

PH Crane Installation Manual (Part 1 of 4)

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Design | Manufacture | Installation | Training | Service

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1 – INTRODUCTION

1.1 BASIC INFORMATION

This manual provides guidelines to correctly install the PH Cranes on vehicles, as well as to check the correct mounting when the work is finished.

The following symbols are used throughout the manual:



DANGER:

this symbol is used with reference to activities which can involve risk or danger for people.



ATTENTION:

this symbol is used with reference to activities which can involve risk or danger for things.

IMPORTANT:

it indicates useful suggestions or hints for crane installation

NOTE:

it indicates information which can facilitate crane mounting and installation.



ATTENTION

Read this manual carefully before starting each operation related to crane installation.



ATTENTION

Read the “INSTALLATION INSTRUCTIONS” manual of the vehicle’s manufacturer carefully before starting crane installation.

THE COMPETENT PERSON

Is defined in the Approved Code of Practice for LOLER as having “such appropriate practical and theoretical knowledge and experience of the lifting equipment to be thoroughly examined as will enable them to detect defects or weaknesses and to assess their importance in relation to the safety and continued use of the lifting equipment”

THE INSTALLER

It is the responsibility of the installer to ensure that the loader crane is correctly mounted, that the relevant EHSRs (Essential Health & Safety Requirements) have been considered and the appropriate CE documentation is completed. The installer must follow the recommendations of both the loader crane manufacturer and the chassis manufacturer. An incorrectly mounted loader crane may be unsafe to use and its warranty will be invalidated, it may also effect the safe use of the vehicle to which it is installed and effect the vehicle warranty.

The installer should nominate a Responsible Person who will compile a Technical File of the complete build. This Technical File must be maintained and be available for inspection by authorities for a period of ten years. Stability and axle load calculations must be carried out. A dimensional drawing must be produced as a record of the build. The helper frame must be designed in conjunction with the chassis manufacturer requirements.

INSTALLATION TECHNICAL FILES

1. Who the guidance is aimed at:

- Manufacturers and installers of loader cranes.
- Persons conducting thorough examinations of loader cranes and their employers.
- Persons and organisations that own and operate loader cranes.
- National enforcing authorities.
- Any other persons who may be deemed a duty holder under the requirements of the Lifting Operations & Lifting Equipment Regulations (LOLER) 1998, or the Provision and Use of Work Equipment Regulations (PUWER) 1998.

2. What the law says:

- Loader crane installers should record and maintain the contents of a technical file covering the installation from enquiry to handover. Technical files demonstrate how machinery meets the relevant health and safety requirements.

Note: Lorry loader technical files are also commonly referred to as 'build files'.

- The Machinery Directive is European law which is intended to ensure that all new machinery is suitable and safe, and that important issues, including foreseeable misuse and foreseeable human error, have been addressed. The Machinery Directive 2006/42/EC states in Annex VII (A): "The technical file must demonstrate that the machinery complies with the requirements of this Directive. It must cover the design, manufacture and operation of the machinery to the extent necessary for this assessment".
- The Essential Health and Safety Requirements (EHSRs) of the Machinery Directive are enacted in the United Kingdom through the Supply of Machinery (Safety) Regulations 2008. Part 7 of Schedule 2 of these Regulations describes the procedure for compiling a technical file, and replicates the requirements from the Machinery Directive.
- The Supply of Machinery (Safety) Regulations 2008 require the technical file to be retained for at least 10 years from the machinery's date of manufacture.
- Manufacturers / installers are not obliged to make the contents of technical files available to other suppliers, or eventual users of the machinery. However, it is a recommendation in BS7121 Part 4 at 11.4 that the owner / duty holder maintains records, such as: "technical information, including maintenance instructions and performance data provided by the manufacturer".

Note: The contents of the 'machine history file' kept by the loader crane owner are listed in

BS7121-2-4, 7.5.

3. Technical file contents guidance:

A typical lorry loader technical file could contain the following:

- Order Confirmation:
Including copies of production specifications and drawings; and a general description of the machinery.
- Technical Calculations and Drawings:
These could include: installation instructions; payload, axle loading and stability calculations; subframe designs and specifications; and stability monitoring system settings. These calculations and drawings are commonly completed using manufacturer technical calculation software packages.

*Note: Further detail on the required contents of loader crane mounting instructions are listed in BS-EN12999, 7.2.2. **The installer is responsible for carrying out the loader crane manufacturer's installation instructions.***

- Loader Crane Manufacturer's EC Declaration(s) of Conformity:
- This (along with affixing a CE marking on the loader crane itself) is the loader crane manufacturer's EC Declaration of Conformity with the EHSRs of the Machinery Directive.

Suppliers Declaration of Conformity must:

- State the name and address of the manufacturer and, where appropriate, the name and address of their authorised representative;
- Contain a description of the machinery, its make, type and serial number;
- Indicate all European laws (Directives) with which the machinery complies;
- State details of any notified body that has been involved;
- Specify which standards have been used in the manufacture (if any);
- State the place and date of the Declaration; and
- Be signed by a person with authority to do so.

Note: The Supply of Machinery (Safety) Regulations 2008 set out the requirements for EC Declarations of Conformity in Schedule 2, Part 2, Annex II to Regulation 7(2)(e) and 8(1)(c).

Historical Note: Since 29th December 2009, the Machinery Directive classifies a loader crane as a machine at the point at which it is first made available for sale, i.e. when it has been built by the manufacturer. Historically, a loader crane had been classed as "partially completed" machinery on the understanding that it does not become "completed machinery" until it has been mounted and had a power source fitted, i.e. fitted to the vehicle. In these circumstances, loader crane manufacturers used to supply a 'Declaration of Incorporation', with the installer being responsible for completing a Declaration of Conformity once they had completed the installation.

REFERENCE

Installer's EC Declaration(s) of Conformity

- A second Declaration of Conformity is required from the installer, and a CE plate mounted on the installation itself.
- This is separate from the Installer's Plate, the requirements of which are detailed in BS-EN12999, 7.3.3.

Installer's plate

An installer's plate shall be fixed to the crane or the supporting item containing the following information:

- a) Installer's name and address;
- b) Year of installation;
- c) Crane serial number, chassis or registration number of vehicle (if applicable).

Commissioning Documents

This could include:-

- The commissioning Report of Thorough Examination for the loader crane
- Commissioning Report of Thorough Examination for any attachments
- Stability test report
- Calculations of stability at intermediate positions
- Lorry loader inspection sheet
- Attachment inspection sheet
- Function test
- Dynamic test and calibration test records
- Any other technical reports and certificates, such as end of build compliance check sheets and non-compliance reports.

For further information on installation testing and test procedures, refer to BS7121 & BS-EN12999

Vehicle Manufacturer Recommendations

- The process of checking the vehicle manufacturer's recommendations should be verifiable. This could include taking photographs and retaining any drawings that have been followed as proof that these checks have been made, and the work complies with the recommendations. Typically, this could also include a documented incoming chassis inspection assessment report, Certificate of Completion, Weight Tests including axle loadings.

Specification Details

- Such as workshop instructions and works orders
- Full specification information for the crane
- Production notes and plans
- Subframe specifications
- Details on the position and orientation of the loader crane
- Stabiliser beam type and span
- Control systems installed
- Mounting specifications, including holding down bolts specifications
- Information on special features
- Information on specific operating conditions, such as de-rated areas; parts lists, etc.

Electrical Drawings

- Including installation wiring diagrams of electrical systems and control circuits.
- Check Sheets & Inspection Report Forms:
- Signed and dated check sheets showing all items checked by the installer, including stage inspections; installation completion inspections; quality control reports.

Loader Crane Manufacturer's Pre-Delivery Inspection Form

- For all items, including the setup of any specific safety systems, such as stability monitoring devices.

Photographs

- Photographs of the lorry loader under load test during commissioning and of the finished installation from multiple angles, immediately prior to handover. These photographs could be of assistance during repeat builds and may assist in dispute resolution, if required.

Vehicle Collection/Handover Documents

- Including a checklist of all handover items not covered elsewhere, such as warranty information and service log books.

Axle loading & stability calculations

- It is essential that axle loading and stability calculations are made before any vehicle mounted lifting equipment is purchased. Reputable commercial vehicle converters, bodybuilders and lifting equipment manufacturers that offer fitting will offer this service. The calculations will determine if a product is suitable, depending on what needs to be lifted and where the item needs to be placed. These checks are essential in order to ensure that plated axle loads are not exceeded and that loads can be distributed evenly in both running order (unladen) and at gross vehicle weight (when the load takes mass off the front axle).
- These calculations also generate a theoretical stability envelope with the crane and its sub frame in position and determine possible stabiliser leg requirements. A commercial vehicle may be stable when the boom is fully retracted, but there may be non-linear moments with the mass of the extending booms themselves which will also contribute to the tipping point. This may well require working with an OEM and third party converter to determine an adequate chassis and sub frame.
- From a design and construction perspective, stress calculations which take into account the torsional rigidity and mass of the chassis, using OEM's data is key, but it shouldn't end there. From an operational perspective, understanding the exact current and future duties of the vehicle and loader crane is vital. A higher specification crane is likely to require a heavier duty chassis cab.

Whole Vehicle Type Approval

Further to confirmation from the Vehicle Certification Agency on 06.10.16, Penny Hydraulics can confirm that:

- Cranes fitted internally into vans are out of scope of the Enhancement Scheme.
- Cranes fitted to chassis cabs are outside the scope of Whole Vehicle Type Approval if the Mass in Running Order of the vehicle is not increased by more than 3%. Mass in Running Order is the weight of the van or chassis cab as it left the factory including a full fuel tank and a nominal driver weight of 75kg. If the 3% is exceeded, the crane must be fitted post registration and is then classed as payload.
- On fitting the crane, the installer must carry out overall/axle mass checks, stability calculations and supply a test certificate.

In the above cases, the vehicle does not require a further stage of Type Approval or Individual Vehicle Approval.

This considered, should the vehicle still require bodywork and/or related work to be Type Approved, then Penny Hydraulics can arrange this on your behalf through a network of trusted

converter/bodybuilder partner companies throughout the UK. Please be advised that there are cost and time implications involved in this process so this should be considered and discussed as early as possible in the specification process.

The installer should nominate a Responsible Person who will compile a Technical File of the complete build. This Technical File must be maintained and be available for inspection by authorities for a period of ten years. Stability and axle load calculations must be carried out. A dimensional drawing must be produced as a record of the build. The helper frame must be designed in conjunction with the chassis manufacturer requirements.

The Health and Safety at Work Act 1974

Under Section 3 of the Health and Safety at Work Act the prime duty of care rests with the employer, but employees have legal duties too, particularly under Sections 7 and 8 of the Act. These include:

- Taking reasonable care for their own Health & Safety and that of others who may be affected by what they do or don't do.
- Co-operating with their employer on Health & Safety matters.
- Not interfering with or misusing anything provided for their health, safety and welfare.

The Health and Safety at Work Act will also be used by the enforcing authority as it requires, in general terms, that the safety of all persons is, so far as is reasonably practicable, ensured at all times.

Employers have a Duty of Care for the safety of staff on work journeys whether full- or part-time or driving their own vehicle on business, their road safety is the concern of the company.

(LOLER) Lifting Operation and Lifting Equipment Regulations 1998

LOLER was brought about in 1998 to sit alongside the Health & Safety at Work Act 1974, Supply of Machinery Regulations 1992 and the Provision and Use of Work Equipment Regulations 1998. The Regulations impose health and safety requirements with respect to lifting equipment.

Previously, all of these Acts had their own schedule of legal requirements for the testing and examination of lifting equipment. LOLER sought to harmonise best practice from all previous acts and replace them with one document.

Two examples of the provisions made within LOLER are:

- The strength and stability of lifting equipment.
- Reports of thorough examinations and records of inspections.

