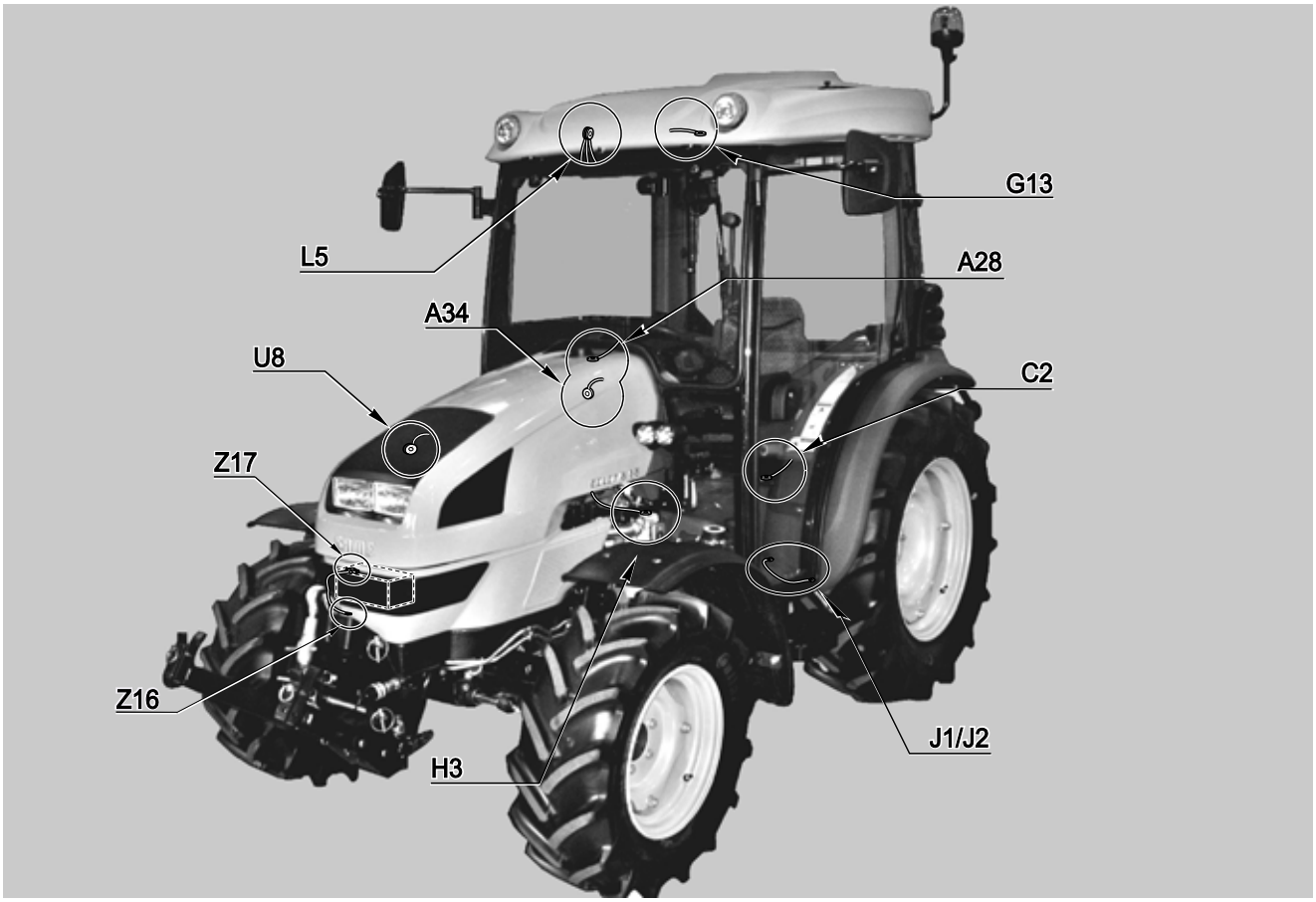
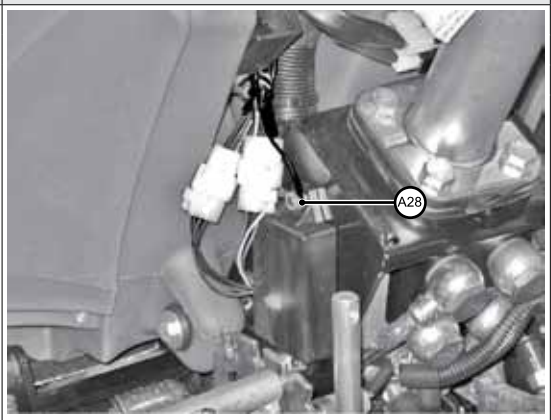
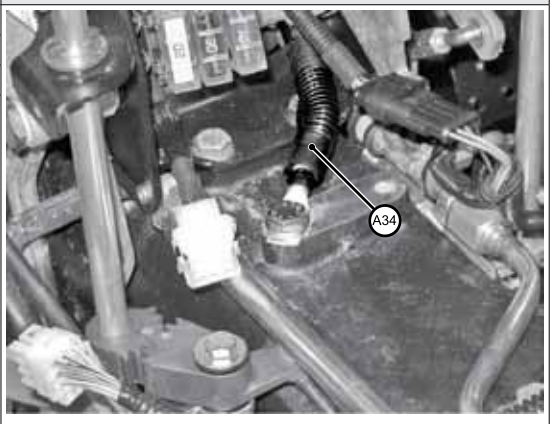
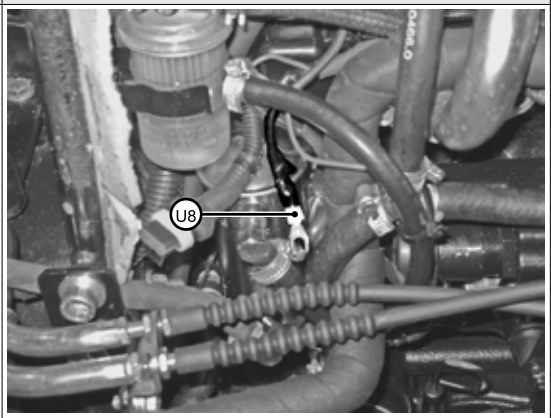
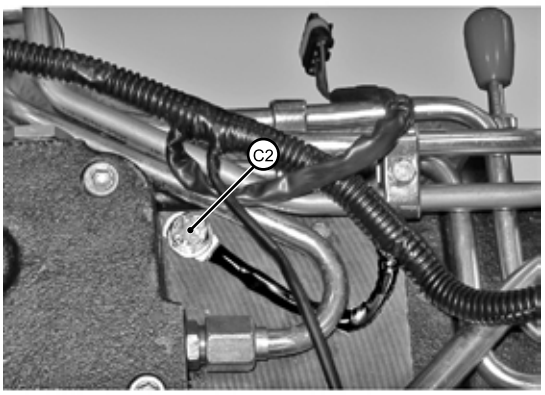
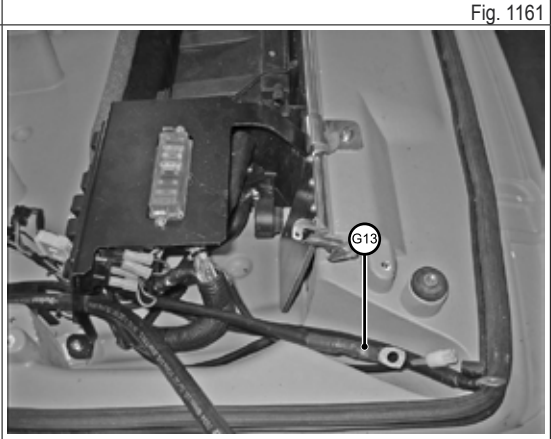
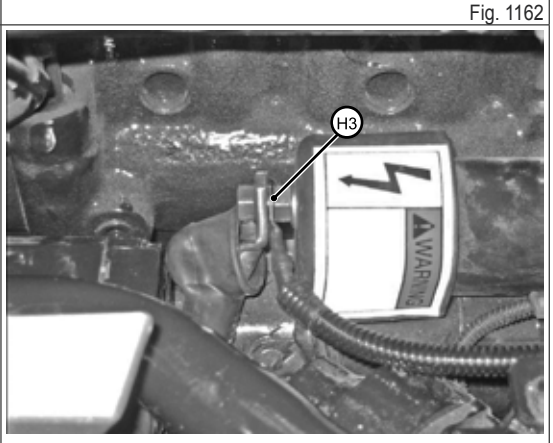
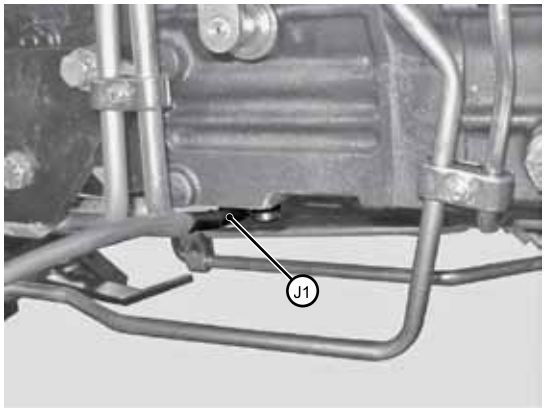
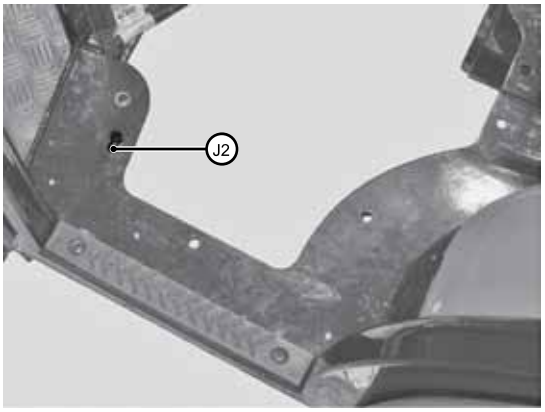
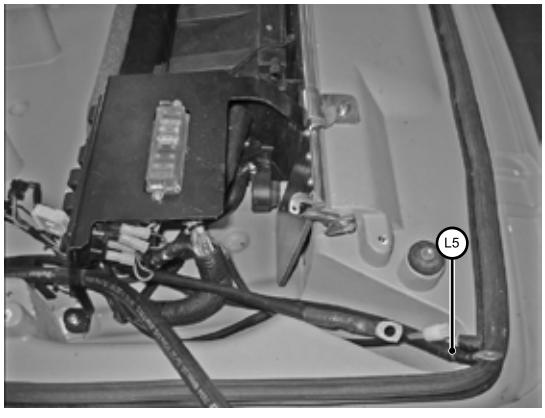


Fig. 1158 - Radar earthing points

Connector positions

Table 116

CONNEC-TOr/SYS-TEM	CONNECTOr POSITIONS	CONNEC-TOr/SYS-TEM	CONNECTOr POSITIONS
A28	 Fig. 1159	A34 – GND6 –	 Fig. 1160

CONNEC-TOr/SYS-TEM	CONNECTOr POSITIONS	CONNEC-TOr/SYS-TEM	CONNECTOr POSITIONS
U8	 Fig. 1161	C2	 Fig. 1162
G13	 Fig. 1163	H3	 Fig. 1164
J1	 Fig. 1165	J2	 Fig. 1166
L5	 Fig. 1167	-	-

40.3.2 - Starting

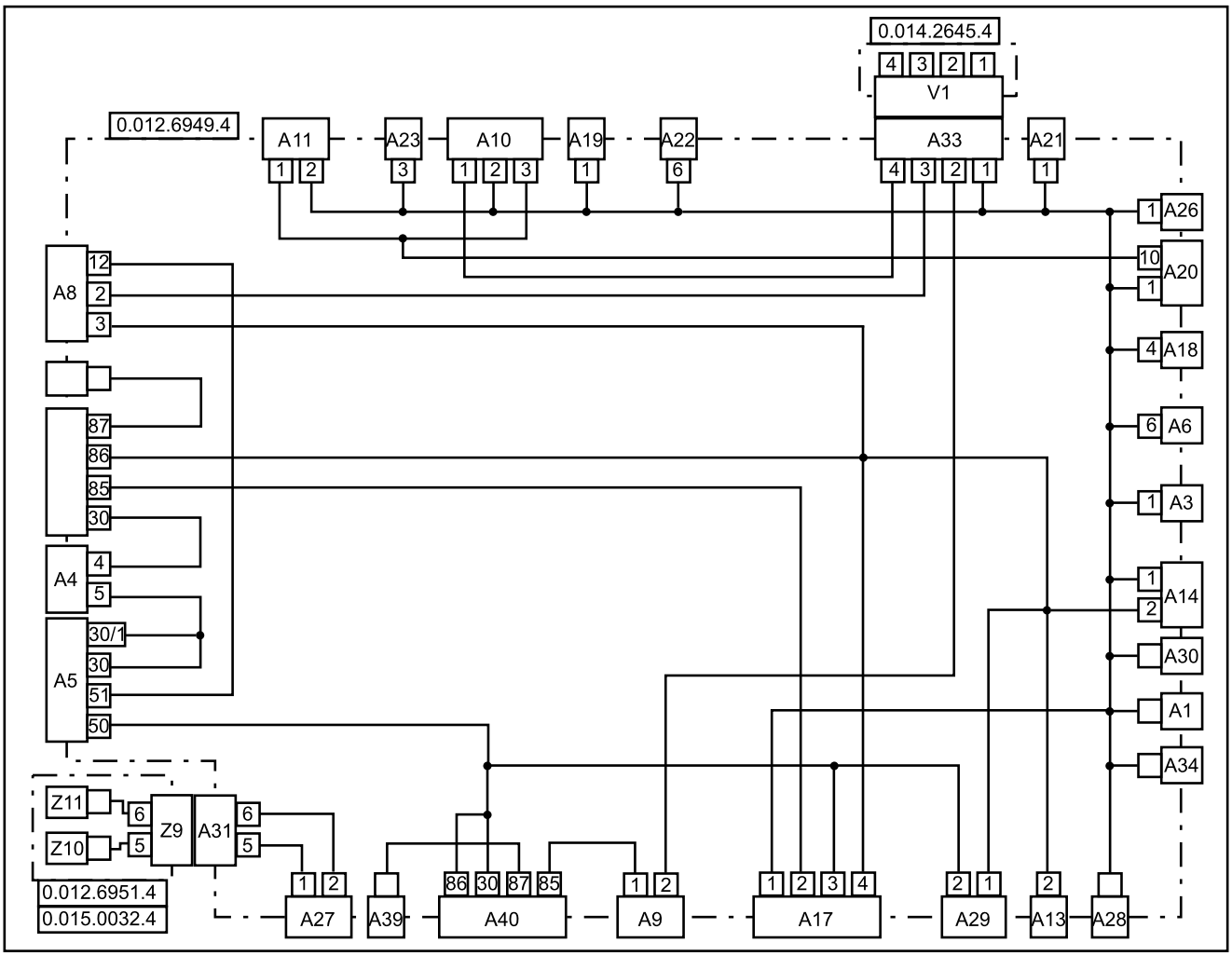


Fig. 1168 - Starting

Key

- A1 External 12 volt outlet socket
- A3 LH headlight
- A4 Maxi fuses
- A5 Starter switch
- A6 Differential switch
- A8 Fusebox
- A9 Clutch enable switch
- A10 PTO enable
- A11 Clutch
- A13 Brakes
- A14 LH headlight
- A17 Preheating relay control unit
- A18 Instrument panel
- A19 Coolant temperature gauge
- A20 Instrument panel
- A21 Rev counter
- A22 Fuel gauge
- A23 Fuel level float switch
- A24 Pre-heating relay
- A26 Flasher
- A27 Engine stop control unit
- A28 Earth
- A29 Engine STOP
- A30 RH headlight
- A31 To front wiring

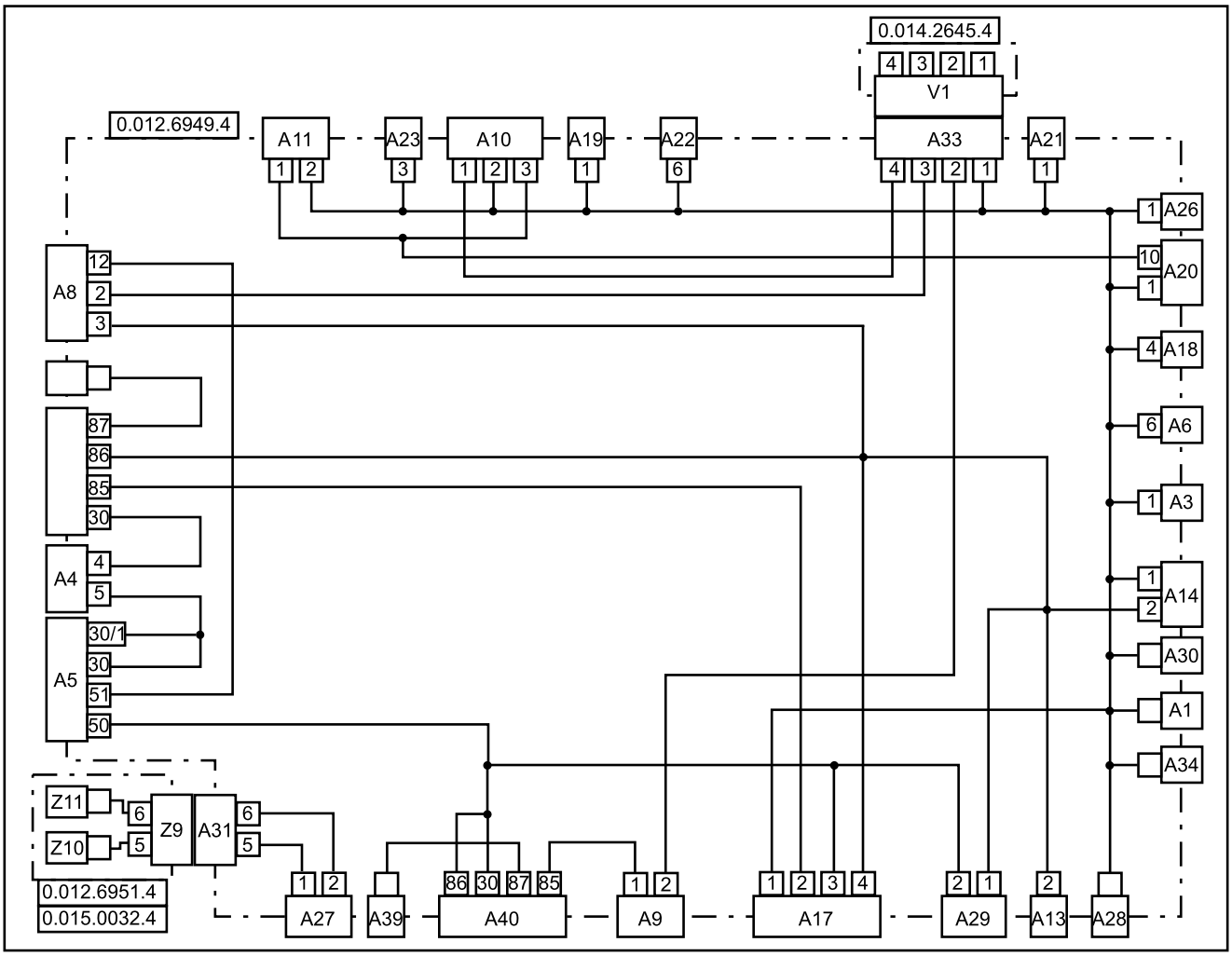


Fig. 1168 - Starting

- A32 Glowplugs
- A33 Front PTO
- A34 Earth
- A39 Starter motor
- A40 Starter motor
- V1 To central wiring
- Z9 To central wiring
- Z10 Engine stop solenoid
- Z11 Engine stop solenoid

Wiring and connectors list

- 0.012.6949.4 - Central wiring
  - **See para. 40.4.11 - Central wiring - 0.012... - page 40-71**
  - **See para. 40.4.12 - Positions of central w... - page 40-74**
- 0.014.2645.4 - PTO wiring
  - **See para. 40.4.3 - Front PTO wiring - 0.0... - page 40-61**
  - **See para. 40.4.4 - Positions of front PTO... - page 40-61**
- 0.015.0032.4 - Front wiring with cab / 0.012.6951.4 - Front wiring
  - **See para. 40.4.9 - Front wiring with cab - page 40-66**
  - **See para. 40.4.10 - Positions of front wir... - page 40-68**
  - **See para. 40.4.1 - Wiring harnesses - page 40-57**
  - **See para. 40.4.2 - Positions of front wir... - page 40-58**

40.3.3 - Control unit - fan

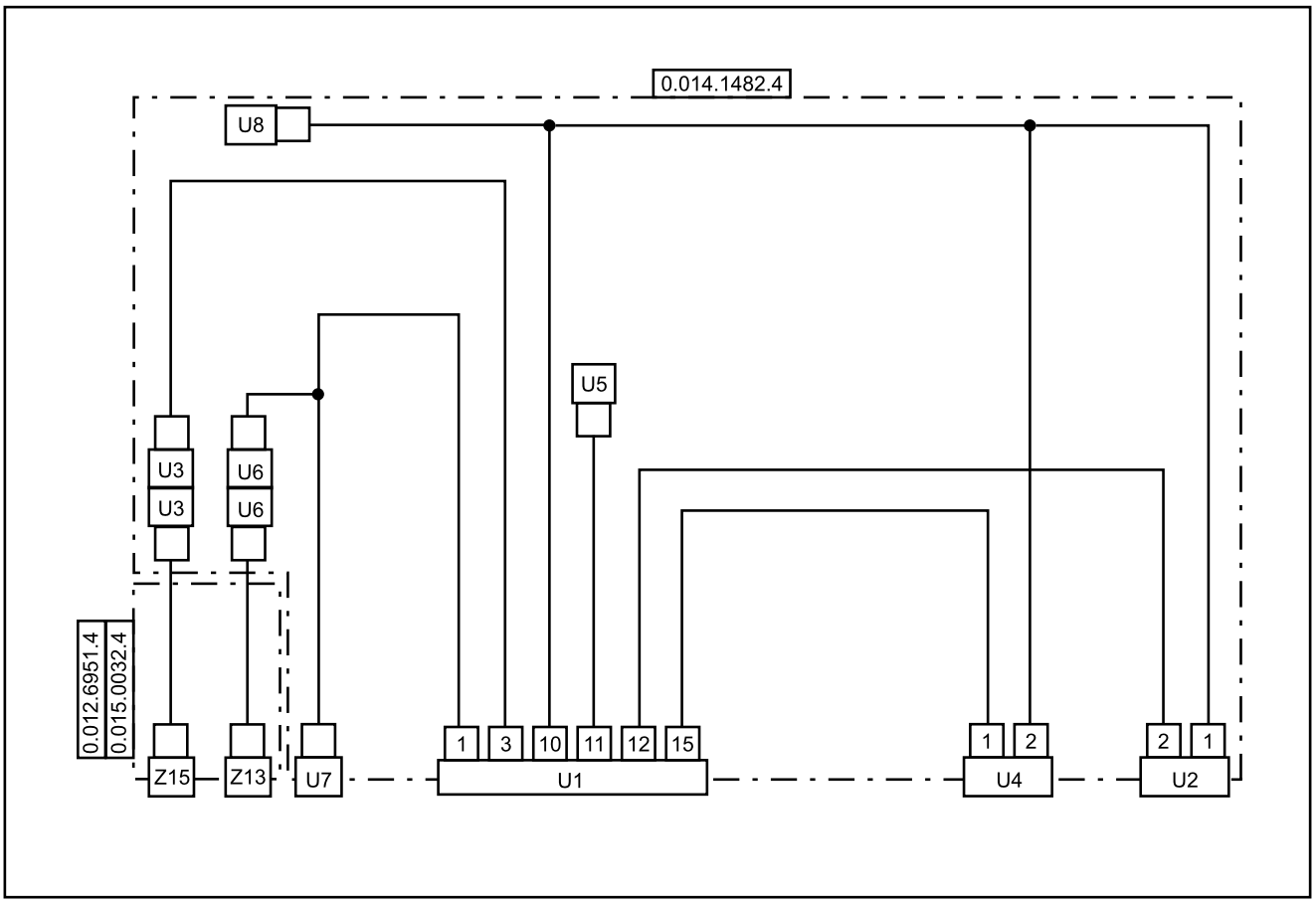


Fig. 1169

Key

- U1 Control unit
- U2 Fan
- U3 Indicator light
- U4 Temperature
- U5 Temp
- U6 Female connector terminal
- U7 Male connector terminal
- U8 Earth
- Z13 Fuel lift pump
- Z15 Engine coolant temperature sensor for warning light

Wiring and connectors list

- 0.014.1482.4 - Fan wiring
  - **See para. 40.4.13 - Solenoid valve wiring ... - page 40-80**
  - **See para. 40.4.14 - Positions of solenoid ... - page 40-81**
- 0.015.0032.4 - Front wiring with cab / 0.012.6951.4 - Front wiring
  - **See para. 40.4.9 - Front wiring with cab - page 40-66**
  - **See para. 40.4.10 - Positions of front wir... - page 40-68**
  - **See para. 40.4.1 - Wiring harnesses - page 40-57**
  - **See para. 40.4.2 - Positions of front wir... - page 40-58**

40.3.4 - Steering column lights switch

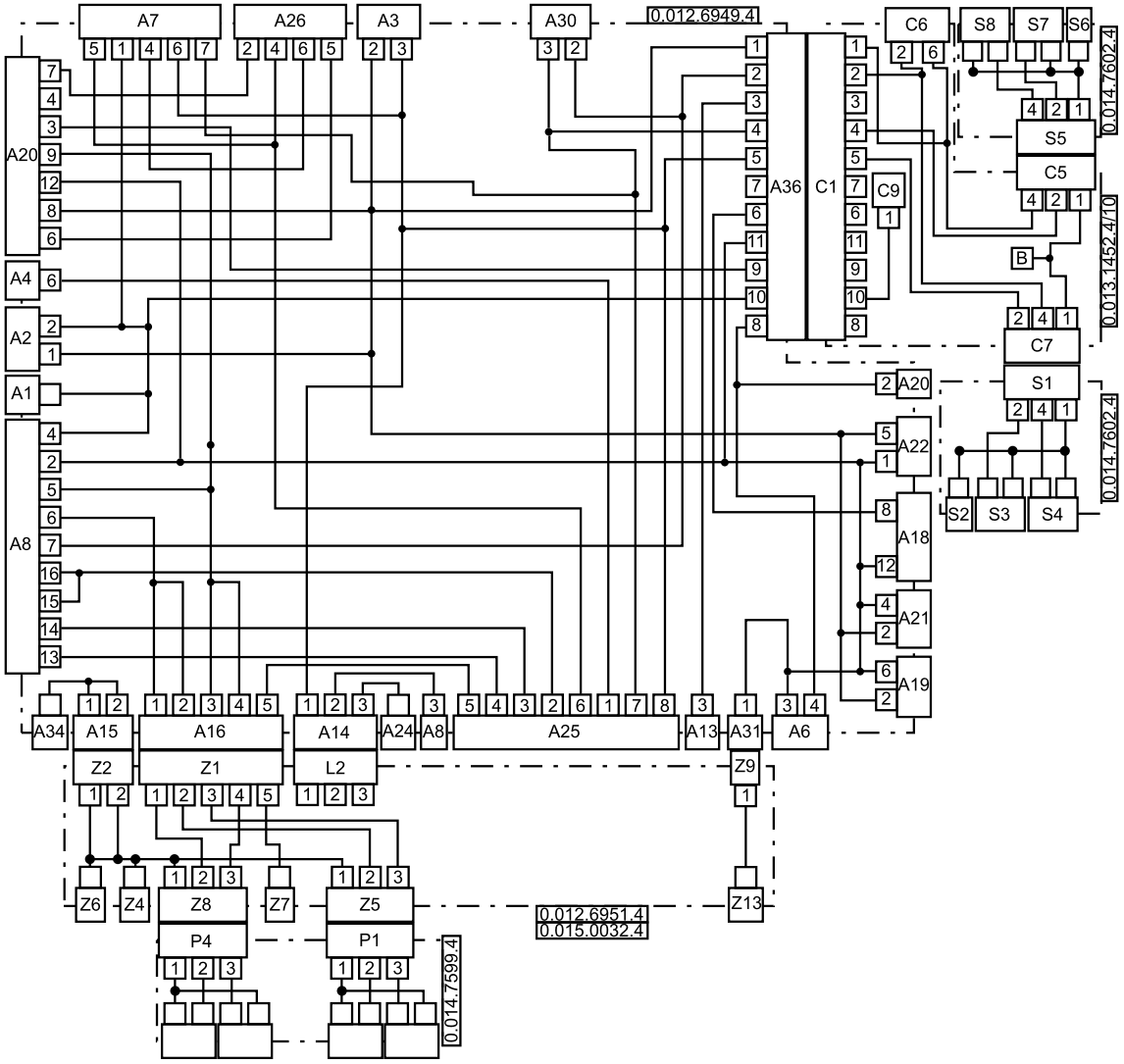


Fig. 1170 - Steering column lights switch

Key

- A1 External 12 volt outlet socket
- A2 Cab power supply
- A3 LH headlight
- A4 Maxi fuses
- A6 Differential switch
- A7 Emergency switch
- A8 Fusebox
- A13 Brakes
- A14 LH headlight
- A15 To front wiring
- A16 To front wiring
- A17 Preheating relay control unit
- A18 Instrument panel
- A19 Coolant temperature gauge
- A20 Instrument panel
- A21 Rev counter

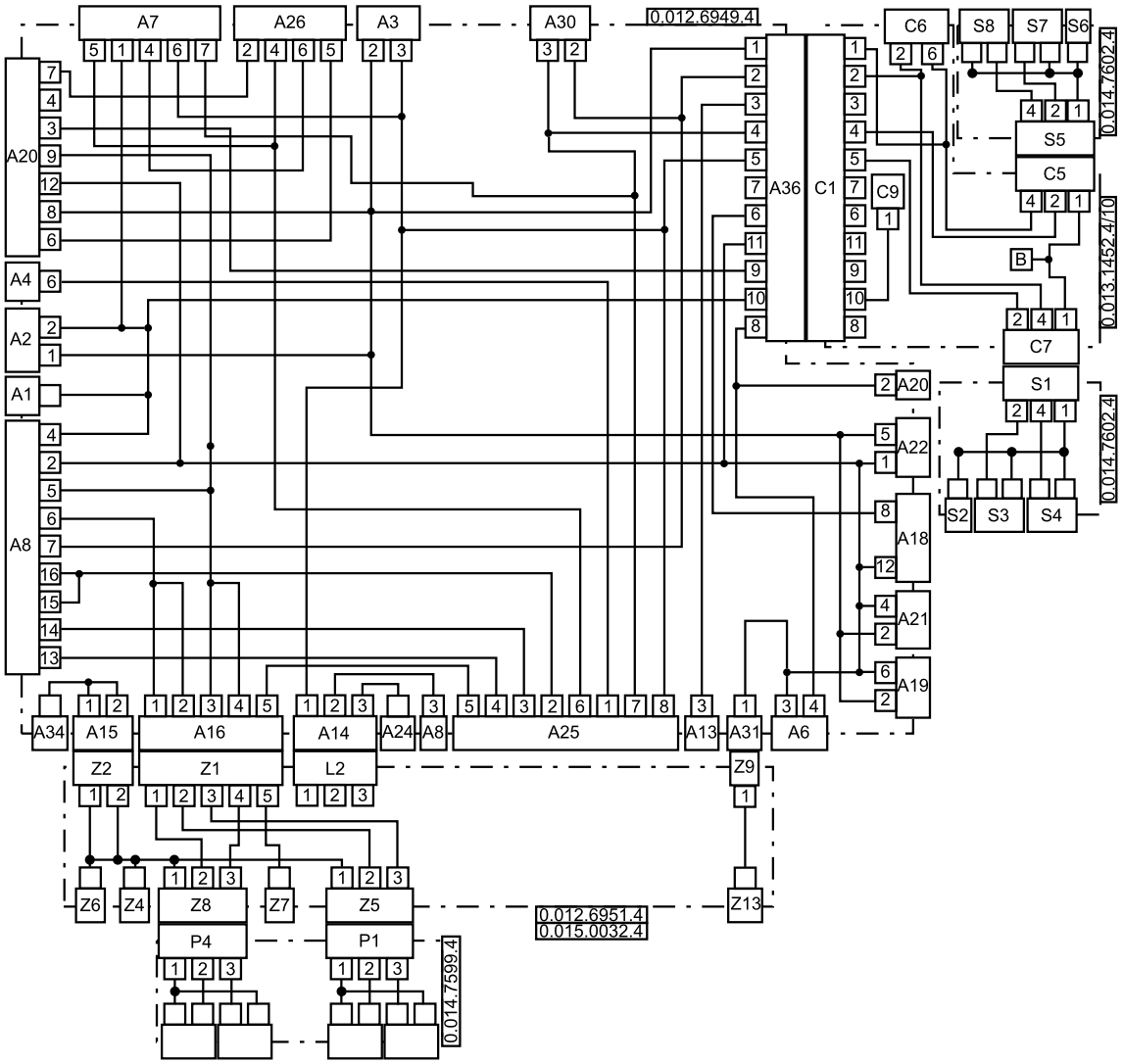


Fig. 1170 - Steering column lights switch

- A22 Fuel gauge
- A24 Pre-heating relay
- A25 Steering column switch unit
- A26 Flasher
- A30 RH headlight
- A31 To front wiring
- A34 Earth
- A36 To rear wiring
- C1 To central wiring
- C5 RH rear light
- C6 Trailer socket
- C7 LH rear socket
- C9 Worklight
- L2 To front worklight
- P1 To front wiring
- P4 To front wiring
- S1 To rear wiring
- S2 To LH rear light
- S3 To LH rear light

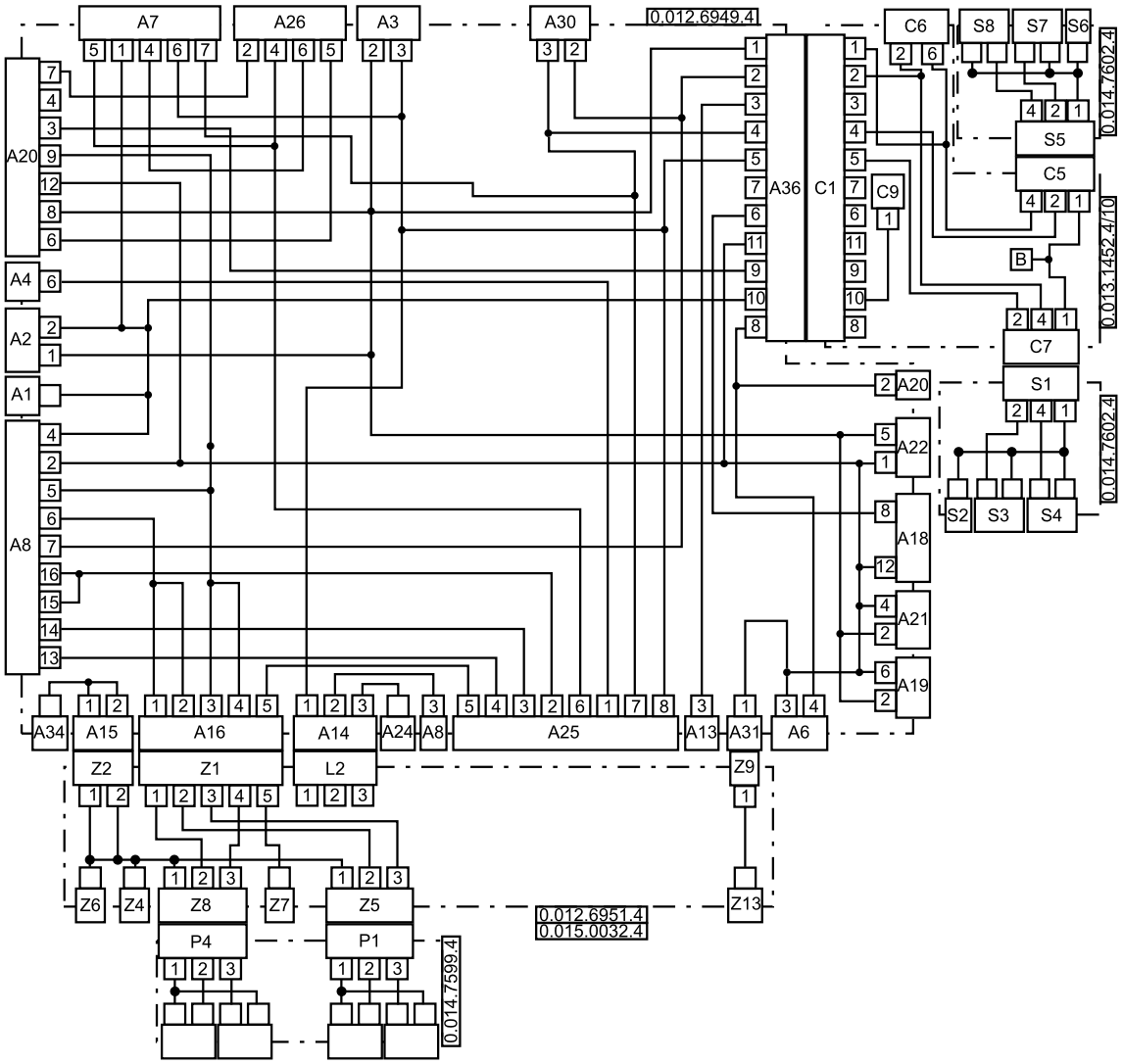


Fig. 1170 - Steering column lights switch

- Z13 Fuel lift pump
- S4 To LH rear light
- S5 To rear wiring
- S6 To RH rear light
- S7 To RH rear light
- S8 To RH rear light
- Z1 To central wiring
- Z2 To central wiring
- Z4 Air cleaner clogging sensor
- Z5 RH headlight
- Z6 Horn
- Z7 Horn
- Z8 LH front light
- Z9 To central wiring

Wiring and connectors list

- 0.012.6949.4 - Central wiring
  - **See para. 40.4.11 - Central wiring - 0.012... - page 40-71**
  - **See para. 40.4.12 - Positions of central w... - page 40-74**

- 0.013.1452.4/10 - Rear wiring
  - **See para. 40.4.15 - Rear wiring - 0.013.14... - page 40-82**
  - **See para. 40.4.16 - Positions of rear wiri... - page 40-84**
- 0.014.7596.4 - Worklights, number plate, flashing light wiring
  - **See para. 40.4.28 - Worklights-number plat... - page 40-98**
  - **See para. 40.4.29 - Positions of worklight... - page 40-99**
- 0.014.7599.4 - Front lights wiring
  - **See para. 40.4.5 - Front lights wiring - ... - page 40-62**
  - **See para. 40.4.6 - Positions of front lig... - page 40-63**
- 0.014.7602.4 - Rear lights wiring
  - **See para. 40.4.18 - Rear lights wiring - 0... - page 40-86**
  - **See para. 40.4.19 - Positions of rear ligh... - page 40-87**
- 0.015.0032.4 - Front wiring with cab / 0.012.6951.4 - Front wiring
  - **See para. 40.4.9 - Front wiring with cab - page 40-66**
  - **See para. 40.4.10 - Positions of front wir... - page 40-68**
  - **See para. 40.4.1 - Wiring harnesses - page 40-57**
  - **See para. 40.4.2 - Positions of front wir... - page 40-58**