More detail again is available in the Approved Code of Practice associated with LOLER.

An Approved Code of Practice gives one interpretation of the regulations and if this course of action is followed then a court of law would not disagree with it. The Code of Practice refers to BS7121 regarding the load testing of lifting equipment.

There may be even more detailed information available for some lifting equipment that "puts flesh on the bones"

The Provision and Use of Work Equipment Regulations 1992 (PUWER)

PUWER is a broad based set of regulations with responsibilities for purchasers and operators. Any person who buys equipment must ensure that it is suitable for its intended use. They must also ensure that it is properly maintained, regularly inspected and the information logged. PUWER also determines any specific risks and details what information and instructions must be made available to operators.

The Supply of Machinery (Safety) Regulations 1992 – Machinery Directive

Manufacturers have a high degree of responsibility to produce information for operators as part of the CE marking process. This takes the form of producing operating manuals, description of the intended use, service schedules and inspection regimes.

Sticking to these regimes will ensure that they meet their obligations as an operator. They have to be aware though that if there has been a significant change, accident or a major new component fitted to a lifting machine then a further thorough examination and load test may be required.

The Supply of Machinery (Safety) Regulations 1992, also called the Machinery Directive, contains the essential health and safety criteria that all machines must meet. There are responsibilities for designers, manufacturers and suppliers. The manufacturer must have developed a “technical file” that is a legal requirement and it documents how they meet the criteria. Having documented how they meet the criteria, they can fix the CE mark to the machine and release a “Declaration of Conformity”.

BS 7121 Safe use of cranes, Parts 2 and 4

BS EN 12999 Cranes – Loader Cranes

British BS, European EN and International ISO Standards

Standards do not generally have the force of law; the application of a standard is almost always voluntary, although standards are very often used in support of legislation, and compliance with a standard is sometimes quoted in legislation as offering a route to discharging legal obligations. Good examples of this are references to BS7121 in the Guidance to LOLER.

British Standards (BS) are generally restricted to Codes of Practice for safe use of equipment e.g. BS7121-4 Safe Use of Lorry Loaders.

European (EN) standards cover requirements for basic principles - (Type A),

Common product requirements - (Type B)

Specific product requirements - (Type C) e.g. EN12999 Cranes – Loader Cranes.

Harmonised European Standards, which give presumption of conformity to the Essential Health and Safety Requirements of the Machinery Directive.

International Standards (ISO) cover both the safe use and specification of cranes and components. They do not have any legal status but are often taken as good practice and are cited as normative references in some EN product standards.

ALLMI Code of Practice for Installation Application and Operation

The Association of Lorry Loader Manufacturers and Importers (ALLMI) was founded in 1978 at the request of the Health and Safety Executive, and it remains today as the UK's only Trade Association devoted exclusively to the lorry loader industry. It serves, represents and promotes the interests of its members and the industry at large, and it is the natural focus and authority on all issues involving the design, manufacture, application and use of lorry loaders.

ALLMI's core aims are:

- To promote the safe use of lorry loaders.
- To ensure that the Association is involved in the formulation of any legislation which affects the industry's interests.
- To promote compliance with training requirements embodied in current legislation.

ALLMI has members drawn from all parts of the industry, including manufacturers / importers, service agents, ancillary equipment manufacturers / suppliers, fleet owners and site operators. All members share the same objective of promoting safe use and best practice.

2 – MOUNTING PREPARATION

2.1 STARTING PREPARATION

Each **PH** Crane is delivered mounted to a pallet for ease of moving by forklift or pallet truck. Along with each crane the following are delivered:

Materials

- For cranes with outrigger base: brackets, tie bolts fitted with nuts and lock nuts, relevant support plates for fixing to the vehicle's frame
- For cranes in standard version: tie bolts, nuts and lock nuts
- Grease cartridge gr. 400, type recommended for slewing gears lubrication
- A second loading capacity plate (the first is applied to the crane boom), to be placed in the most appropriate position for the operator
- Hydraulic power pack (only for electric cranes)
- Two keys for the main board switch.

Documents

- Warranty certificate
- Operating and maintenance
- Spare parts manual
- CE conformity declaration
- Certificate of origin (only Italy)
- other certificates when compulsory in the destination Country, or expressly requested by the Customer.



Check that the above equipment is delivered complete. If not, get in touch with Penny Hydraulics for any missing items.

2.2 CRANE MOVING AND STORAGE

Each **PH** Crane is equipped with a lifting eye located on the upper side of the main boom. To lift the crane, cut the upper part of the nylon package, in order to gain access. This is marked by stickers. Attach a steel shackle of proper dimensions and capacity to the lifting eye before attempting to lift the crane.



DANGER

The lifting eye is suitable for the crane weight, whatever the version is. Note: the position of the eye is only suitable for cranes in standard version (without outrigger base). For cranes fitted with base, the centre of gravity can vary according to the version and the options chosen for the stabilisers.

2.3 Table of crane masses and sizes

Listed below are the masses and overall dimensions of **PH** Cranes in standard version (see Pict. 1).

MODEL	MASS [kg] standard crane	MASS [kg] base and stabilise. (variable according to the options chosen)	DIM. B L x B [mm]	HEIGHT H [mm]
PH 110 M	105	40 (vers. A) 64÷88 (vers. B)	670 x 390	1210
PH 110 E	100		670 x 390	1210
PH 110.1 H	105		670 x 390	1210
PH 110.1 ERS	125		670 x 390	1210
PH 110.2 H	125		670 x 390	1210
PH 110.2 ERS	145		670 x 390	1210
PH 110.3 H	155		730 x 390	1220
PH 110.3 ERS	175		730 x 390	1220
PH 150.1 H	165	64÷88	690 x 360	1320
PH 150.1 E	185		690 x 360	1320
PH 150.2 H	175		690 x 360	1320
PH 150.2 E	195		690 x 360	1320
PH 150.3 H	185		790 x 360	1340
PH 150.3 E	205		790 x 360	1340
PH 180.2 H	180	102÷109	690 x 360	1320
PH 180.2 E	200		690 x 360	1320
PH 180.3 H	190		790 x 360	1340
PH 180.3 E	210		790 x 360	1340
PH 230.2 H	225	102÷109	790 x 400	1420
PH 230.2 E	245		790 x 400	1420
PH 230.3 H	255		790 x 400	1450
PH 230.3 E	275		790 x 400	1450

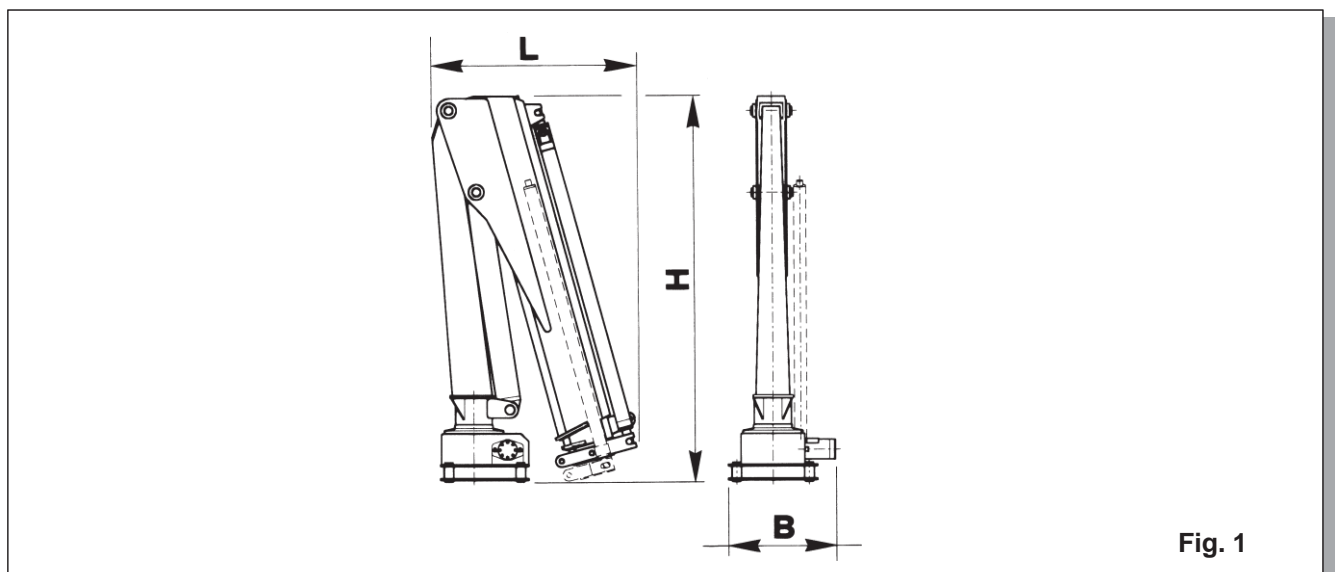


Fig. 1

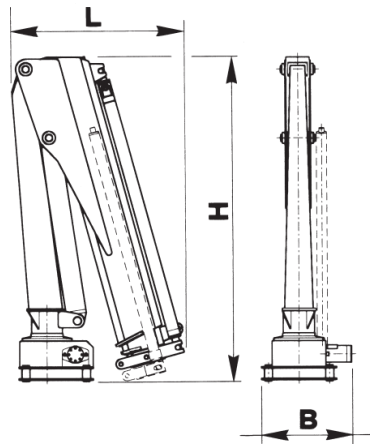


Fig. 1

MODEL	MASS [kg] standard crane	MASS [kg] base and stabilise. (variable according to the options chosen)	DIM. B L x B [mm]	HEIGHT H [mm]
PH 270.2 H	225	102÷109	790 x 400	1420
PH 270.2 E	245		790 x 400	1420
PH 270.3 H	255		790 x 400	1450
PH 270.3 E	275		790 x 400	1450
PH 270L.2 H	235		1130 x 400	1510
PH 270L.2 E	255		1130 x 400	1510
PH 270L.3 H	270		1130 x 400	1520
PH 270L.3 E	290		1130 x 400	1520
PH 330.2 H	270	130÷140	820 x 440	1550
PH 330.2 E	290		820 x 440	1550
PH 330.3 H	295		820 x 440	1550
PH 330.3 E	315		820 x 440	1550
PH 330.4 H	325		930 x 440	1570
PH 330.4 E	345		930 x 440	1570
PH 380.2 H	310	158÷160	870 x 450	1630
PH 380.2 E	330		870 x 450	1630
PH 380.3 H	345		870 x 450	1630
PH 380.3 E	365		870 x 450	1630
PH 380.4 H	375		940 x 450	1650
PH 380.4 E	395		940 x 450	1650
PH 400.2	460		1505 x 1250	1830
PH 400.3	500		1505 x 1250	1830
PH 400L.2	490		1675 x 1250	1800
PH 400L.3	540		1675 x 1250	1800
PH 400L.4	570		1715 x 1250	1800
PH 500.2	470		1505 x 1250	1830
PH 500.3	510		1505 x 1250	1830
PH 500L.2	500		1675 x 1250	1800
PH 500L.3	550		1675 x 1250	1800
PH 500L.4	580		1715 x 1250	1800
PH 510.2	465	240÷270 (vers. A) 305÷345 (vers. B)	1380 x 545	1830
PH 510.3	500		1380 x 545	1830
PH 510L.2	485		1510 x 545	1790
PH 510L.3	530		1510 x 545	1790
PH 510L.4	565		1510 x 545	1790



Before moving the crane, ensure that a lifting device with proper capacity is available. Relevant lifting accessories (shackles, chains, hooks, ropes, etc.) must have a suitable capacity and have a relevant test certificate.



The crane is to be moved cautiously, in order to avoid damage to its parts, especially to the components of the electric and hydraulic circuits, and the safety and protection systems. Should it be noticed that, during transport or moving, some damage has occurred, the parts concerned are to be replaced by original **Penny Hydraulics** spare parts before putting the crane into operation.



The crane is to be stored in a covered and dry place. The nylon bag must be removed only when mounting the crane on the vehicle.

Should the crane need to be stored for some time, place on timbers, taking care to secure it in a safe way by ropes or other suitable means to ensure its protection and prevent its overturning.

IMPORTANT

After long storage periods (for instance: 12 months or more, even depending on the environmental conditions), when putting the crane into service for the first time you could notice some anomalies due to the seals sticking on rods, sliders, valves, etc. because of long inactivity. In case of doubt, consult Penny Hydraulics.

2.4 PRECAUTIONS TO BE RESPECTED

- 1 Keep the crane mounting area clear of unrelated machinery, vehicles and personnel.
- 2 Care must be taken when welding and the area must be well ventilated.
- 3 Appropriate actions must be taken to prevent slips, trips and falls.
- 4 Care must be taken to prevent risk of injury from corrosives (such as battery acid) and fluids under pressure (splits in hydraulic hoses).
- 5 Appropriate PPE (Personal Protective Equipment) must be worn at all times.
- 6 Operate in a safe environment, well aired, with clean and dry floors. Avoid using flammable or toxic detergents.

3 – CRANE - VEHICLE COMPATABILITY

3.1 Minimum vehicle

It is important to specify the right crane for the vehicle. This ensures the safety and satisfaction of the customer as well as proving the installer's professionalism.

Please use the tables below showing vehicles "minimum wheelbase" and "minimum unladen weight" as a guide for choosing the appropriate crane. This should then be clarified using calculations and practical tests detailed in the ensuing paragraphs.

MOUNTING WITHOUT SUPPLEMENTARY OUTRIGGERS Table [A]

Crane model	Vehicle's minimum unladen weight [Kg.] (vehicle's unladen weight, including body, excluding the crane itself and its stabilising system)	Vehicle's minimum wheelbase (mm)
PH 110	1400	2000
PH 150	1400	2450
PH 180	1840	2800
PH 230	2000	2800
PH 270-ML 330	2200	2800
PH 380	1850	3200
PH 510	3200	3690

MOUNTING WITH SUPPLEMENTARY OUTRIGGERS Table [B]

Crane model	Vehicle's minimum unladen weight [Kg.] (vehicle's unladen weight, including body, excluding the crane itself and its stabilising system)	Vehicle's minimum wheelbase (mm)
PH 110	1200	1800
PH 150	1200	2200
PH 180	1450	2200
PH 230	1450	2450
PH 270-ML 330	1750	2450
PH 380	1750	2800
PH 510	2800	3100

3.2 CHECKING THE CRANE - VEHICLE COMPATABILITY

Axle Loadings

The installation on a vehicle of a crane, a body, a supplementary outrigger, etc., involves a new distribution of loads on the vehicle's axles.

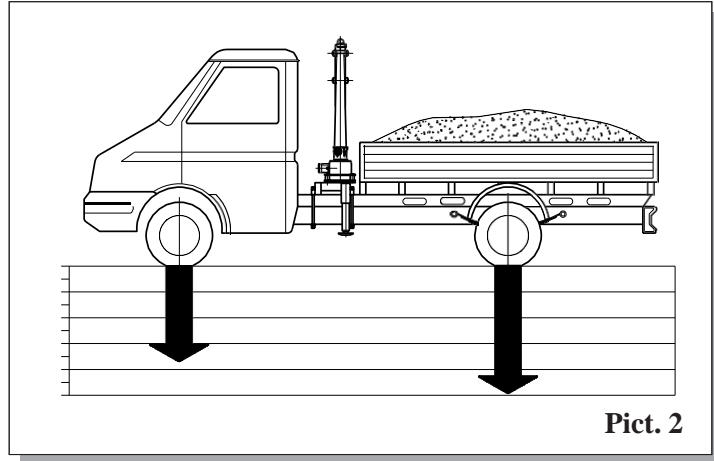
Therefore, the manufacturer states some limit rates which must be respected:

- the maximum admissible load on each axle
- g.v.w., i.e., the maximum total vehicle's weight when fully loaded
- the ratio between the maximum load on each axle when fully loaded and empty.

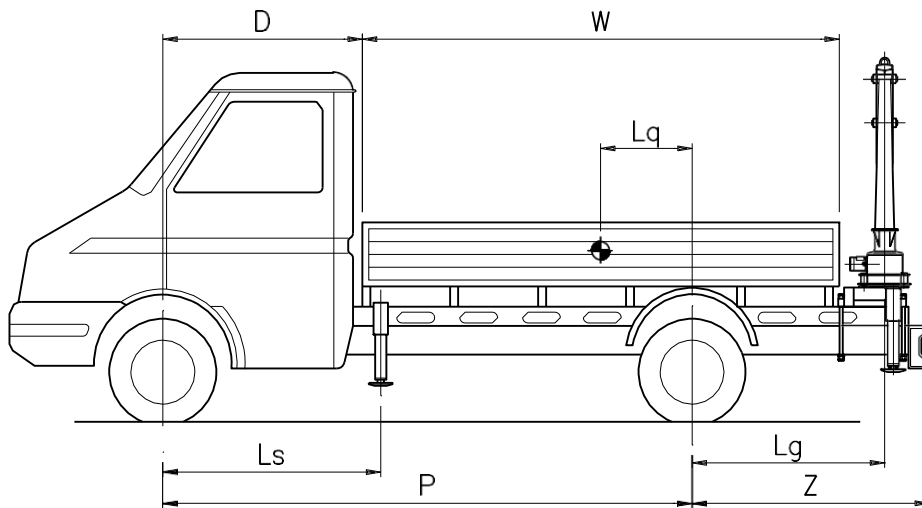
Therefore, it must be checked that the foreseen installation respects such limits.

The different existing loads, e.g.:

- body's mass when empty
- crane's mass
- supplementary outriggers' mass, if any
- mass of the sub-frame
- axle loadings must be calculated using weight pads weigh bridge or by calculation



Pict. 2



Pict. 3

Key:**P_g** = Crane's Mass***T_a** = Distribution Van Chassis' Unladen weight – Front Axle**P_c** = Body's Mass**T_t** = Total Unladen weight**P_{tt}** = Compl. Mass with Full Load**Z** = Distance Rear Axle – Final Body Part**D** = Distance Front Axle – Initial Body Part**L_q** = Body Barycentre Feed (=P-D-W/2)***T** = Van Chassis Unladen Weight***T_p** = Distribution Van Chassis' Unladen Weight – Rear Axle**P_s** = Mass Front Supplementary Outrigger (if present)**Q** = PTT-TT = Remaining Payload**P** = Wheelbase**W** = Body Length**L_g** = Distance Rear Axle – Crane Barycentre**L_s** = Distance Supplementary Outriggers from Rear Axle

* Rates drawn from the homologation booklet of the vehicle or by "Direct Weighing".
N.B. The crane centre of gravity is considered in the transport position.

Finally, check that, when the crane is working with the loads mentioned on the loading chart:

- the overload on the front axle does not exceed 25% of its maximum allowed rate
- the overload on the rear axle does not exceed 50% of its maximum allowed rate.

The maximum allowed rates on axles are mentioned on the homologation booklet of the vehicle.

The lifting moment rates to be used for the verification are mentioned in the following Tab [E].

If the check is not fulfilled, it is necessary to mount a supplementary outrigger system.

3.3 STABILITY CALCULATIONS & TEST

It is a requirement of the Supply of Machinery (Safety) Regulations, Schedule 3, Section 1.3.1, that "machines must be so designed and constructed that they are stable enough under the foreseen conditions for use without risk of overturning." The purpose of the Stability Test is to verify the stability of the loader crane mounted onto the unloaded vehicle (EN12999). This test is required for new installations.

- The Stability Test load shall be determined using a computer package, such as Trailer Win, or according to the Calculation of the Stability Test Load.
- The Stability Test shall be conducted with the vehicle unloaded and without the driver or any ancillary crane or chassis equipment (this includes timber cranes).
- The RCL and RCI will need to be disabled.
- The test should be carried out at the following radii:
 - Maximum radius with any special extensions.
 - Maximum radius attainable with hydraulic outreach.
- A Stability Test will be made for each slew sector, e.g. if a reduced capacity exists over the cab of the chassis.
- In cases where the crane has a stabiliser safety system which allows the crane to be used with various stabiliser beam spans, the stability will be checked for any reduced capacity areas/sectors.

- At each radius the load should be slewed slowly through the full slewing arc.
- During the Stability Test, one or more stabiliser legs or wheels may lift from the ground. However, at least one of the hand-braked wheels should remain in contact with the ground.
- The Stability Test shall be made according to the least favourable boom/extension configuration within the whole slewing range.
- The test shall be considered successful if the test load is held static throughout the full slewing arc of the loader crane and at least one hand-braked wheel remains in contact with the ground. It must also be the case that no crack, permanent deformation, paint flaking or damage to the lorry loader occurs as a result of the test.
- All safety devices should be reconnected, reset and resealed before the lorry loader is released from testing.



For the above mentioned reasons, it is always compulsory to carry out the practical stability test with completely installed vehicle, and using the prescribed test loads. (see EN 12999 – point 6.2.5.1)

The results of the stability checks, both theoretic and practical, are to be recorded and reported on the Technical File which the installer is obliged to draw up for each installation.

The EN 12999 Norm – point 6.2.5 establishes that it must be considered as applied to the hook a test load equal to:

$$P_t = K_s \times P + 0.2 \times F \quad [\text{kg}]$$

- where: **P** = load chart capacity of the crane at the considered outreach
F = equivalent dead weight of boom system, applied on hook distance (it is shown in the table [D] for each crane and each outreach).
K_s = 1.2 for all **PH** Cranes

The stability is assured if, for each load chart capacity and relevant outreach it results:

$$\frac{\text{sum stabilising effects}}{\text{sum overturning effects}} \geq 1.25$$

The check is to be carried out for the full 360 degrees of the horizontal slewing arc. If the above calculation is not satisfactory, you must reduce such arc (for instance, only the rear 180 degrees of the vehicle), or **P_t** by reducing the load chart capacity at that outreach.