40.3.5 - Instrument panel

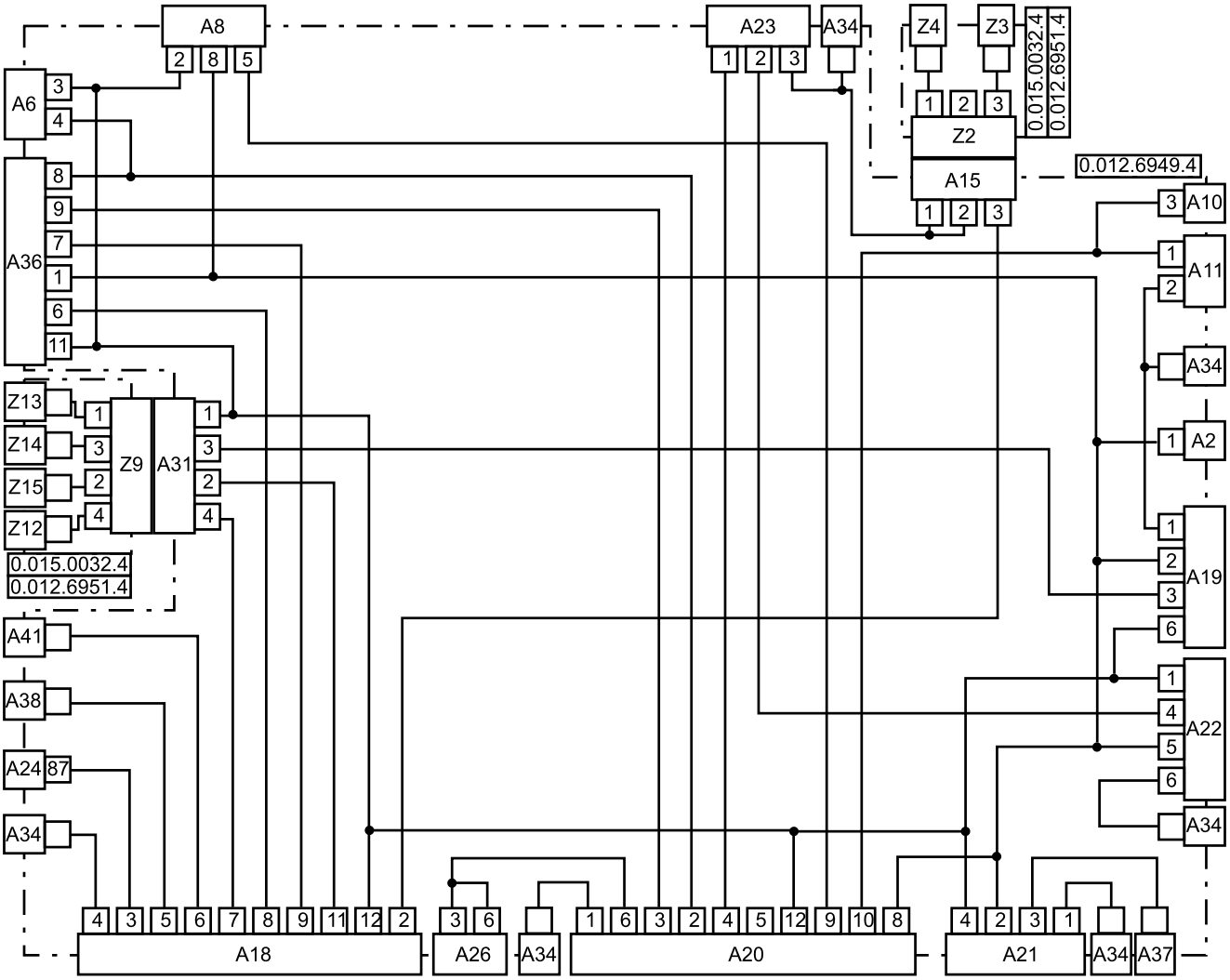


Fig. 1171 - Instrument panel

Key

- A2 Cab power supply
- A6 Differential switch
- A8 Fusebox
- A10 PTO enable

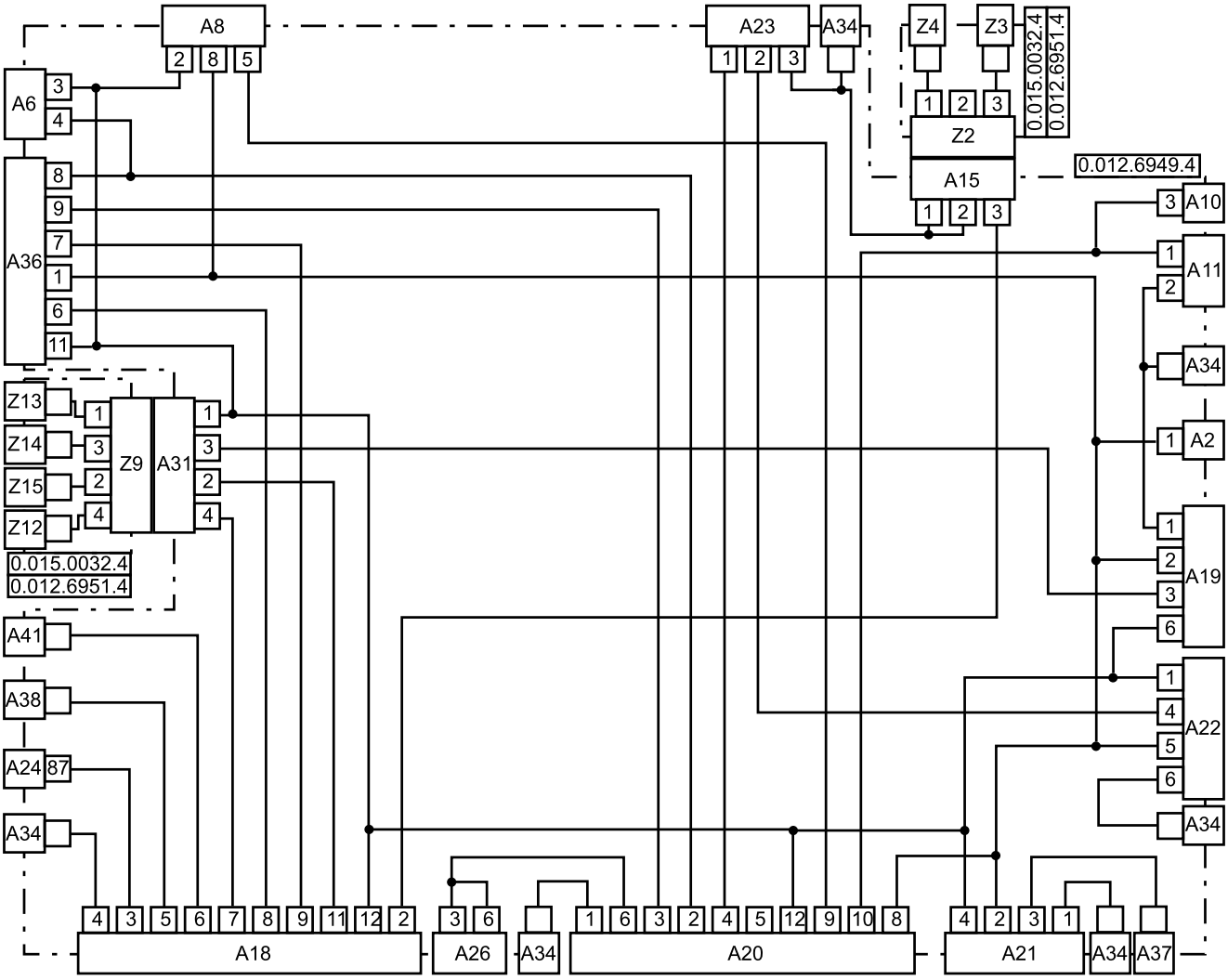


Fig. 1171 - Instrument panel

- A11 Clutch
- A15 To front wiring
- A18 Instrument panel
- A19 Coolant temperature gauge
- A20 Instrument panel
- A21 Rev counter
- A22 Fuel gauge
  A23 Fuel level float switch
- A24 Pre-heating relay
- A26 Flasher
- A31 To front wiring
- A34 Earth
- A36 To rear wiring
- A37 Alternator
- A38 Alternator
- A41 Oil filter
- Z2 To central wiring
- Z3 Air cleaner clogging sensor
- Z4 Air cleaner clogging sensor
- Z9 To central wiring
- Z12 Engine oil pressure switch
- Z13 Fuel lift pump
- Z14 Coolant temperature sensor
- Z15 Engine coolant temperature sensor for warning light

Wiring and connectors list

- 0.012.6949.4 - Central wiring
  - **See para. 40.4.11 - Central wiring - 0.012... - page 40-71**
  - **See para. 40.4.12 - Positions of central w... - page 40-74**
- 0.015.0032.4 - Front wiring with cab / 0.012.6951.4 - Front wiring
  - **See para. 40.4.9 - Front wiring with cab - page 40-66**
  - **See para. 40.4.10 - Positions of front wir... - page 40-68**
  - **See para. 40.4.1 - Wiring harnesses - page 40-57**
  - **See para. 40.4.2 - Positions of front wir... - page 40-58**

40.3.6 - Cab

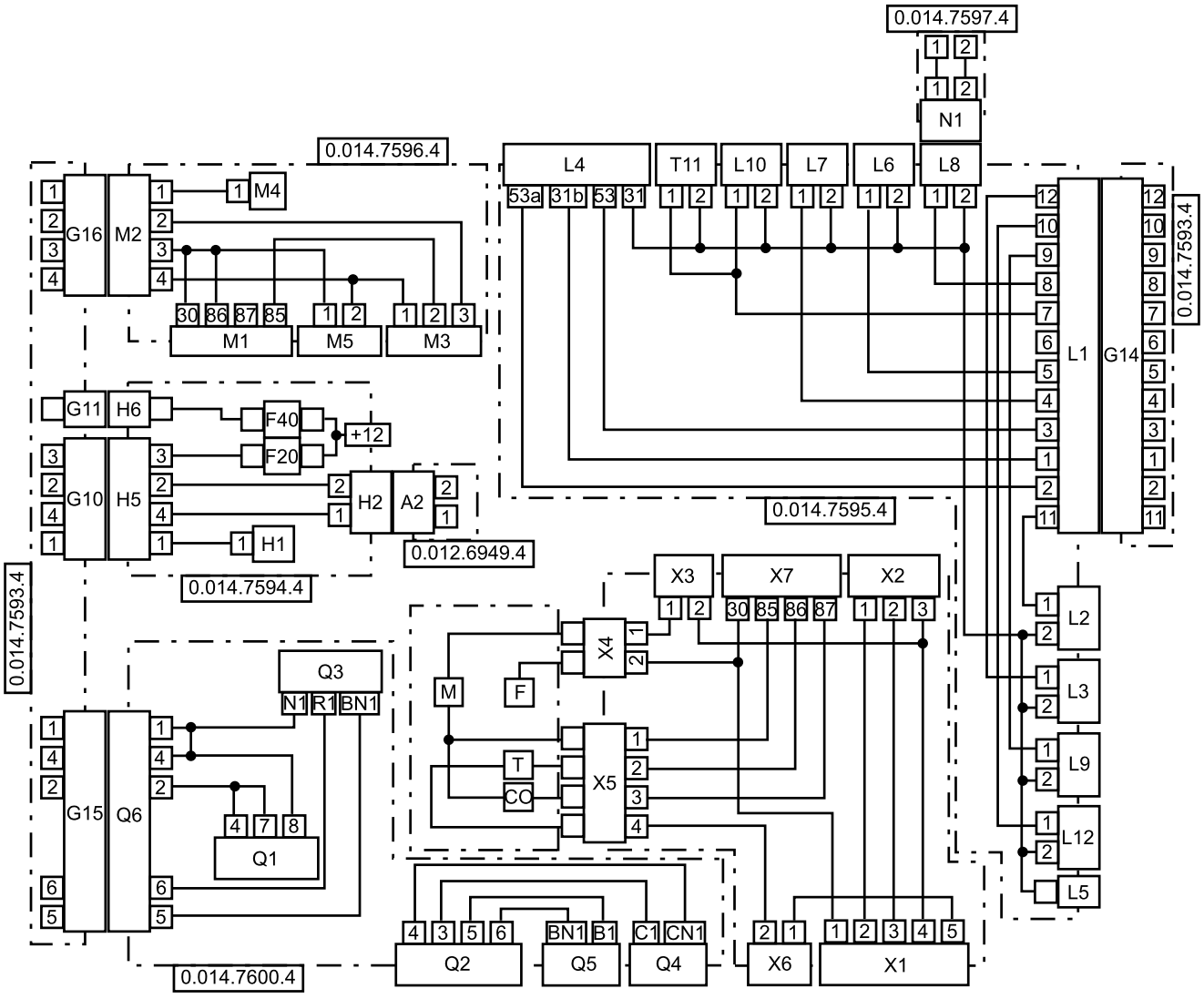


Fig. 1172 - Cab

Key

- A2 Cab power supply
- G10 Power supply
- G11 Power supply
- G14 To worklights wiring
- G15 To radio/interior light wiring
- G16 To A/C wiring
- H1 To compressor
- H2 To central wiring
- H5 To cab wiring
- H6 To relay
- L1 To aereo cab wiring
- L2 To front worklights

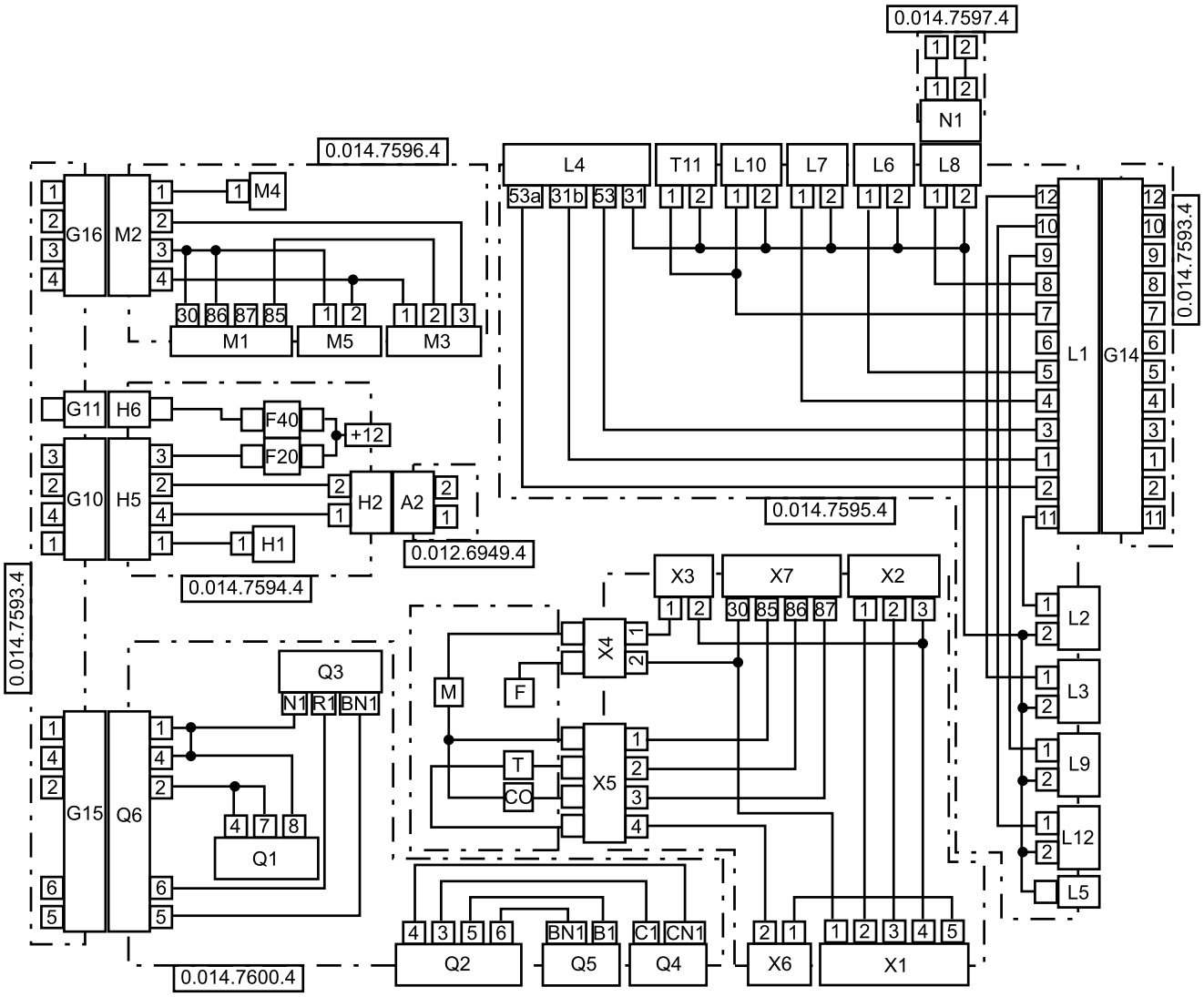


Fig. 1172 - Cab

- L3 To front worklights
- L4 To rear wiper
- L5 Earth
- L6 To front worklights
- L7 To front worklights
- L8 To rotating beacon
- L9 To LH rear worklight
- L10 To number plate light
- L11 To number plate light
- L12 To RH rear worklight
- M1 Relay
- M2 Aereo-cab system
- M3 To receiver-drier
- M4 To receiver-drier
- M5 To fan
- N1 Worklight connection
- Q1 Provision for radio
- Q2 Provision for radio
- Q3 Interior roof light
- Q4 RH loudspeaker
- Q5 LH loudspeaker
- Q6 To aereo-cab wiring
- X1 Fan speed selector switch
- X2 Fan speed resistor
- X3 Electric fan

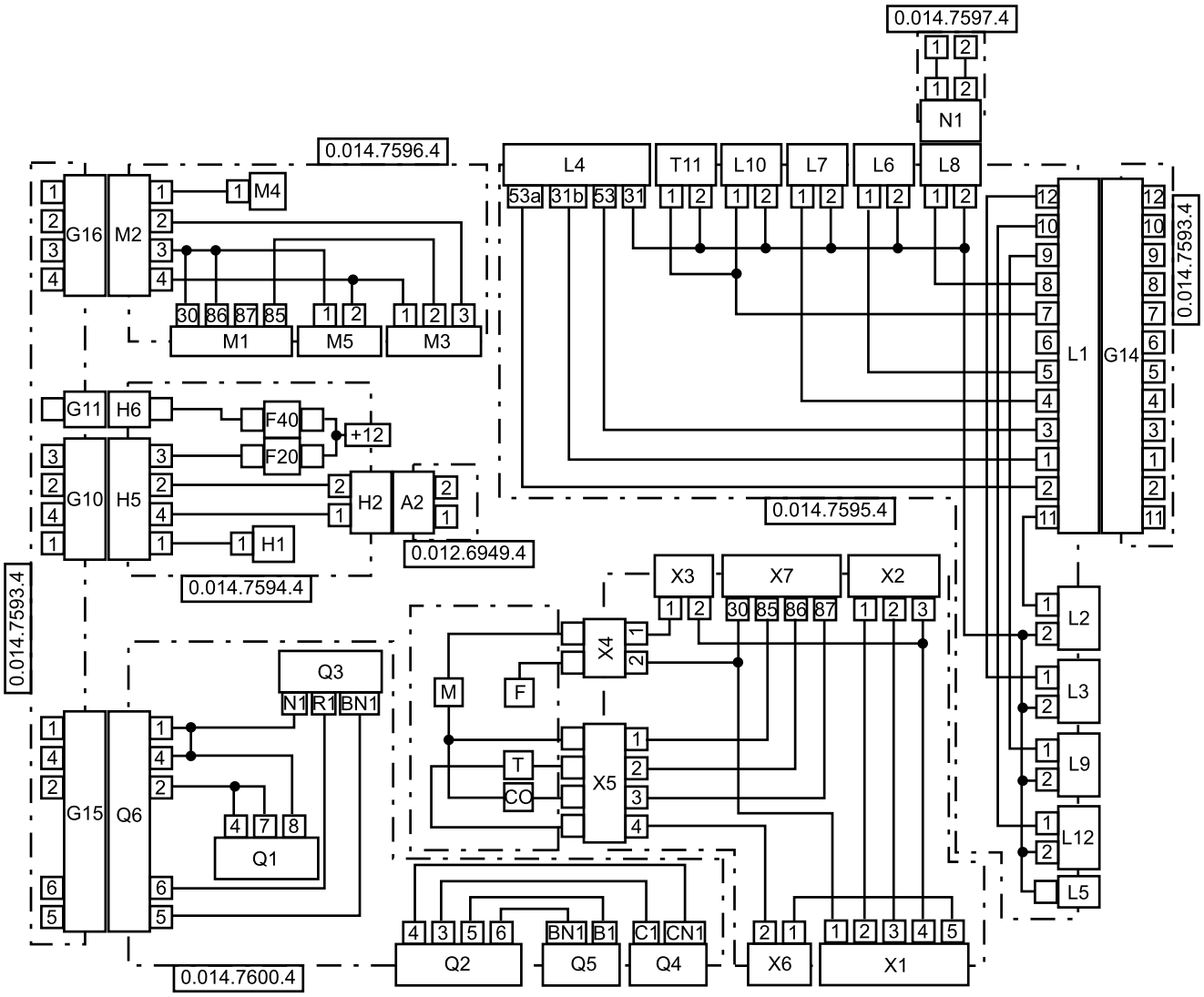


Fig. 1172 - Cab

- X4 Power supply block
- X5 Block for air conditioning variant
- X6 Antifrost thermostat
- X7 Air conditioning relay
- Y1 Compressor
- Y2 Power supply fuse
- Y3 Earth
- Y4 Air conditioning pressure switch

Wiring and connectors list

- 0.012.6949.4 - Central wiring
  - **See para. 40.4.11 - Central wiring - 0.012... - page 40-71**
  - **See para. 40.4.12 - Positions of central w... - page 40-74**
- 0.014.7593.4 -Aereo-cab wiring
  - **See para. 40.4.20 - Aereo cab wiring - 0.0... - page 40-89**
  - **See para. 40.4.21 - Positions of aereo-cab... - page 40-90**
- 0.014.7594.4 - Cab power supply wiring
  - **See para. 40.4.22 - Cab power supply - 0.0... - page 40-92**
  - **See para. 40.4.23 - Positions of cab power... - page 40-93**
- 0.014.7595.4 - Worklights, number plate, flashing light wiring
  - **See para. 40.4.28 - Worklights-number plat... - page 40-98**
  - **See para. 40.4.29 - Positions of worklight... - page 40-99**

- 0.014.7596.4 - Air conditioning system wiring
  - **See para. 40.4.24 - Air conditioning syste... - page 40-94**
  - **See para. 40.4.25 - Position of air condit... - page 40-94**
- 0.014.7597.4 - Flashing light wiring
  - **See para. 40.4.30 - Flashing light wiring ... - page 40-100**
  - **See para. 40.4.31 - Positions of flashing ... - page 40-101**
- 0.014.7600.4 - Radio wiring
  - **See para. 40.4.34 - Radio wiring - 0.014.7... - page 40-104**
  - **See para. 40.4.35 - Positions of radio-lou... - page 40-104**

40.3.7 - Aereo cab

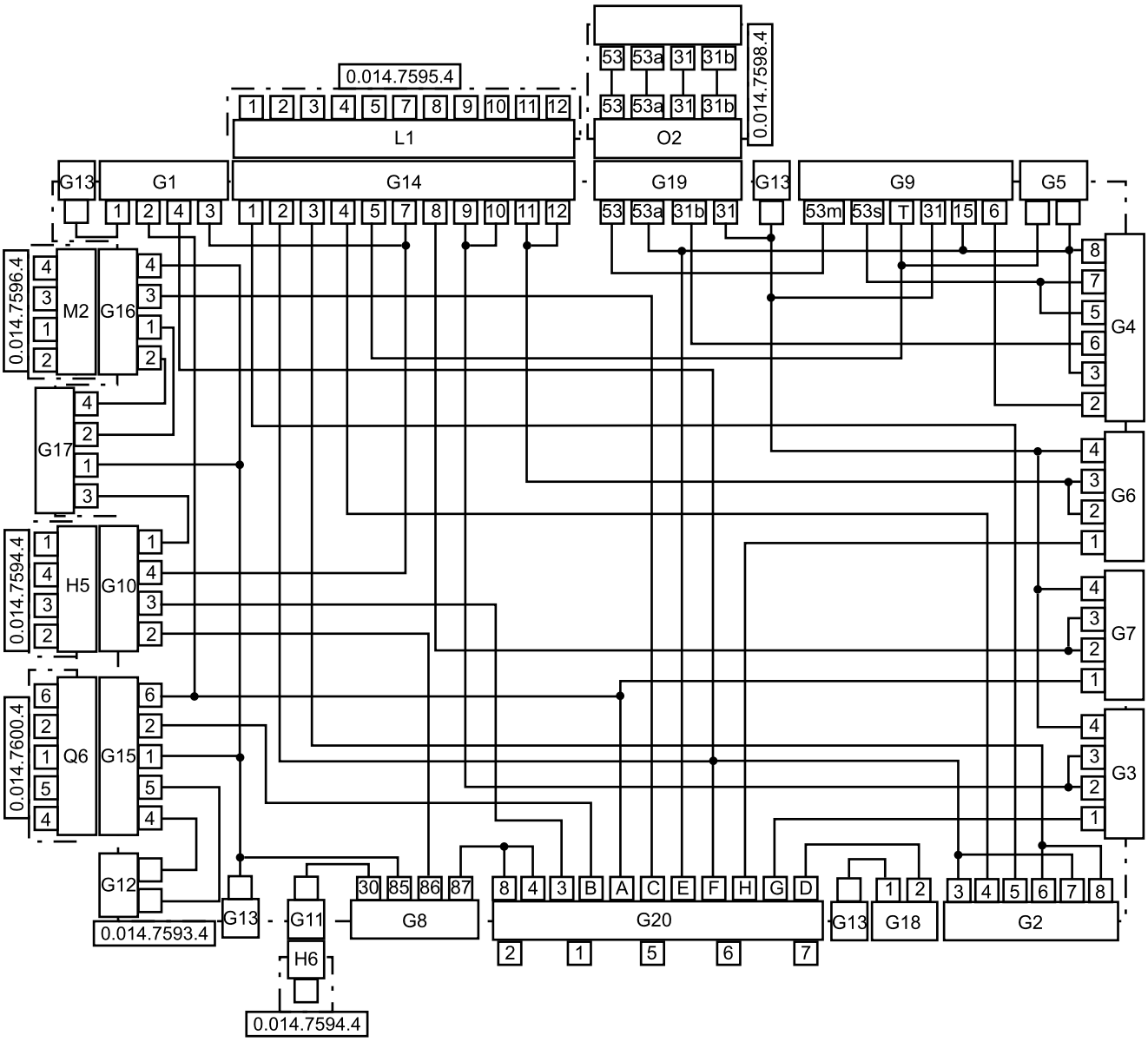


Fig. 1173 - Aereo cab

Key

- G1 Clock
- G2 Rear wiper switch
- G3 Rear worklights switch
- G4 Windscreen wiper switch
- G5 Screenwash pump
- G6 Front lights switch
- G7 Flashing light switch
- G8 Relay

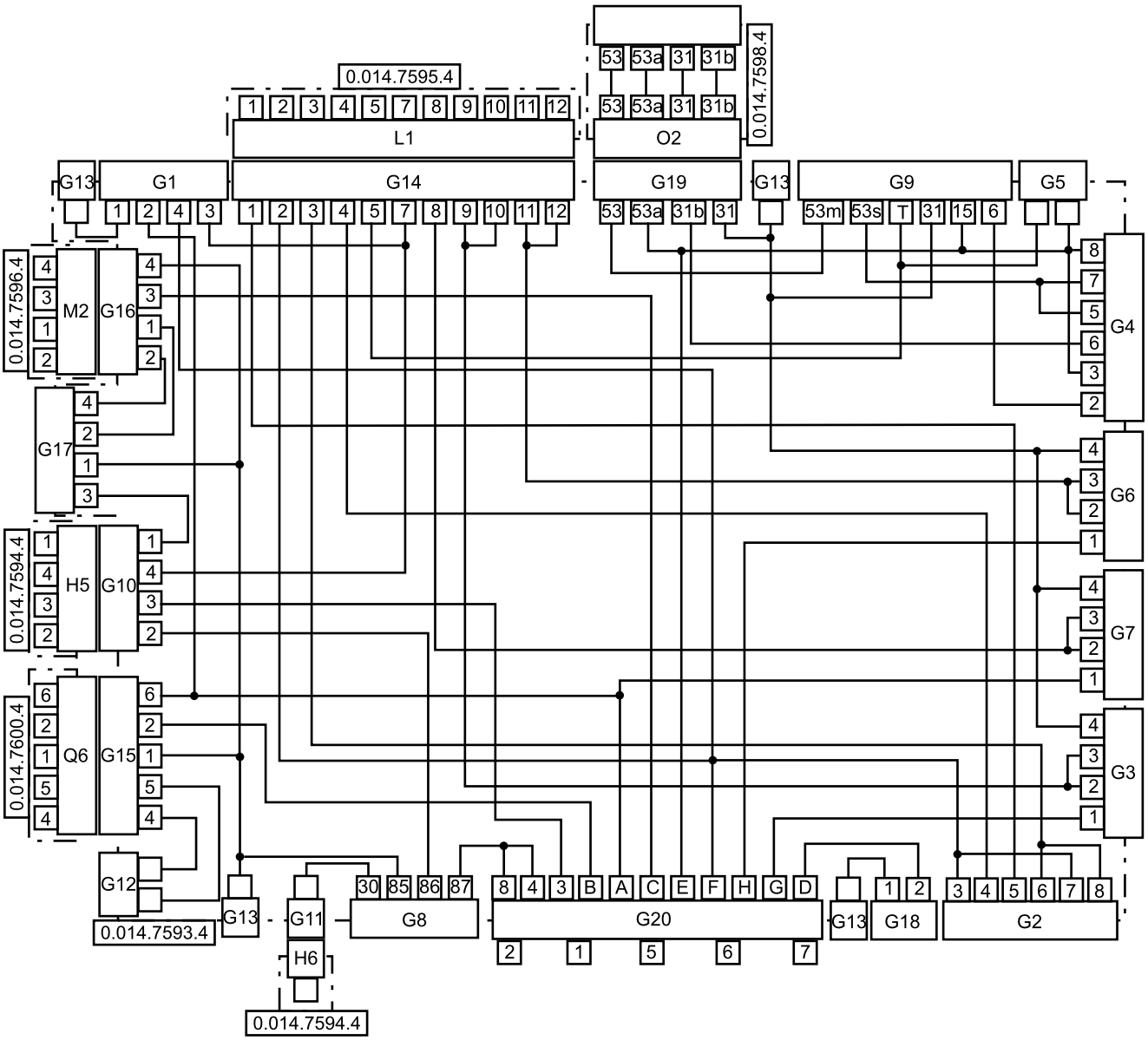


Fig. 1173 - Aereo cab

- G9 Timer
- G10 Power
- G11 Power
- G12 To door switch
- G13 Earth
- G14 To worklights wiring
- G15 To radio/interior light wiring
- G16 To A/C wiring
- G17 To Borletti heater - air conditioning unit
- G18 To Borletti heater - air conditioning unit
- G19 To windscreen wiper
- G20 Fusebox
- H5 To aereo-cab wiring
- H6 To relay
- L1 To aereo-cab wiring
- M2 Aereo-cab system
- O2 To aereo-cab wiring
- Q6 To aereo-cab wiring

Wiring and connectors list

- 0.014.7593.4 -Aereo-cab wiring
  - **See para. 40.4.20 - Aereo cab wiring - 0.0... - page 40-89**
  - **See para. 40.4.21 - Positions of aereo-cab... - page 40-90**
- 0.014.7594.4 - Cab power supply wiring
  - **See para. 40.4.22 - Cab power supply - 0.0... - page 40-92**
  - **See para. 40.4.23 - Positions of cab power... - page 40-93**
- 0.014.7595.4 - Worklights, number plate, flashing light wiring
  - **See para. 40.4.28 - Worklights-number plat... - page 40-98**
  - **See para. 40.4.29 - Positions of worklight... - page 40-99**
- 0.014.7596.4 - Air conditioning system wiring
  - **See para. 40.4.24 - Air conditioning syste... - page 40-94**
  - **See para. 40.4.25 - Position of air condit... - page 40-94**
- 0.014.7598.4 - Windscreen wiper wiring
  - **See para. 40.4.32 - Windscreen wipers - 0.... - page 40-102**
  - **See para. 40.4.33 - Positions of windscree... - page 40-102**
- 0.014.7600.4 - Radio wiring
  - **See para. 40.4.34 - Radio wiring - 0.014.7... - page 40-104**

See para. 40.4.34 - Radio wiring - 0.014.7... - page 40-104

40.3.8 - PTO

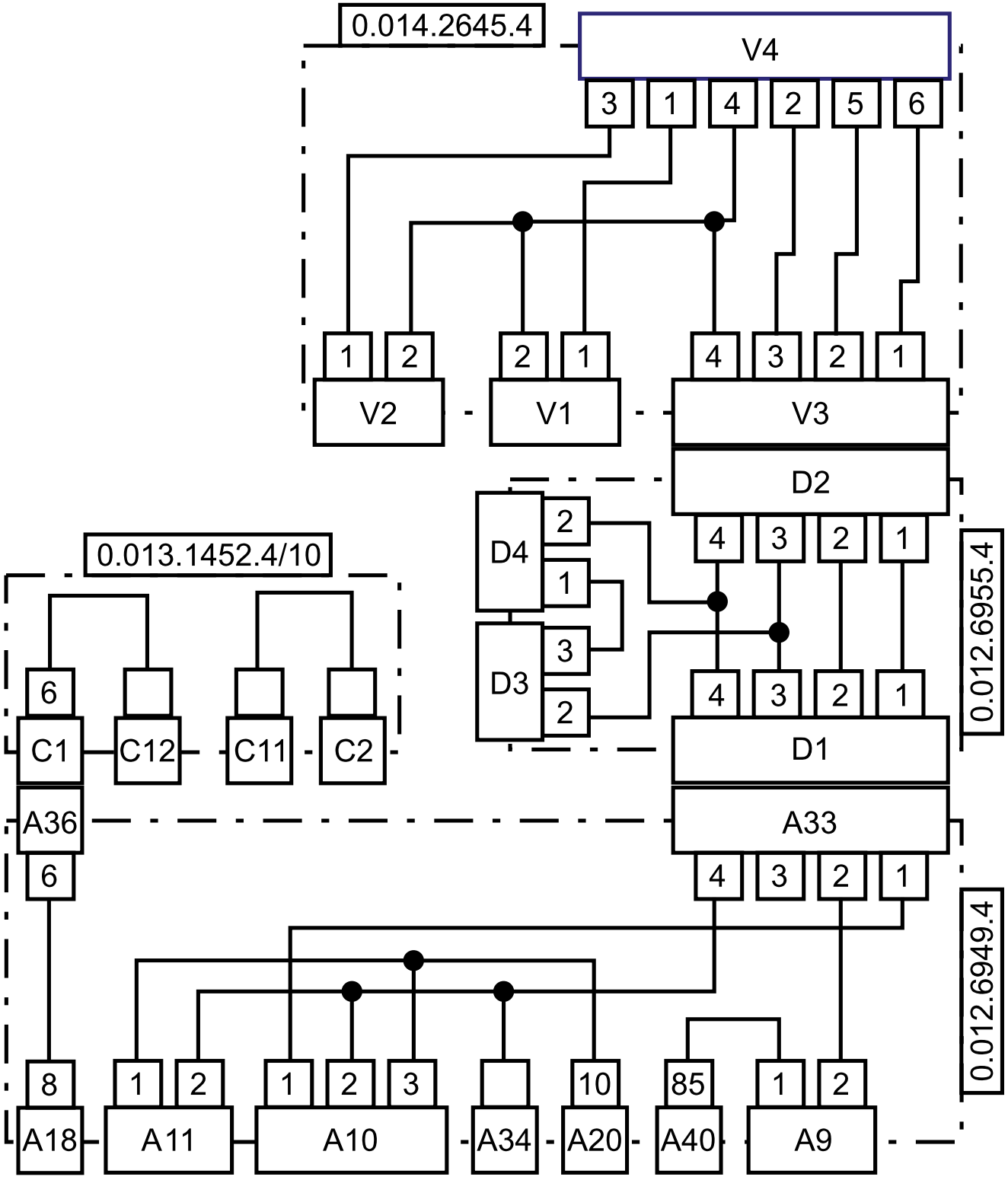


Fig. 1174 - PTO

Key

- A9 Clutch enable switch
- A10 PTO enable
- A11 Clutch
- A18 Instrument panel
- A20 Instrument panel
- A33 Front PTO
- A34 Earth

- A36 To rear wiring
- A40 Starter motor
- C1 To central wiring
- C2 Earth
- C11 PTO speed indicator light switch switch
- C12 PTO speed indicator light switch switch
- D1 To central wiring
- D2 To PTO wiring
- D3 Flow control switch
- D4 To platform wiring
- V1 To central wiring
- V2 PTO brake
- V3 PTO
- V4 PTO switch

Wiring and connectors list

- 0.012.6949.4 - Central wiring
  - **See para. 40.4.11 - Central wiring - 0.012... - page 40-71**
  - **See para. 40.4.12 - Positions of central w... - page 40-74**
- 0.013.1452.4/10 - Rear wiring
  - **See para. 40.4.15 - Rear wiring - 0.013.14... - page 40-82**
  - **See para. 40.4.16 - Positions of rear wiri... - page 40-84**
- 0.012.6955.4 - Remote valve wiring
  - **See para. 40.4.17 - Remote valve wiring - ... - page 40-86**
- 0.014.2645.4 - Front PTO wiring
  - **See para. 40.4.3 - Front PTO wiring - 0.0... - page 40-61**
  - **See para. 40.4.4 - Positions of front PTO... - page 40-61**