Equivalent dead weight rates **F** of boom system, applied on hook distance. Table [D]

Model	Outreach [mt]	rate F mobile parts [kg]	Model	Outreach [mt]	rate F mobile parts [kg]
PH 50	0.98	21.00	PH 230.2 - PH 270.2	1.20	61.20
	1.70	20.00		2.20	71.50
	2.42	16.00		3.20	63.60
PH 110.1	1.05	25.70		4.20	53.50
				5.20	44.90

	1.93	29.20	PH 230.3 - PH 270.3	1.26	67.70
	2.80	25.90		2.26	81.60
PH 110.2	1.05	29.30		3.26	75.20
	1.93	34.10		4.20	64.90
	2.80	30.10		5.20	54.00
	3.73	25.20	PH 270L.2	1.40	66.90
	4.50	21.60		2.60	78.40
PH 110.3	1.10	31.60		3.80	69.40
	1.98	38.30		5.00	58.40
	2.85	35.10		6.00	50.10
	3.73	30.00	PH 270L.3	1.46	74.50
	4.50	25.60		2.66	90.00
PH 150.1	1.16	36.00		3.86	82.70
	2.08	41.30		5.00	71.10
	3.01	36.30		6.00	60.60
	4.00	30.60	PH 330.2	1.30	82.20
	5.00	25.70		2.30	92.10
PH 150.2 - PH 180.2	1.16	42.80		3.30	83.00
	2.08	50.60		4.36	70.50
	3.01	44.30		5.36	60.70
	4.00	36.60		6.36	52.30
	5.00	30.50			

Model	Outreach [mt]	rate F mobile parts [kg]	Model	Outreach [mt]	rate F mobile parts [kg]
PH 330.3	1.36	88.20	PH 400-500-510L.4	1.83	142.60
	2.36	100.80		3.18	170.40
	3.36	93.40		4.53	160.40
	4.36	80.80		5.83	143.20
	5.36	69.00		6.83	127.80
	6.36	59.40			
PH 330.4	1.43	93.30			
	2.43	109.20			
	3.43	103.60			
	4.43	91.80			
	5.36	80.10			
	6.36	68.70			
PH 380.2	1.45	81.10			
	2.55	103.50			
	3.65	97.00			
	4.72	86.00			
	5.79	75.00			
	6.79	65.70			
PH 380.3	1.52	86.20			
	2.62	112.10			
	3.72	107.60			
	4.72	97.10			
	5.79	84.00			
	6.79	73.40			
PH 380.4	1.59	92.40			
	2.69	122.50			
	3.79	120.30			
	4.79	111.10			
	5.79	97.80			
	6.79	85.10			
PH 400-500-510.2	1.44	109.80			
	2.54	128.40			
	3.64	116.40			
	4.70	100.80			
	5.70	87.70			
	6.70	76.20			
PH 400-500-510.3	1.50	115.10			
	2.60	137.40			
	3.70	127.30			
	4.70	112.20			
	5.70	97.10			
	6.70	84.20			
PH 400-500-510L.2	1.69	122.30			
	3.04	139.10			
	4.39	123.70			
	5.75	104.80			
	6.75	92.00			
	PH 400-500-510L.3	1.75	129.50		
3.10		151.10			
4.45		138.00			
5.75		119.00			
6.75		104.00			

3.4 SUB-FRAME OR REINFORCING CHASSIS FRAME

It is normal to stiffen the chassis by a supplementary reinforcing structure called a sub-frame or a “reinforcing chassis counter-frame”. Considerations must include:

- Size and strength of the section (and its mass for line meter)
- Shape and design of the sub-frame to avoid existing vehicle equipment.

A computer program such as Frame WIN can be used to determine the strength of the sub-frame. Alternatively, calculations can be used.



The following calculation method does not replace the OEM Vehicle Manufacturers Installation Instructions.

3.4.1 Reinforcing chassis calculation

- Key:
- Jt:** bending moment of inertia of chassis' section [mm⁴]
 - Jc:** bending moment of inertia of reinforcing chassis' sect. [mm⁴]
 - Wt:** bending module of resistance of chassis' sect. [mm³]
 - Wc:** bending module of res. of reinforcing chassis' sect. [mm³]
 - M:** max. crane lifting moment (dynamic) [daNmm] as mentioned on Tab.[E]
 - Mt.:** max. admissible moment on chassis [daNmm]
 - Mc:** max. admissible moment on reinforcing chassis [daNmm]
 - st:** max. admissible stress for the material of the chassis [daNmm²]
 - sc:** max. admissible stress for the material of the reinforcing chassis, see Tab. [F] [daN/mm²]

Max. dynamic lifting moments **PH** Crane. Table [E]

Crane model	Lifting moment [daN*mm]
PH 50	678.695
PH 110	1.275.027
PH 150	1.762.935
PH 180	2.042.262
PH 230	2.870.777
PH 270	3.061.536
PH 330	3.806.322
PH 380	4.585.821
PH 400	5.845.420
PH 500 - 510	6.833.974

3.4.2 Materials for reinforcing chassis

Only use structural steel. Make sure that the quality chosen is actually supplied, even requesting proof of the milling certificates.

STEEL TYPES COMMONLY USED FOR REINFORCING CHASSIS Tab. [F]

Standard EN 10025	Standard UNI 7070	Ultimate strength [daN/mm ²]	Admissible stress sc [daN/mm ²]
Fe E 235	Fe 360	>= 36	16
Fe E 275	Fe 430	>= 43	18.3
Fe E 355	Fe 510	>= 52	24

3.4.3 Reinforcing chassis calculation

First check that the reinforcing chassis is actually needed. When the crane is very small in relation to the truck where it is mounted, the vehicle's chassis may suffice to bear crane stresses:

$$s = M / 2 \cdot Wt < st$$

The vehicle's chassis is in itself sufficient, only a stress distribution plate of proper length between crane and chassis is required (see par. 3.5).

Otherwise, the verification depends on whether:

- A)** the crane is installed behind the cab
- B)** the crane is installed rearbody.

A) CRANE INSTALLED BEHIND THE CAB

The dynamic moment of the crane is to be split up in parts proportional to the moments of inertia of the chassis' and reinforcing chassis' sections, by imposing the following equations:

$$Mt = 2st \cdot Wt \quad Mc = M - Mt$$

The following relations must be simultaneously verified:

$$Jc \geq Mc \cdot Jt / Mt \quad Wc \geq Mc / 2sc$$

If not so, the calculation is to be repeated by adopting a different reinforcing chassis' section (with bigger thickness or height).

B) CRANE INSTALLED REAR BODY (= on the rear overhang of the truck)

The building of the reinforcing chassis is more complicated and exacting, because it is to be carried out so that it forms only one structure with the vehicle's chassis, with a suitable contrast in bending and torsion (see following par. 3.5).

Considering: $J =$ bending moment of inertia of the global section formed by the chassis' and reinforcing chassis' sections, considered as all in one [mm⁴]

Z_{sup} , Z_{inf} = distances of the extreme borders of the reinforcing chassis and the chassis from the centre of gravity of the global section [mm]

$$W_{sup} = J / Z_{sup} \text{ [mm}^3\text{]} , W_{inf} = J / Z_{inf} \text{ [mm}^3\text{]}$$

The calculation is verified if:

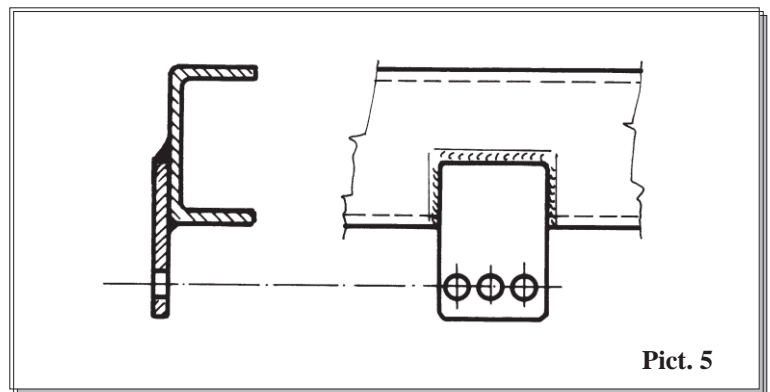
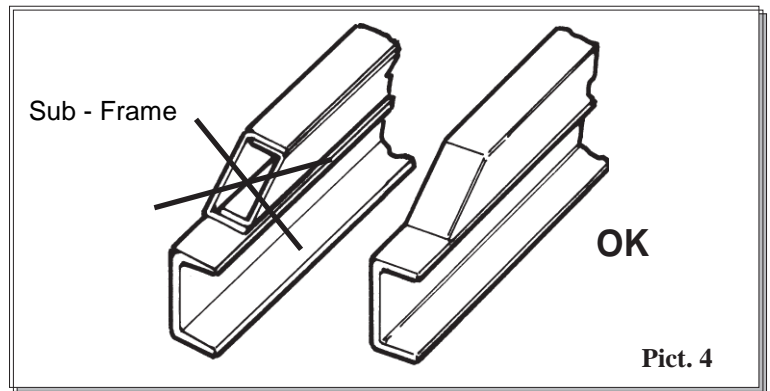
$$W_{sup} \geq M / (2 \cdot st) , W_{inf} \geq M / (2 \cdot sc)$$

If not so, the calculation must be repeated choosing a different reinforcing chassis' section (with bigger thickness or height).

3.5 BUILDING A REINFORCMENT CHASSIS

Before starting any mounting operation, it is necessary to make sure that the vehicle's chassis is parallel and not warped. Check by levels and other tools. We also advise against welding the reinforcing frame directly onto vehicle's chassis; instead, make use of proper supports, adjusting so that a firm and level reference is ensured. The counter-frame is then to be protected and painted before its installation on the vehicle. We draw your attention to the fact that, while travelling on roads, such structures shall be subjected to the continuous action of water, mud, salt, sand and crushed stones abrasions, etc. The frame is inaccessible, therefore not easy to inspect and restore. Take care then of its protection including:

- sand-blasting
- painting by products of the same kind of those used by the vehicle's Manufacturer to protect the chassis, in suitable thicknesses (at least 60-80 microns)
- the open tubular parts of the reinforcing chassis are to be closed by welding some steel

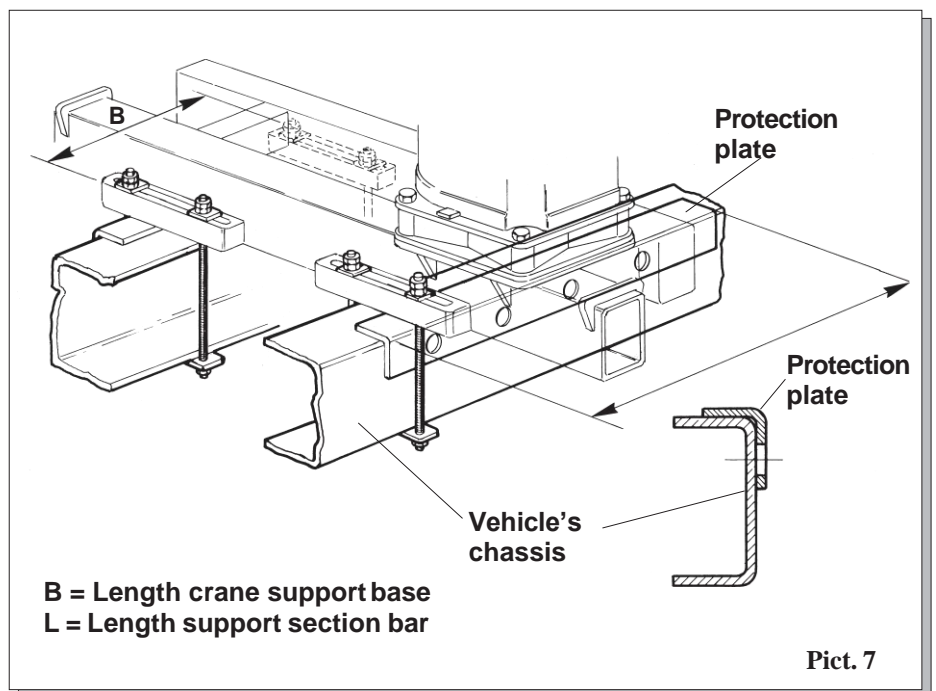
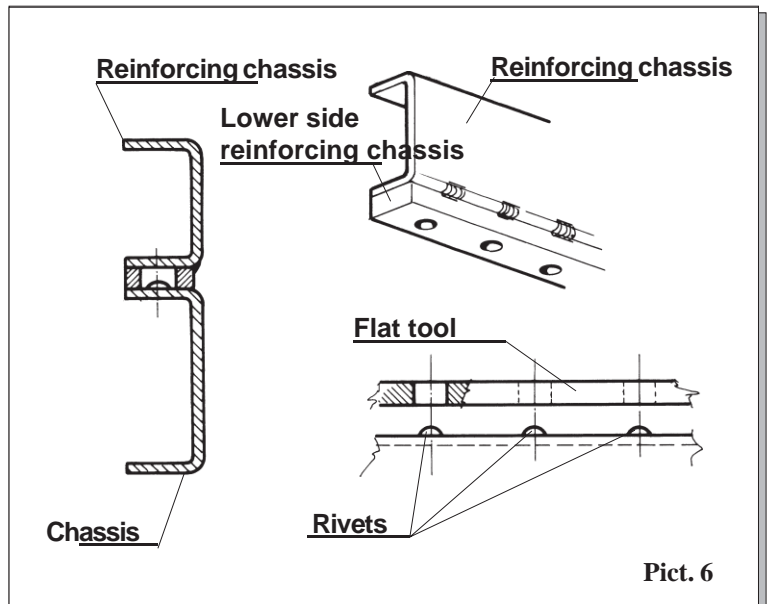


plates (see Pict. 4) (where not possible, close with sealing beads, or apply inside of the tubular parts oil- wax or bituminous bodywork products). If there are any plates, markings, or other identification signs, these should be adequately protected and highlighted, too, in order to guarantee their locality and readability in the future.

Since it is a structural part, the construction welding of the reinforcing chassis is to be carried out only by skilled, trained staff, provided with proper machinery, equipment and materials. The joints are to be worked in flat, properly orientating the pieces to weld. The edges to weld are to be adequately prepared and cleaned from rust, grease, paint, etc.

The fixing plates of the reinforcing chassis are to be welded on the whole of their external perimeter with continuous beads, as shown in Pict. 5. When mounting and fixing the sub-frame onto the chassis, the complete mating of the surfaces must be guaranteed. If there are rivets on the upper side of the chassis (Pict. 6), a packer is

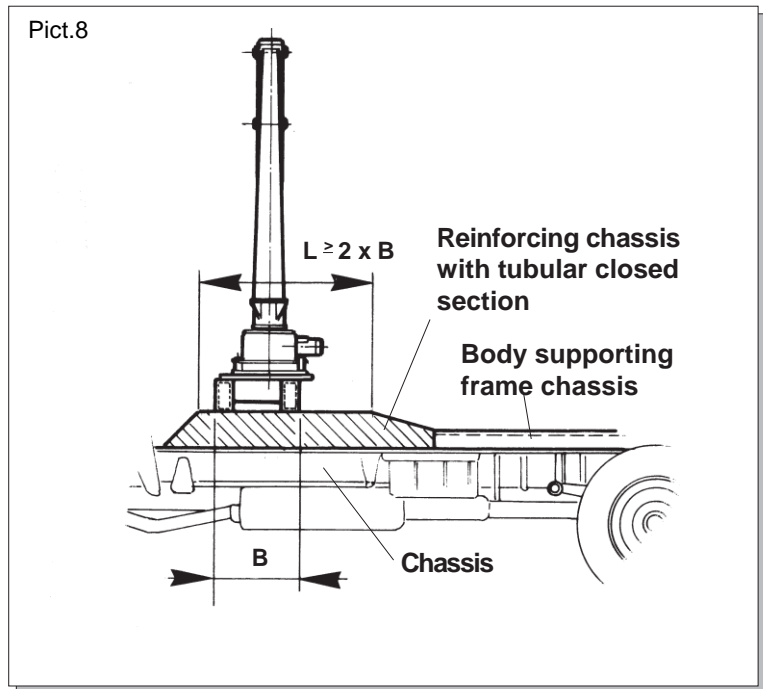
to be prepared by placing in the way a drilled iron plat-band in correspondence of the rivets' heads, with thickness bigger than the protrusions. This is to be welded to the lower profile of the reinforcing chassis, and will have the same width as the chassis. Should the result of the size calculations of the reinforcing chassis demonstrate that this is not necessary, it is enough to place a plate (Pict.7) as wide as the chassis' wing (eventually drilled as shown in pict.6 if there are rivetings), for a length at least equal to the crane support base, between the crane support base and the chassis. Its function is to simply split up the concentrated stresses due to tightening of tie rods. The plate can be L-shaped, in order to allow the safe fixing with bolts. The reinforcing chassis' section must be a closed profile in the bearing area of the crane.



The length of the reinforcing chassis must comply with the following points:

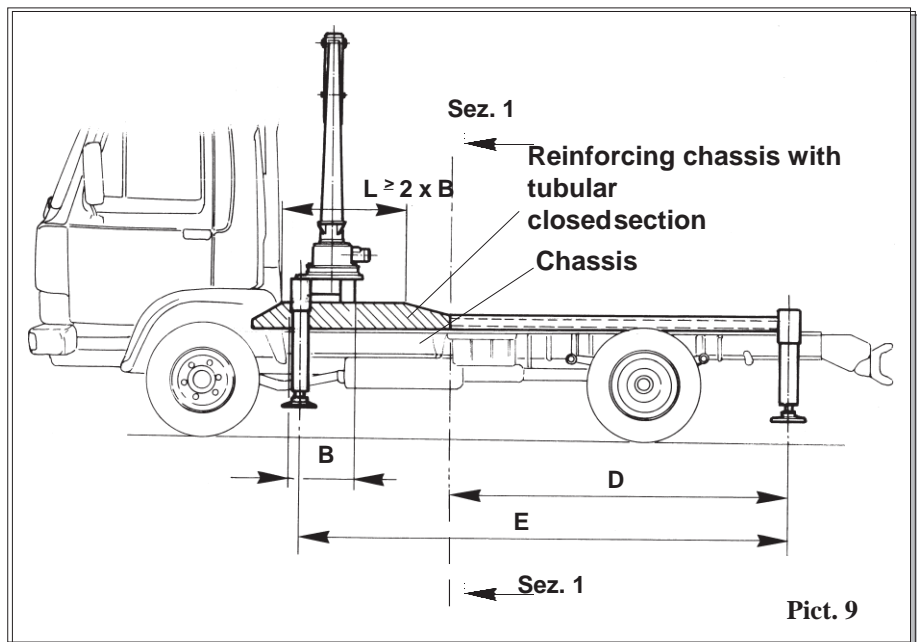
Crane behind driver's cab, without rear supplementary outriggers

Constant box-section (Pict. 8) with length at least equal to $2 \times B$ (= twice the length of the crane support base). The side-members of the reinforcing chassis are to come forward as much as possible, by tapering, up to the connection of the front shock absorbers, whilst in the back they are to connect to the body frame, compulsorily ending after one of the connection brackets bolted to the side of the vehicle chassis.



Crane behind driver's cab, with rear supplementary outriggers

As for previous case, but the reinforcing chassis is to extend in the back until it connects to the rear outrigger beam (Pict. 9). The reinforcing chassis' should be box section for the part $2 \times B$ where the crane leans. Then it can become C-section, without changes in height and thickness, up to the stabilisers.

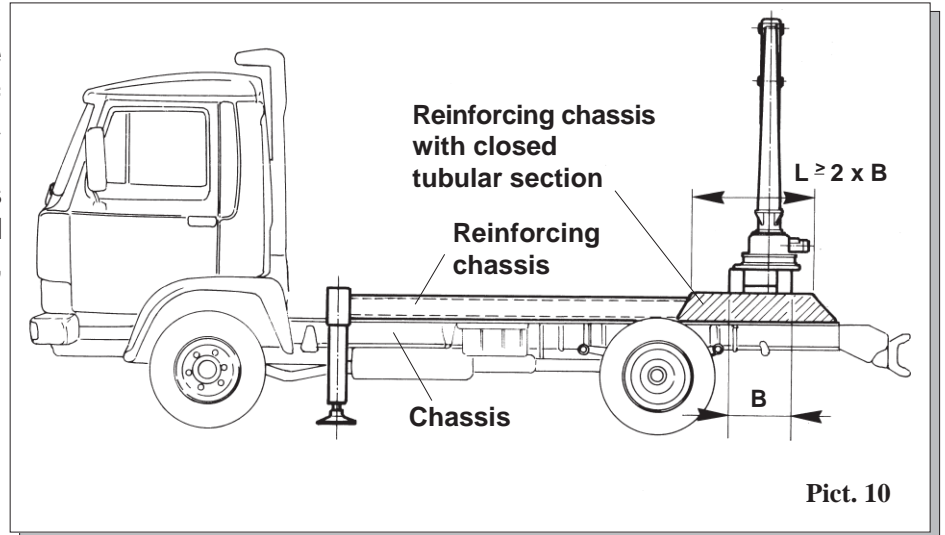


Crane mounted rear-body (or in other middle position)

The reinforcing chassis is to be box-section for a length $L \geq 2 \times B$ in the crane support area (Pict. 10).

The reinforcing chassis section must extend forward keeping a **constant** section, up to:

- the supplementary front stabilisers, if installed, or
- the front shock absorbers' connection.

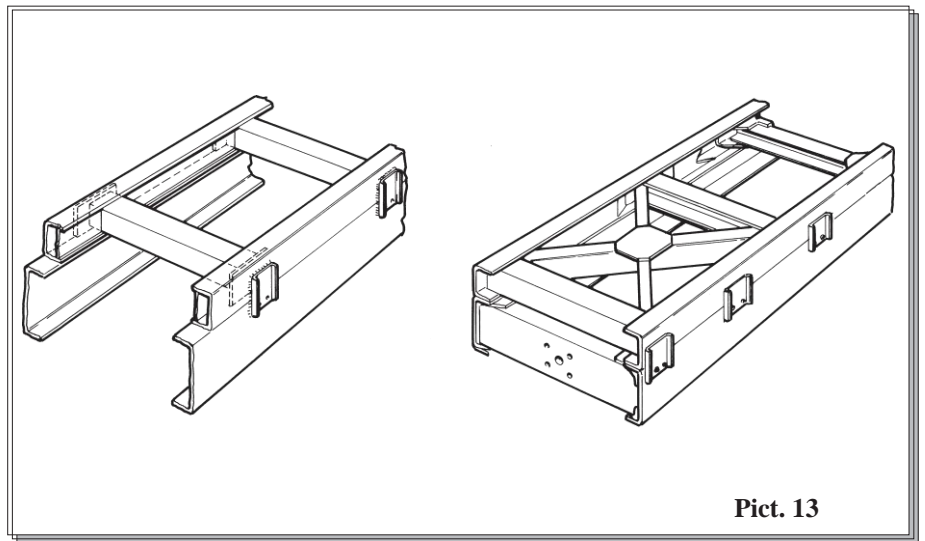


As well as the longitudinal side-members of the vehicle's chassis, the sub-frame also needs to be mounted to the cross bearers. Such parts are to be made of the same material used for the reinforcing chassis and can be welded or bolted to the side-members according to the normal rules of metal constructions.

You can use open C section, or box section, in case you wish to give the reinforcing chassis a higher stiffness to torsion.

The connection parts can be of two sorts (pict.13):

- simple beams, in equal or higher number than chassis' beams,
- cross-welded diagonals, which give high torsional stiffness, are often required when the crane is not mounted behind the cab.



3.6 REINFORCING CHASSIS OR SUB-FRAME FIXING ON THE VEHICLE

When installing a sub-frame, the OEM (original vehicle manufacturers) body builder guidelines MUST be followed. **Note:** Generally, it is forbidden to weld directly to a vehicle chassis.

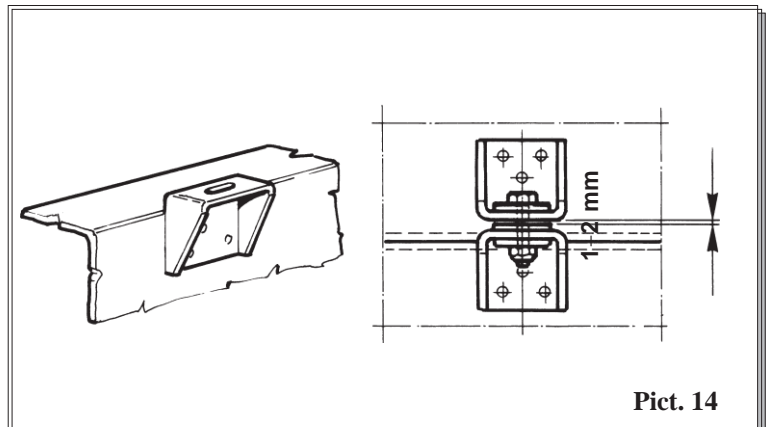


DANGER

While fixing the reinforcing chassis to the chassis, follow the OEM body builder guidelines.