40.3.9 - front axle differential lock

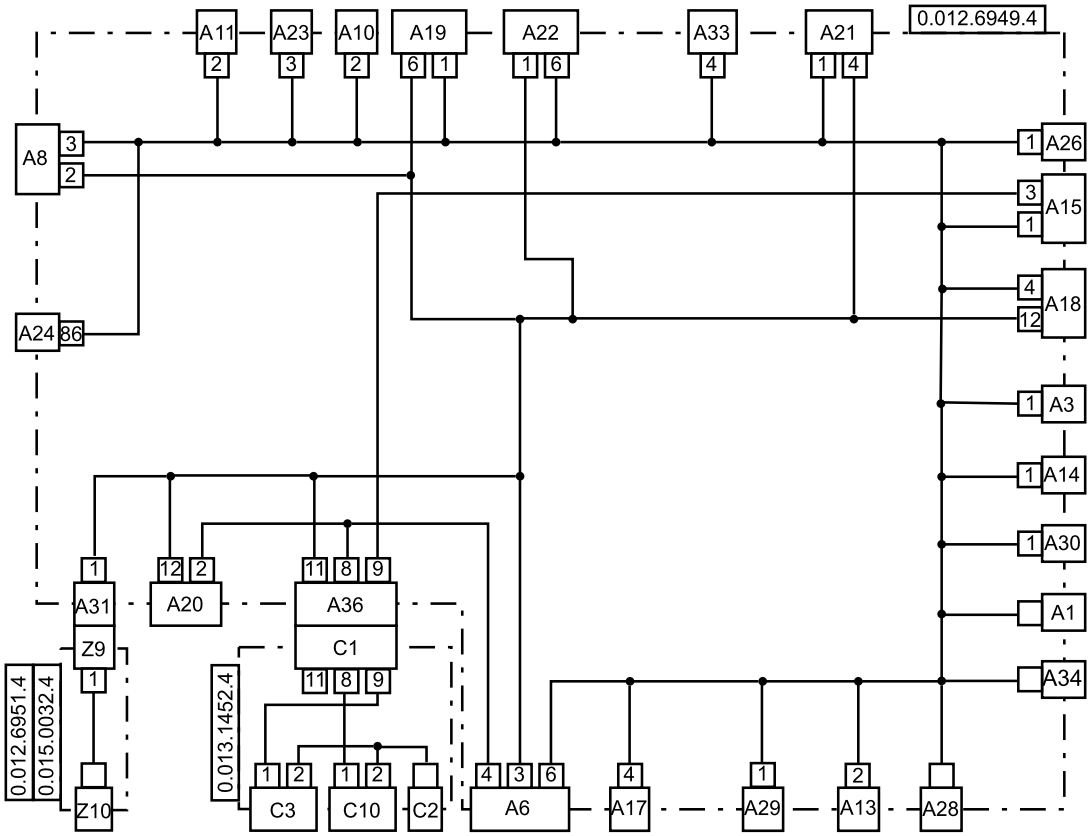


Fig. 1175 - Front axle differential lock

Key

- A1 External 12 volt outlet socket
- A3 LH headlight
- A6 Differential switch
- A8 Fusebox
- A10 PTO enable
- A11 Clutch
- A13 Brakes
- A14 LH headlight
- A15 To front wiring
- A17 Preheating relay control unit
- A18 Instrument panel
- A19 Coolant temperature gauge
- A20 Instrument panel
- A21 Rev counter
- A22 Fuel gauge
- A23 Fuel level float switch
- A24 Pre-heating relay
- A26 Flasher
- A28 Earth
- A29 Engine STOP
- A30 RH headlight
- A31 To front wiring
- A33 Front PTO

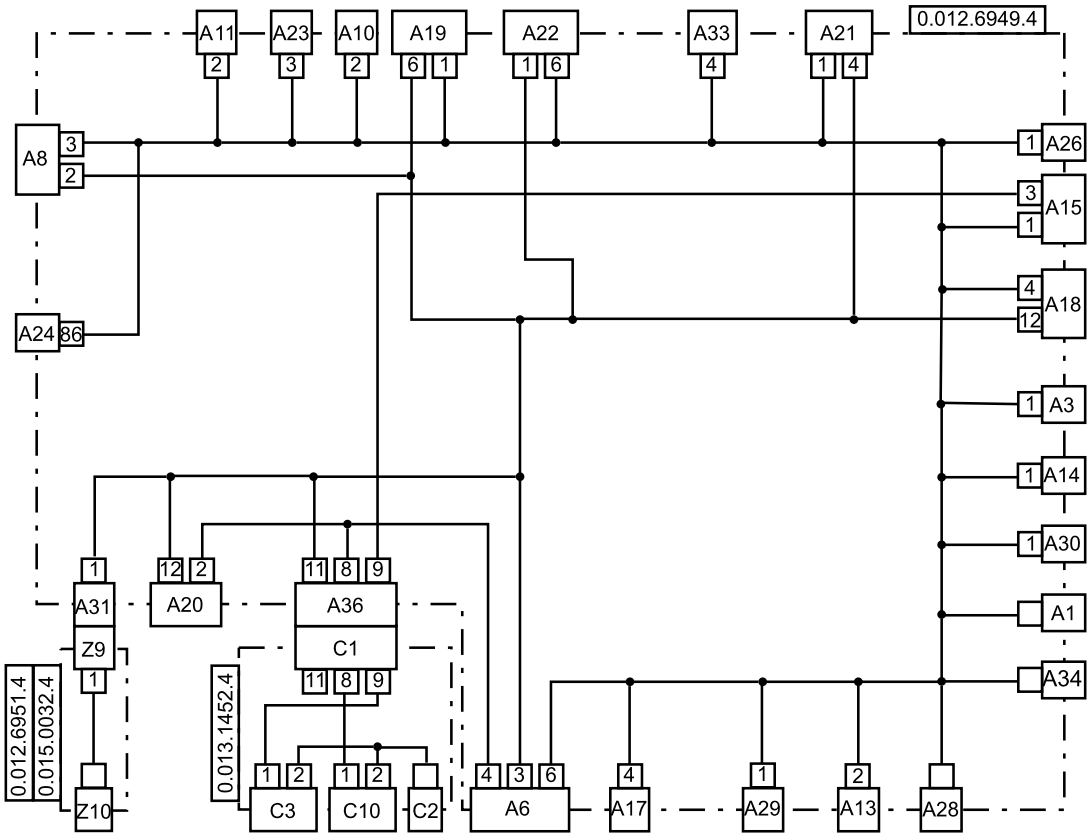


Fig. 1175 - Front axle differential lock

- A34 Earth
- A36 To rear wiring
- C1 To central wiring
- C2 Earth
- C3 4WD engagement light switch
- C10 Diff. lock engagement control solenoid
- Z9 To central wiring
- Z10 Engine stop solenoid

Wiring and connectors list

- 0.012.6949.4 - Central wiring
  - **See para. 40.4.11 - Central wiring - 0.012... - page 40-71**
  - **See para. 40.4.12 - Positions of central w... - page 40-74**
- 0.013.1452.4/10 - Rear wiring
  - **See para. 40.4.15 - Rear wiring - 0.013.14... - page 40-82**
  - **See para. 40.4.16 - Positions of rear wiri... - page 40-84**
- 0.015.0032.4 - Front wiring with cab / 0.012.6951.4 - Front wiring
  - **See para. 40.4.9 - Front wiring with cab - page 40-66**
  - **See para. 40.4.10 - Positions of front wir... - page 40-68**
  - **See para. 40.4.1 - Wiring harnesses - page 40-57**
  - **See para. 40.4.2 - Positions of front wir... - page 40-58**

40.3.10 - brakes

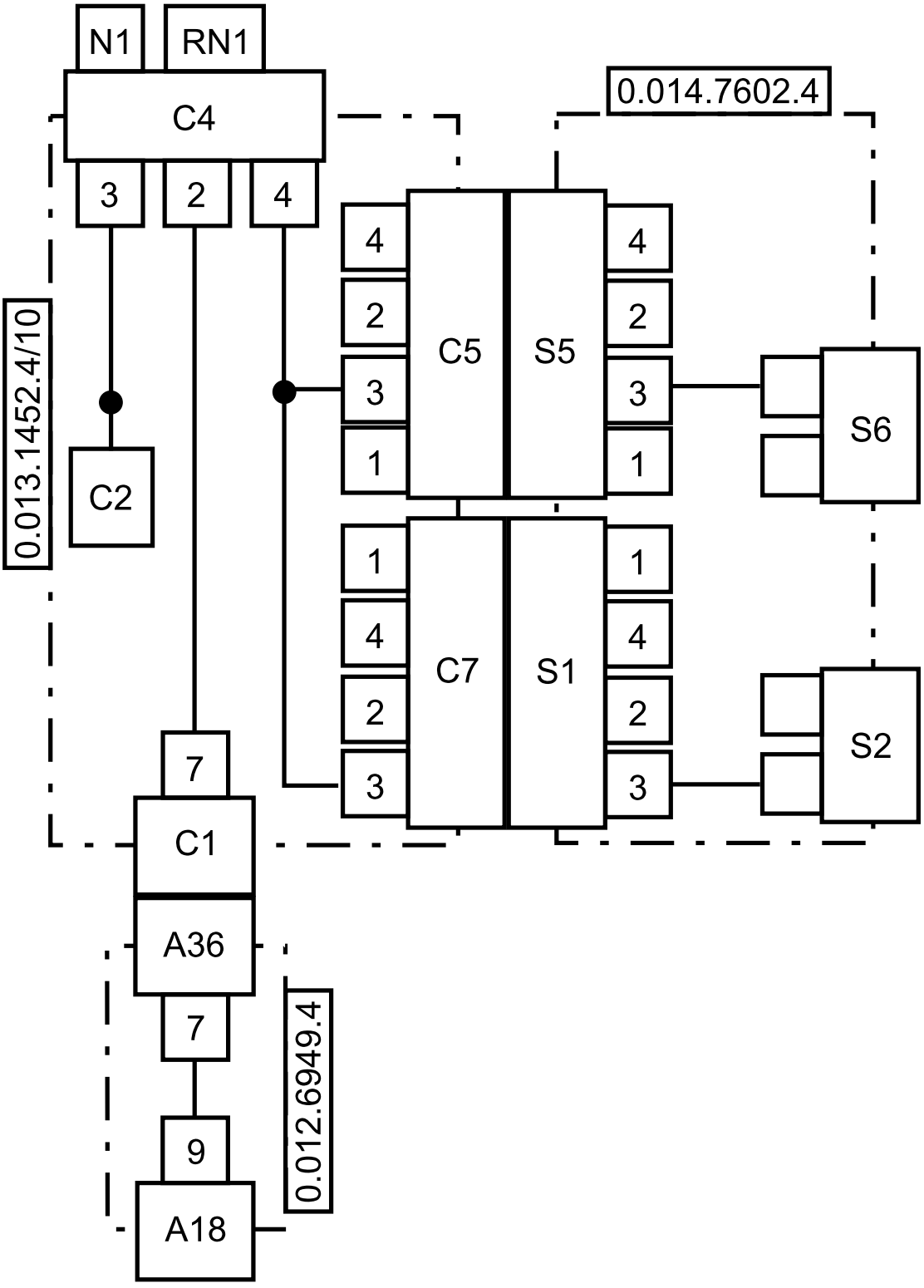


Fig. 1176 - Brakes

Key

- A18 Instrument panel
- A36 To rear wiring
- C1 To central wiring
- C2 Earth
- C4 Handbrake switch
- C5 RH rear light
- C7 LH rear socket

- S1 To rear wiring
- S2 To LH rear lights
- S5 To rear wiring
- S6 To RH rear lights

Wiring and connectors list

- 0.012.6949.4 - Central wiring
  - **See para. 40.4.11 - Central wiring - 0.012... - page 40-71**
  - **See para. 40.4.12 - Positions of central w... - page 40-74**
- 0.013.1452.4/10 - Rear wiring
  - **See para. 40.4.15 - Rear wiring - 0.013.14... - page 40-82**
  - **See para. 40.4.16 - Positions of rear wiri... - page 40-84**
- 0.014.7602.4 - Rear lights wiring
  - **See para. 40.4.18 - Rear lights wiring - 0... - page 40-86**
  - **See para. 40.4.19 - Positions of rear ligh... - page 40-87**

40.4 - WIrINg harNESSES

40.4.1 - Wiring harnesses

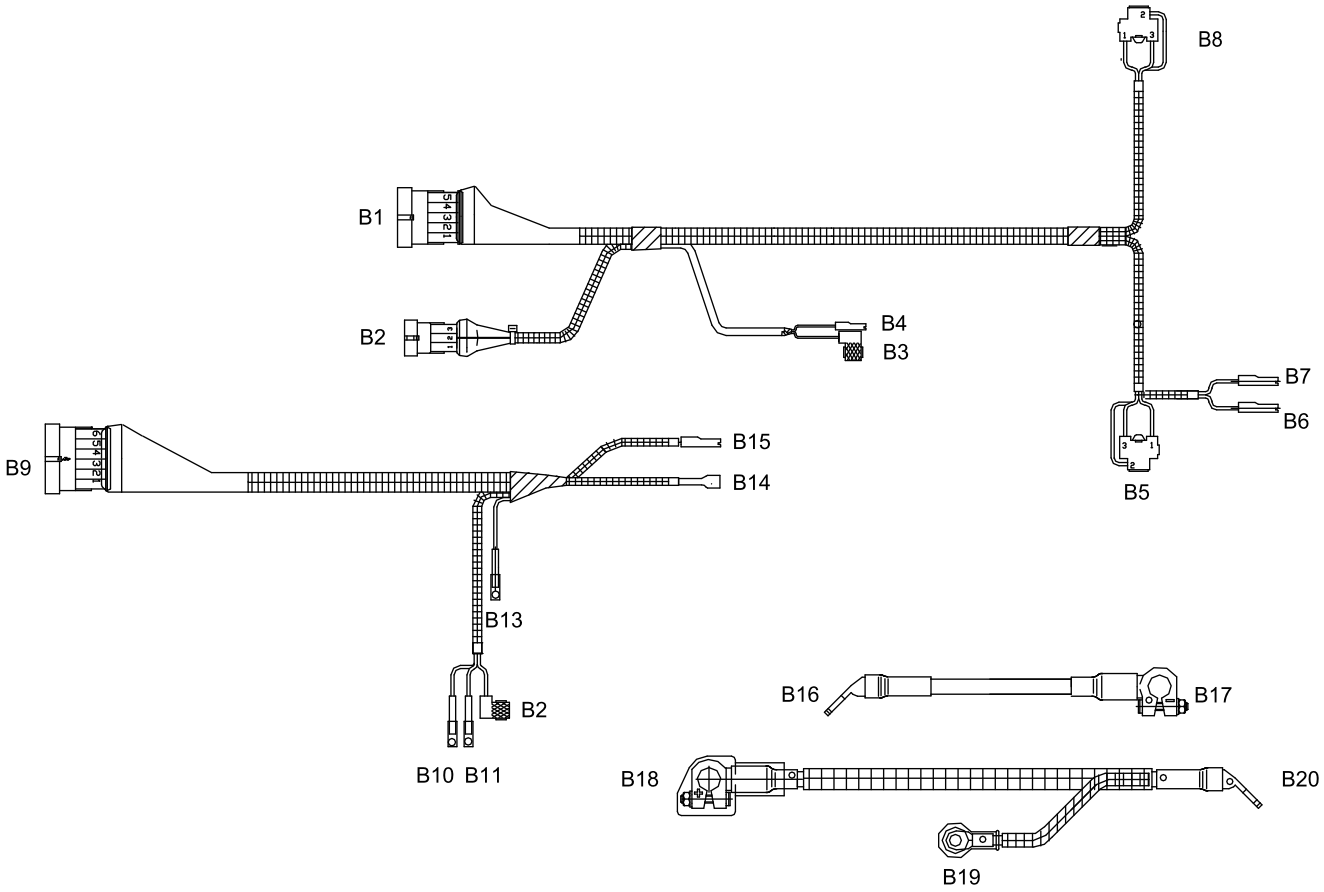


Fig. 1177 - Front wiring (1/2)

Connectors list

- B1 - To central wiring
- B2 - To central wiring
- B3 - Air cleaner clogging sensor
- B4 - Air cleaner clogging sensor
- B5 - RH front light
- B6 - Horn
- B7 - Horn
- B8 - LH front light
- B9 - To central wiring
- B10 - Engine stop solenoid
- B11 - Engine stop solenoid
- B12 - Engine oil pressure switch
- B13 - Fuel lift pump
- B14 - Coolant temperature sensor
- B15 - Coolant temperature sensor for warning light
- B16 - Earth
- B17 - Battery negative
- B18 - Battery positive
- B19 - Heatshrink sheath
- B20 - Earth

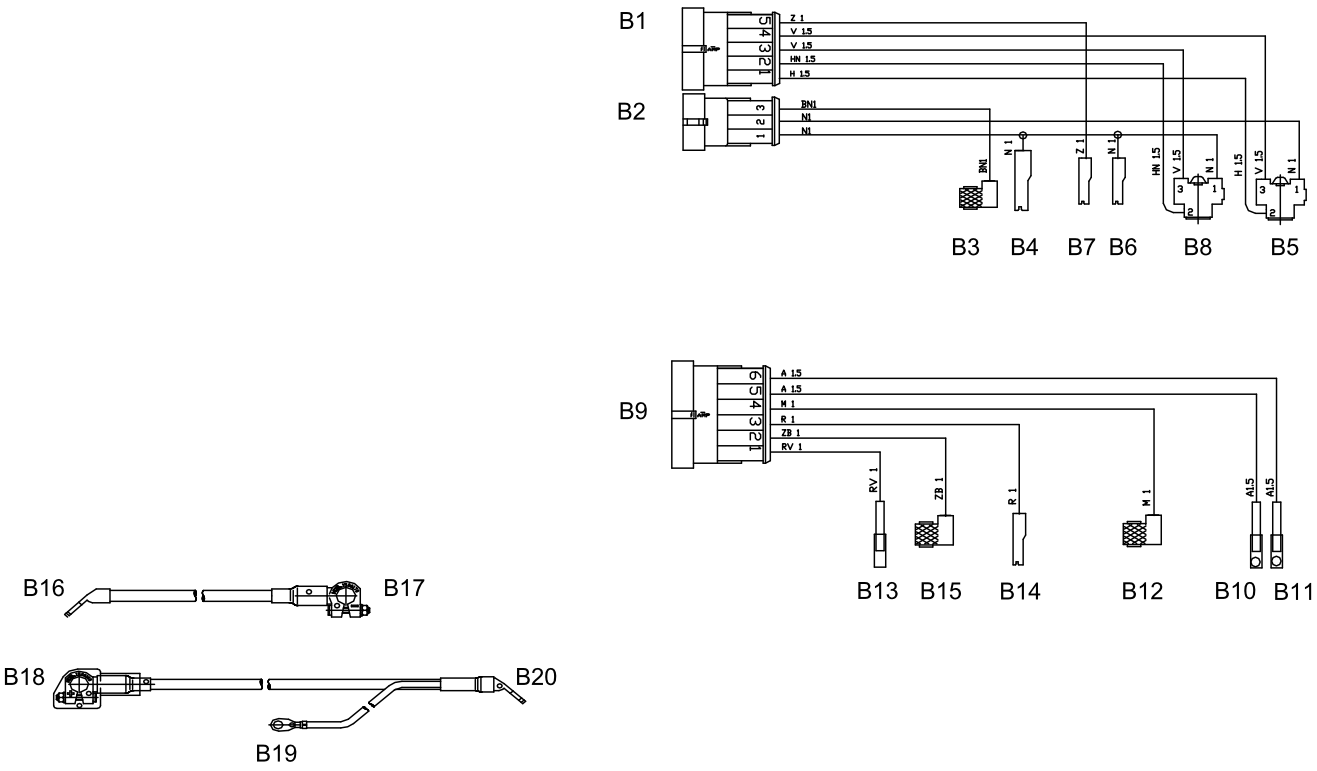


Fig. 1178 - Front wiring (2/2)

40.4.2 - Positions of front wiring connectors

View of wiring

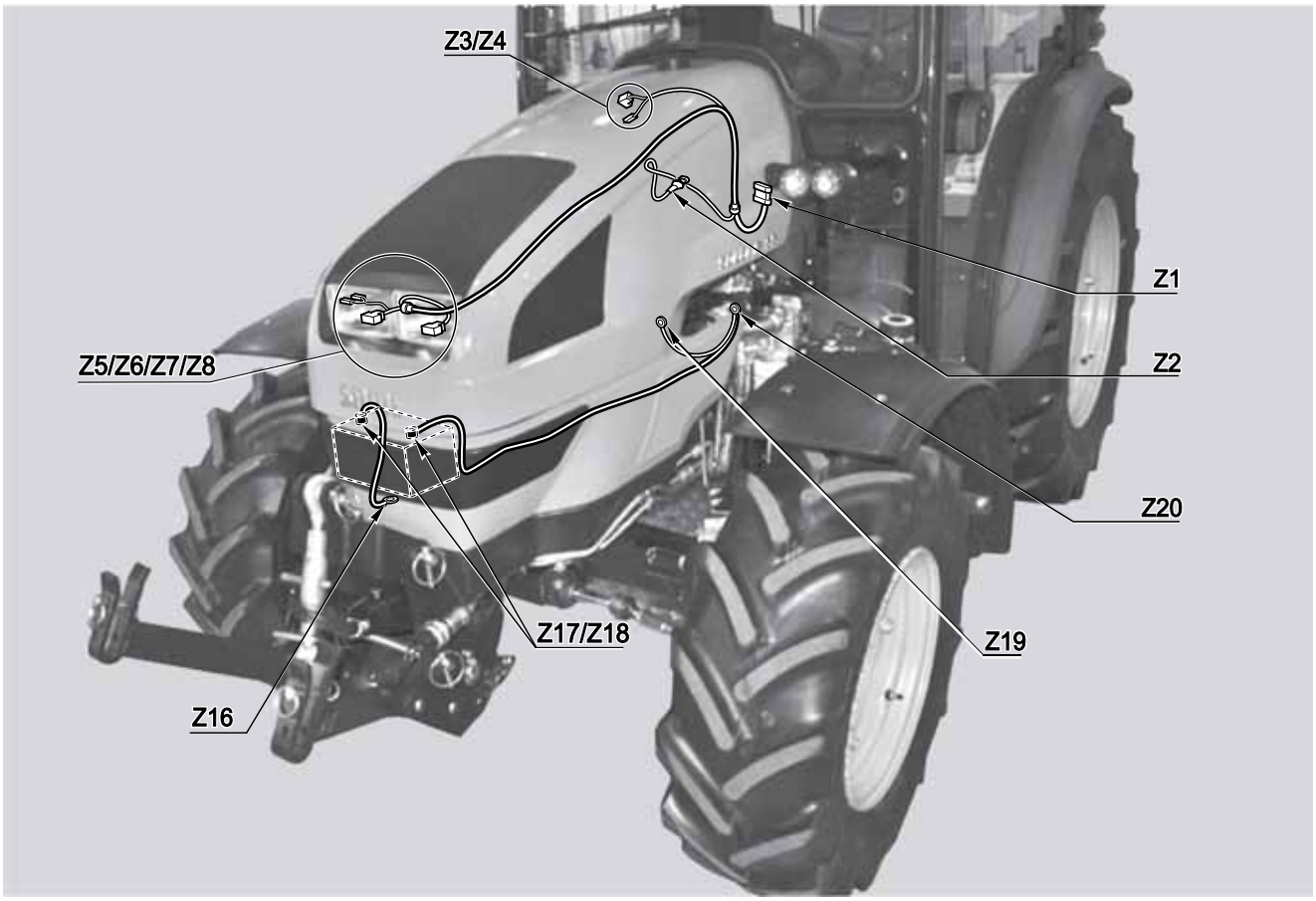


Fig. 1179 - Positions of front wiring connectors (1/2)

View of wiring

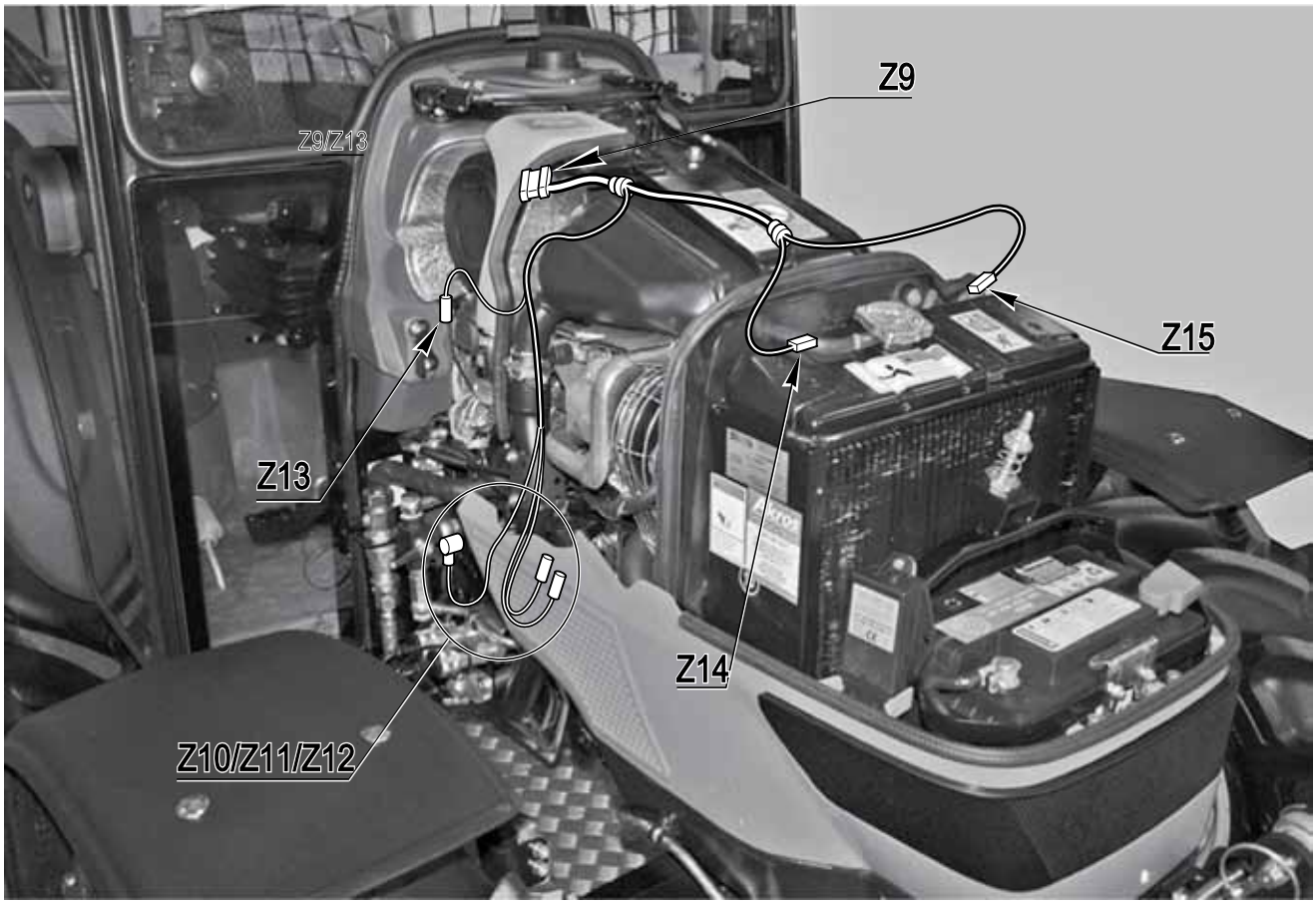


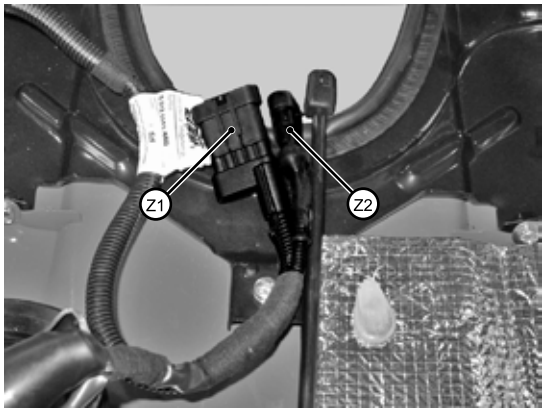
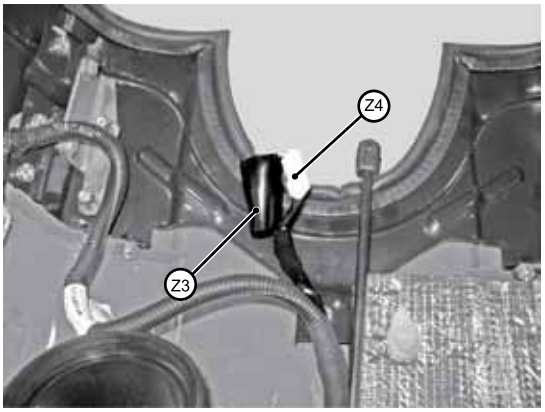
Fig. 1180 - Positions of front wiring connectors (2/2)

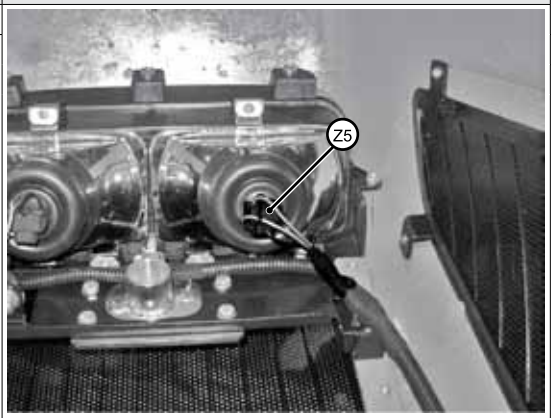
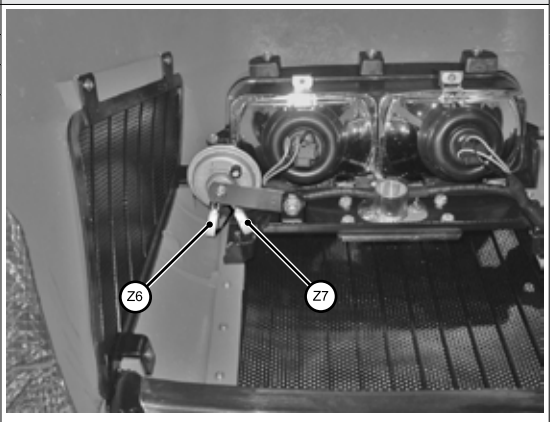
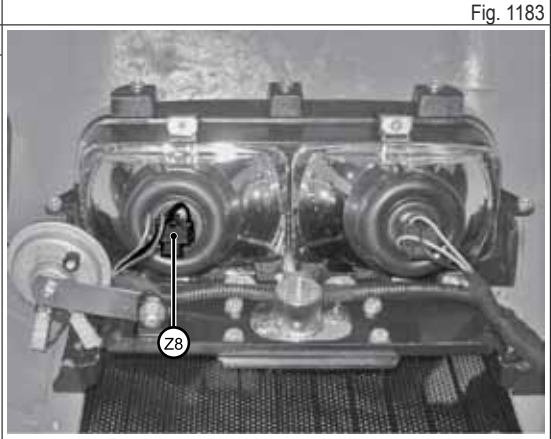
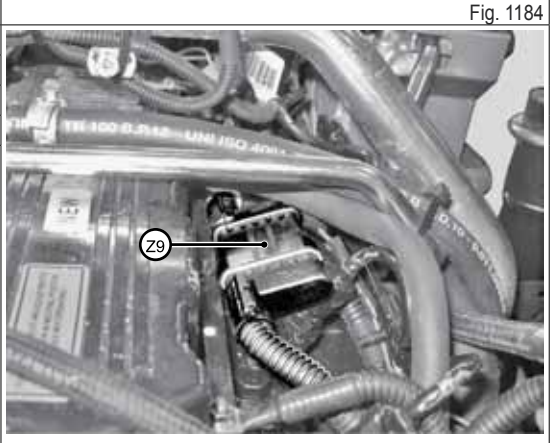
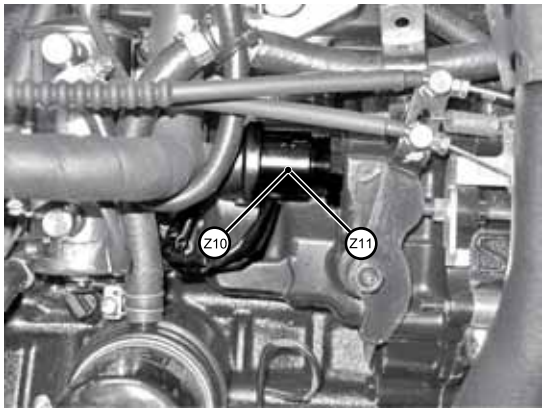
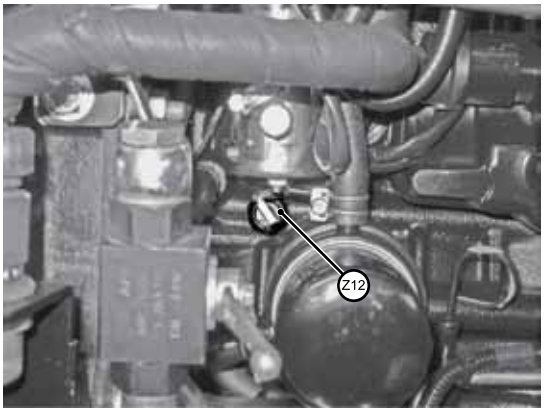
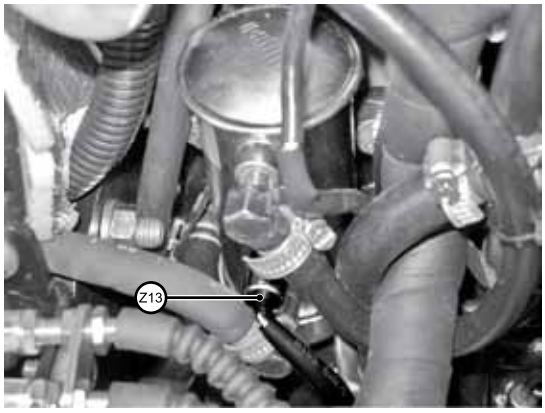
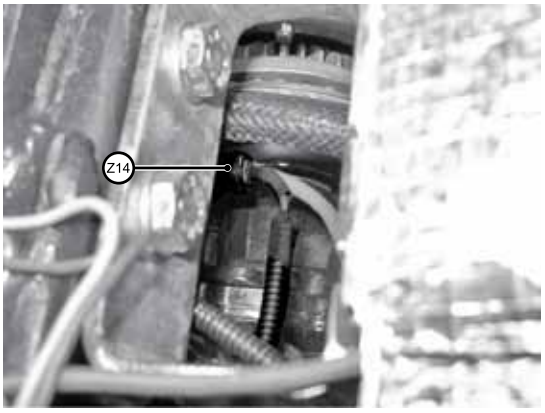
0.012.6951.4

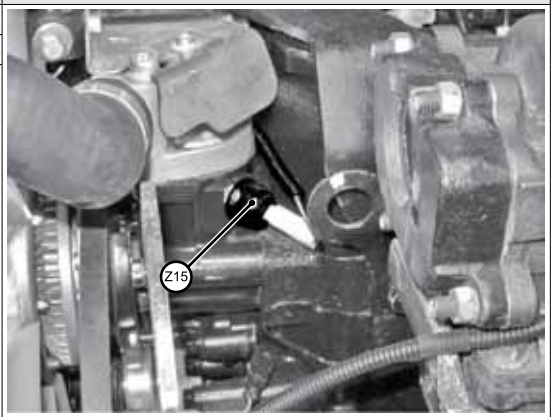
• **See para. 40.4.1 - Wiring harnesses - page 40-57**

Connector positions

Table 117

CONNEC-TOr/SYS-TEM	CONNECTOr POSITIONS	CONNEC-TOr/SYS-TEM	CONNECTOr POSITIONS
Z1 **40-40** Z2 **40-40** **40-43**	 Fig. 1181	Z3 **40-43** Z4 **40-40** **40-43**	 Fig. 1182

CONNEC-TOr/SYS-TEM	CONNECTOr POSITIONS	CONNEC-TOr/SYS-TEM	CONNECTOr POSITIONS
Z5 **40-40**	 Fig. 1183	Z6 **40-40** Z7 **40-40**	 Fig. 1184
Z8 **40-40**	 Fig. 1185	Z9 **40-37** **40-40** **40-52** **40-43**	 Fig. 1186
Z10 **40-52** **40-37** Z11 **40-37**	 Fig. 1187	Z12 **40-43**	 Fig. 1188
Z13 **40-39** **40-40** **40-43**	 Fig. 1189	Z14 **40-43**	 Fig. 1190

CONNEC-TOr/SYS-TEM	CONNECTOr POSITIONS	CONNEC-TOr/SYS-TEM	CONNECTOr POSITIONS
Z15 **40-39** **40-43**	 Fig. 1191	-	

40.4.3 - Front PTO wiring - 0.014.2645.4

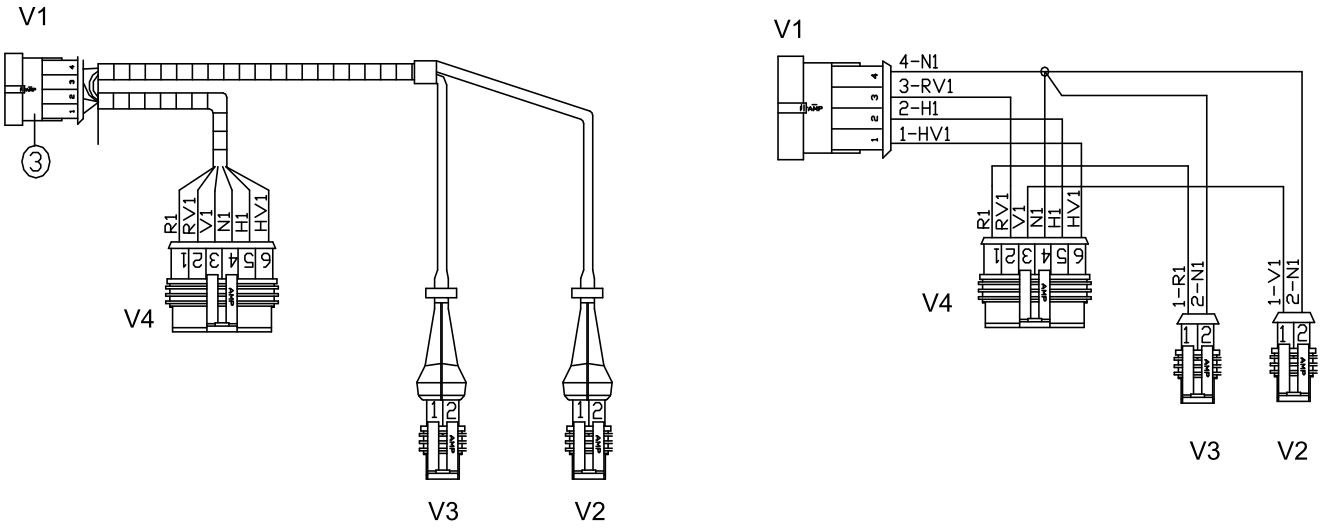


Fig. 1192 - Front PTO wiring

Connectors list

- V1 - To central wiring
- V2 - PTO brake
- V3 - PTO
- V4 - PTO switch

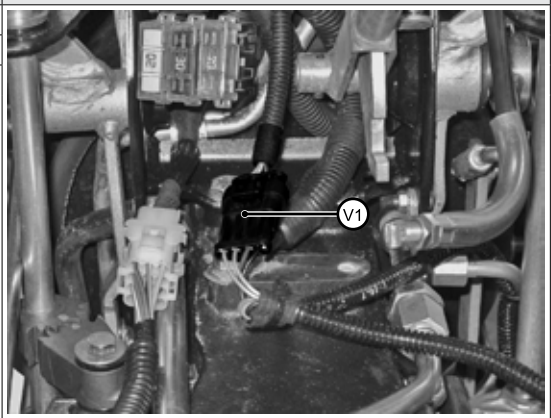
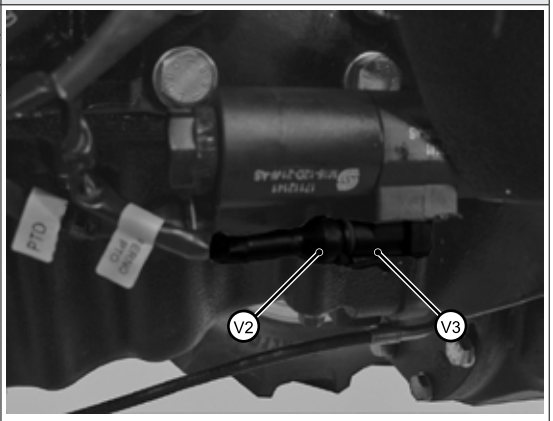
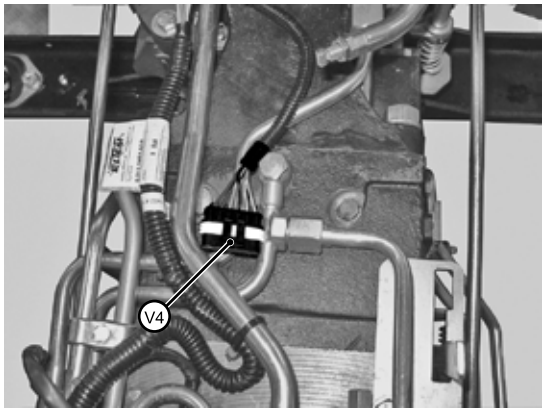
40.4.4 - Positions of front PTO wiring connectors.