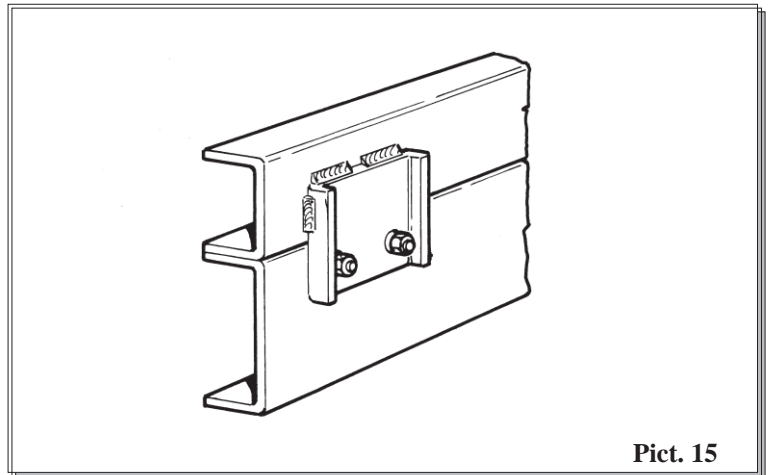
In short, the three fixing ways of the reinforcing chassis are:

- 1 - Fixing by brackets & tie bolts.
- 2 - Fixing by screwed flanges.
- 3 - A combination of the previous two.



1 - Most vehicles' chassis' are already fitted with chassis brackets. Therefore, it is enough to bolt the sub-frame onto the respective sub-frame. The number and diameter of the fixing bolts should be calculated. Normally, a 700-1000 [mm] constant pitch between the bolts is sufficient, with the first bolt placed not more than 300 [mm] far from the beginning of the reinforcing chassis in the crane supporting area.

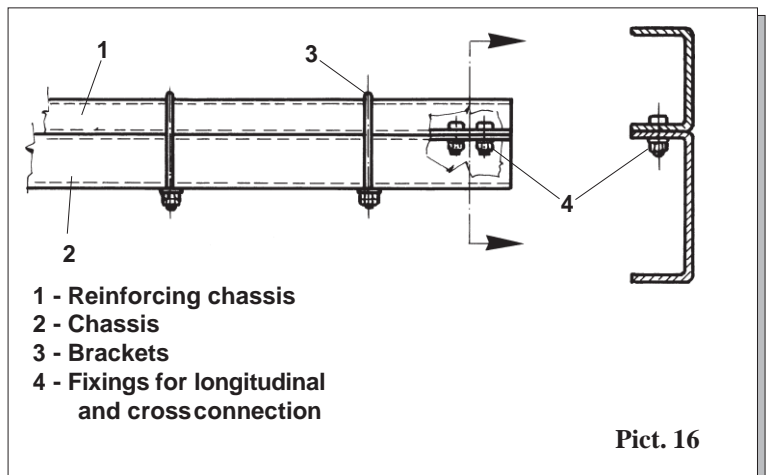
2 - (Pict. 15) screwed flanges ensure the highest connection stiffness, and therefore the best exploitation of the endurance of the longitudinal sections, as well as a higher stability of the vehicle. The flanges are to be screwed using the existing holes on the chassis, then welded or screwed onto the reinforcing chassis.



Pict. 15

3 - (Pict. 16) combination of flanges and brackets, joins together the advantages of options 1 & 2. E.g.

-fixing brackets in the crane support area in order to exploit its elasticity
 - fixing by flange for the remaining length of the reinforcing chassis, to benefit from the connection's stiffness and stability.



Pict. 16

General advice:

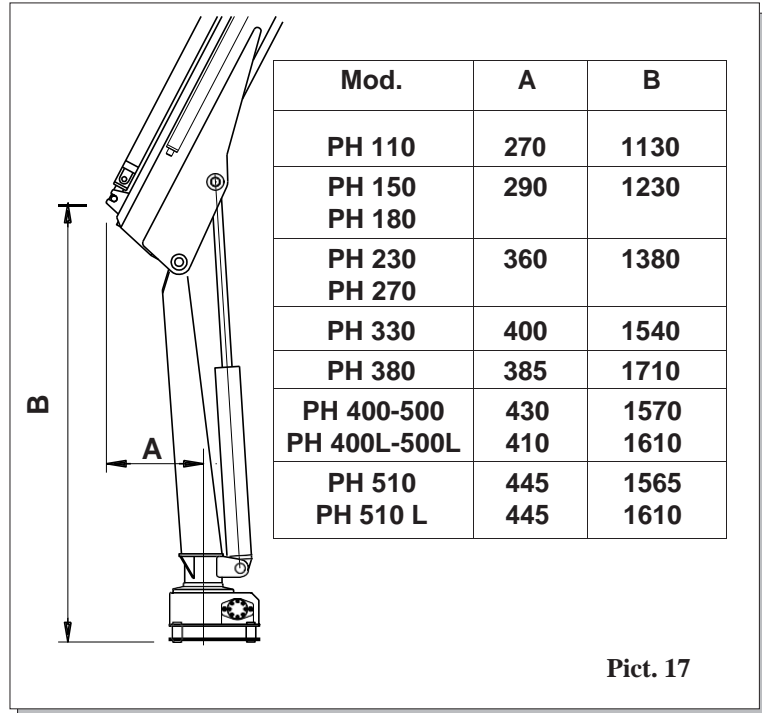
- for all bolts use material class 8.8 or higher; the nuts have to be one class lower than respective screw
- for the flanges use the same material and thickness of those used for the vehicle's chassis
- fixings are to be fitted with proper nyloc nuts or spring washers to prevent unscrewing.

4 - CRANE FASTENING ON THE VEHICLE

4.1 GENERAL INSTRUCTIONS

When the position of the crane on the vehicle has been decided, (for instance: behind the cab, rear body, driver's side, passenger's side, etc.) as well as the kind of mounting chosen (for instance: on the body, between cab and body, etc.) go on checking the following points:

- 1 - The crane must have sufficient space around to allow for maintenance, its operation, as well as the unfolding and folding manoeuvres. Refer also to the overall dimensions shown in Pict. 17.
- 2 - The arrangement chosen should not involve modifications to vehicle's systems or components (for instance: batteries, spare wheels, fuel and compressed air tanks) which are not allowed or foreseen by the vehicle's Manufacturer.
- 3 - The stop-point of crane slewing (dead point position) is not to fall in an area where the free slewing movement is required.
- 4 - The stop-point ensures that the crane cannot slew over the head of the operator.



NOTE

Please note, unless expressly requested when placing the order with Penny Hydraulics, the standard dead point position is as follows:

Cranes fitted with outrigger base (Picts. 18-19-20-21)

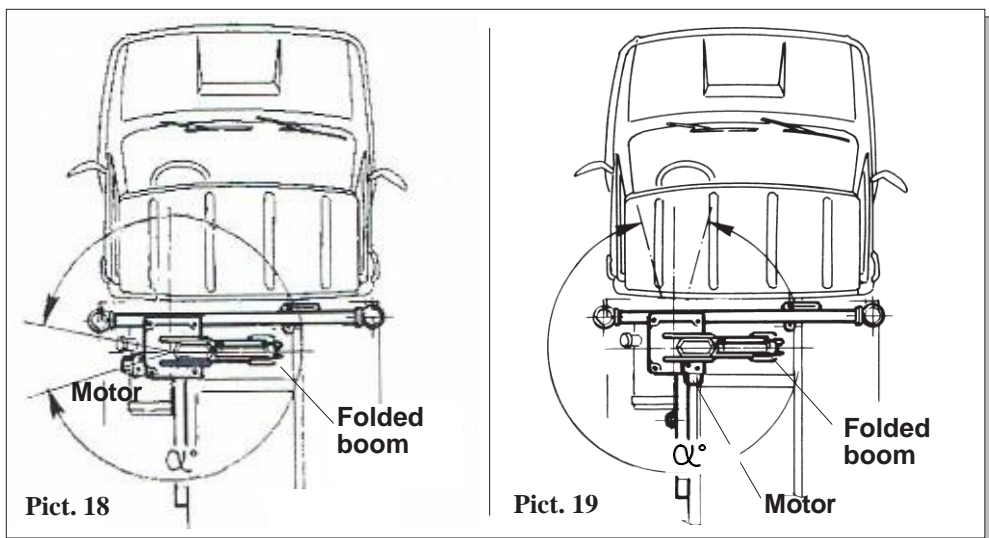
PH 110 - 150 - 180 dead point in the position shown, which means, crane on the left side behind the cab

$\alpha^\circ = 330^\circ$ for models:

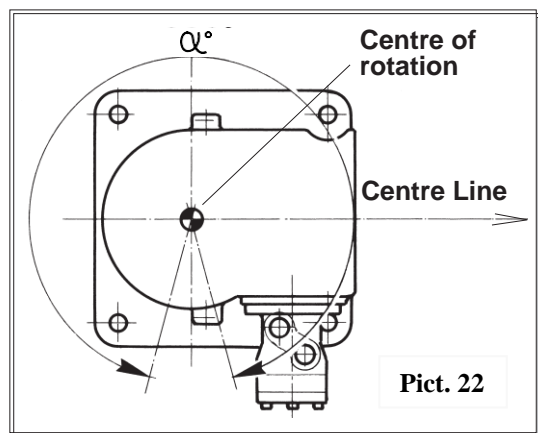
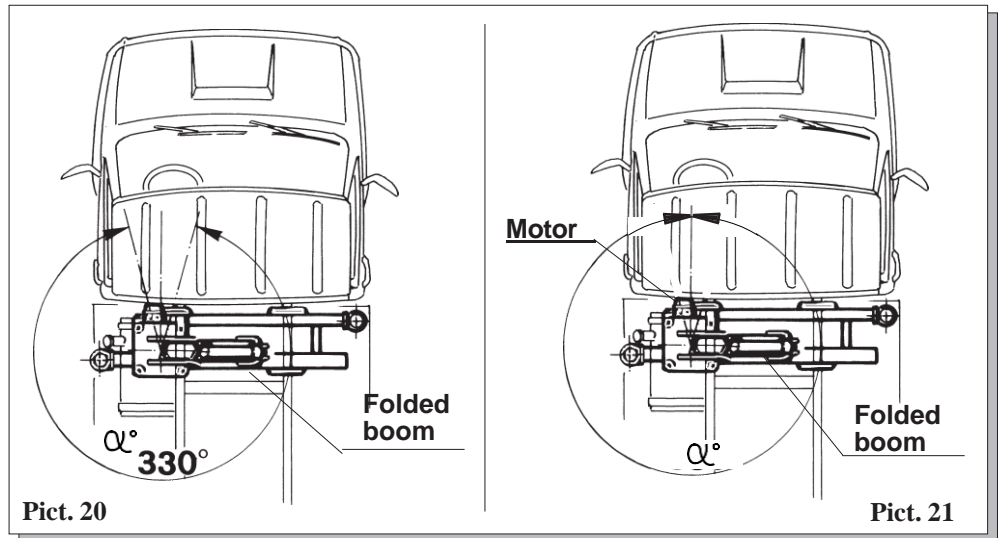
PH110 (pict.18)

PH150 (pict.19)

PH180 (Pict. 20)



$\alpha^\circ = 360^\circ$ for models:
PH 230-270-330-380
(Pict. 21)

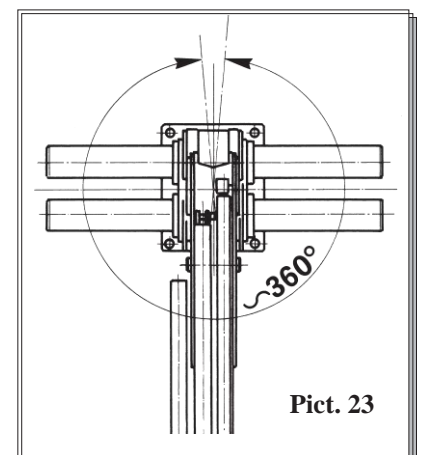


Standard cranes without outrigger base

$\alpha^\circ = 330^\circ$ for models:
PH 110-150-180

$\alpha^\circ = 360^\circ$ for models:
PH 230-270-330-380

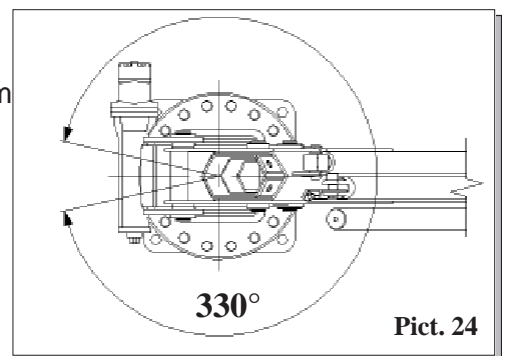
For all the PH range dead point as shown, which means



(Pict. 22) that it is on the hydraulic motor side

Cranes with rack and pinion slewing **PH 400-500**:
dead point as shown, that is (Pict. 23) opposite side of the boom

PH 510 (Pict. 24)



4.2 CHANGING THE DEAD POINT POSITION

If necessary, the dead point can be changed from its original position.