0.014.2645.4

- **See para. 40.4.3 - Front PTO wiring - 0.0... - page 40-61**

Connector positions

Table 118

CONNEC-TOr/SYS-TEM	CONNECTOr POSITIONS	CONNEC-TOr/SYS-TEM	CONNECTOr POSITIONS
V1 **40-43** **40-50**	 Fig. 1193	V2 **40-50** V3 **40-50**	 Fig. 1194
V4 **40-50**	 Fig. 1195	-	

40.4.5 - Front lights wiring - 0.014.7599.4

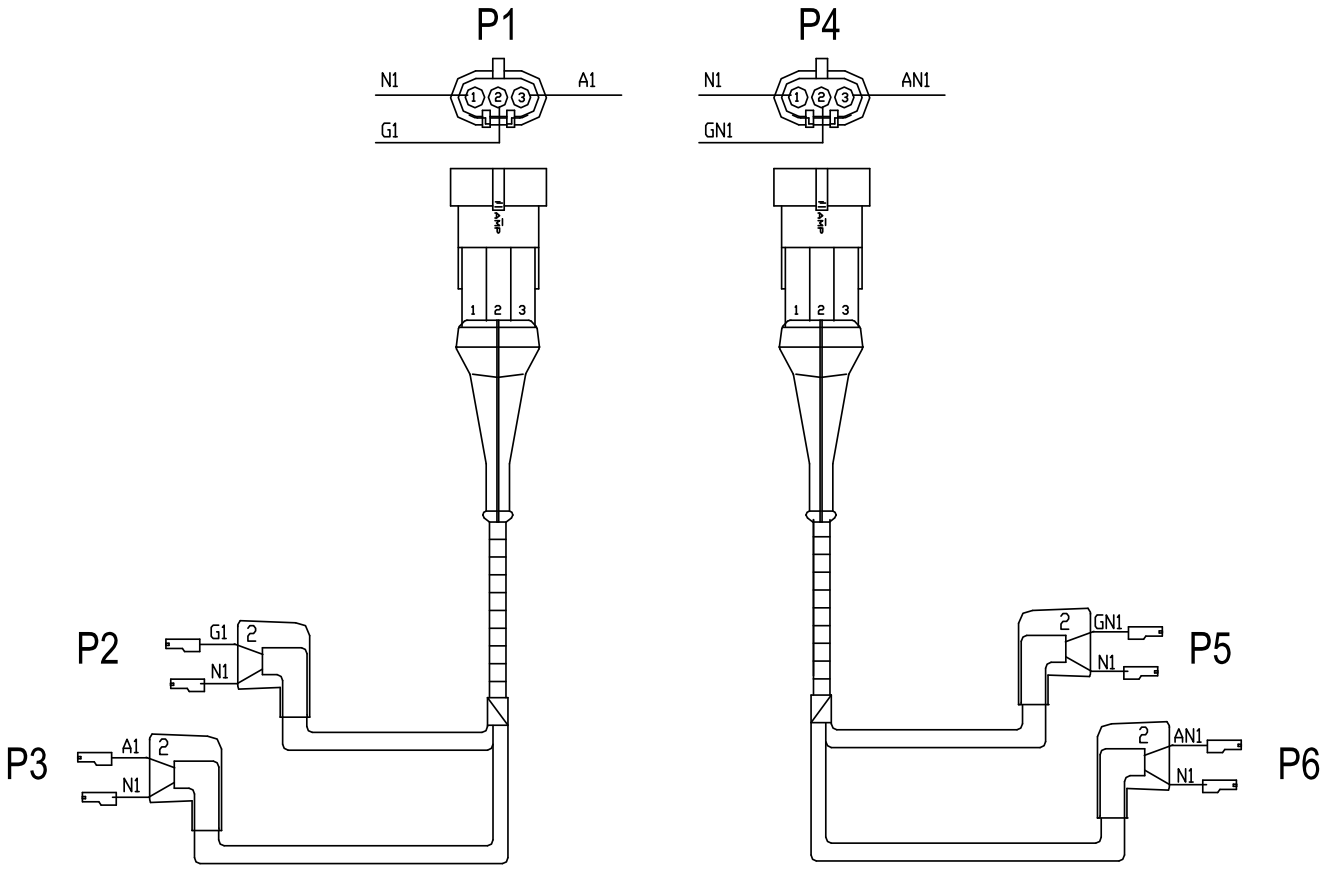


Fig. 1196 - Front lights wiring

Connectors list

- P1 - To front wiring
- P2 - To RH front lights
- P3 - To RH front lights
- P4 - To front wiring
- P5 - To LH front lights
- P6 - To LH front lights

40.4.6 - Positions of front light wiring connectors

View of wiring

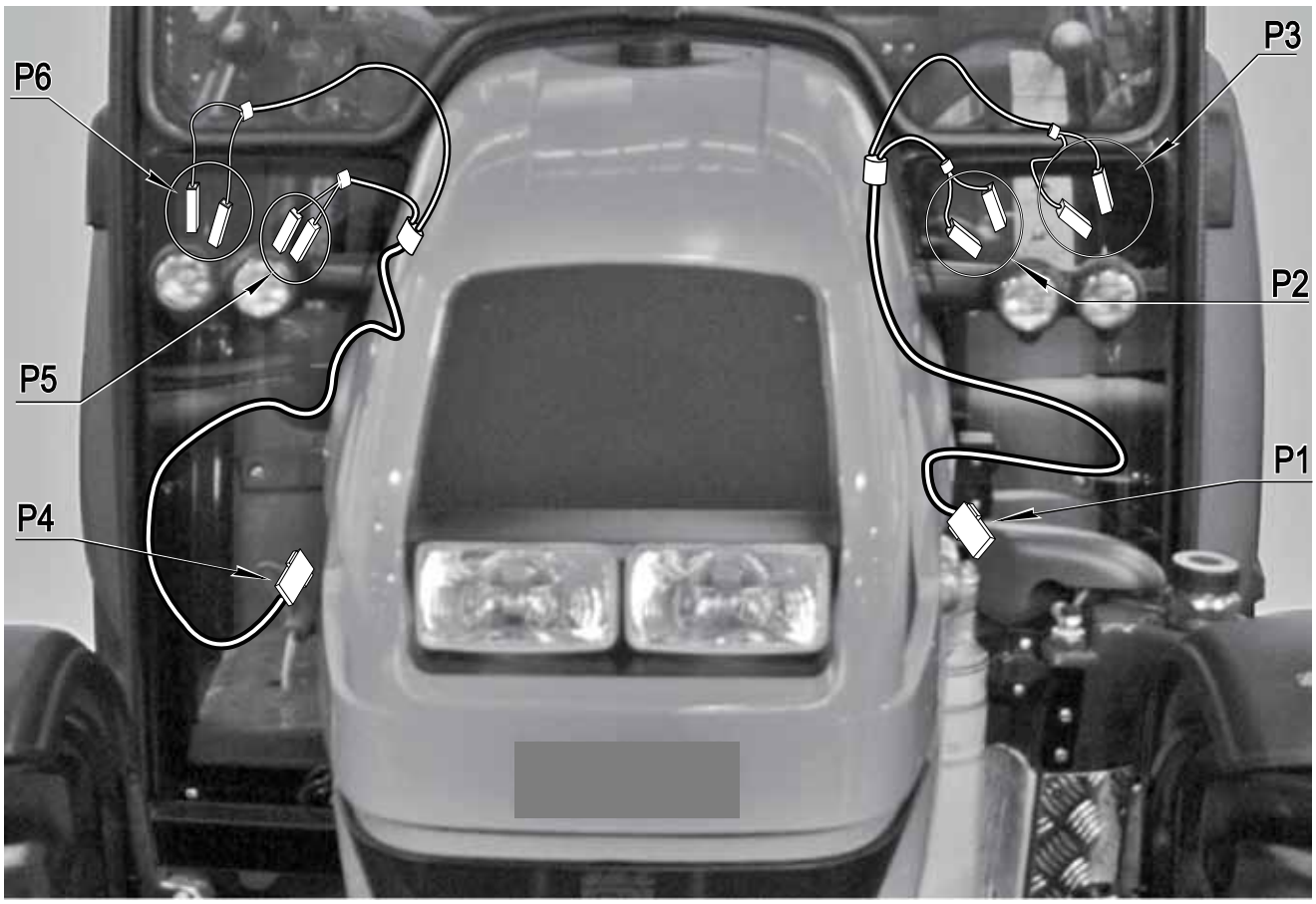


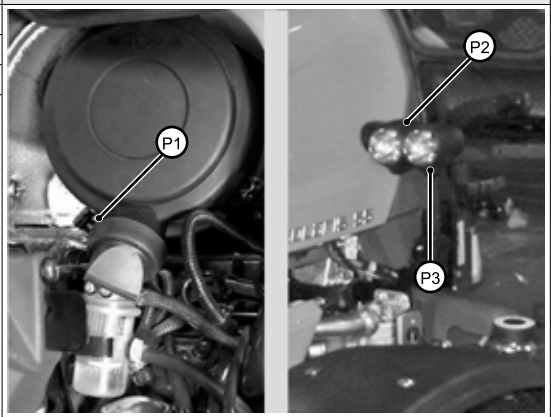
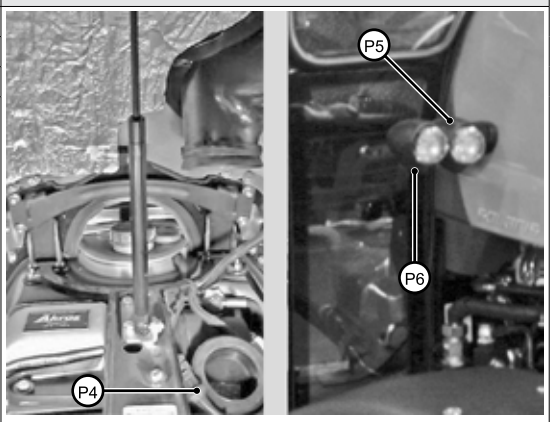
Fig. 1197 - Positions of front light wiring connectors

0.014.7599.4

- **See para. 40.4.5 - Front lights wiring - ... - page 40-62**

Connector positions

Table 119

CONNEC-TOr/SYS-TEM	CONNECTOr POSITIONS	CONNEC-TOr/SYS-TEM	CONNECTOr POSITIONS
P1 **40-40** P2 P3	 Fig. 1198	P4 **40-40** P5 P6	 Fig. 1199

40.4.7 - Compressor wiring - 0.014.7601.4

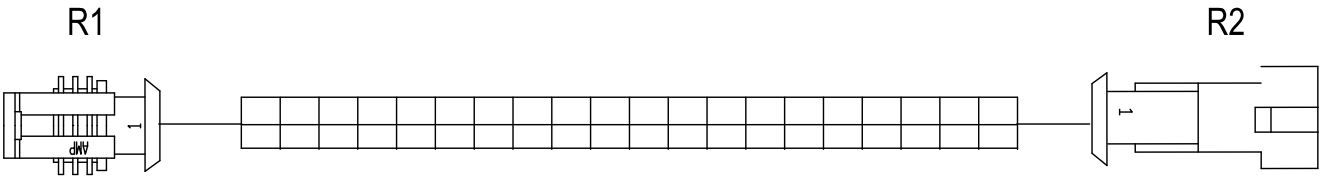


Fig. 1200 - Compressor wiring

Connectors list

- R1 - Connector
- R2 - Connector

40.4.8 - Positions of compressor wiring connectors

View of wiring

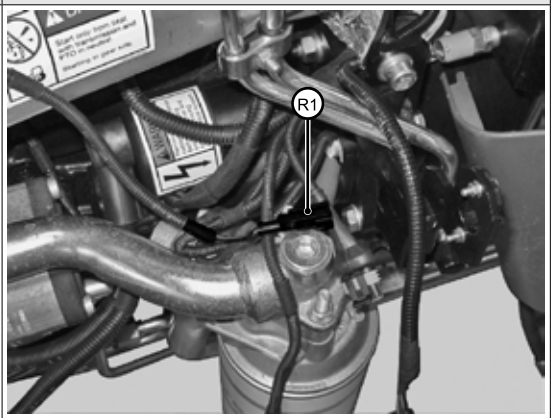
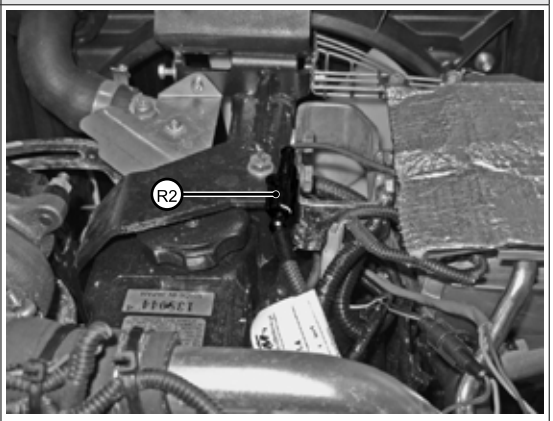
Fig. 1201 - Positions of compressor wiring connectors

0.014.7601.4

- **See para. 40.4.7 - Compressor wiring - 0.... - page 40-65**

Connector positions

Table 120

CONNEC-TOr/SYS-TEM	CONNECTOr POSITIONS	CONNEC-TOr/SYS-TEM	CONNECTOr POSITIONS
R1	 Fig. 1202	R2	 Fig. 1203

40.4.9 - Front wiring with cab

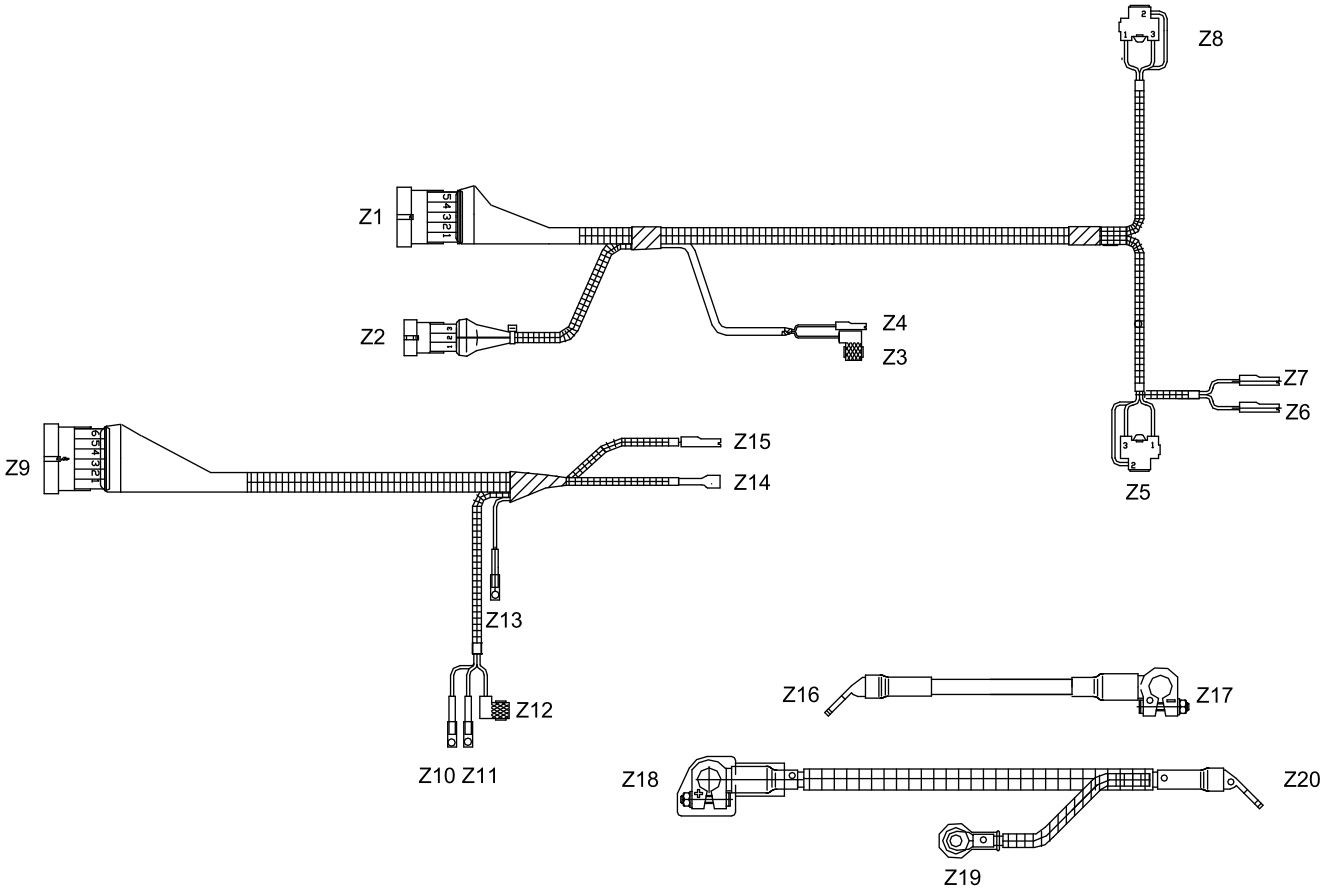


Fig. 1204 - Front wiring with cab (1/2)

Connectors list

- Z1 - To central wiring
- Z2 - To central wiring
- Z3 - Air cleaner clogging sensor
- Z4 - RH front light
- Z5 - Horn
- Z6 - LH headlight
- Z7 - To central wiring

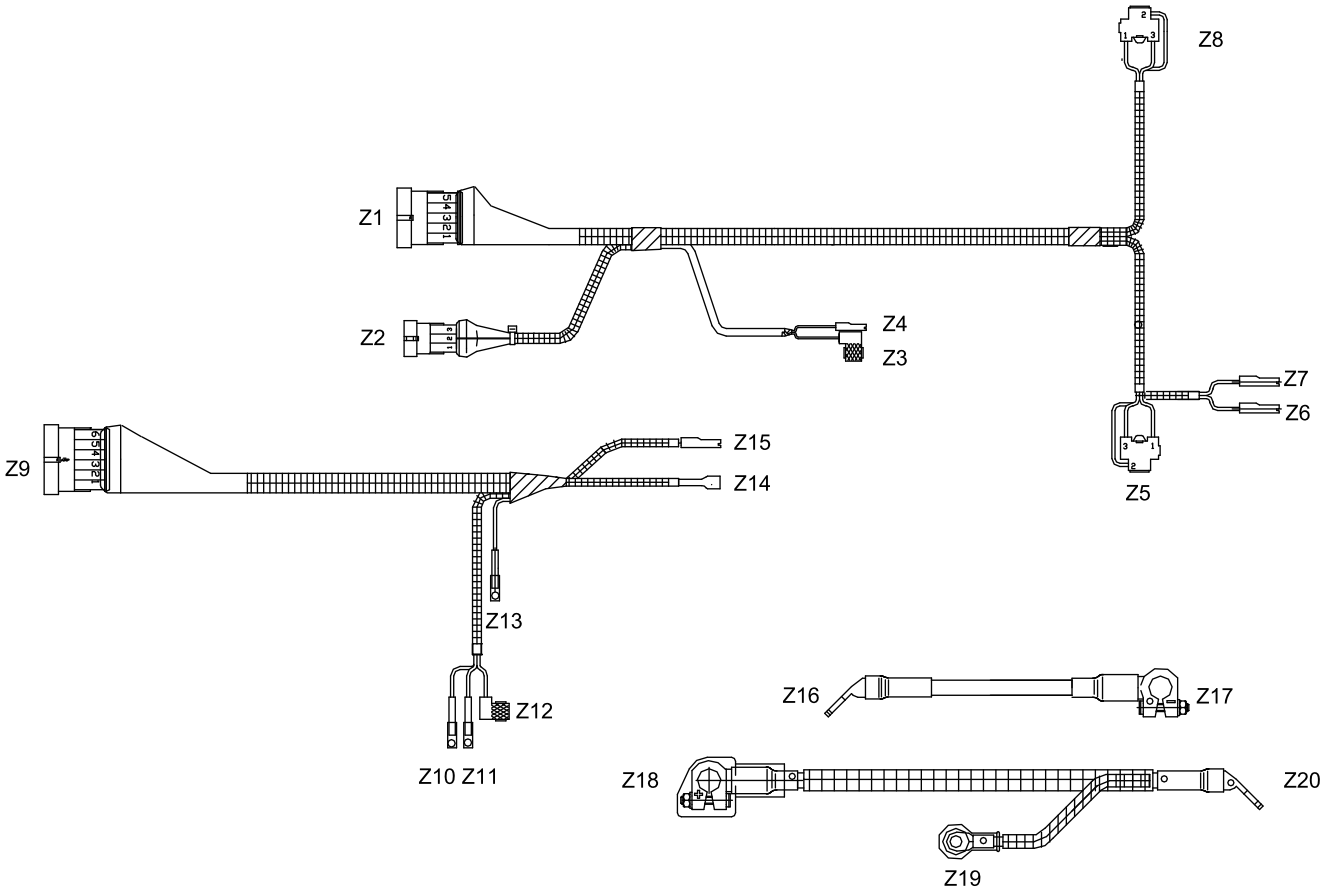


Fig. 1204 - Front wiring with cab (1/2)

- Z8 - Engine stop solenoid
- Z9 - Engine oil pressure switch
- Z10 - Fuel lift pump
- Z11 - Coolant temperature sensor
- Z12 - Coolant temperature sensor for warning light
- Z13 - Earth
- Z14 - Battery negative
- Z15 - Battery positive
- Z16 - Heatshrink sleeve
- Z17 - Earth

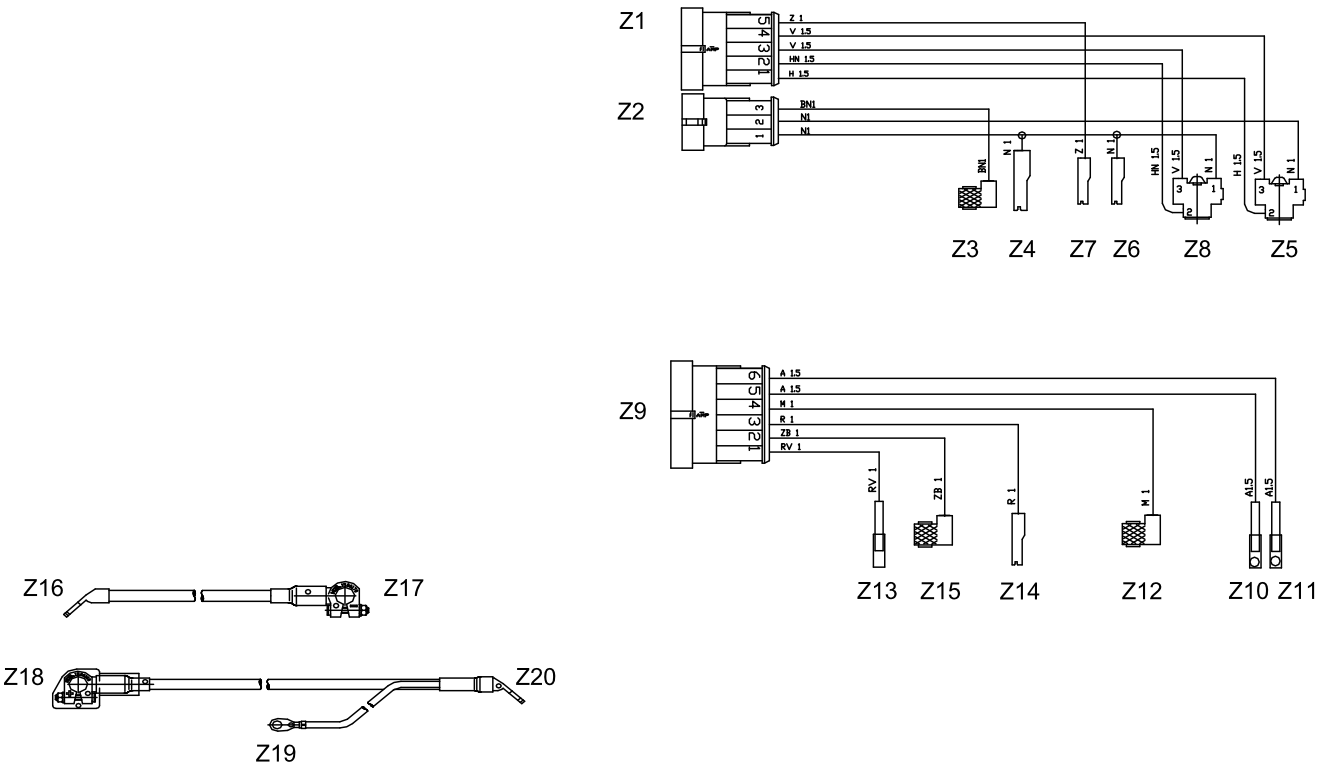


Fig. 1205 - Front wiring with cab (2/2)

40.4.10 - Positions of front wiring connectors with cab

View of wiring

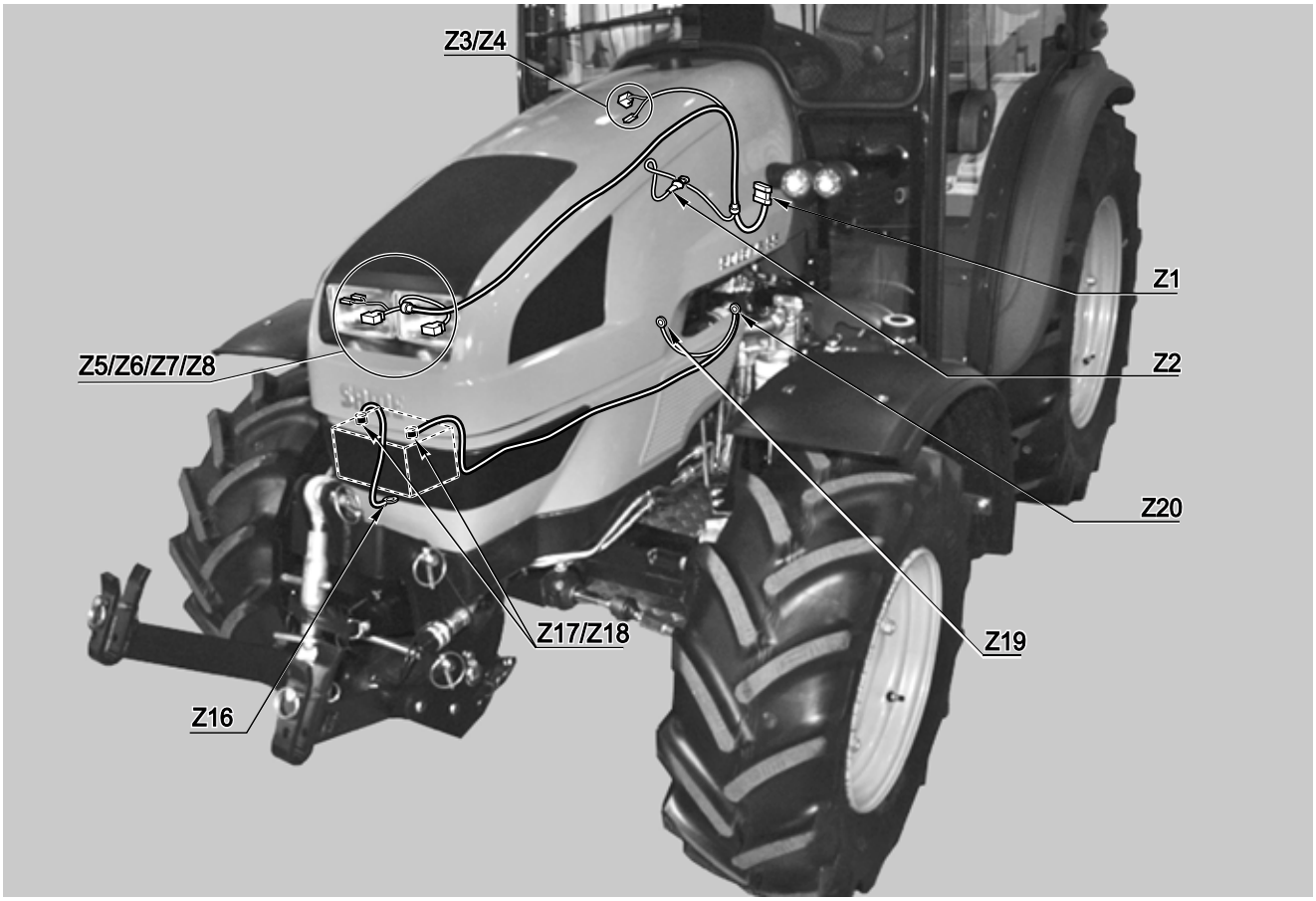


Fig. 1206 - Positions of front wiring connectors with cab (1/2)

View of wiring

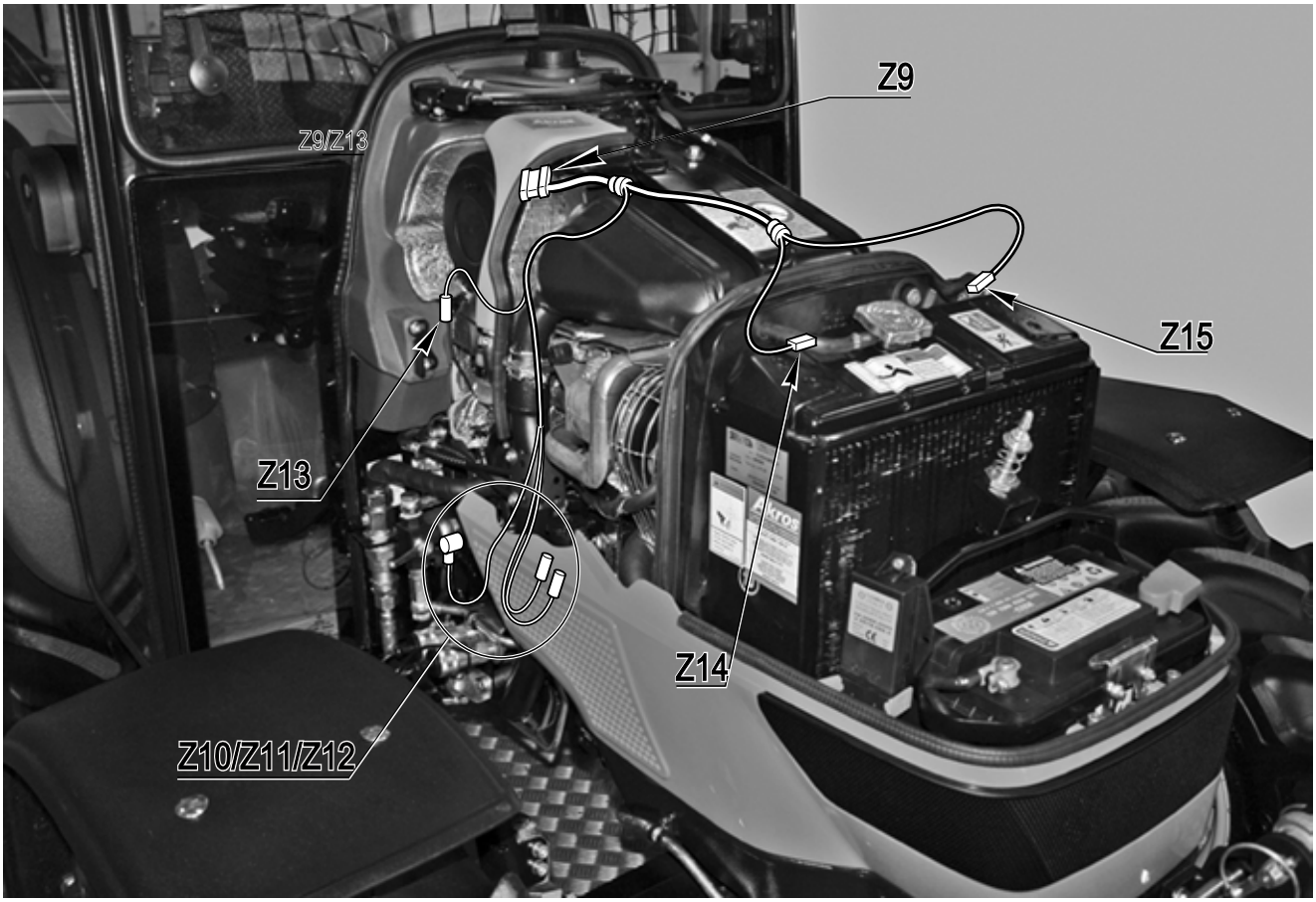


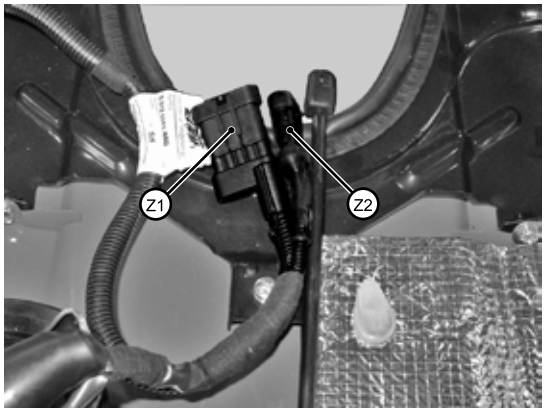
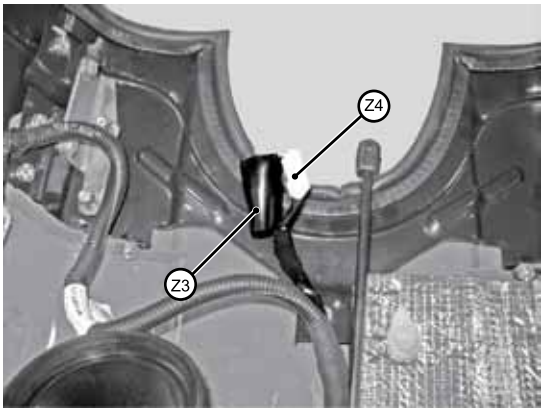
Fig. 1207 - Positions of front wiring connectors with cab (2/2)

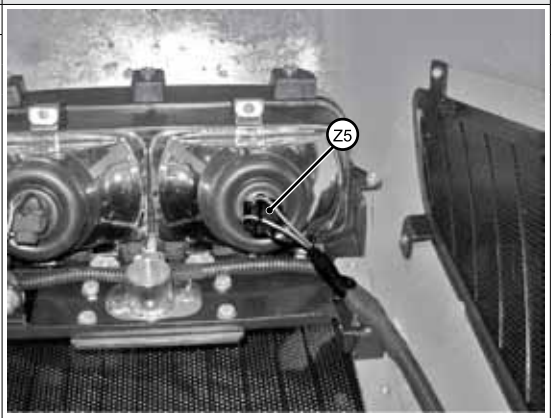
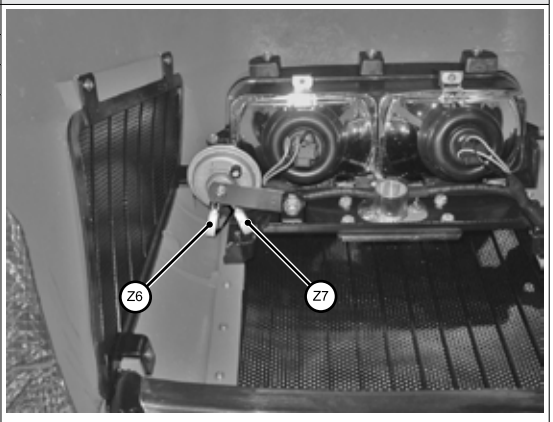
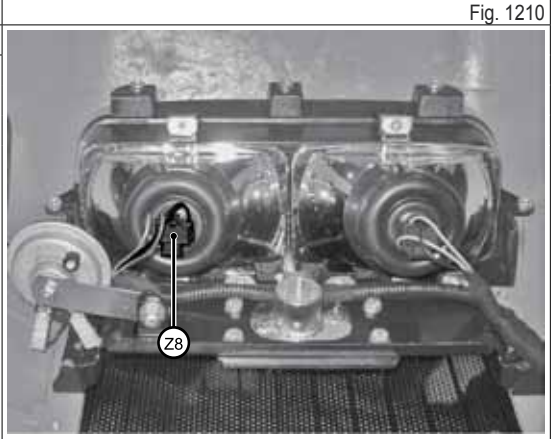
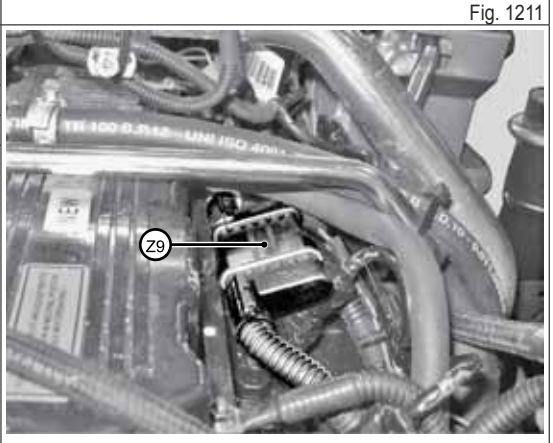
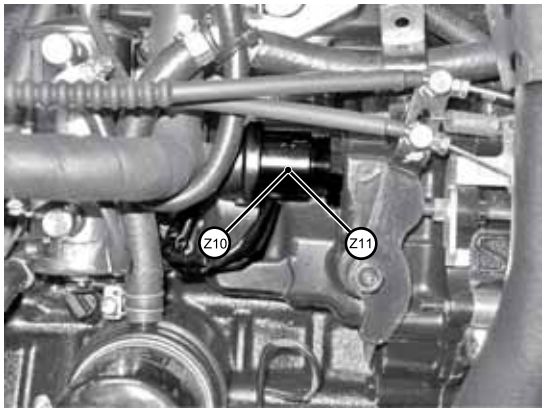
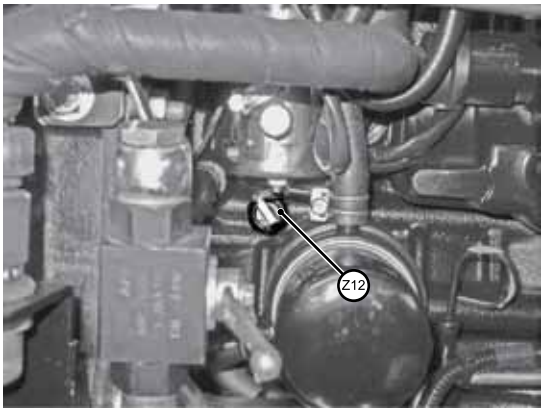
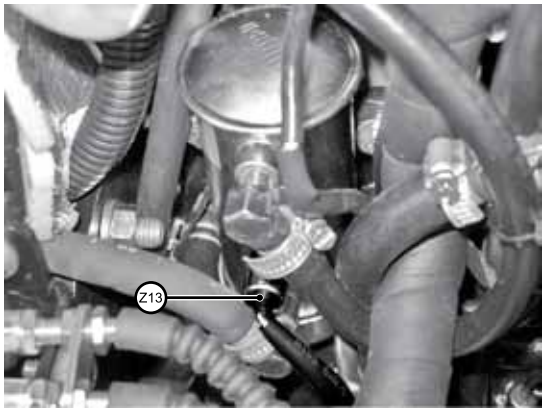
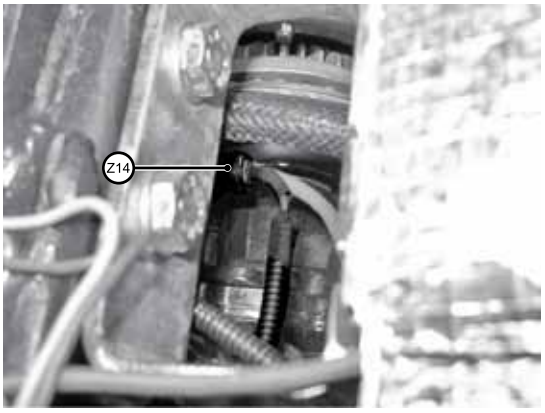
0.015.0032.4

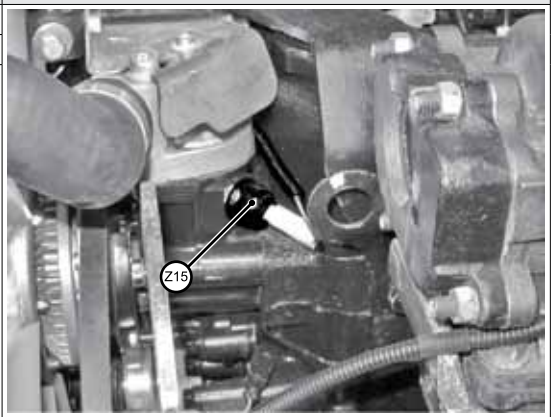
- **See para. 40.4.9 - Front wiring with cab - page 40-66**

Connector positions

Table 121

CONNEC-TOr/SYS-TEM	CONNECTOr POSITIONS	CONNEC-TOr/SYS-TEM	CONNECTOr POSITIONS
Z1 **40-40** Z2 **40-40** **40-43**	 Fig. 1208	Z3 **40-43** Z4 **40-40** **40-43**	 Fig. 1209

CONNEC-TOr/SYS-TEM	CONNECTOr POSITIONS	CONNEC-TOr/SYS-TEM	CONNECTOr POSITIONS
Z5 **40-40**	 Fig. 1210	Z6 **40-40** Z7 **40-40**	 Fig. 1211
Z8 **40-40**	 Fig. 1212	Z9 **40-37** **40-40** **40-52** **40-43**	 Fig. 1213
Z10 **40-52** **40-37** Z11 **40-37**	 Fig. 1214	Z12 **40-43**	 Fig. 1215
Z13 **40-39** **40-40** **40-43**	 Fig. 1216	Z14 **40-43**	 Fig. 1217

CONNEC-TOr/SYS-TEM	CONNECTOr POSITIONS	CONNEC-TOr/SYS-TEM	CONNECTOr POSITIONS
Z15 **40-39** **40-43**	 Fig. 1218	-	

40.4.11 - Central wiring - 0.012.6949.4

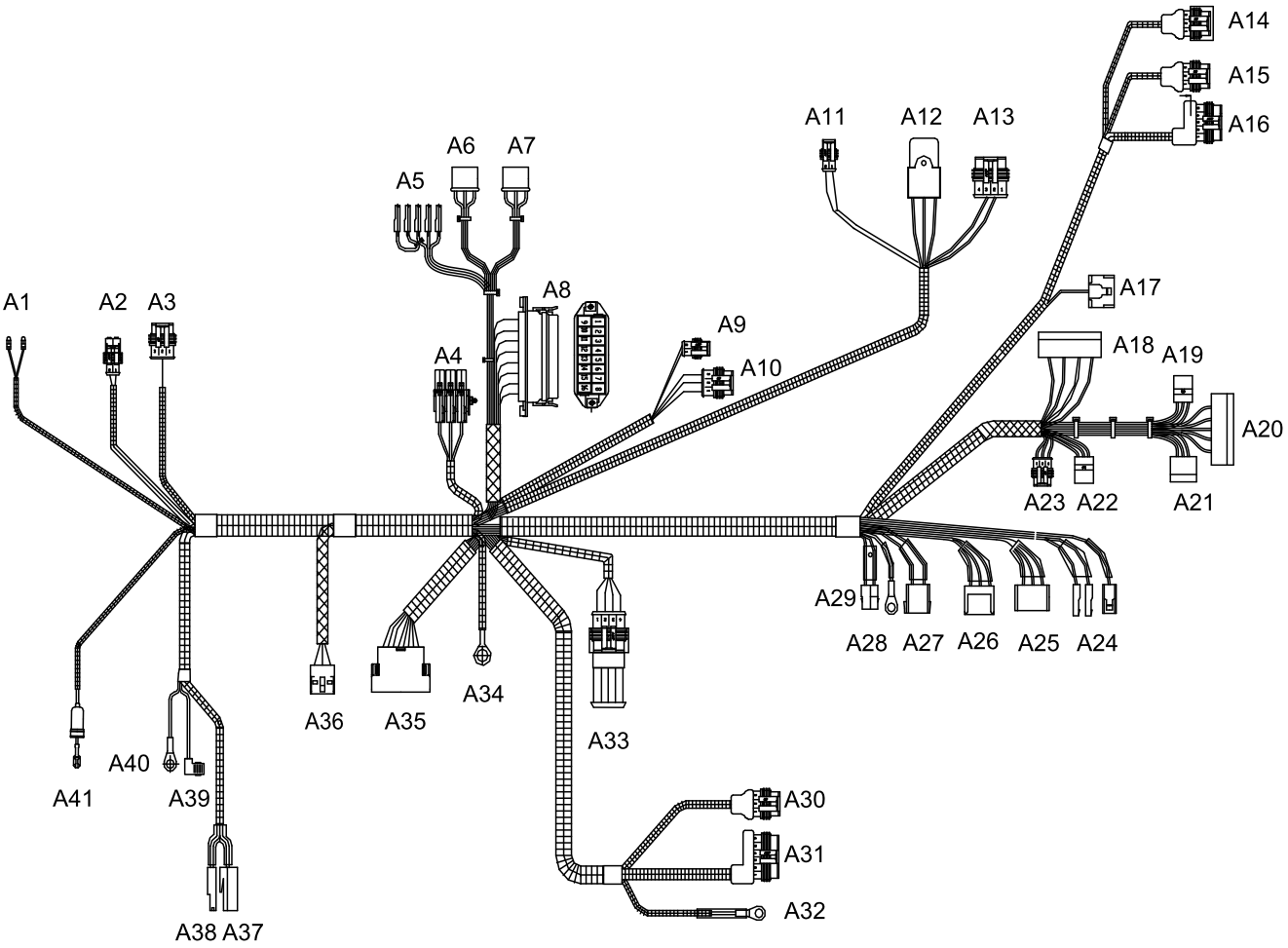


Fig. 1219 - Central wiring (1/2)

Connectors list

- A1 - 12 volt external outlet socket
- A2 - Cab power supply
- A3 - LH light
- A4 - Maxi fuses
- A5 - Starter switch
- A6 - Differential switch
- A7 - Emergency switch
- A8 - Fusebox

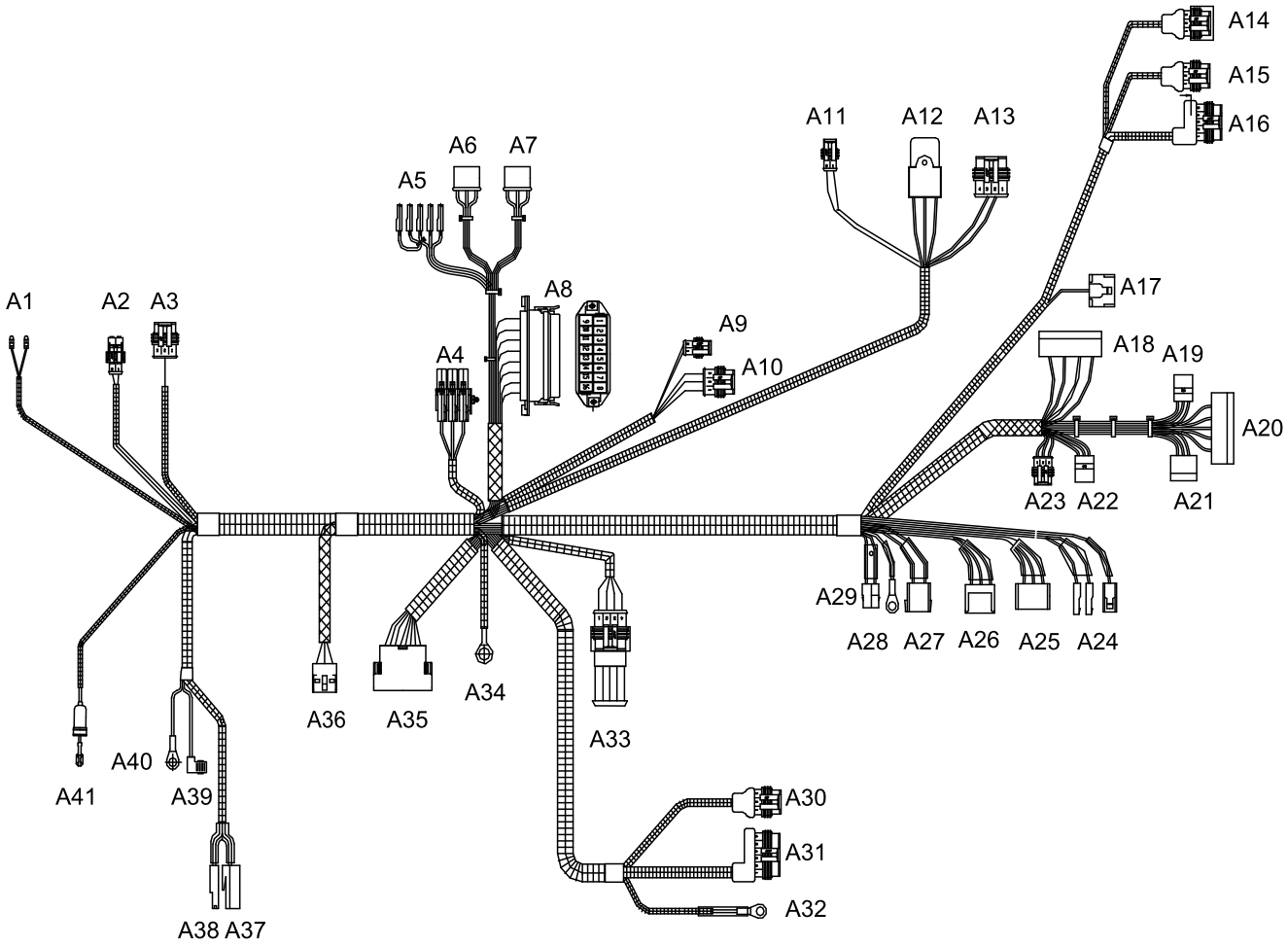


Fig. 1219 - Central wiring (1/2)

- A9 - Clutch enable switch
- A10 - Clutch enable switch
- A11 - Clutch
- A12 - Relay
- A13 - Brakes
- A14 - LH light
- A15 - To front wiring
- A16 - To front wiring
- A17 - Preheating relay control unit
- A18 - Instrument panel
- A19 - Coolant temperature gauge
- A20 - Instrument panel
- A21 - Rev counter
- A22 - Fuel gauge
- A23 - Fuel level float switch
- A24 - Preheating relay
- A25 - Steering column switch
- A26 - Flasher
- A27 - Engine Stop control unit
- A28 - Earth
- A29 - Engine Stop
- A30 - RH light
- A31 - To front wiring
- A32 - Glowplugs
- A33 - Front PTO
- A34 - Earth
- A35 - Joint connector
- A36 - To rear wiring
- A37 - Alternator

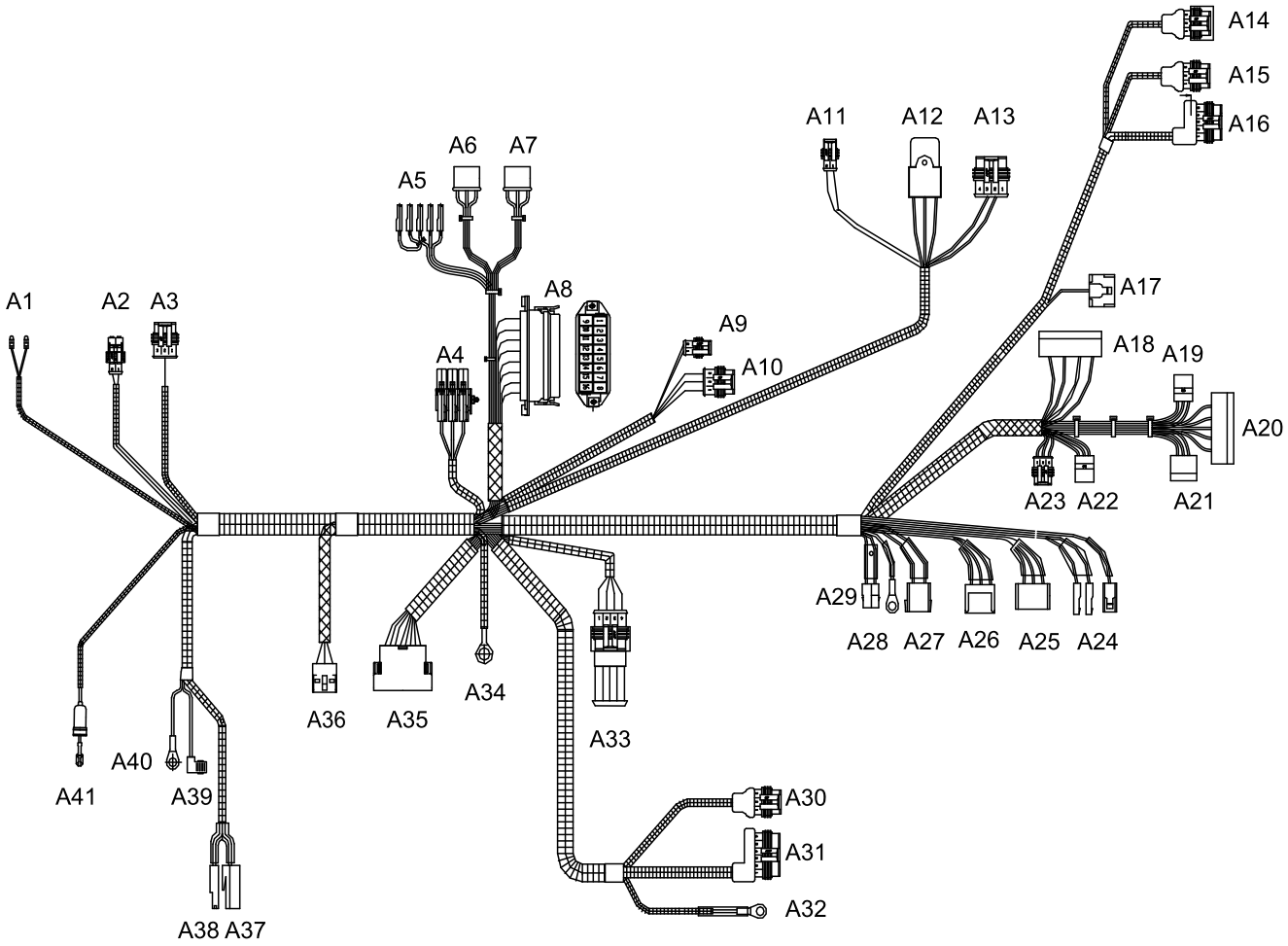


Fig. 1219 - Central wiring (1/2)

- A38 - Alternator
- A39 - Starter motor
- A40 - Starter motor
- A41- Oil filter

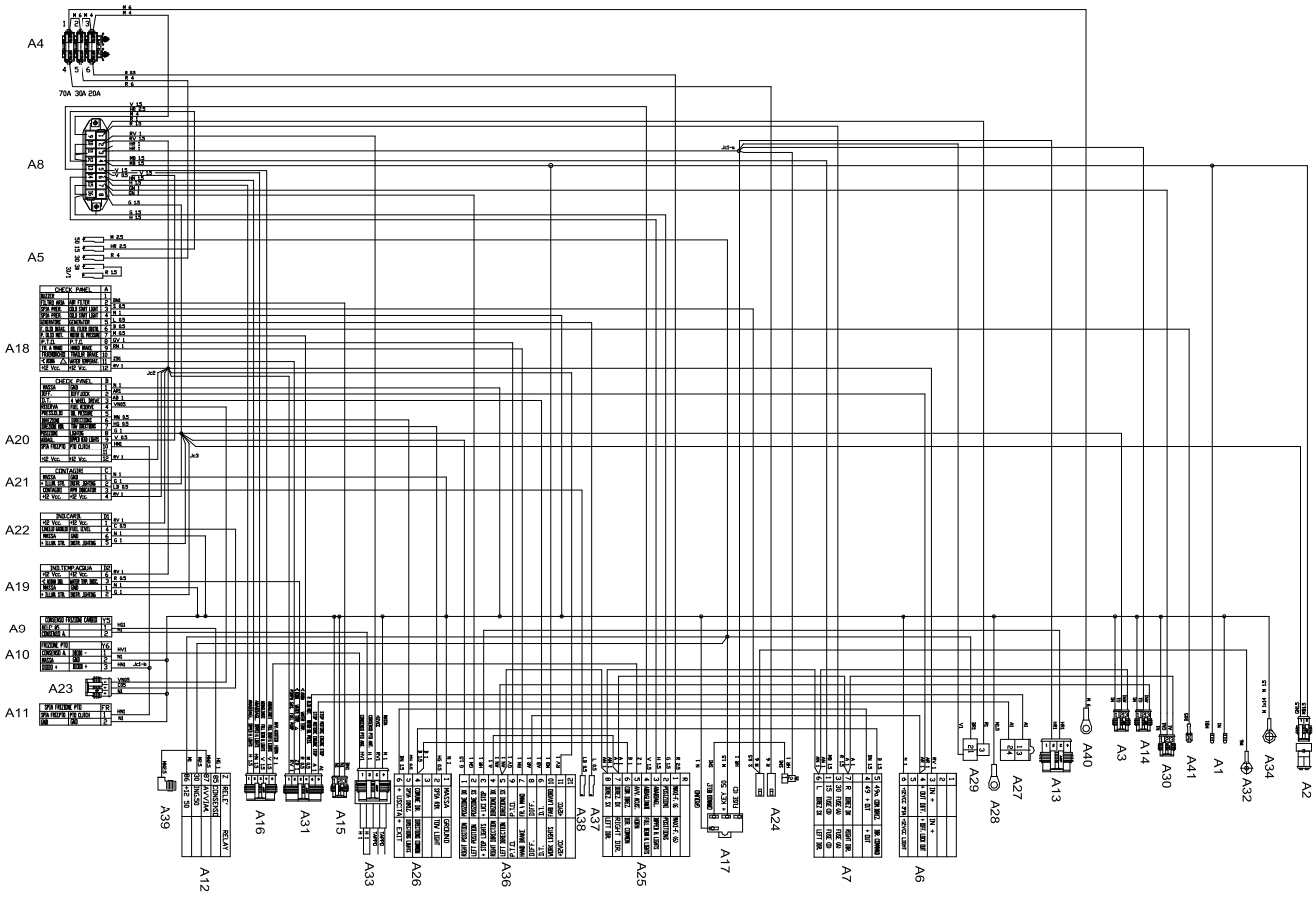


Fig. 1220 - Central wiring (2/2)

40.4.12 - Positions of central wiring connectors

View of wiring

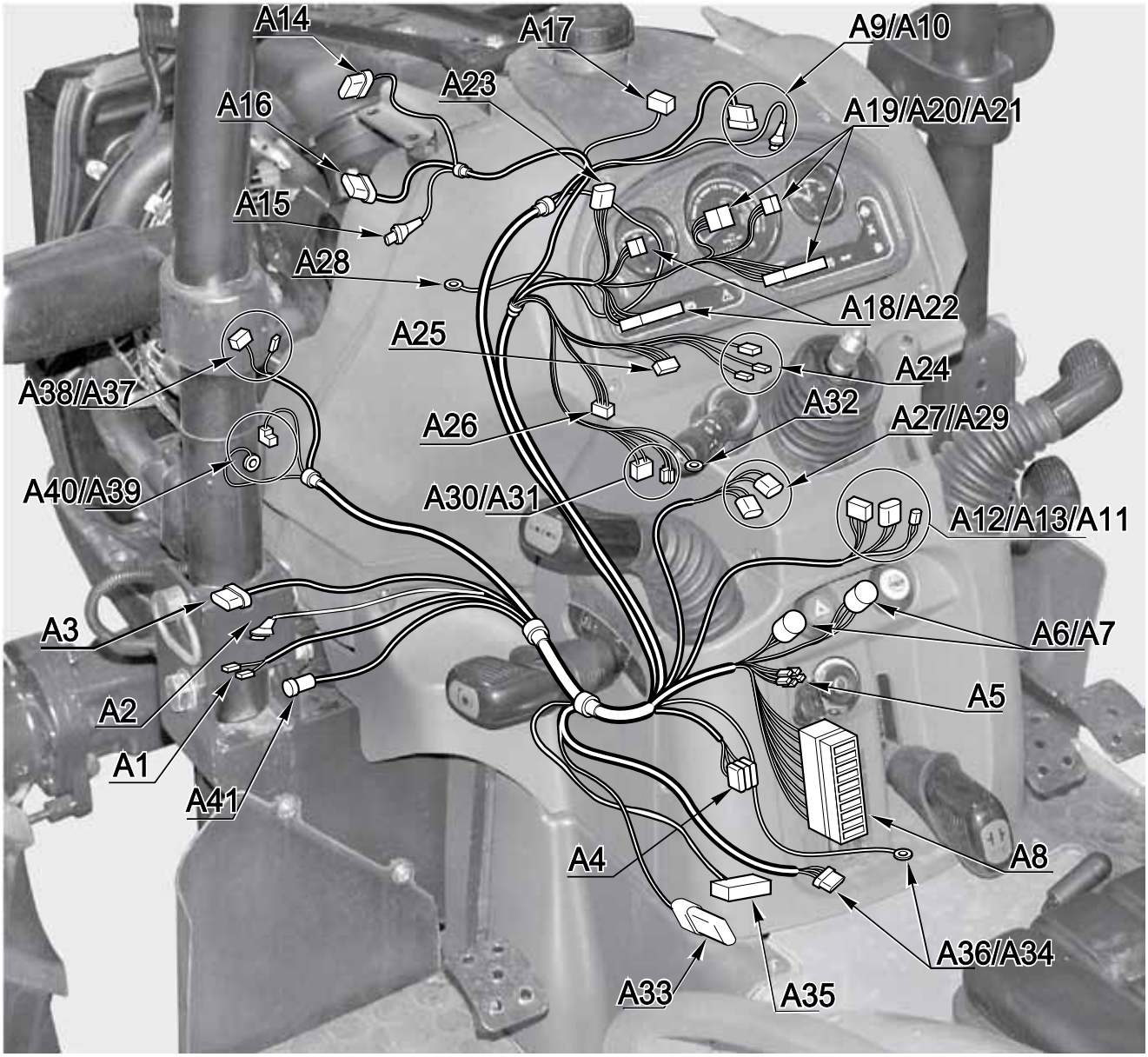


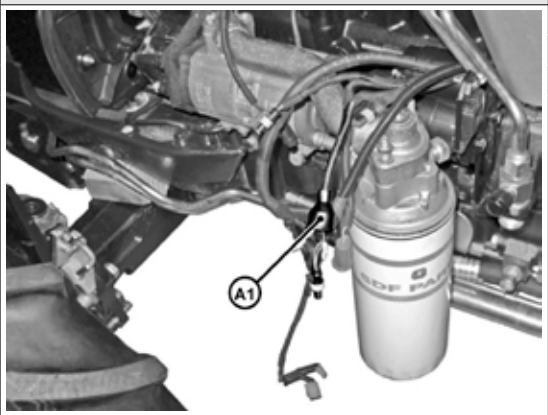
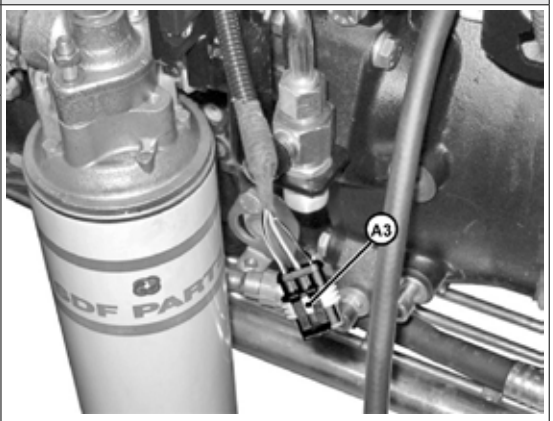
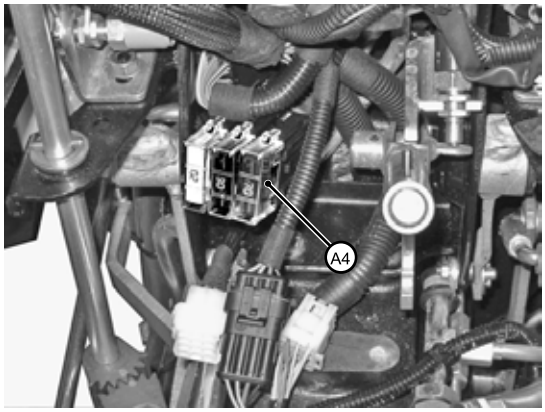
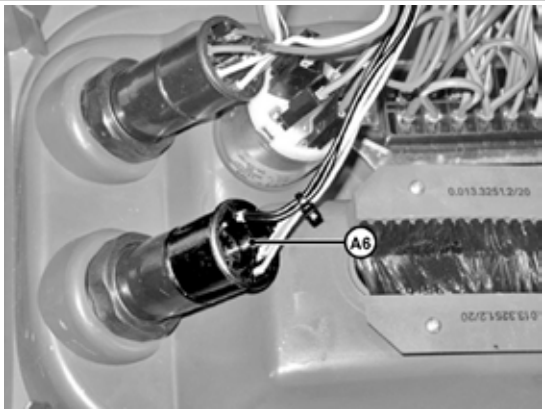
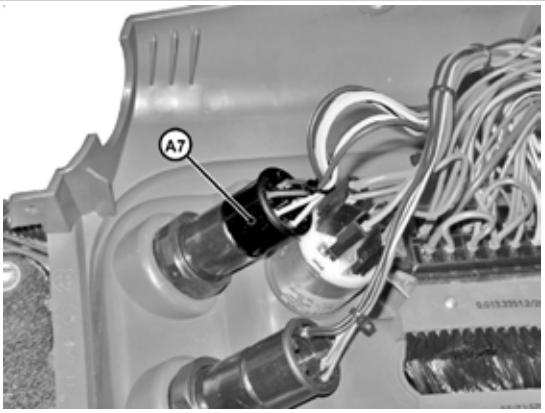
Fig. 1221 - Positions of central wiring connectors

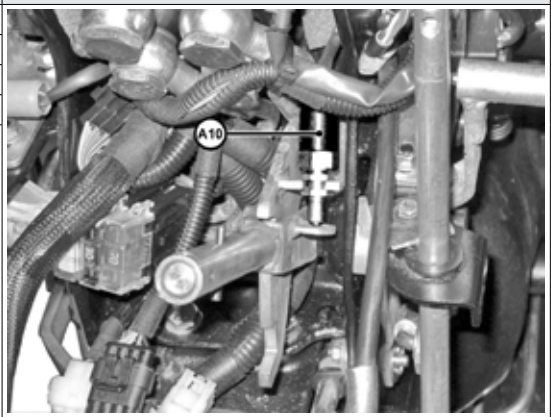
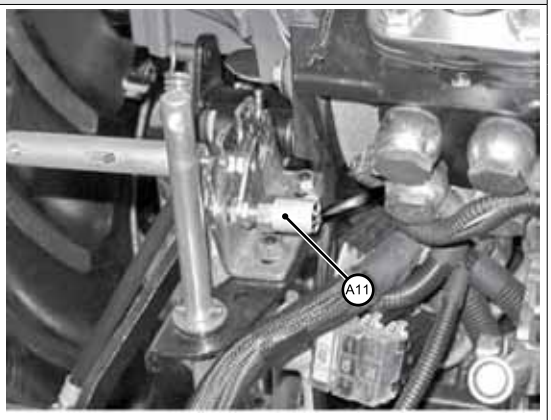
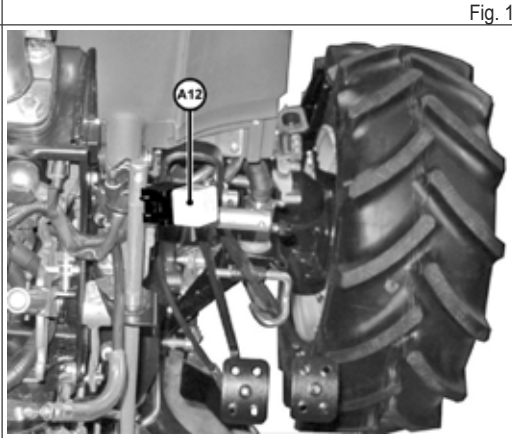
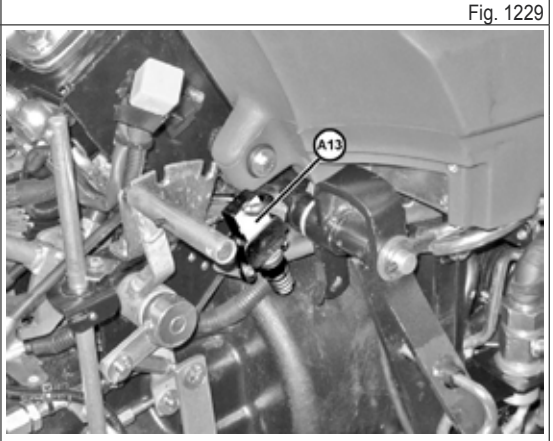
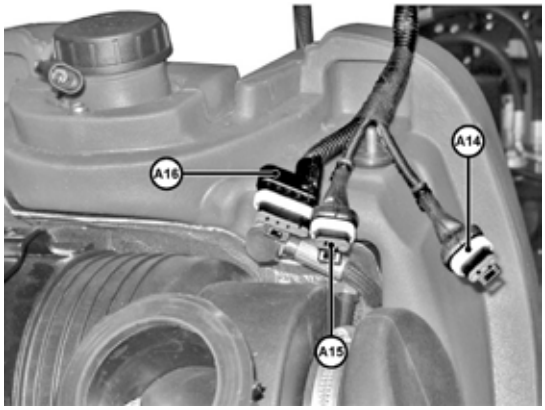
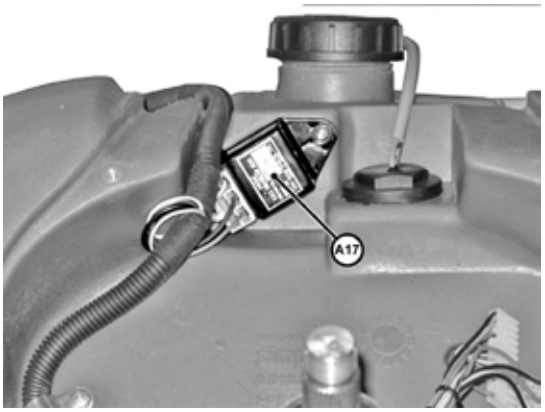
0.012.6949.4

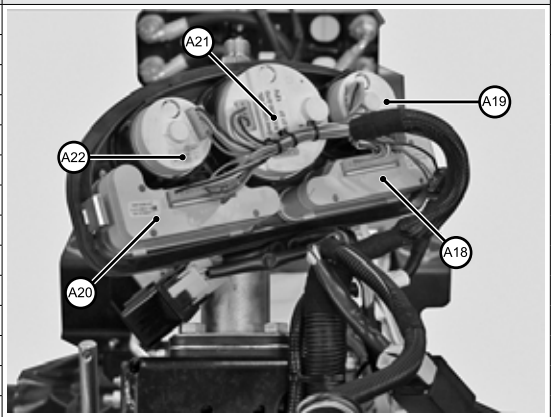
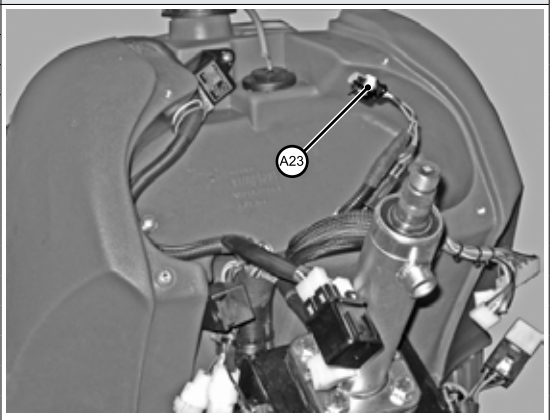
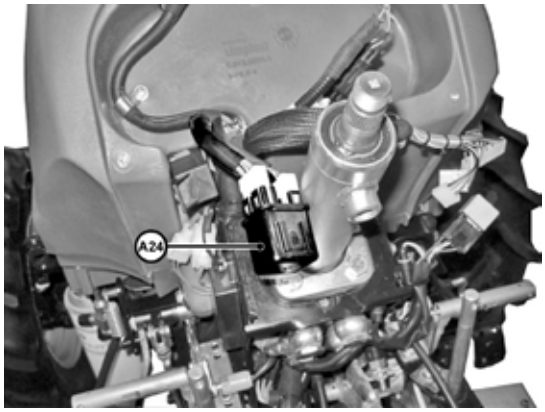
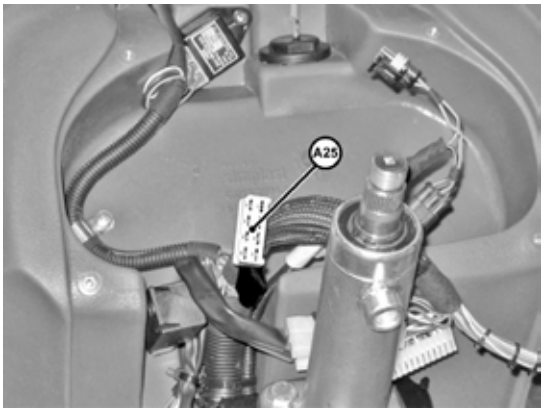
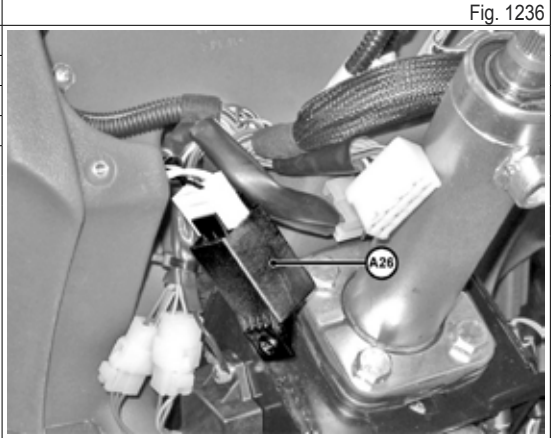
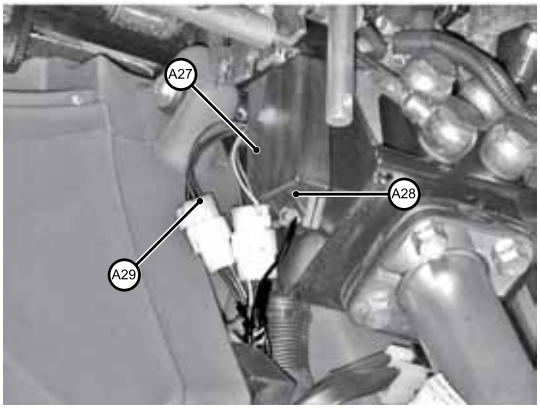
• **See para. 40.4.11 - Central wiring - 0.012... - page 40-71**