Before starting to change the dead point position, carefully read the following instructions and ensure you fully understand the whole procedure.

PENNY HYDRAULICS DOES NOT ACKNOWLEDGE ANY WARRANTY FOR DAMAGES CAUSED BY INCORRECT OR POOR RE-POSITIONING OF THE DEAD POINT.

4.2.1 Worm gear operated cranes

For the cranes with slewing by worm gear the dead point can be adjusted every 90 degrees, this can be carried out in 2 different ways:

1 - **Change of the dead point by re-positioning the slewing stop screw** (Pict. 25):

unscrew the column screw (A) and lift the column from its base completely. This way two threaded holes, one of which is already engaged by the screw (B), become visible on the lower side of the worm gear. Remove this slewing stop screw (B) from its hole on the lower part of the gear, carefully clean and take the grease off it, then screw it again in the opposite hole using some Loctite 242. Position the column back on the crane pivot and put the stop screw (A) back with its tightening lock nut.



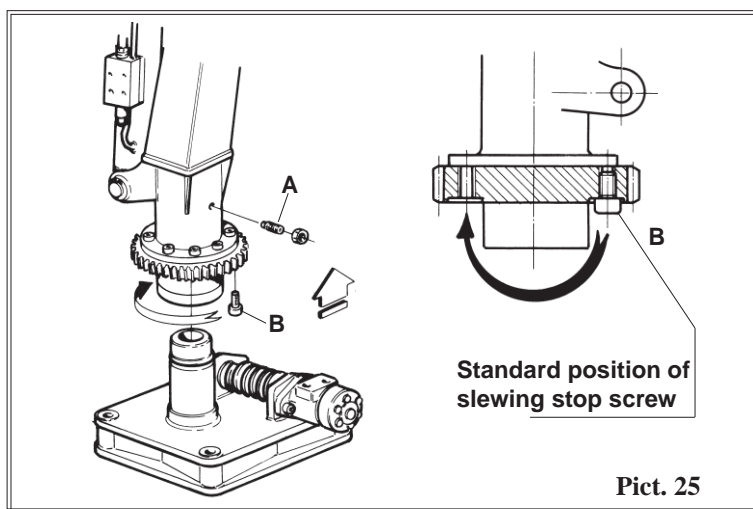
Whilst positioning the column on the pivot, proceed cautiously, so that the gear teeth slip into the vanes of the screw thread without causing damage (Pict. 26).

While lowering the column slightly rotate (helical movement) at the same time.

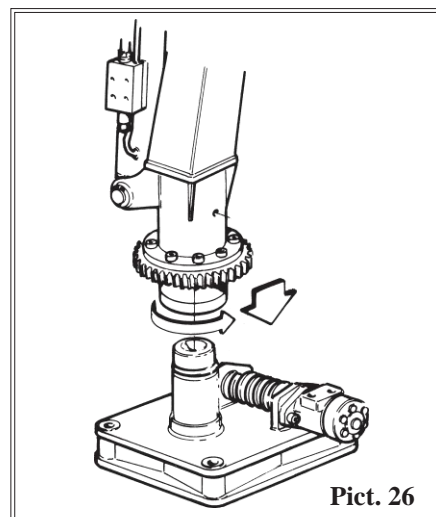


The slewing stop screw must be placed exclusively in the countersunk holes specially provided for that purpose.

Pict. 27 shows the starting conditions and the results after the transformation.



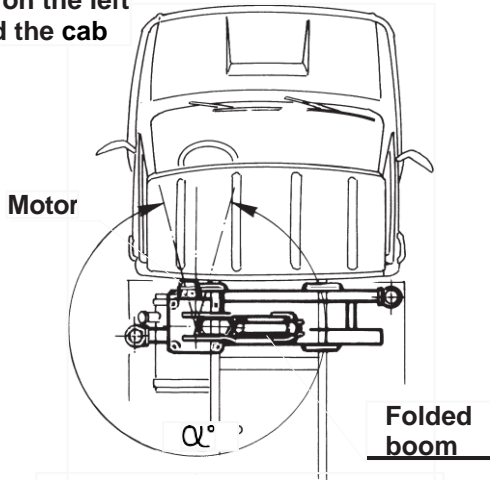
Pict. 25



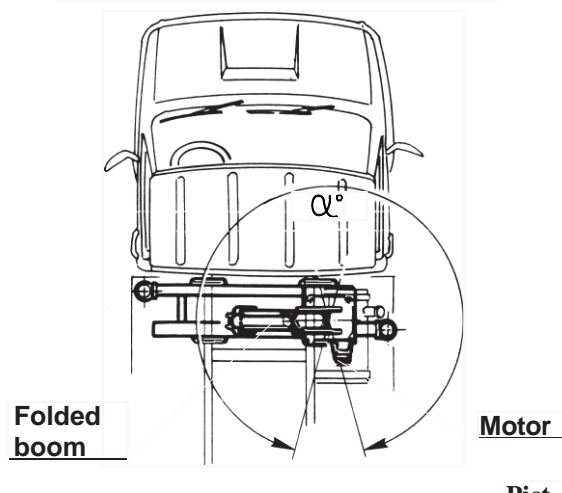
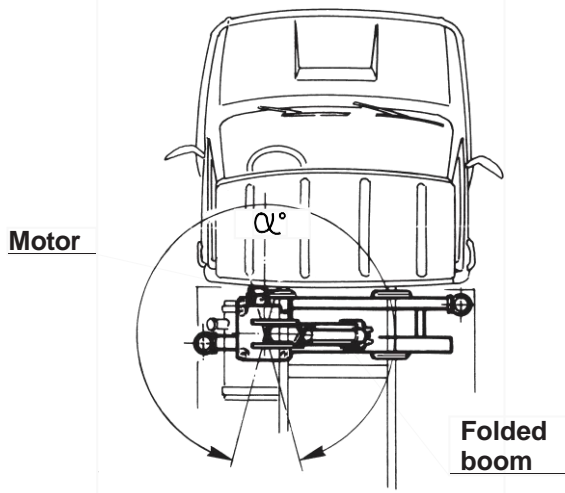
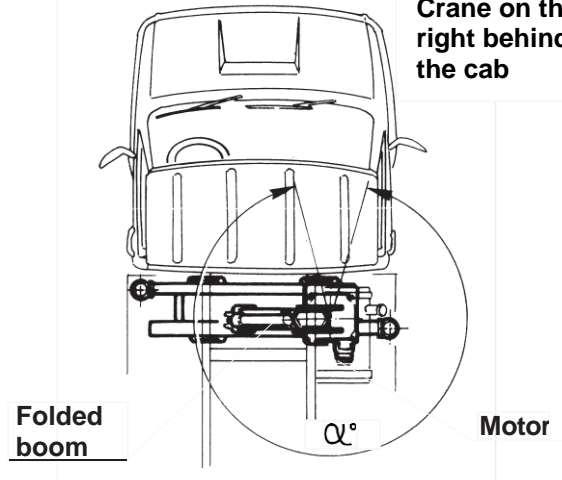
Pict. 26

VARIATION OF THE SLEWING DEAD POINT BY SHIFTING OF THE STOP SCREW

Crane on the left
behind the cab

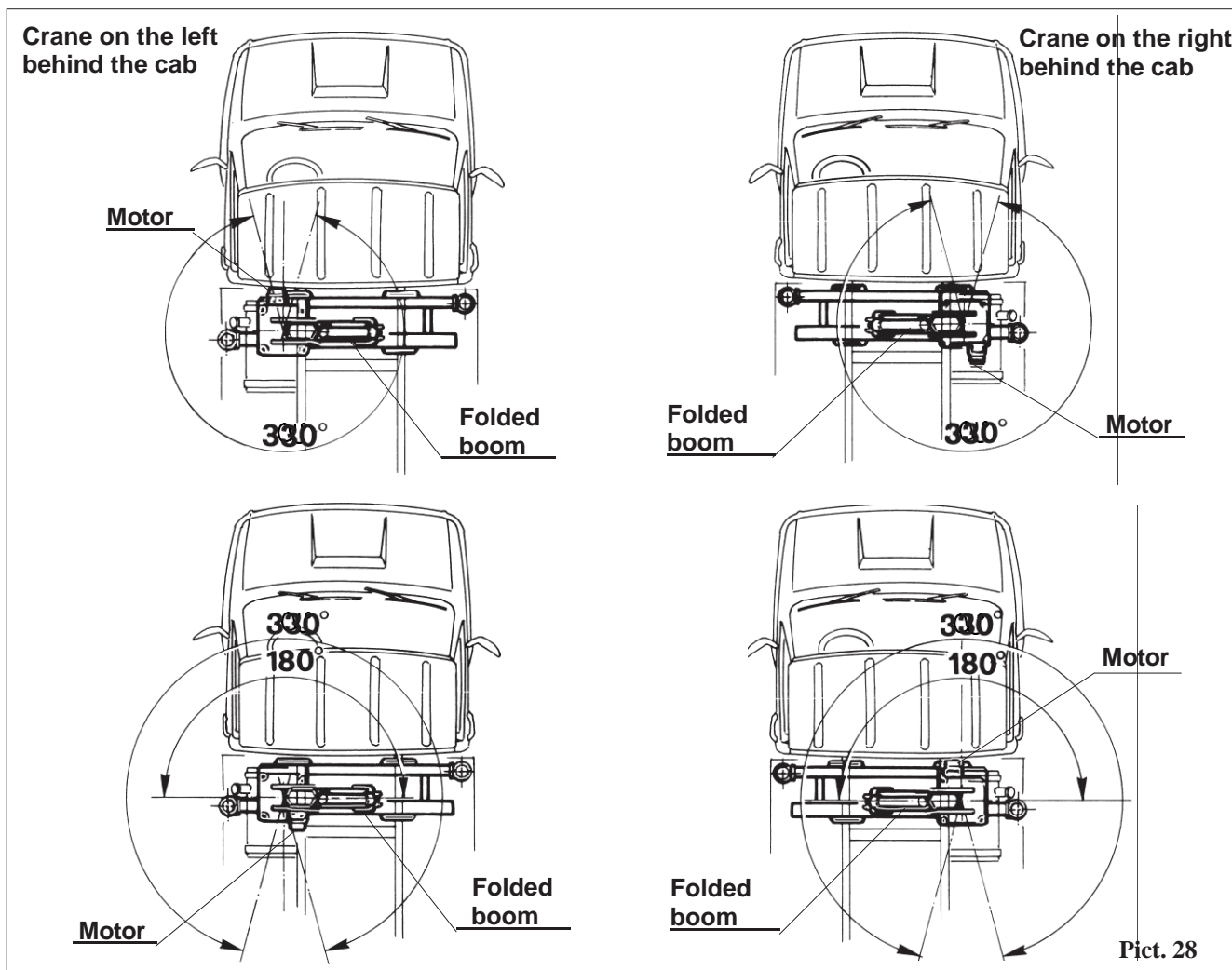


Crane on the right
behind the cab



Pict. 27

2 - Variation of the dead point when modifying slewing support



ATTENTION

Changing the dead point in this way, the hydraulic motor will protrude the overall width of the crane outrigger base. Check that this does not cause any problem.