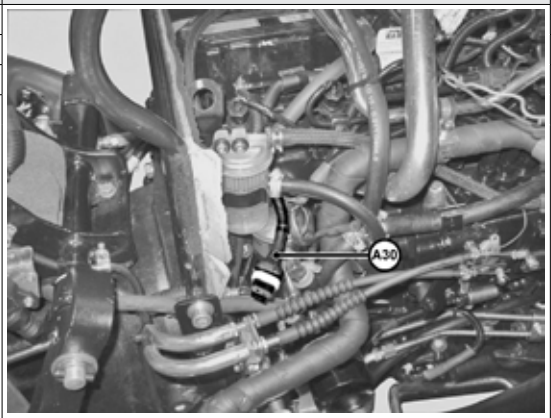
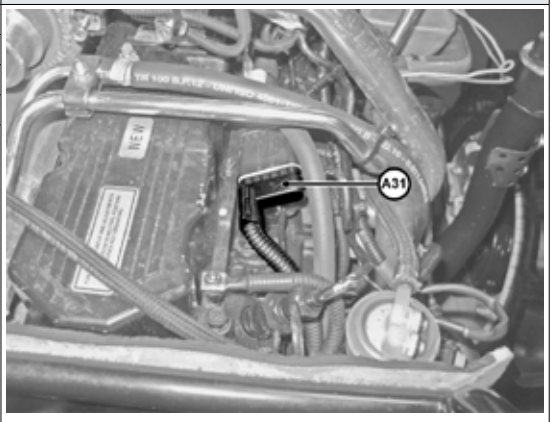
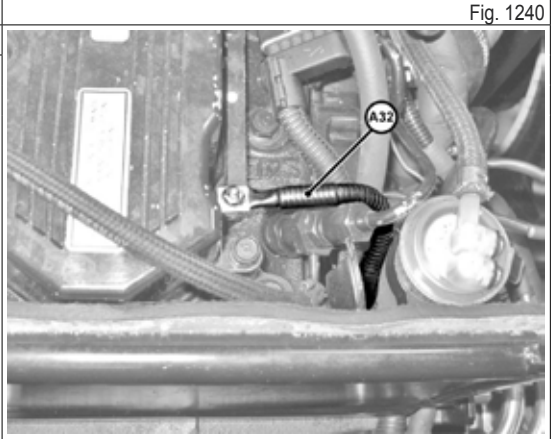
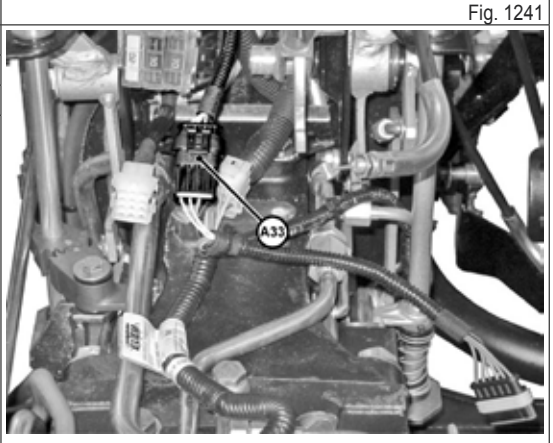
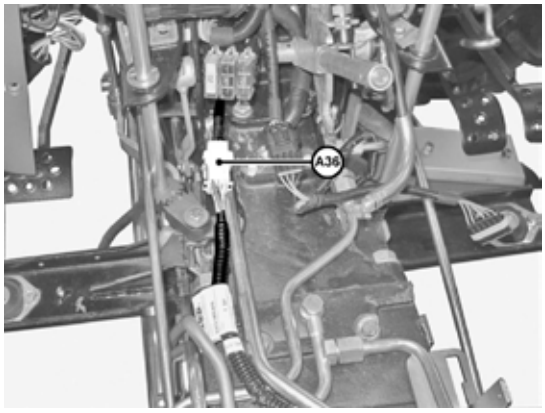
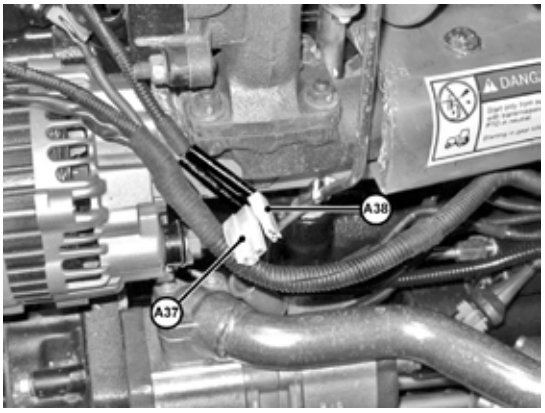
Connector positions

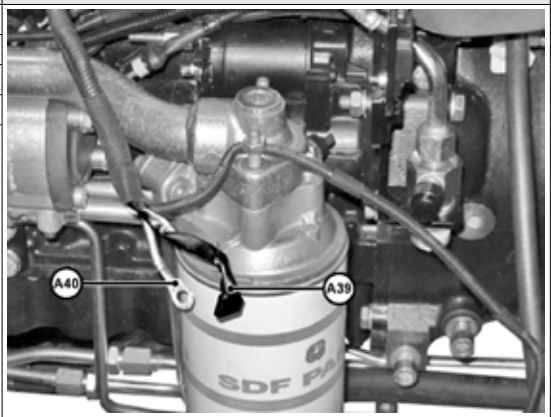
Table 122

CONNEC-TOr/SYS-TEM	CONNECTOr POSITIONS	CONNEC-TOr/SYS-TEM	CONNECTOr POSITIONS
A1 **40-37** **40-52** **40-40**	 Fig. 1222	A3 **40-37** **40-52** **40-40**	 Fig. 1223
A4 **40-37** **40-40**	 Fig. 1224	A5 **40-40**	 Fig. 1225
A6 **40-37** **40-40** **40-43** **40-52**	 Fig. 1226	A7 **40-40**	 Fig. 1227

CONNEC-TOr/SYS-TEM	CONNECTOr POSITIONS	CONNEC-TOr/SYS-TEM	CONNECTOr POSITIONS
A10 **40-52** **40-50** **40-37** **40-43**	 Fig. 1228	A11 **40-50** **40-52** **40-43** **40-43**	 Fig. 1229
A12	 Fig. 1230	A13 **40-37** **40-52** **40-40**	 Fig. 1231
A14 **40-37** **40-40** **40-52** A15 **40-52** **40-40** **40-43** A16 **40-40**	 Fig. 1232	A17 **40-37** **40-40** **40-52**	 Fig. 1233

CONNEC-TOr/SYS-TEM	CONNECTOr POSITIONS	CONNEC-TOr/SYS-TEM	CONNECTOr POSITIONS
A18 **40-37** **40-40** **40-43** **40-50** **40-52** **40-55** A19 **40-37** **40-40** **40-43** **40-52** **40-50** **40-55** A20 **40-37** **40-40** **40-43** **40-50** **40-52** A21 **40-37** **40-40** **40-43** **40-52**	 Fig. 1234	A23 **40-37** **40-43** **40-52**	 Fig. 1235
A22		-	
A24 **40-37** **40-37** **40-43** **40-52**	 Fig. 1236	A25 **40-40**	 Fig. 1237
A26 **40-37** **40-40** **40-43** **40-52**	 Fig. 1238	A27 **40-37** A28 **40-37** **40-52** A29 **40-52** **40-37**	 Fig. 1239

CONNEC-TOr/SYS-TEM	CONNECTOr POSITIONS	CONNEC-TOr/SYS-TEM	CONNECTOr POSITIONS
A30 **40-37** **40-40** **40-52**	 Fig. 1240	A31 **40-37** **40-40** **40-43** **40-52**	 Fig. 1241
A32 **40-37**	 Fig. 1242	A33 **40-50** **40-37** **40-52**	 Fig. 1243
A34 **40-37** **40-40** **40-43** **40-50** **40-52**	 Fig. 1244	A35	 Fig. 1245
A36 **40-40** **40-43** **40-50** **40-52** **40-55**	 Fig. 1246	A37 **40-43** A38 **40-43**	 Fig. 1247

CONNEC-TOr/SYS-TEM	CONNECTOr POSITIONS	CONNEC-TOr/SYS-TEM	CONNECTOr POSITIONS
A39 **40-37** A40 **40-37** **40-50**	 Fig. 1248	A41 **40-43**	 Fig. 1249

40.4.13 - Solenoid valve wiring - 0.014.1482.4

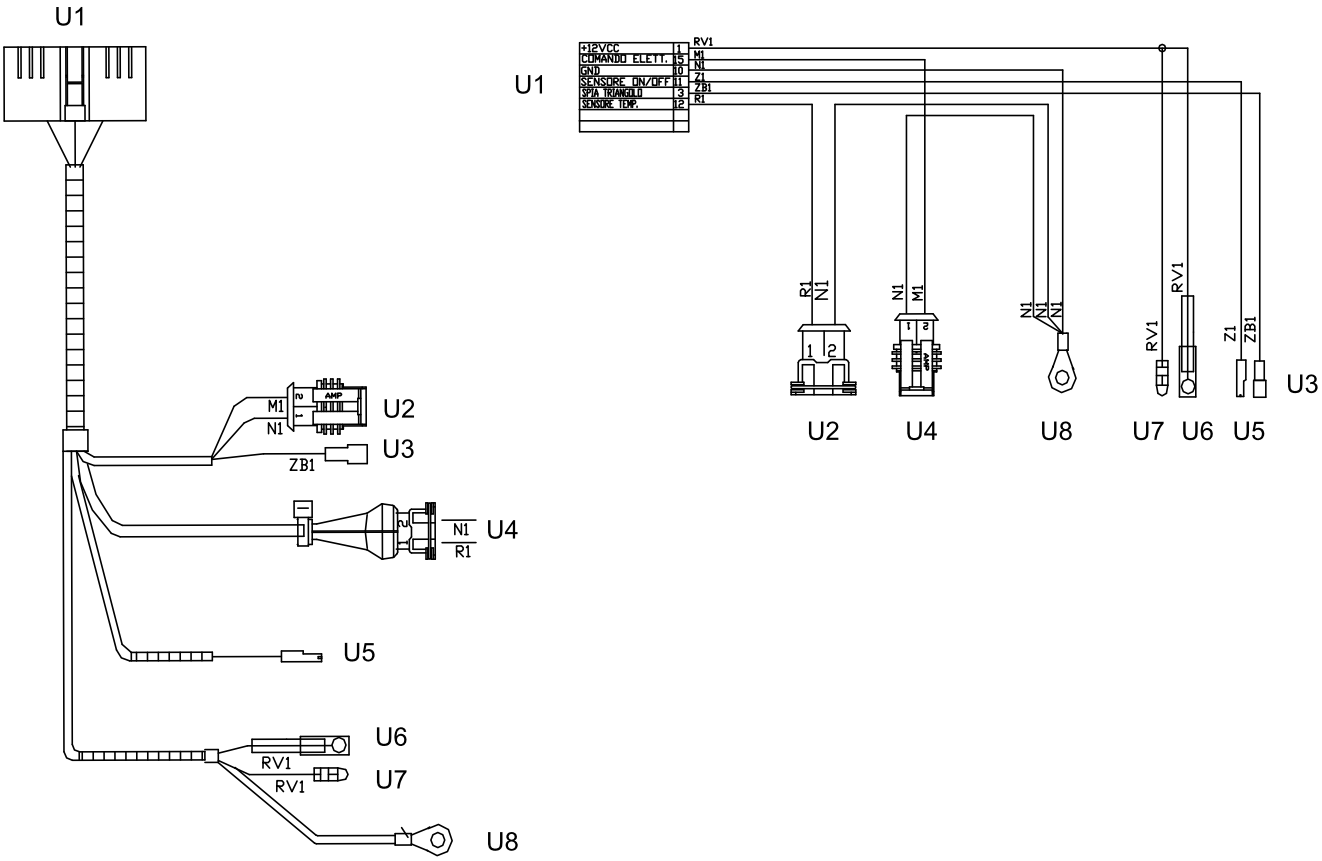


Fig. 1250 - Solenoid valve wiring

Connectors list

- U1 - Control unit
- U2 - Fan
- U3 - Indicator light
- U4 - Temperature
- U5 - Temp
- U6 - Female connector terminal
- U7 - Male connector terminal
- U8 - Earth

40.4.14 - Positions of solenoid valve wiring connectors

View of wiring

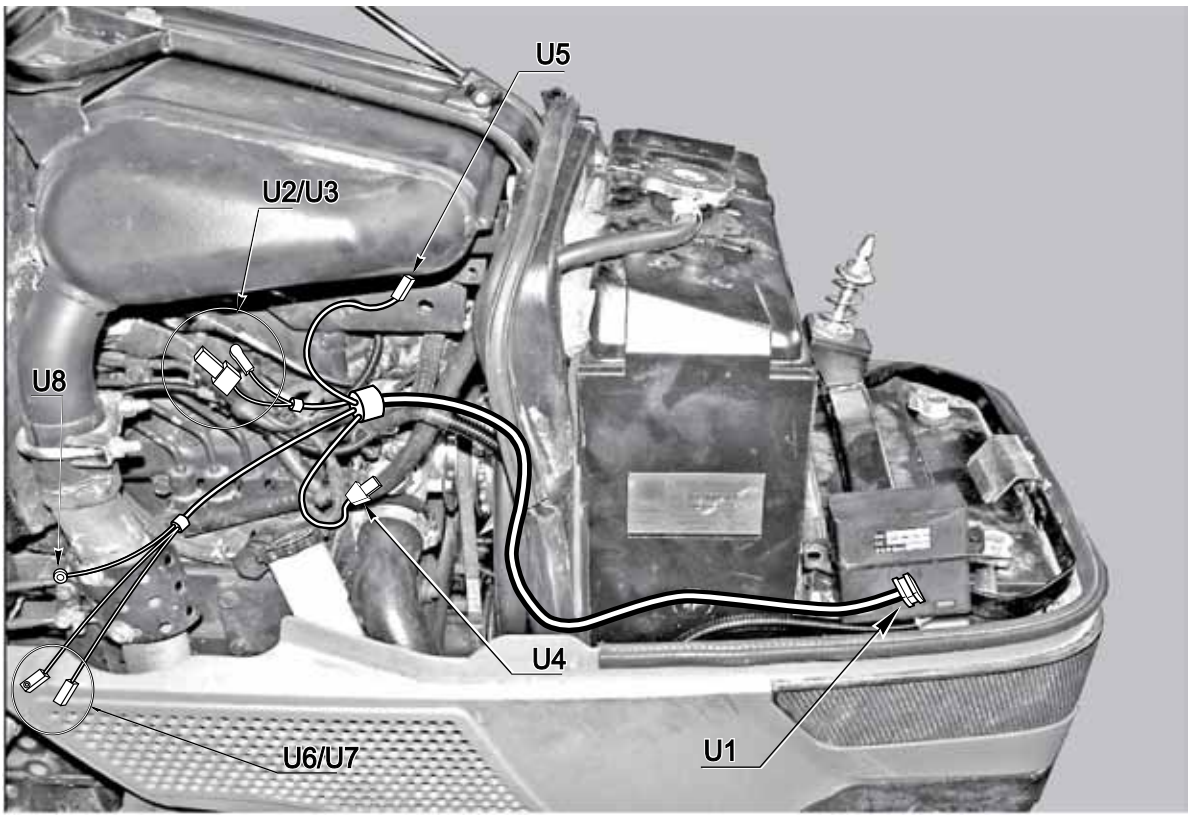


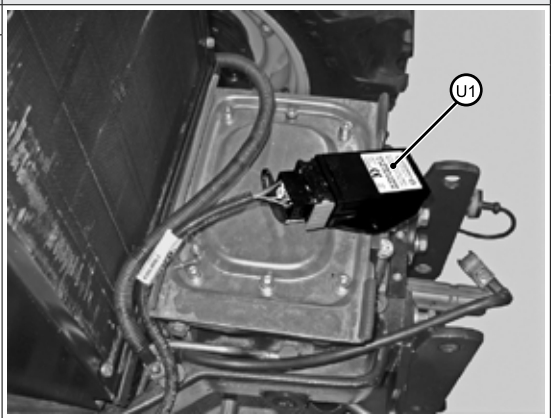
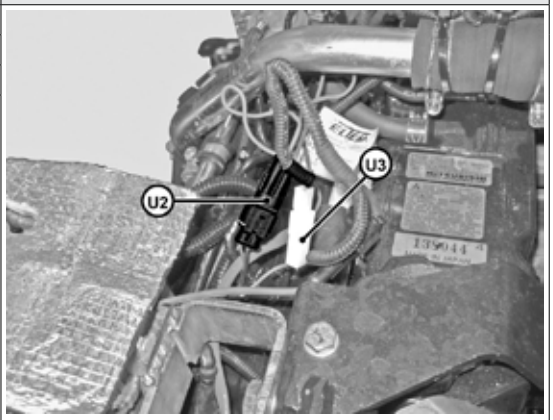
Fig. 1251 - Positions of solenoid valve wiring connectors

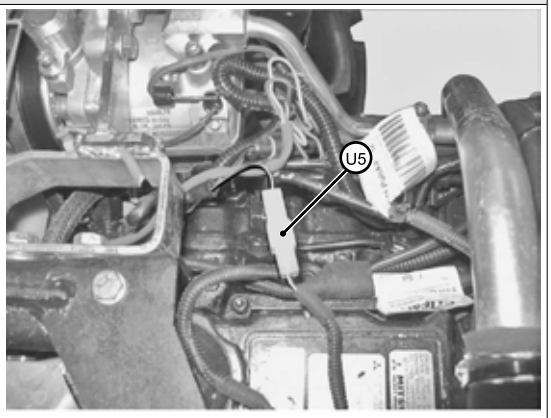
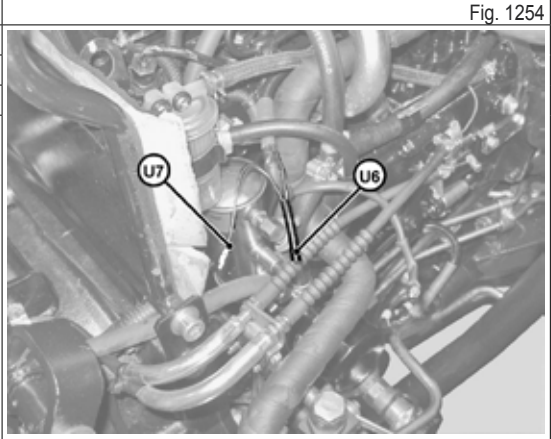
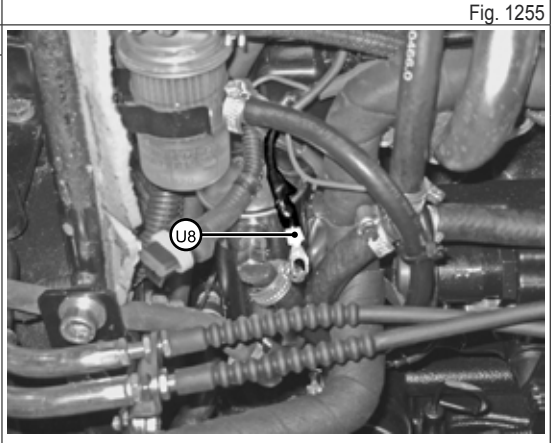
0.014.1482.4

- **See para. 40.4.13 - Solenoid valve wiring ... - page 40-80**

Connector positions

Table 123

CONNEC-TOr/SYS-TEM	CONNECTOr POSITIONS	CONNEC-TOr/SYS-TEM	CONNECTOr POSITIONS
U1 **40-39**	 Fig. 1252	U2 **40-39** U3 **40-39**	 Fig. 1253

CONNEC-TOr/SYS-TEM	CONNECTOr POSITIONS	CONNEC-TOr/SYS-TEM	CONNECTOr POSITIONS
U4 **40-39**	 Fig. 1254	U5 **40-39**	 Fig. 1255
U6 **40-39** U7 **40-39**	 Fig. 1256	U8 **40-39**	 Fig. 1257

40.4.15 - Rear wiring - 0.013.1452.4/10

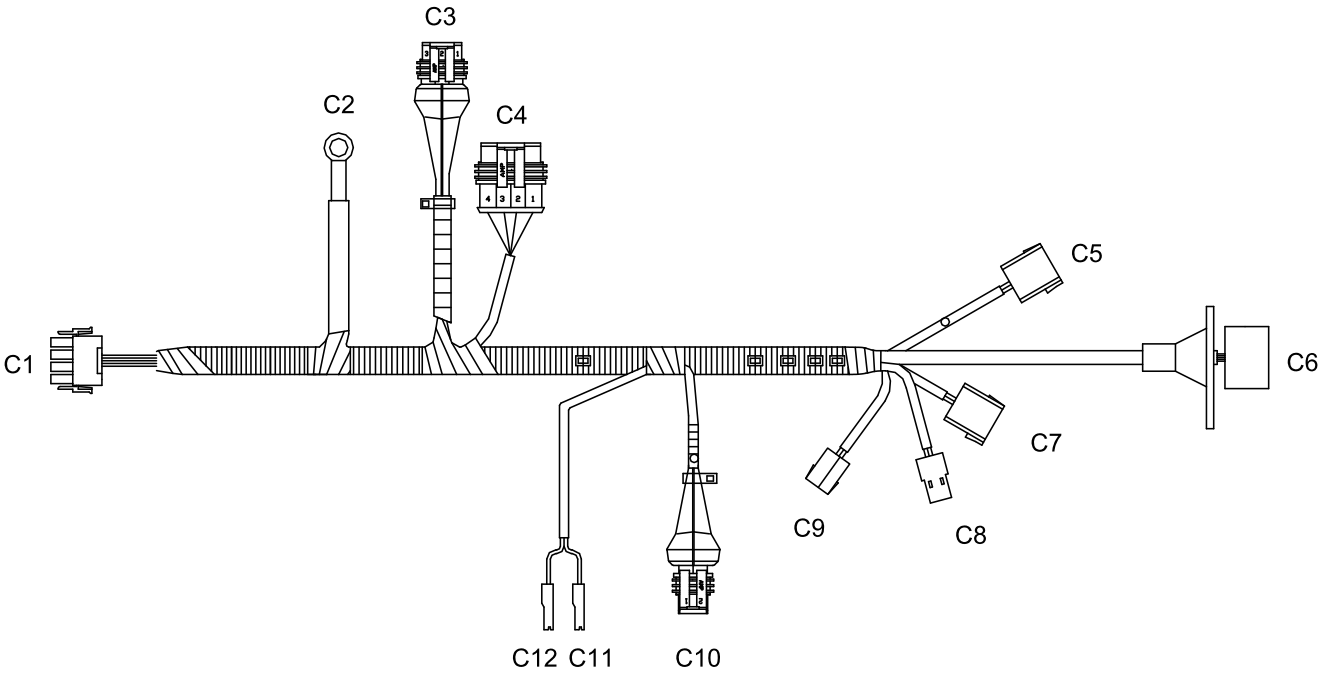


Fig. 1258 - Rear wiring

Connectors list

- C1 - To central wiring
- C2 - Earth

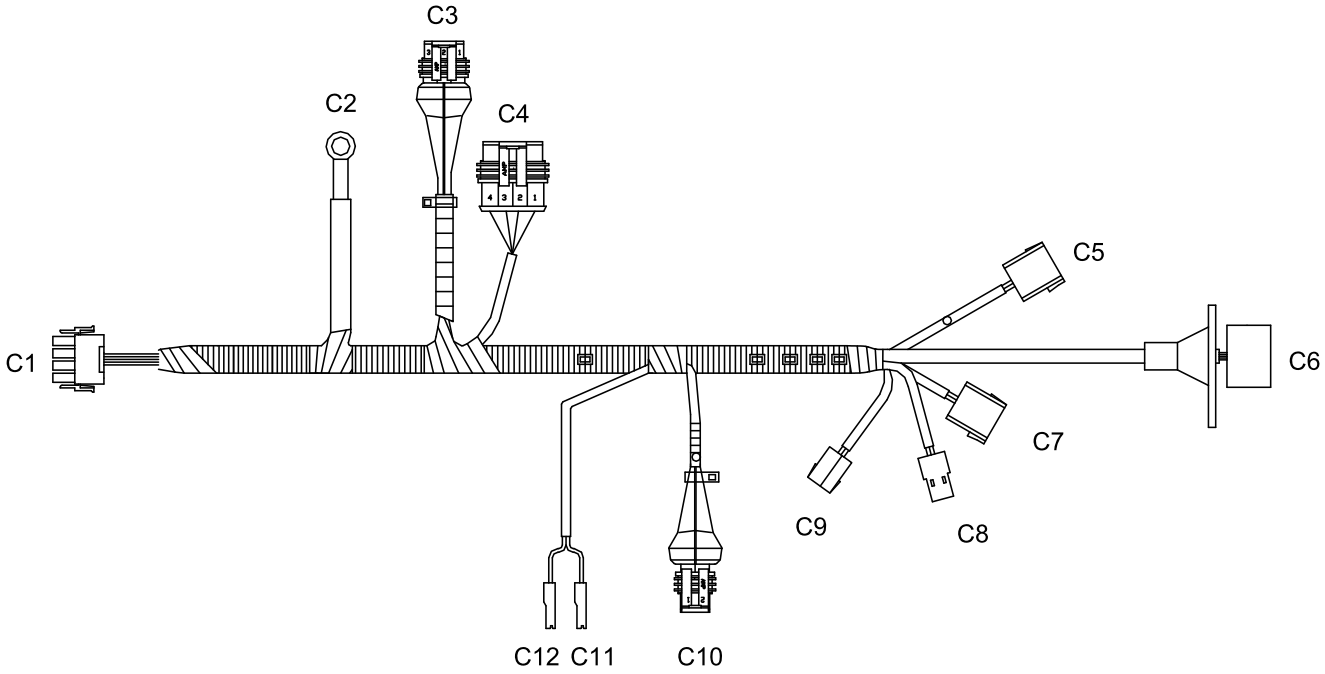


Fig. 1258 - Rear wiring

- C3 - 4WD engagement light switch
- C4 - Handbrake switch
- C5 - RH rear light
- C6 - Trailer socket
- C7 - LH rear socket
- C8 - Number plate light
- C9 - Worklight
- C10 - Diff. lock engagement control solenoid
- C11 - PTO speed indicator light switch
- C12 - PTO speed indicator light switch

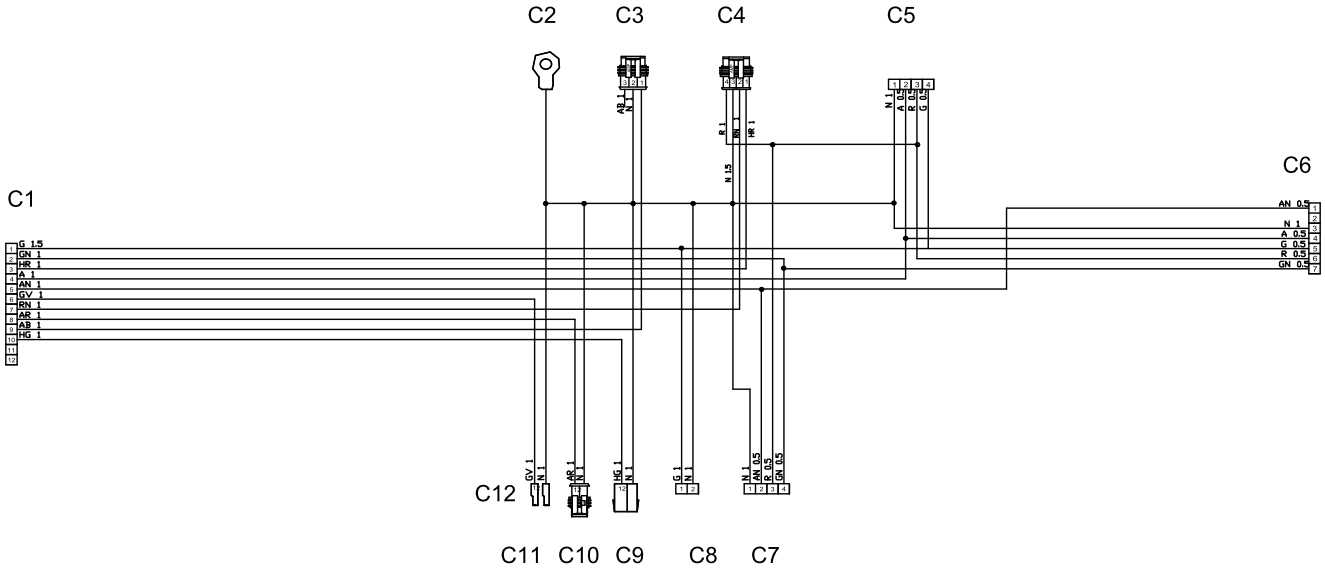


Fig. 1259

40.4.16 - Positions of rear wiring connectors

View of wiring

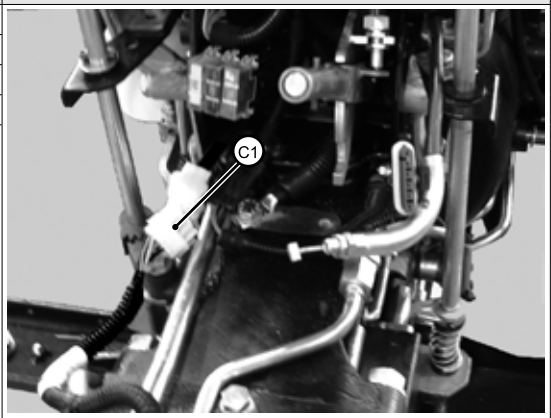
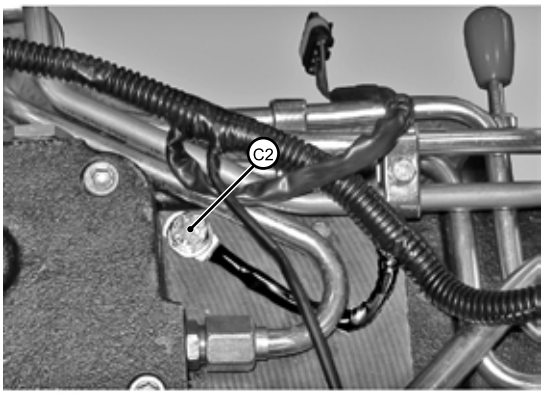
Fig. 1260 - Positions of rear wiring connectors

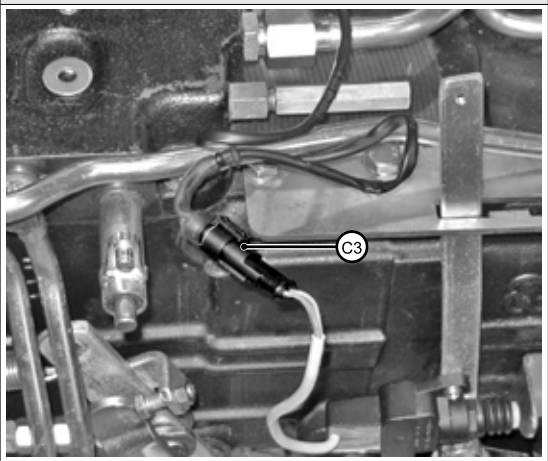
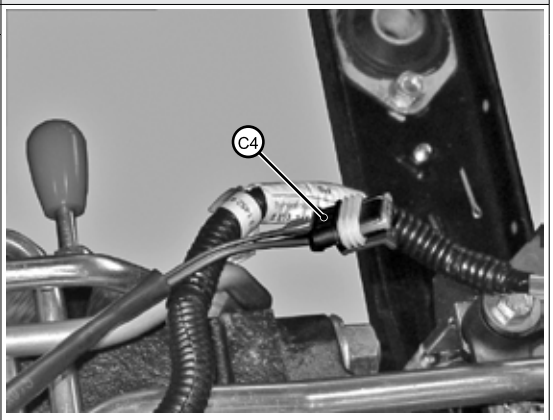
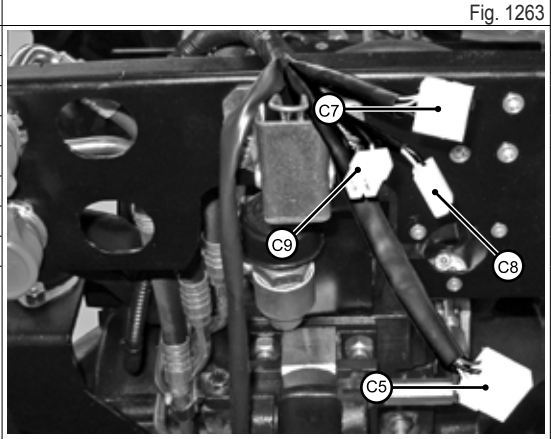
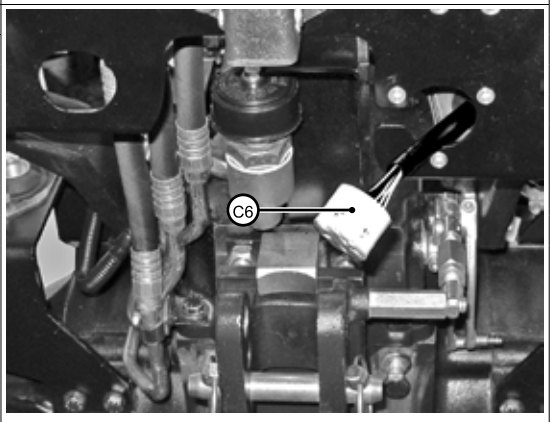
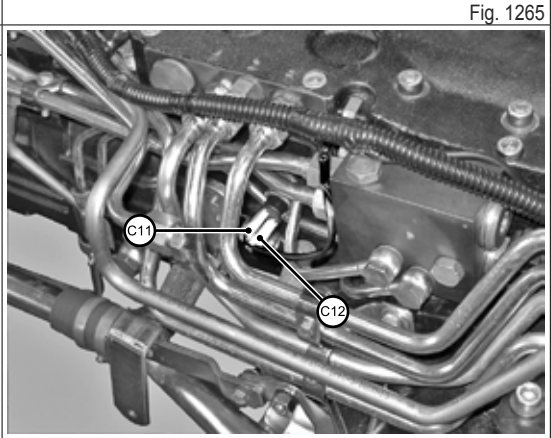
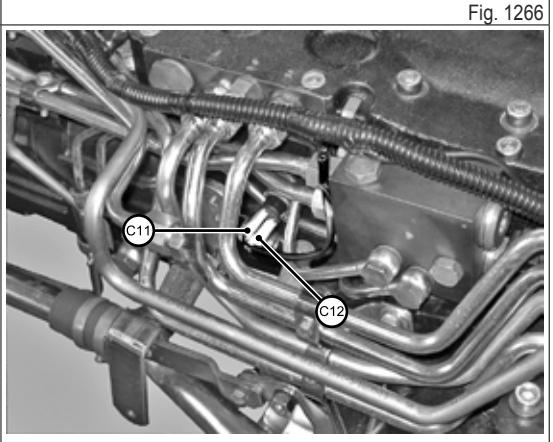
0.013.1452.4/10

- **See para. 40.4.15 - Rear wiring - 0.013.14... - page 40-82**

Connector positions

Table 124

CONNEC-TOr/SYS-TEM	CONNECTOr POSITIONS	CONNEC-TOr/SYS-TEM	CONNECTOr POSITIONS
C1 **40-40** **40-50** **40-52** **40-55**	 Fig. 1261	C2 **40-50** **40-52** **40-55**	 Fig. 1262

CONNEC-TOr/SYS-TEM	CONNECTOr POSITIONS	CONNEC-TOr/SYS-TEM	CONNECTOr POSITIONS
C3 **40-52**	 Fig. 1263	C4 **40-55**	 Fig. 1264
C5 **40-40** **40-55** C7 **40-40** **40-55** C8 C9 **40-40**	 Fig. 1265	C6 **40-40**	 Fig. 1266
C10 **40-52**	 Fig. 1267	C11 **40-50** C12 **40-50**	 Fig. 1267

40.4.17 - Remote valve wiring - 0.012.6955.4

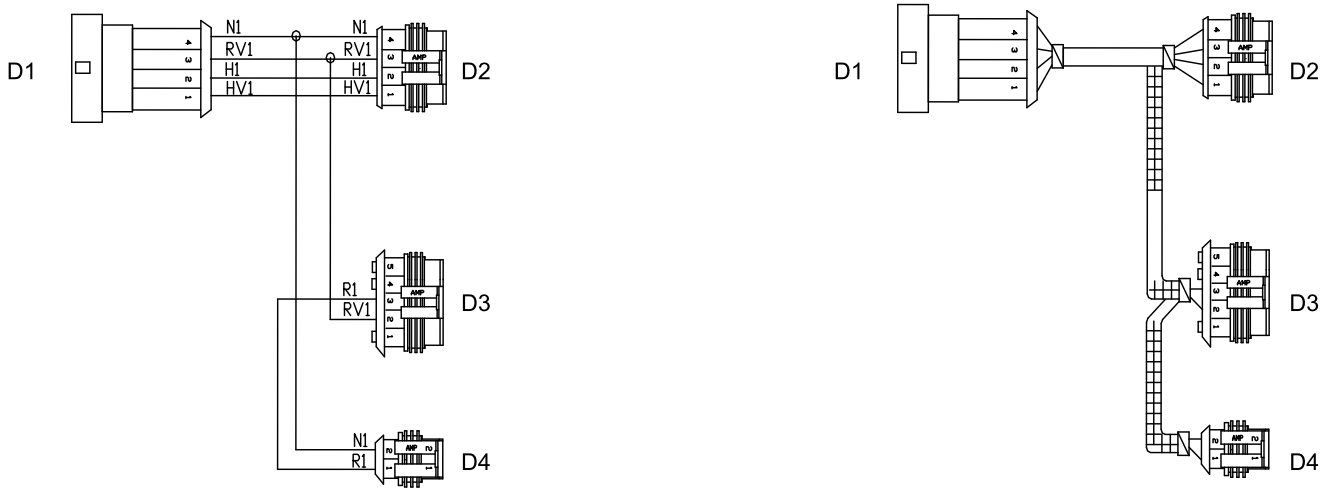


Fig. 1268 - Remote valve wiring

Connectors list

- D1 - To central wiring
- D2 - PTO wiring
- D3 - Flow control switch
- D4 - To platform wiring

40.4.18 - Rear lights wiring - 0.014.7602.4

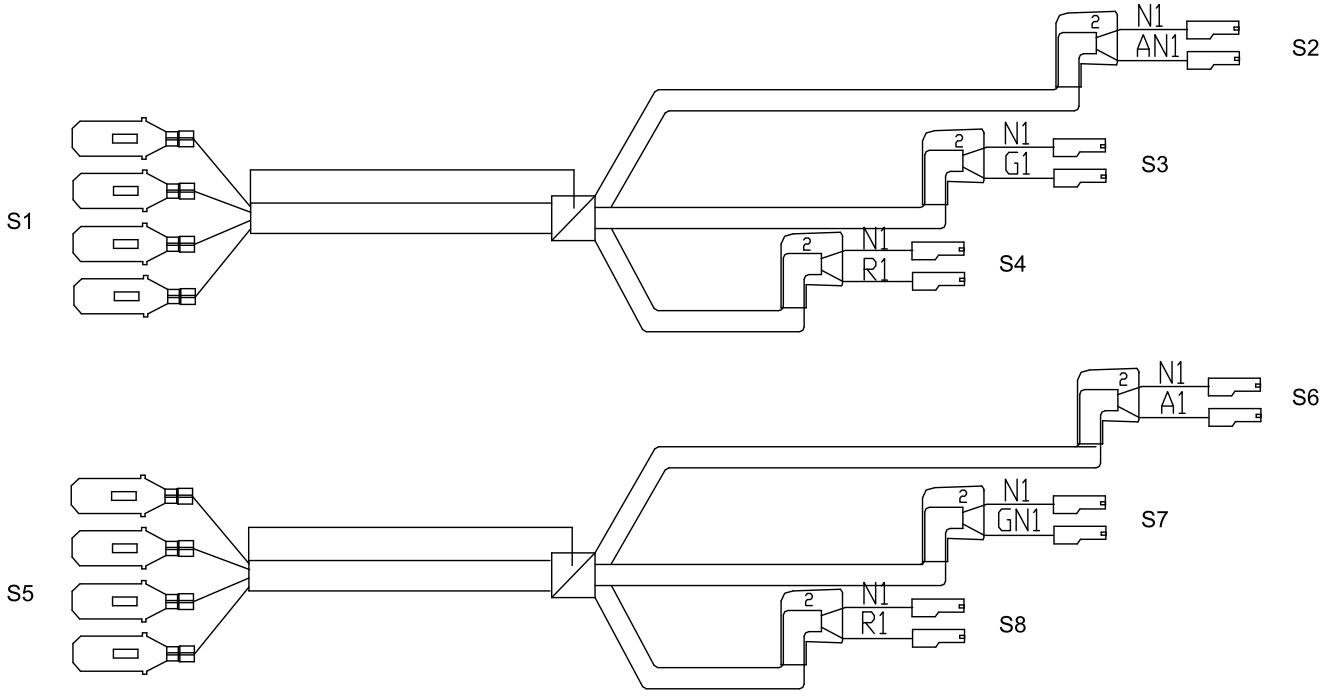


Fig. 1269 - Rear lights wiring

Connectors list

- To rear wiring
- To LH worklights
- To LH worklights
- To LH worklights
- To rear wiring
- To RH worklights
- To RH worklights
- To RH worklights

40.4.19 - Positions of rear light wiring connectors

View of wiring

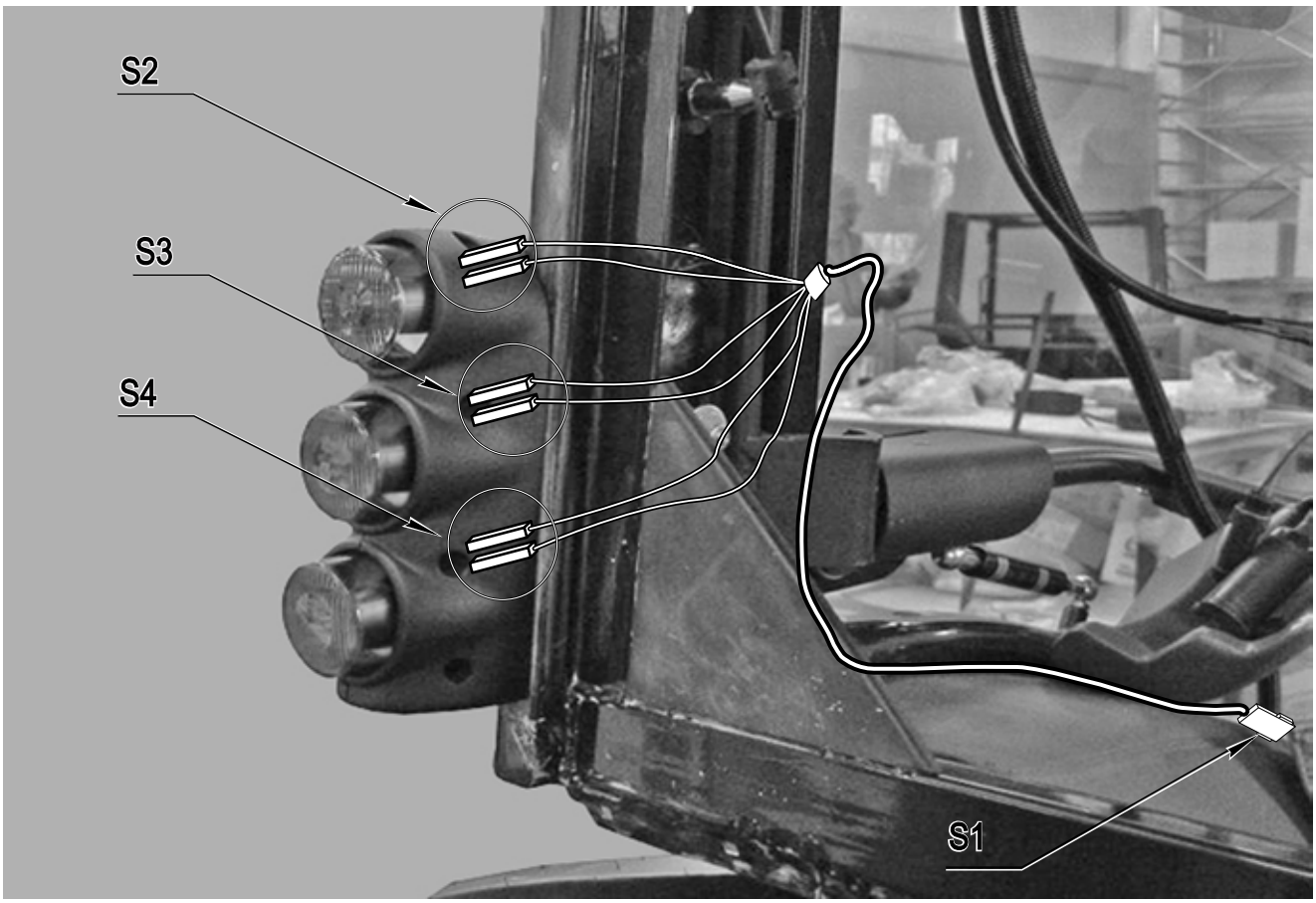


Fig. 1270 - Positions of rear light wiring connectors (LH side)

View of wiring

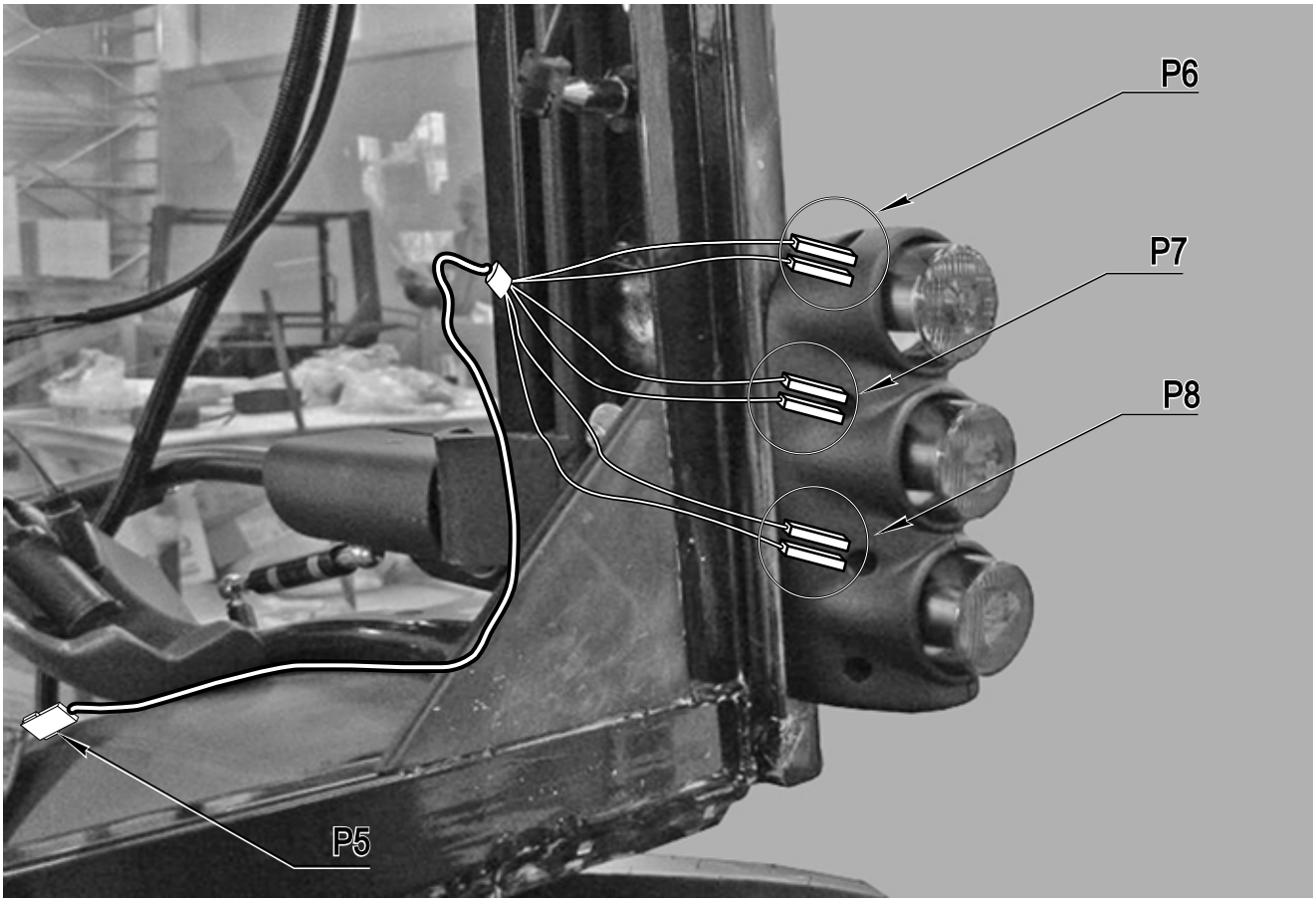


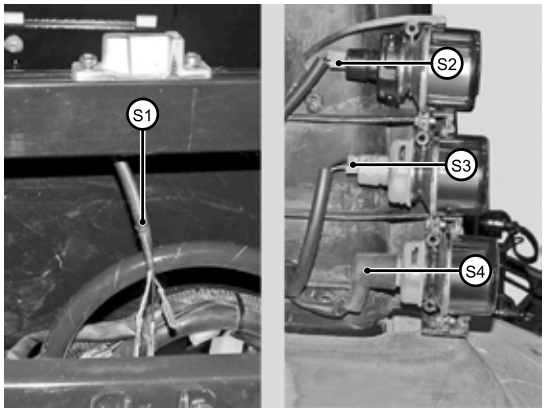
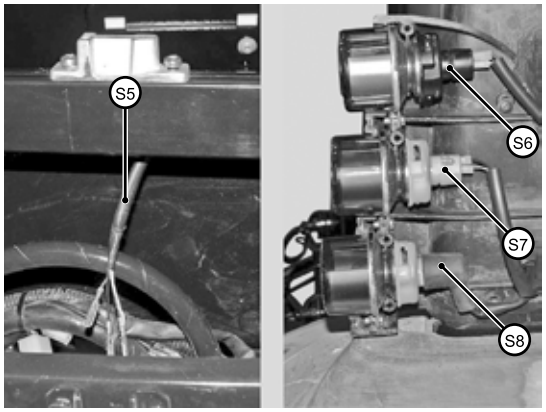
Fig. 1271 - Position of rear light wiring (RH side)

0.014.7602.4

• **See para. 40.4.19 - Positions of rear ligh... - page 40-87**

Connector positions

Table 125

CONNEC-TOr/SYS-TEM	CONNECTOr POSITIONS	CONNEC-TOr/SYS-TEM	CONNECTOr POSITIONS
S1 **40-40** **40-55** S2 **40-40** **40-55** S3 **40-40** S4 **40-40**	 Fig. 1272	S5 **40-40** **40-55** S6 **40-40** **40-55** S7 **40-40** S8 **40-40**	 Fig. 1273

40.4.20 - Aereo cab wiring - 0.014.7593.4

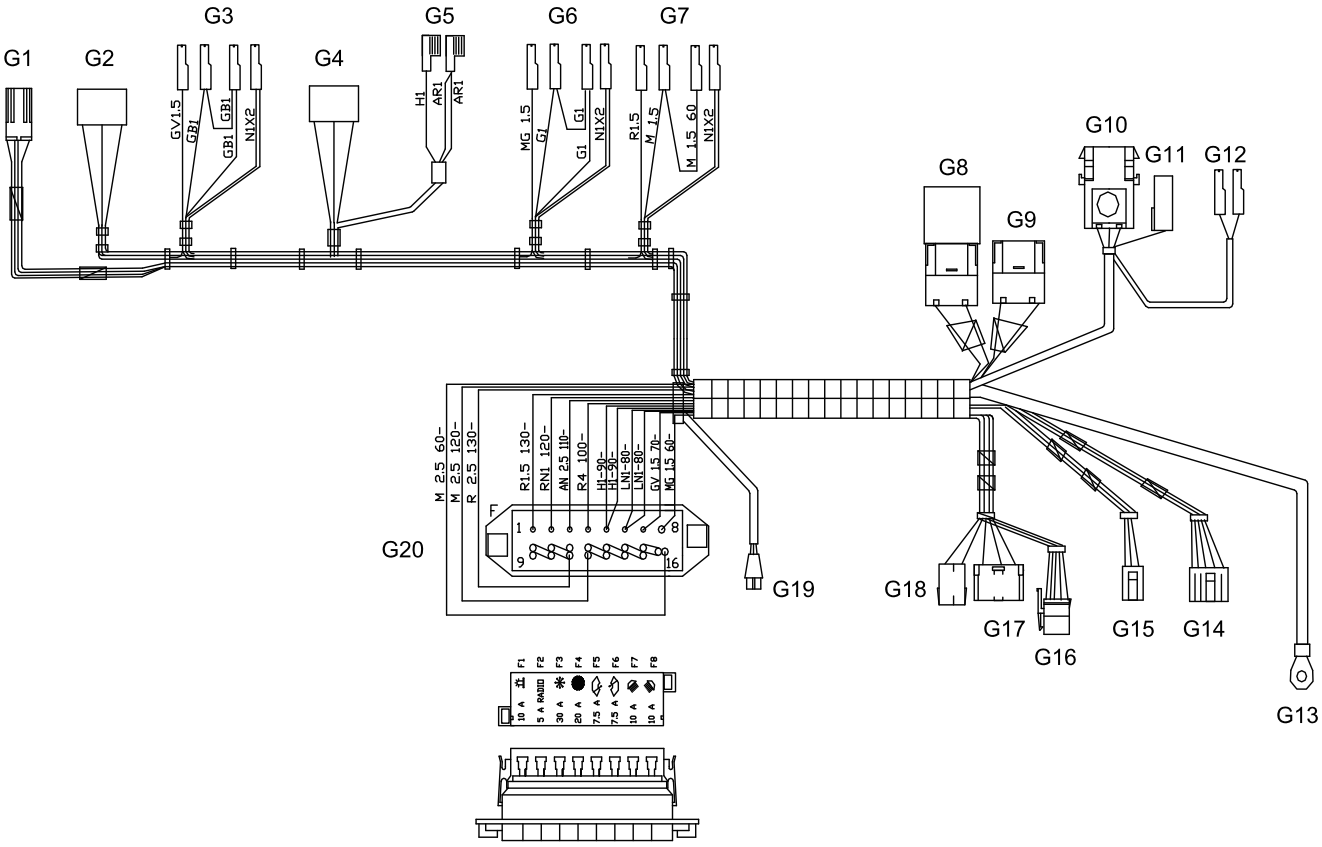


Fig. 1274 - Aereo cab wiring (1/2)

Connectors list

- G1 - Clock
- G2 - Rear wiper switch
- G3 - Rear worklights switch
- G4 - Windscreen wiper switch
- G5 - Screenwash pump
- G6 - Front lights switch
- G7 - Flashing light switch
- G8 - Relay
- G9 - Timer
- G10 - Power supply
- G11 - Power supply
- G12 - To door switch
- G13 - Earth
- G14 - To worklights wiring
- G15 - To radio/interior light wiring
- G16 - To A/C wiring
- G17 - To Borletti heater - air conditioning unit
- G18 - To Borletti heater - air conditioning unit
- G19 - To windscreen wiper
- G20 - Fusebox

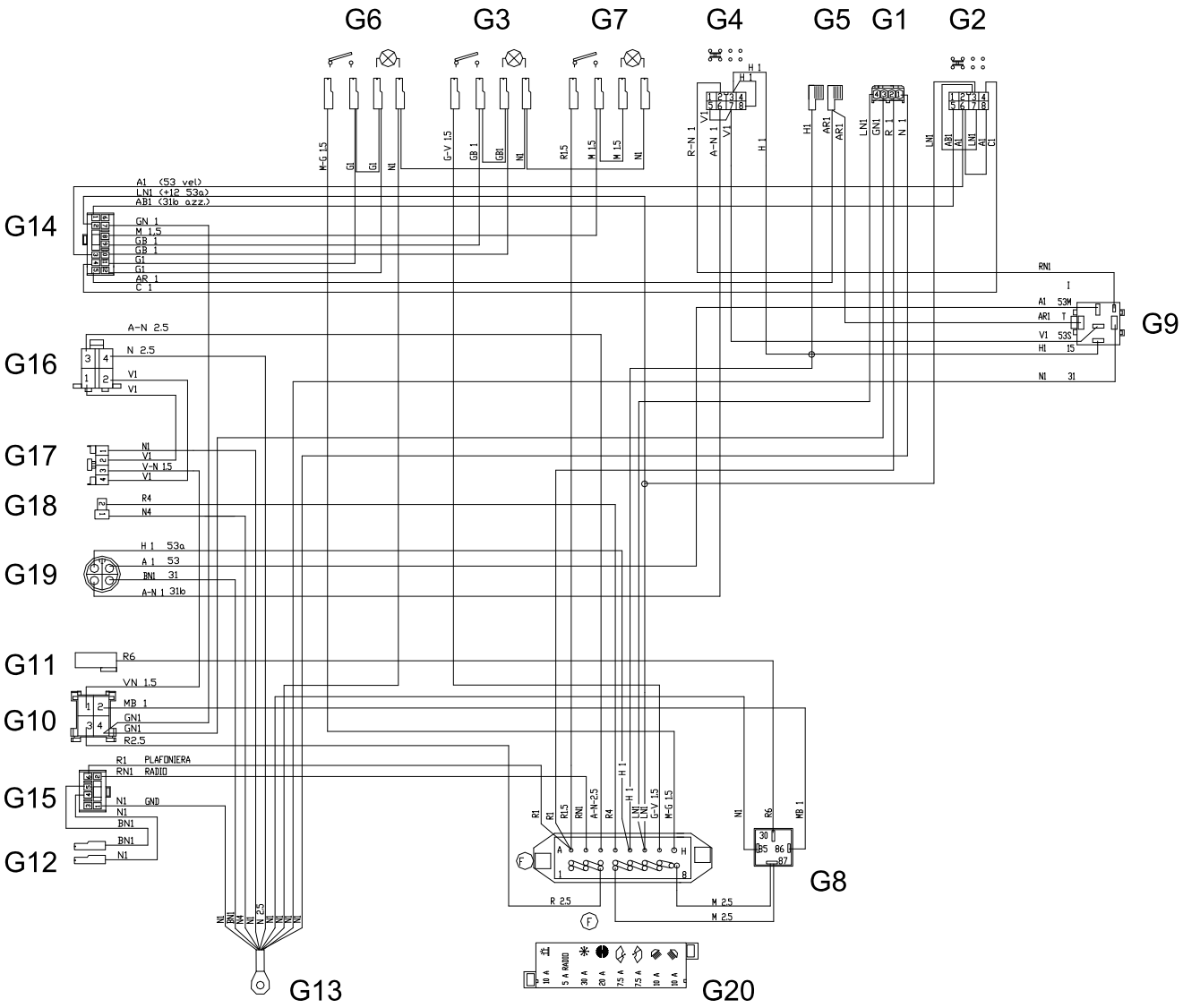


Fig. 1275 - Aereo cab wiring (2/2)

40.4.21 - Positions of aereo-cab wiring connectors

View of wiring

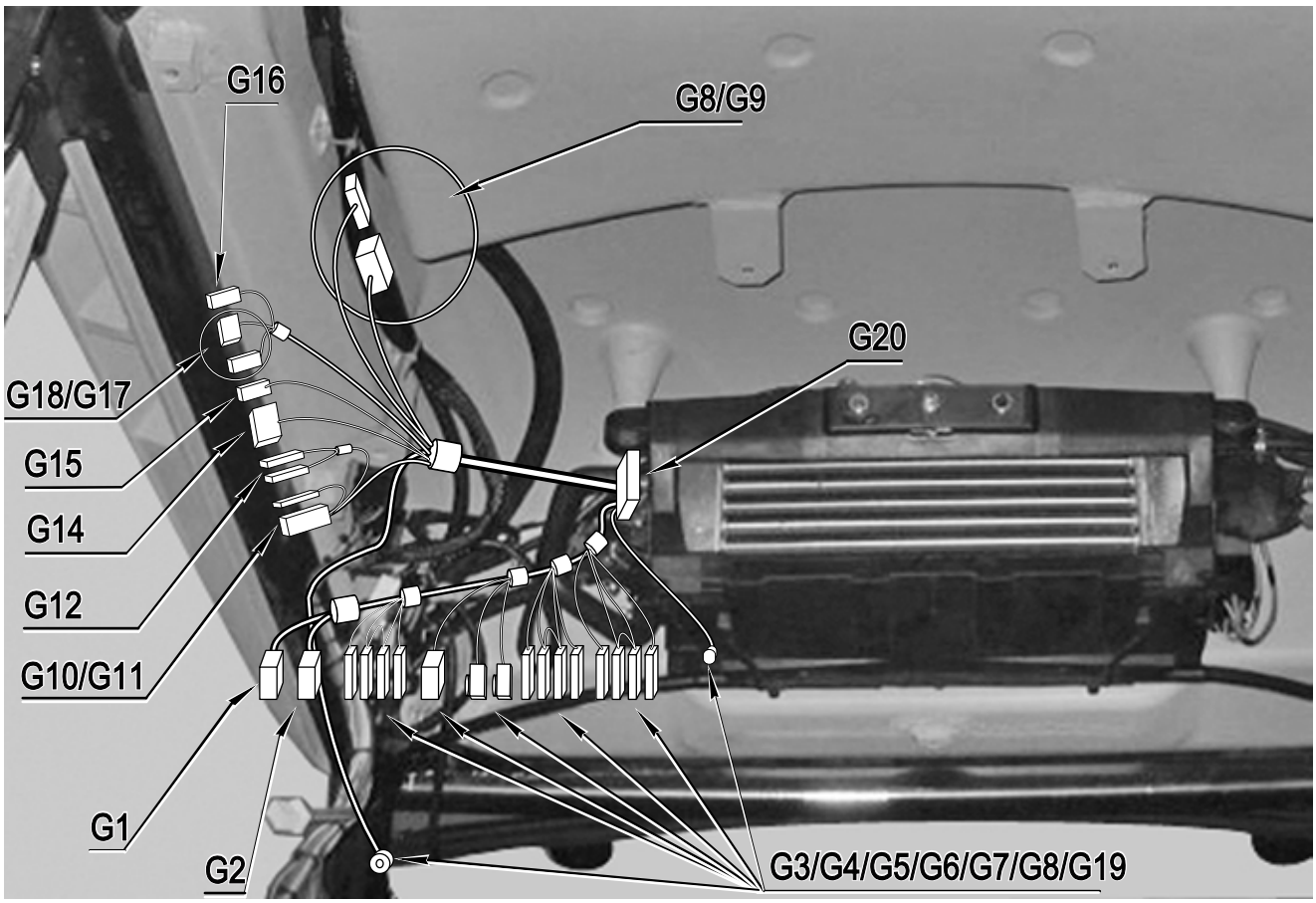


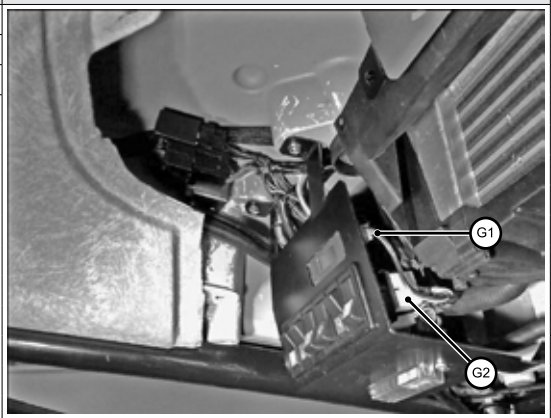
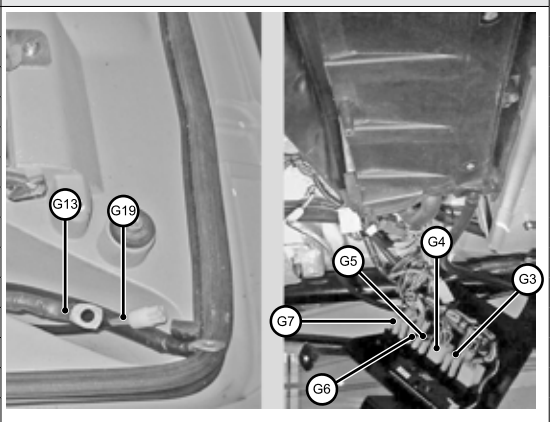
Fig. 1276 - Positions of aereo-cab wiring connectors

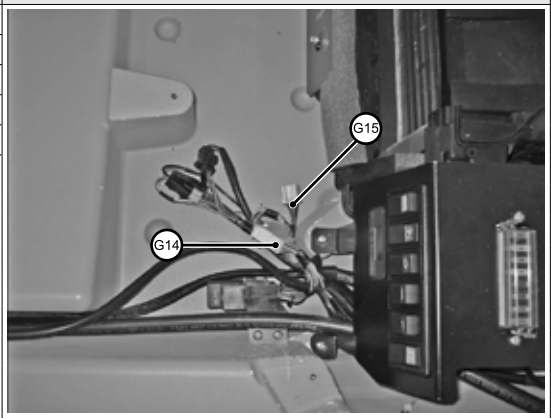
0.014.7593.4

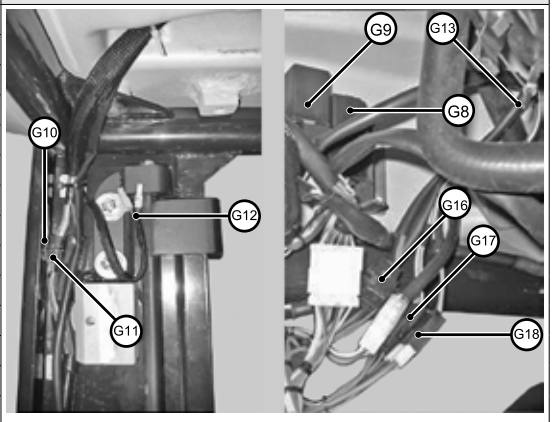
• **See para. 40.4.20 - Aereo cab wiring - 0.0... - page 40-89**

Connector positions

Table 126

CONNEC-TOr/SYS-TEM	CONNECTOr POSITIONS	CONNEC-TOr/SYS-TEM	CONNECTOr POSITIONS
G1 **40-48** G2 **40-48**	 Fig. 1277	G3 **40-48** G4 **40-48** G5 **40-48** G6 **40-48** G7 **40-48** G13 **40-48** G19 **40-48**	 Fig. 1278

CONNEC-TOr/SYS-TEM	CONNECTOr POSITIONS
G14 **40-45** **40-48** G15 **40-45** **40-48**	 Fig. 1279

CONNEC-TOr/SYS-TEM	CONNECTOr POSITIONS
G8 **40-48** G9 **40-48** G10 **40-48** **40-45** G11 **40-48** **40-45** G12 **40-48** G13 **40-48** G16 **40-45** **40-48** G17 **40-48** G18 **40-48**	 Fig. 1280

40.4.22 - Cab power supply - 0.014.7594.4

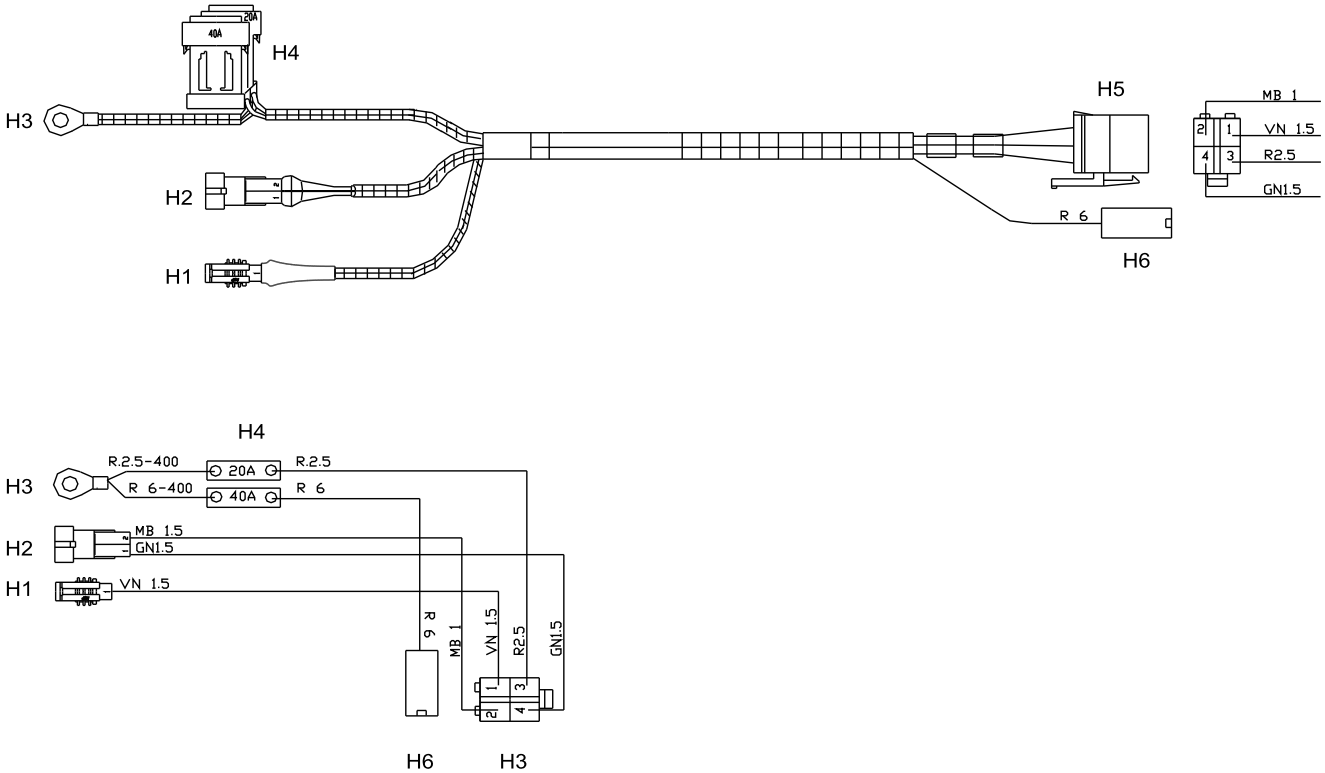


Fig. 1281 - Cab power supply

Connectors list

- H1 - To compressor
- H2 - To central wiring
- H3 - Earth
- H4 - Fuses (20 A - 40 A)
- H5 - To cab wiring
- H6 - To relay

40.4.23 - Positions of cab power supply wiring connectors

View of wiring

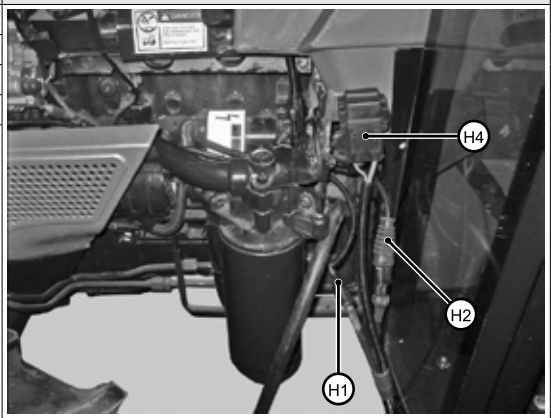
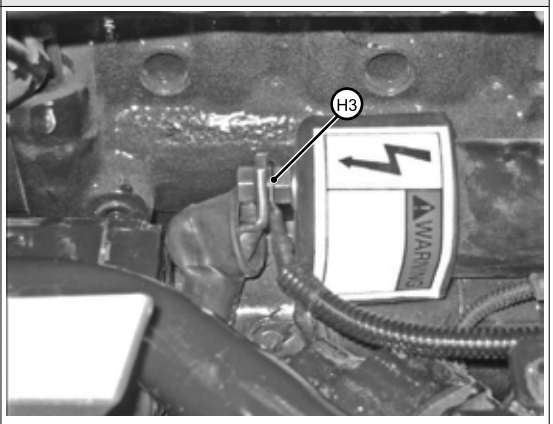
Fig. 1282 - Positions of cab power supply wiring connectors

0.014.7594.4

- **See para. 40.4.22 - Cab power supply - 0.0... - page 40-92**

Connector positions

Table 127

CONNEC-TOr/SYS-TEM	CONNECTOr POSITIONS	CONNEC-TOr/SYS-TEM	CONNECTOr POSITIONS
H1 **40-45** H2 **40-45** H4	 Fig. 1283	H3	 Fig. 1284

40.4.24 - Air conditioning system - 0.014.7596.4

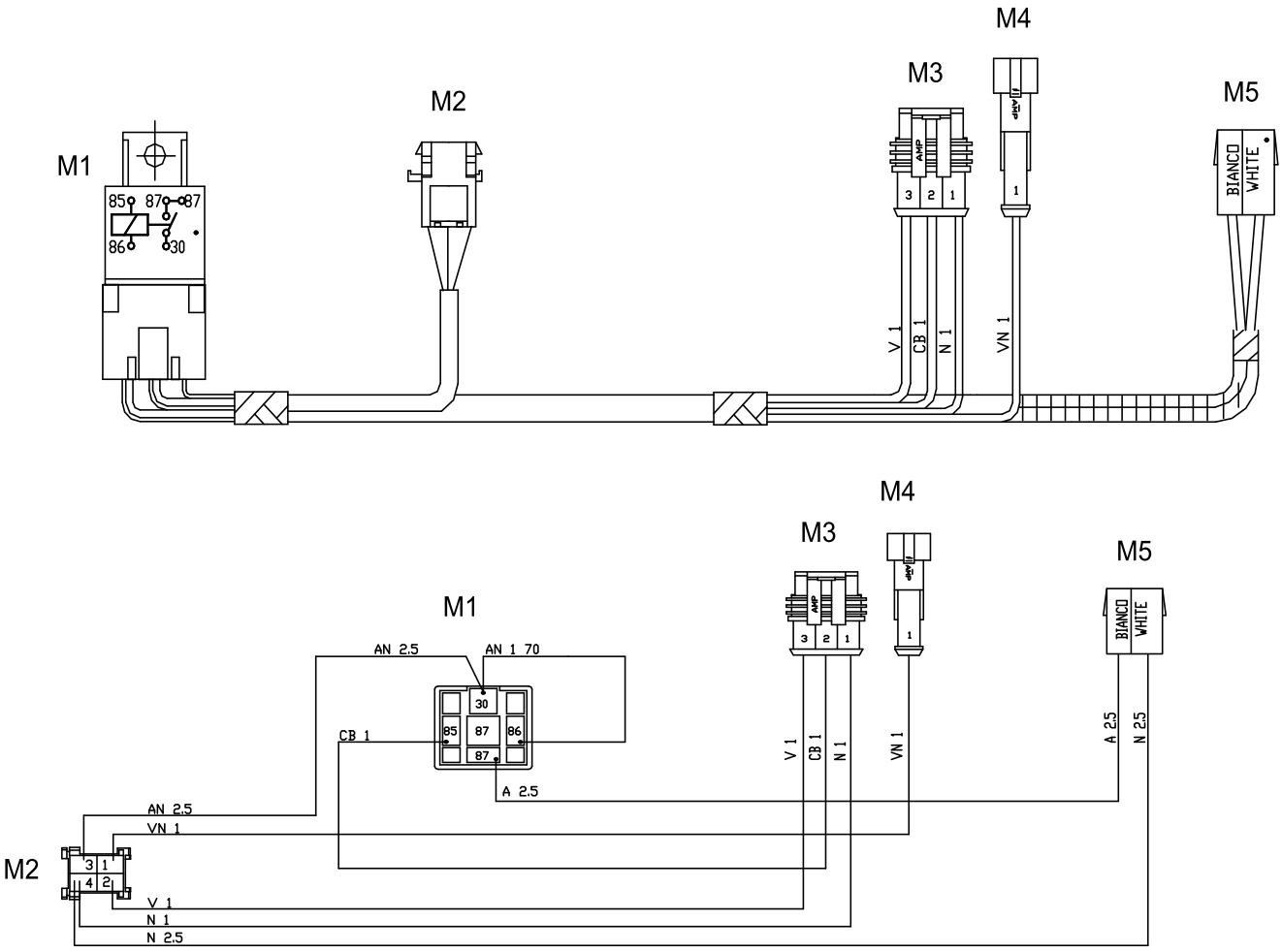


Fig. 1285 - Air conditioning

Connectors list

- M1 - Relay
- M2 - Aereo cab system
- M3 - To receiver-drier
- M4 - To receiver-drier
- M5 - To fan

40.4.25 - Position of air conditioner wiring connectors

View of wiring

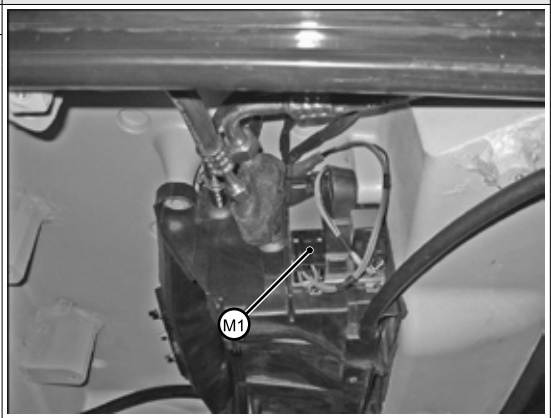
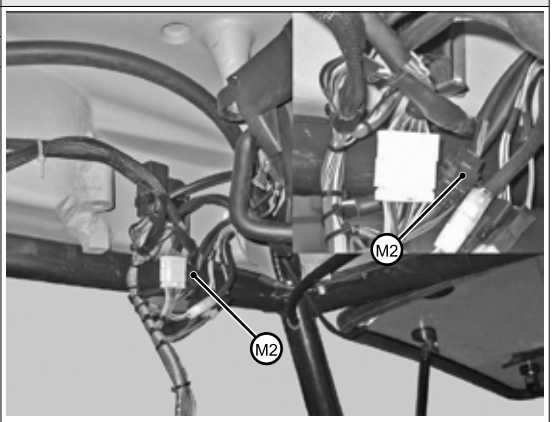
Fig. 1286 - Position of air conditioner wiring connectors

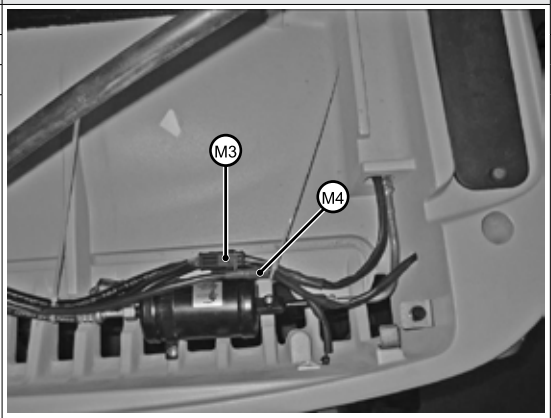
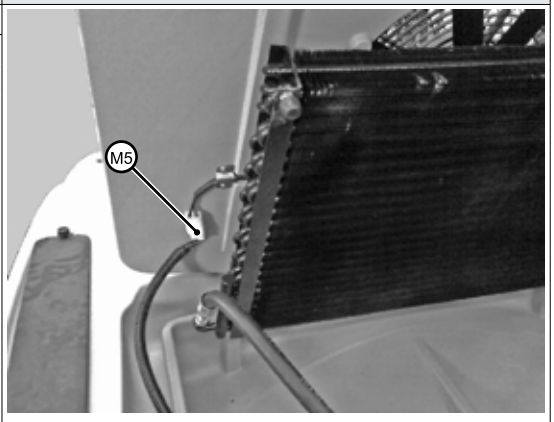
0.014.7596.4

• **See para. 40.4.24 - Air conditioning syste... - page 40-94**

Connector positions

Table 128

CONNEC-TOr/SYS-TEM	CONNECTOr POSITIONS	CONNEC-TOr/SYS-TEM	CONNECTOr POSITIONS
M1 **40-45**	 Fig. 1287	M2 **40-45** **40-48**	 Fig. 1288

CONNEC-TOr/SYS-TEM	CONNECTOr POSITIONS	CONNEC-TOr/SYS-TEM	CONNECTOr POSITIONS
M3 **40-48** M4 **40-45**	 Fig. 1289	M5 **40-45**	 Fig. 1290

40.4.26 - Cab earth wiring - 0.015.0031.4

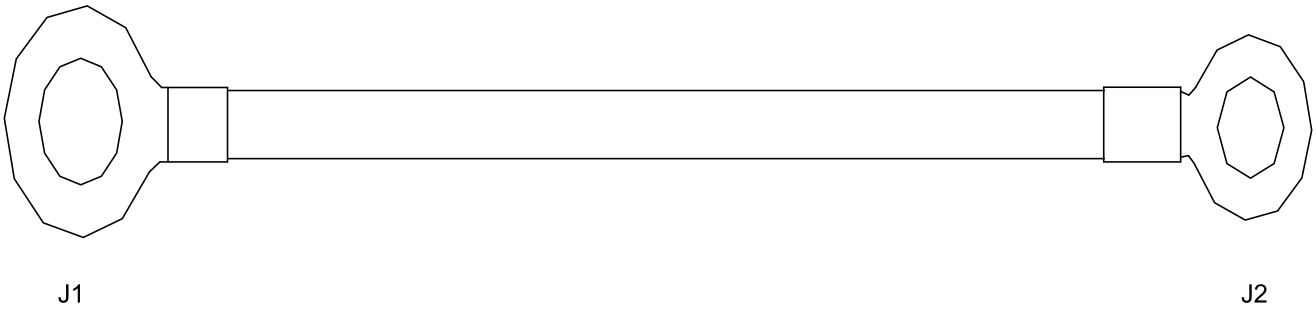


Fig. 1291 - Cab earth wiring

Connectors list

- J1 - Earth 1
- J2 - Earth 2

40.4.27 - Positions of cab earth wiring connectors

View of wiring

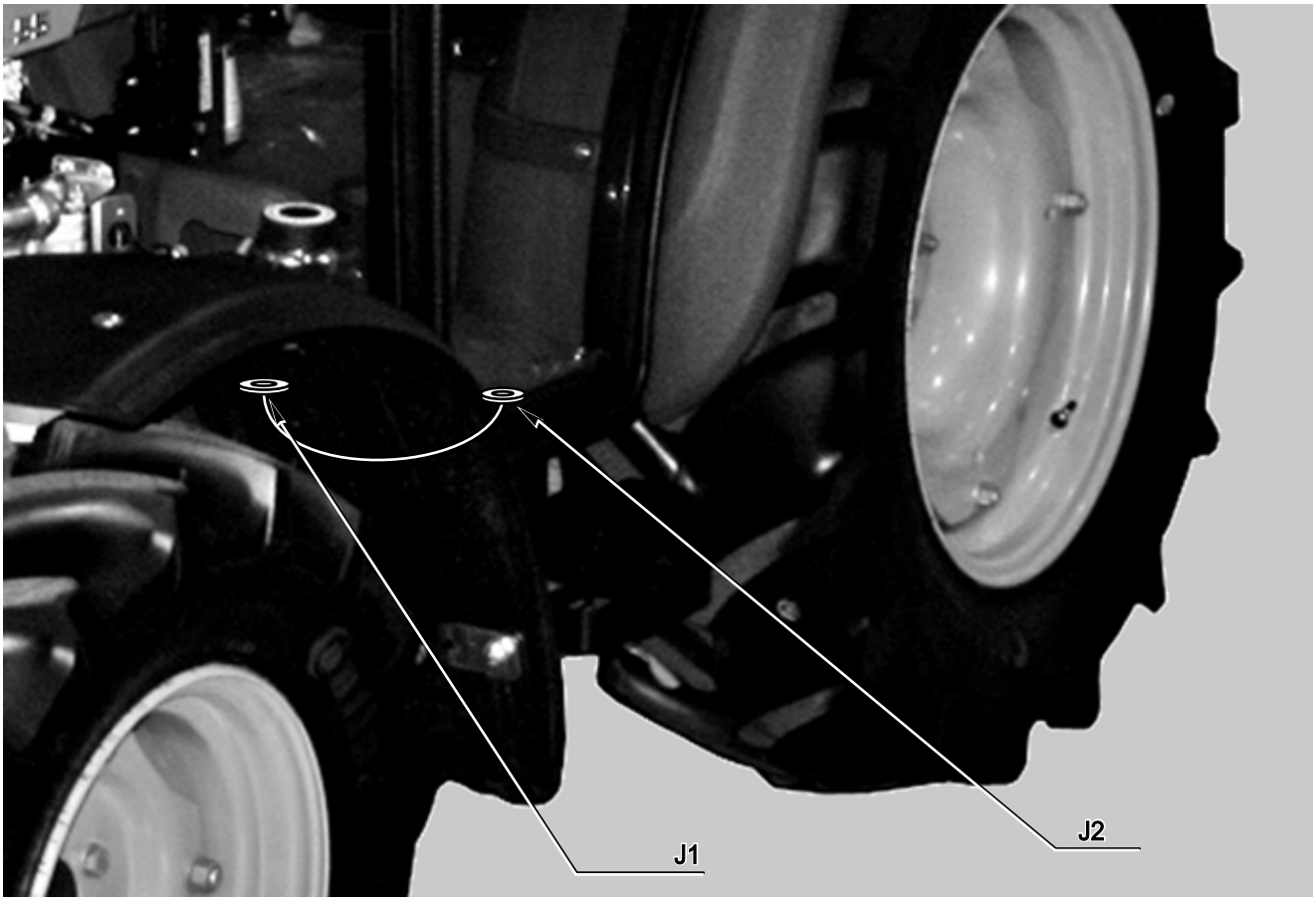


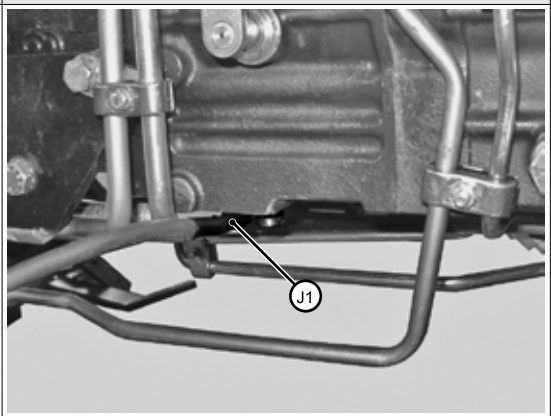
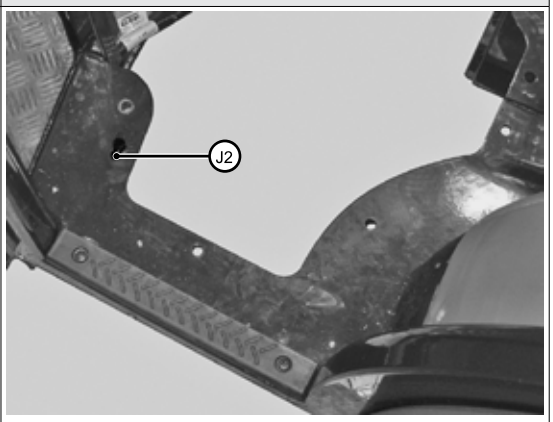
Fig. 1292 - Positions of cab earth wiring connectors

0.015.0031.4

• **See para. 40.4.26 - Cab earth wiring - 0.0... - page 40-96**

Connector positions

Table 129

CONNEC-TOr/SYS-TEM	CONNECTOr POSITIONS	CONNEC-TOr/SYS-TEM	CONNECTOr POSITIONS
J1	 Fig. 1293	J2	 Fig. 1294

40.4.28 - Worklights-number plate light- flashing light - 0.014.7595.4

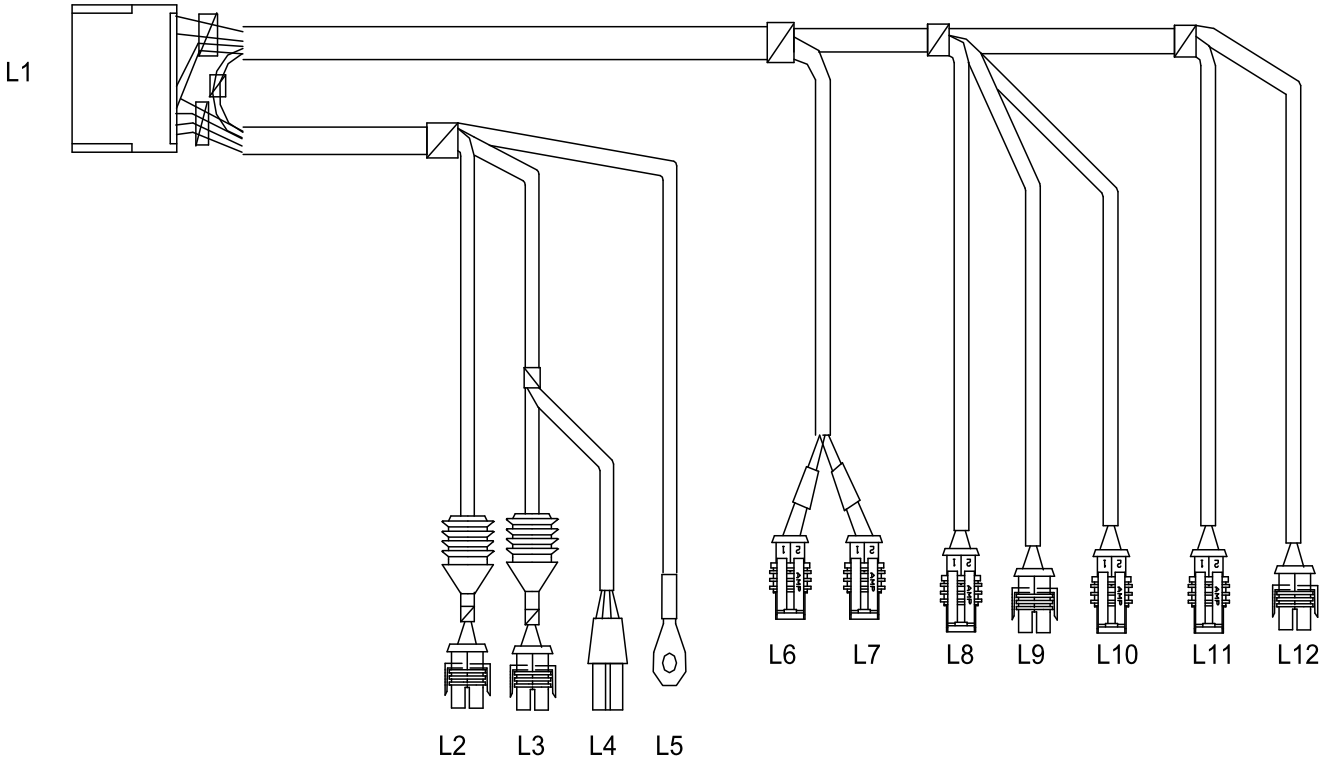


Fig. 1295 - Worklights-number plate light- flashing light (1/2)

Connectors list

- L1 - To aereo cab wiring
- L2 - To front worklights
- L3 - To front worklights
- L4 - To rear wiper
- L5 - Earth
- L6 - To screenwash pumps
- L7 - To screenwash pumps
- L8 - To rotating beacon
- L9 - TO LH rear worklight
- L10 - To number plate light
- L11 - To number plate light
- L12 - To RH rear worklight

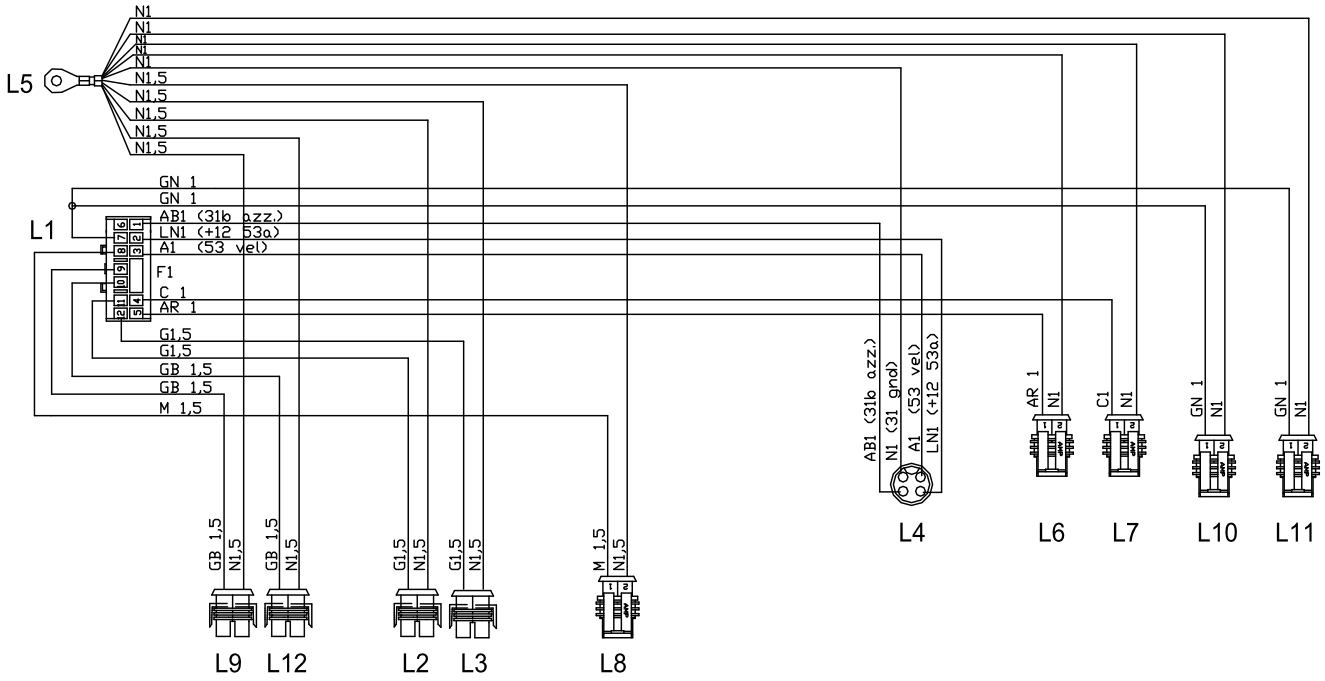


Fig. 1296 - Worklights-number plate light- flashing light (2/2)

40.4.29 - Positions of worklight, number plate and flashing light wiring connectors

View of wiring

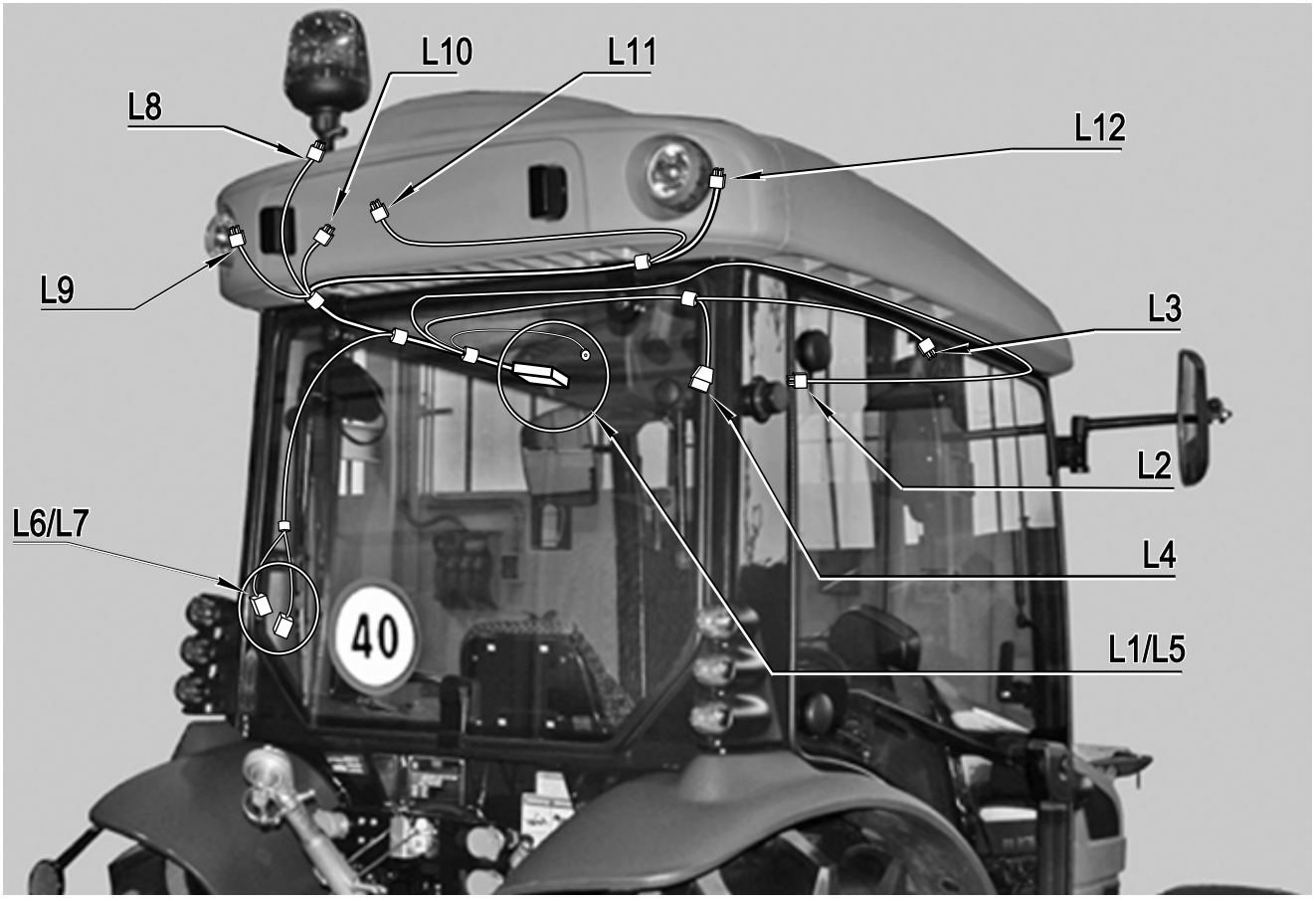


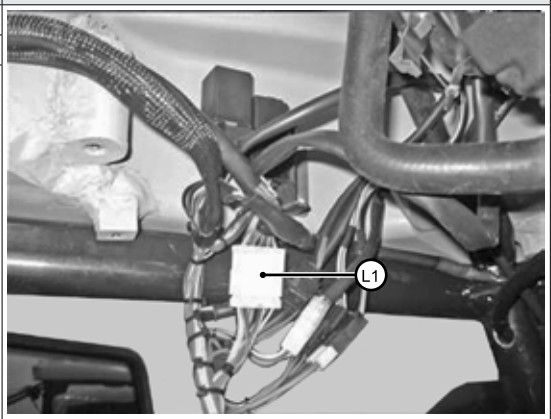
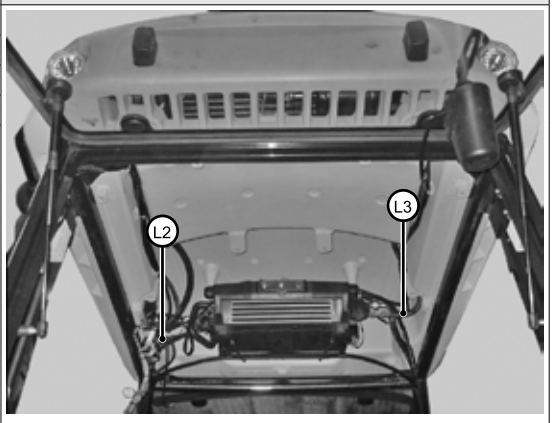
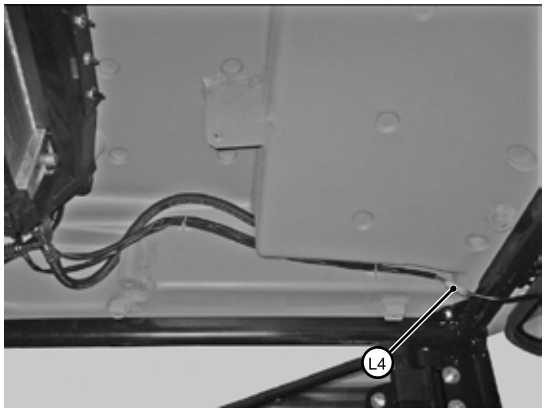
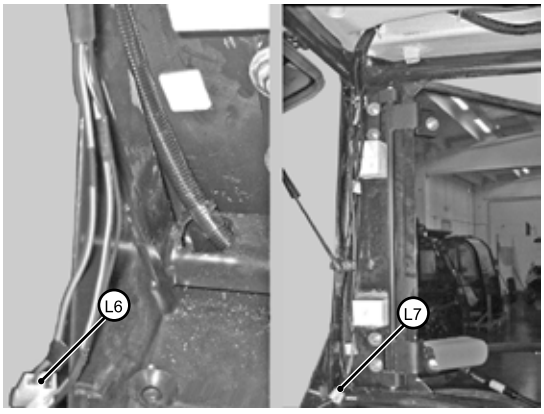
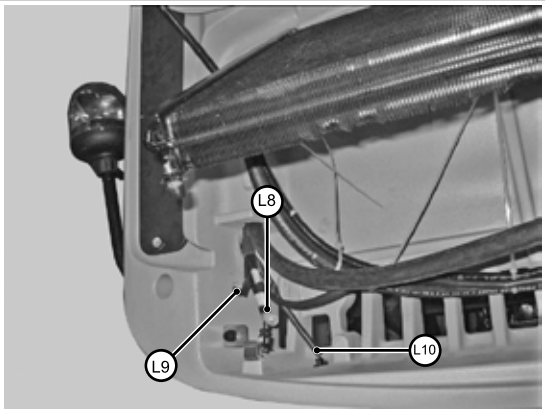
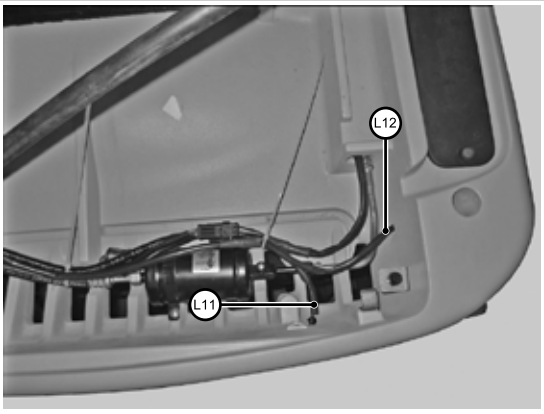
Fig. 1297 - Positions of worklight, number plate and flashing light wiring connectors

0.014.7595.4

- **See para. 40.4.28 - Worklights-number plat... - page 40-98**

Connector positions

Table 130

CONNEC-TOr/SYS-TEM	CONNECTOr POSITIONS	CONNEC-TOr/SYS-TEM	CONNECTOr POSITIONS
L1 **40-45** **40-48**	 Fig. 1298	L2 **40-40** **40-45** T3 **40-45**	 Fig. 1299
L4 **40-45**	 Fig. 1300	L6 **40-45** L7 **40-45**	 Fig. 1301
L8 **40-45** L9 **40-45** L10	 Fig. 1302	L11 L12	 Fig. 1303

40.4.30 - Flashing light wiring - 0.014.7591.4

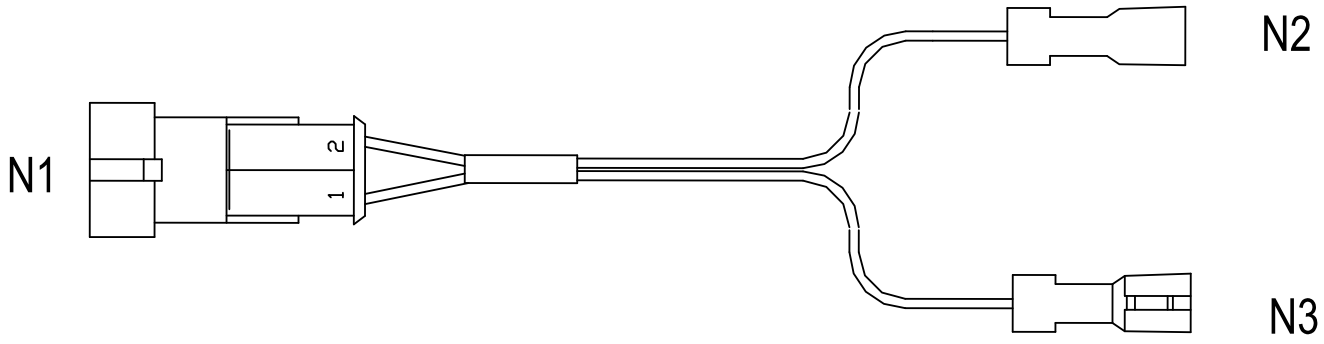


Fig. 1304 - Flashing light wiring

Connectors list

- N1 - Connessione faro lavoro fanalino
- N2 - Rotating beacon connection
- N3 - Rotating beacon connection

40.4.31 - Positions of flashing light wiring connectors

View of wiring

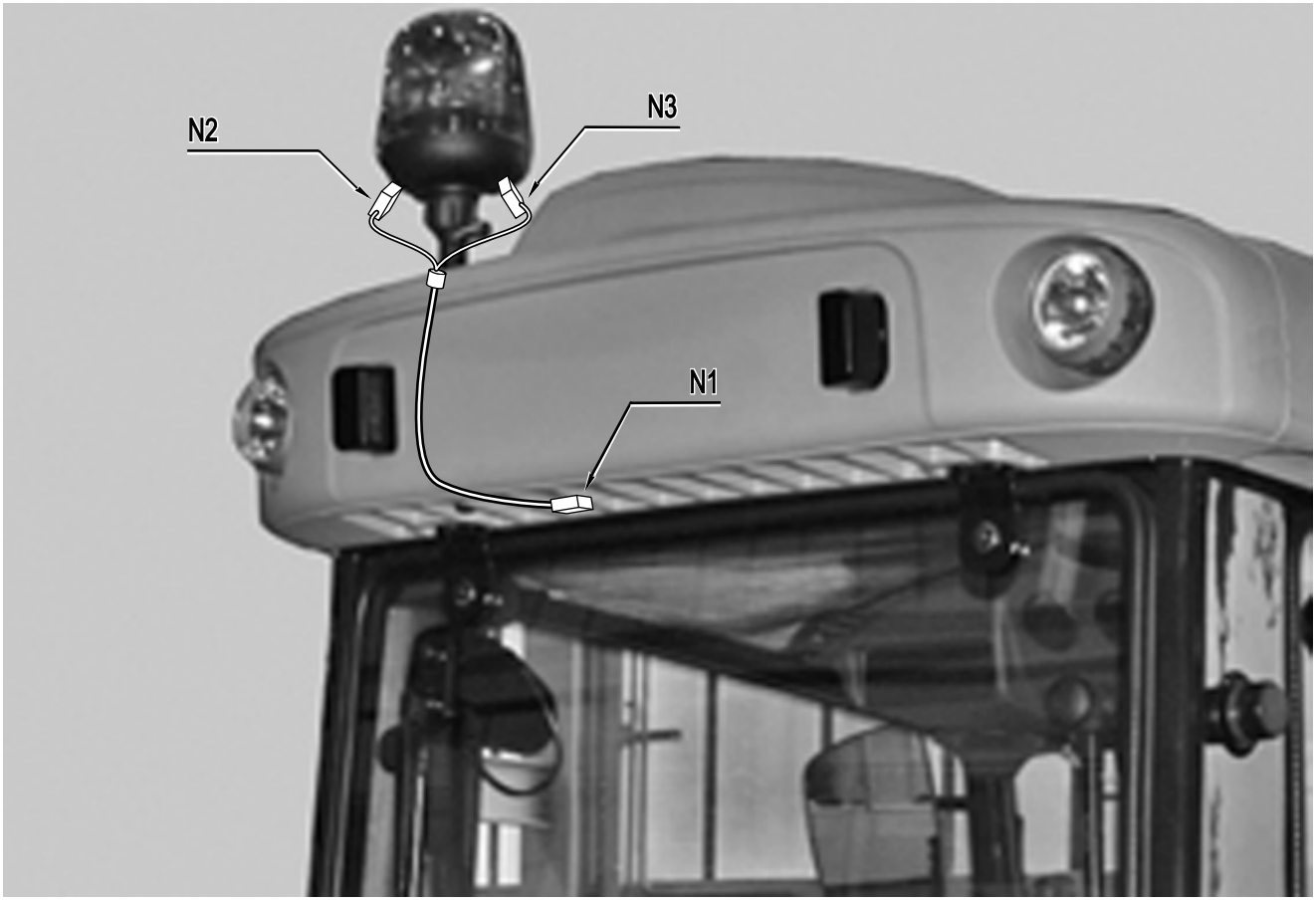


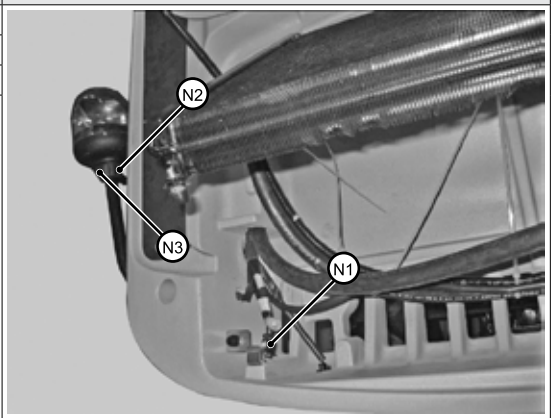
Fig. 1305 - Positions of flashing light wiring connectors

0.014.7597.4

- **See para. 40.4.30 - Flashing light wiring ... - page 40-100**

Connector positions

Table 131

CONNEC-TOr/SYS-TEM	CONNECTOr POSITIONS	CONNEC-TOr/SYS-TEM	CONNECTOr POSITIONS
N1 **40-45** N2 N3	 Fig. 1306		

40.4.32 - Windscreen wipers - 0.014.7598.4

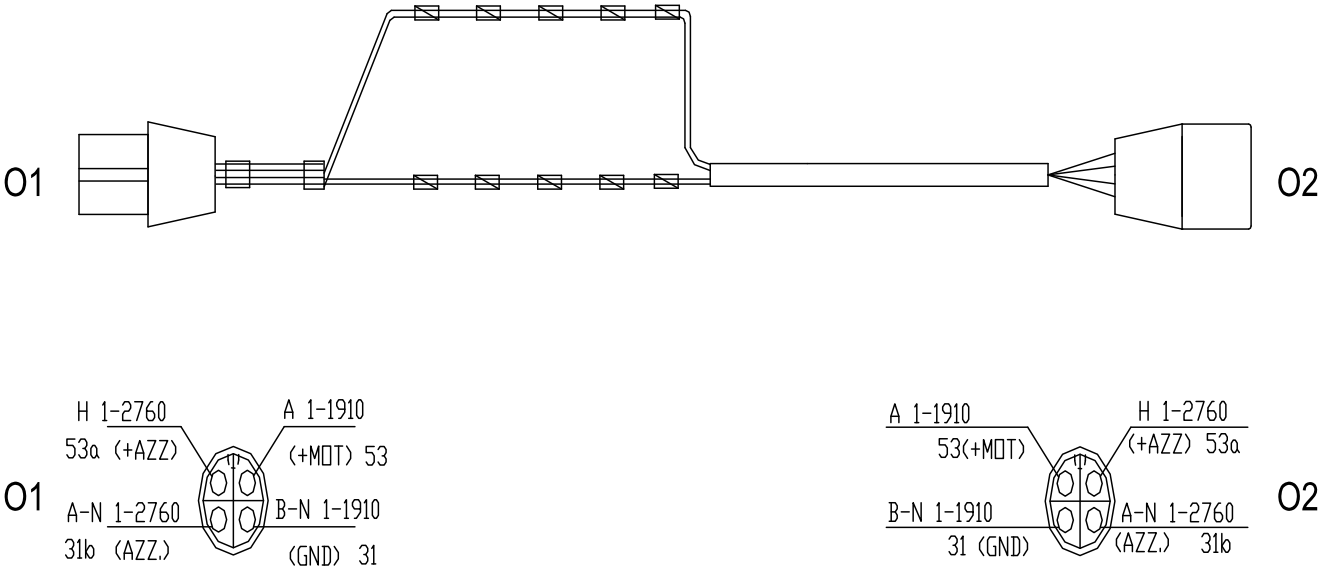


Fig. 1307 - Windscreen wipers

Connectors list

- O1 - To windscreen wipers
- O2 - To aereo wiring

40.4.33 - Positions of windscreen wiper wiring connectors

View of wiring

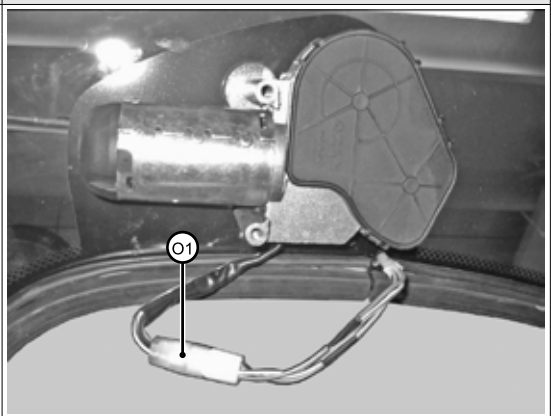
Fig. 1308 - Positions of windscreen wiper wiring connectors

0.014.7598.4

• **See para. 40.4.32 - Windscreen wipers - 0.... - page 40-102**

Connector positions

Table 132

CONNEC-TOr/SYS-TEM	CONNECTOr POSITIONS	CONNEC-TOr/SYS-TEM	CONNECTOr POSITIONS
O1	 Fig. 1309	O2	 Fig. 1310
		40-48	

40.4.34 - Radio wiring - 0.014.7600.4

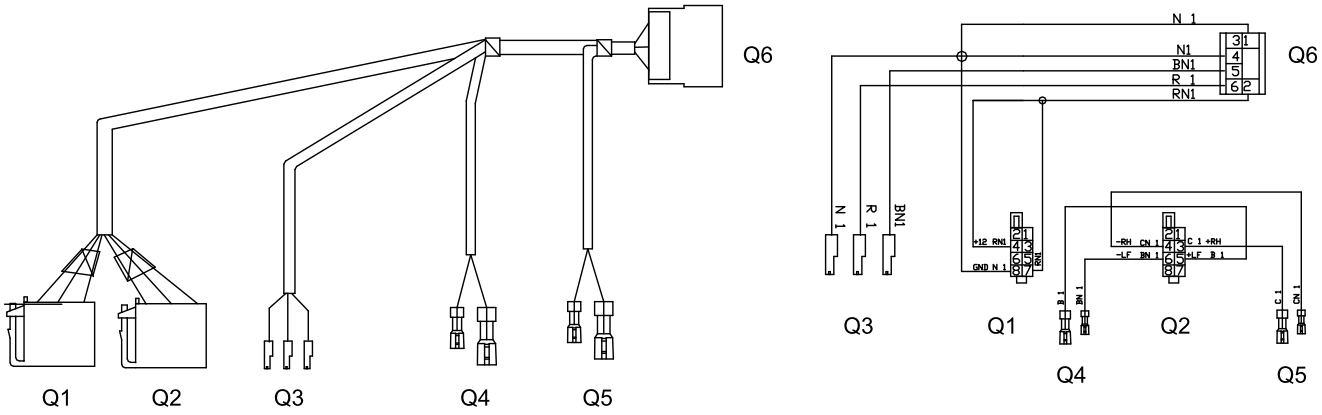


Fig. 1311 - Radio wiring

Connectors list

- Q1 - Provision for radio
- Q2 - Provision for radio
- Q3 - Interior roof light
- Q4 - LH loudspeaker
- Q5 - LH loudspeaker
- Q6 - To aereo wiring

40.4.35 - Positions of radio-loudspeaker wiring connectors

View of wiring

Fig. 1312 - Positions of radio-loudspeaker wiring connectors

0.14.7600.4

- **See para. 40.4.34 - Radio wiring - 0.014.7... - page 40-104**

Connector positions

Table 133

<table>
<tr><th>CONNEC-
TOr/SYS-
TEM</th><th>CONNECTOr POSITIONS</th><th>CONNEC-
TOr/SYS-
TEM</th><th>CONNECTOr POSITIONS</th><th></th></tr>
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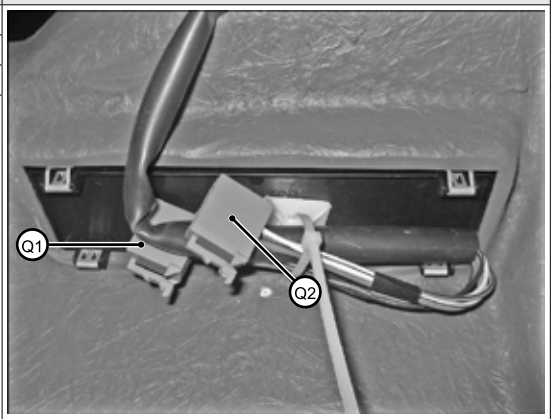
40-45
Q2
40-45</td><td> 

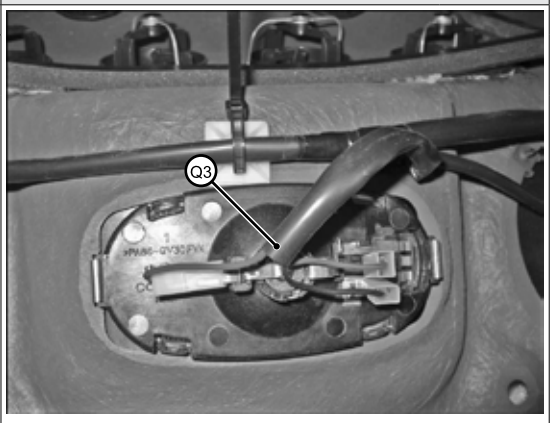
Fig. 1313</td><td>Q3
40-45</td><td> 

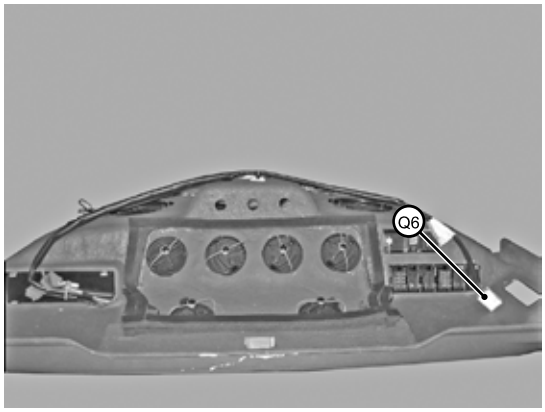
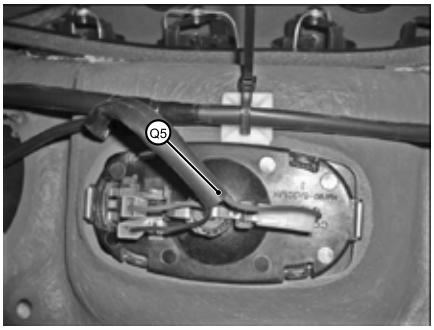
Fig. 1314</td><td></td></tr>
<tr><td>Q6
40-45
40-48</td><td> 

Fig. 1315</td><td>Q5</td><td> 
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