- Unscrew the 4 fixing bolts of the slewing support (Pict. 28)
- lift the crane and turn it 180°
- screw the fixing bolts
- then rotate the crane column 180° to have the boom toward the inner side of the truck.

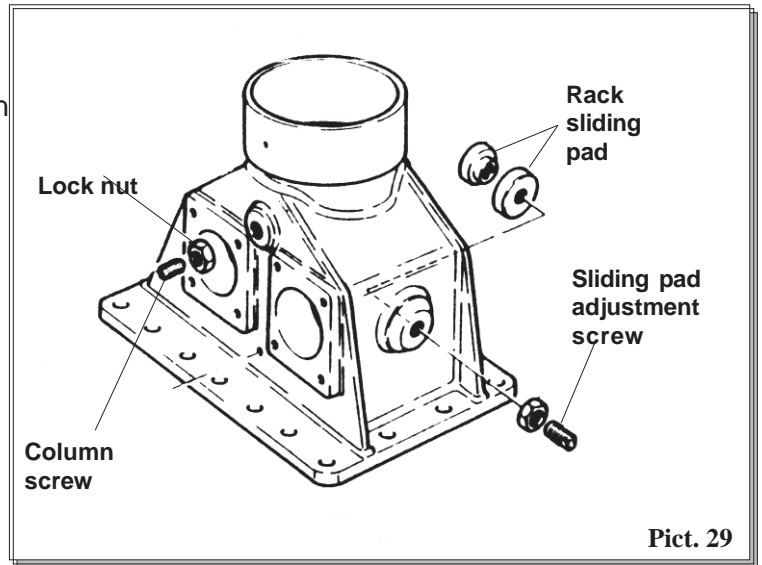
DANGER

The fixing bolts must be tightened by means of torque wrench according to the prescribed torques (see par. 7.2.3). Ensure the fixing bolts are protected against loosening with nyloc nuts or spring washers to prevent unscrewing.

4.2.2 PH Crane rack and pinion models (Pict. 29)

The dead point can be placed in any position

- Slew the crane to the rack end (dead point)
- having loosened the relevant counter-nuts, unscrew completely the column stop bolts
- loosen relevant lock nuts, then unscrew almost completely the adjustment bolts of the rack's sliding pads
- lift the column completely from its support
- before positioning the column back on its support, turn the rack opening the teeth. This way the column pinion will find less resistance while slipping down
- position the crane column on its support, keeping the boom in the position where you want to fix the new dead point
- screw and tighten the column bolts and the rack's sliding pads adjusters.



△ ATTENTION

Restore the correct pressure of the rack's adjusters sliding pad: the sliding pads' adjustment bolts are not to be completely tightened, stop when you feel a slight resistance, and then stop the screw in that position by tightening the lock nut.

4.3 CHECKS AND VERIFICATIONS

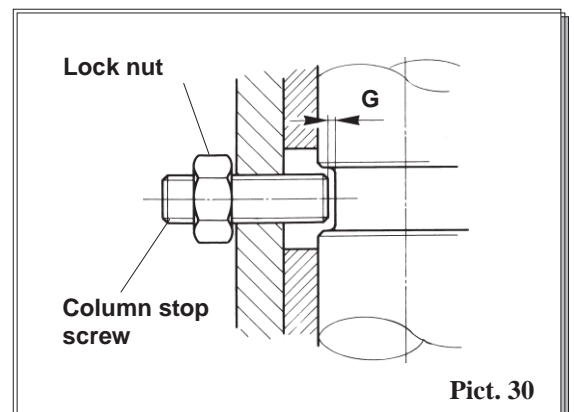
⚠ DANGER

Check the correct tightening of the column screw.

The column screw engages in a circular groove. Between screw and groove is to remain a 1-2 [mm] G clearance (Pict. 30), which is achieved by tightening the screw until you feel some resistance, then unscrewing it off one turn and locking it by lock nut.

After mounting, check:

- a) when making the column turn you must hear no creeping or feel no resistance
- b) if trying to lift the column by pulling it upwards, it must not lift up.





DANGER

After carrying out the re-positioning of the dead point, check that the hoses from the crane base to the column originally provided by Penny Hydraulics for the standard configuration are still suitable for the new position of the column.

This check is to be carried out by rotating, slowly and cautiously, up to the dead point, in both ways, and verifying that the hoses roll and unroll without getting entangled or creeping.



ATTENTION

Any parts damaged during such operations (for instance: tie bolts, nuts, hoses, etc.) are to be replaced with original parts.

5 - CRANE CONNECTION

5.1 General information

The electric power, 12V or 24V, required for the supply of the safety devices' electro valves and the switchboard components (warning lights, key-switches, etc.) must be taken according to the OEM bodybuilders manual/instructions.

Before starting work, make sure that the voltage of the vehicle's electric system and the crane's one are the same.

IMPORTANT

On all of the covers and wrappings of the components of the crane's electric system a plate showing the working voltage is applied in a visible position.



Before starting work, make sure that the vehicle and the crane have the same working voltage.

The damage caused to the crane's electric system, and to its components, by the connection with a wrong supply voltage are not acknowledged under warranty. The wiring diagrams of the different crane models and versions are shown in their relevant operation and maintenance manuals. We hereby recall some basic points:

- 1 - the current draw is to be placed under the vehicle's ignition key, properly protected by a suitable fuse
- 2 - the fuse must be placed in a position easily accessible for checking and replacement. It is to be clearly marked and identifiable, and its position must be made known to the user
- 3 - the supply cables of crane's circuit are clearly marked by the (+) and (-) symbols. Before the connection, make sure of the polarities' correspondence and the correct cable rating vs current draw.



Before carrying out the connections, make sure of the polarities of the cables.

Damage to the crane power pack, and to its parts, caused by the inversion of the polarities are not acknowledged under warranty.



Any welding operation is to be carried out with a disconnected supply and ground cables, in order to avoid the serious damage of existing electric and electronic parts.

NOTE

Some PH crane models are fitted with electronic load limiter.

Description, wiring diagrams and instructions for load limiting device and its components' setting: see the instructions booklet.

5.2 CRANE'S POWER SUPPLY

As far as the service operation period of the crane is concerned, there are basically two possibilities:

- A - the typical working cycle foreseen for the crane is continuous
- B - the working cycle is short, with frequent interruptions and down time longer than the working periods.

It is important that a correct identification of the kind of service is made when ordering the crane, as the two above mentioned possibilities correspond with two different versions of a same crane model:

- A - crane in hydraulic version (with P.T.O. and pump) for continuous working cycle
- B - crane in electro-hydraulic version (with electric pump) for working cycle limited to short periods.



In case of any doubt about the choice, ask Penny Hydraulics.

5.2.1 Crane with working cycle not limited to short periods

The power is to be supplied preferably from the vehicle's gearbox or engine mounted PTO pump.



Before carrying out any operation on the vehicle's engine or gearbox, always consult the "INSTALLATION INSTRUCTIONS" manual of the manufacturer.

5.2.2 Selection of the pump and the PTO

The following is known:

Q =	oil flow required by the crane [litres/min.]	see crane's use/maint. manual
p_{max} =	max. crane working pressure [bar]	see crane's use/maint. manual
N_{pto} =	max. PTO admissible torque [daN*m]	see catalogue PTO's manufact.
N_c =	max. torque which can be drawn from vehicle's gearbox [daN*m]	datum supplied by vehicle's
e =	pump efficiency	see catalogue pump manufact.

The calculation is carried out by considering the vehicle's motor idling speed, normally

$$n = 800-1000 \text{ [rev/min.]}$$

On the PTO's' catalogue you choose, according to the vehicle, a certain PTO model, with a gear ratio

$$i = (\text{rev. number on PTO outlet}) / (\text{motor rev. number})$$

Then, you find the pump displacement required to supply, with vehicle's motor idling, the required oil flow, and this will be:

$$s = \frac{Q \times 1000}{n \times i} \text{ [cm}^3\text{/rev]}$$

From the pumps' catalogue you choose the model with a C_p displacement as closer as possible to the C rate found (besides checking, obviously, that it can stand the max. pressure required by the crane). Once this C_p is known, check that the Q_p oil capacity obtained is close enough to the one required:

$$Q_p = \frac{C_p \times n \times i}{1000} \text{ [lt/min.], must be very close to } Q$$

Small differences can be adjusted by raising or lowering a little the min. motor speed.

Instead, should the capacity be too high (or too low), choose a smaller (or bigger) pump and repeat the calculation.

When done, there are two further final verifications to carry out:

a - that the max. torque required by the pump can be supplied by the PTO:

$$\frac{C_p \times p_{\max}}{628 \times e} < N_{pto} \text{ [daN*m]}$$

b - that the torque required at the inlet of the PTO is lower than the max. torque which can be drawn from the vehicle's gearbox:

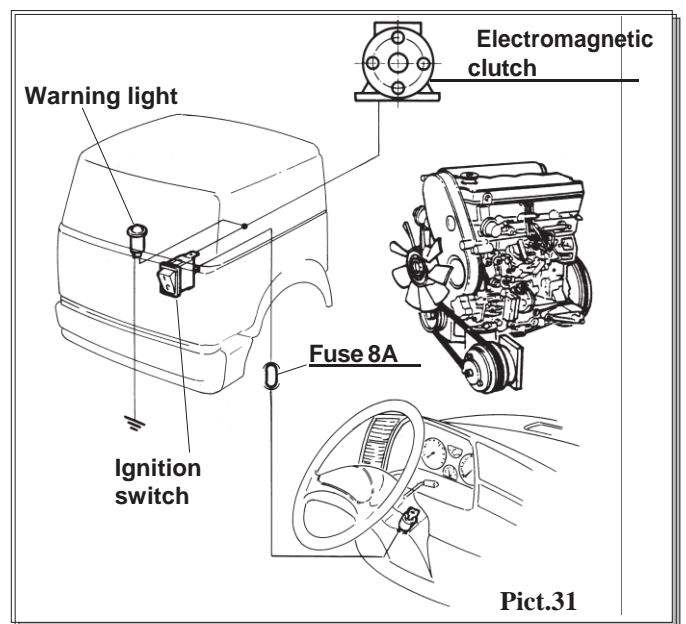
$$\frac{C_p \times p_{\max}}{i \times 628 \times e} < N_c \text{ [daN*m]}$$

⚠ DANGER

If the pump flow is not the prescribed one (see chapt. 10 – technical data Operation and maintenance manual), the crane will not work correctly. Specifically, an oil flow greater than the prescribed one, besides causing poor functionality of the hydraulic circuit (oil overheating), vibrations and counter-pressures on valves and motors, causes too fast crane movements, and therefore dangers such as:

- crane structure's overloading because of dynamic effects
- lower metering of the loads
- lower stability of the vehicle.

In some cases, the vehicle's gearbox is not prepared for the application of PTO. If there is enough room in the engine bay it may be possible to mount a PTO pump to the engine.



5.2.3 Installation of pumps and PTO's

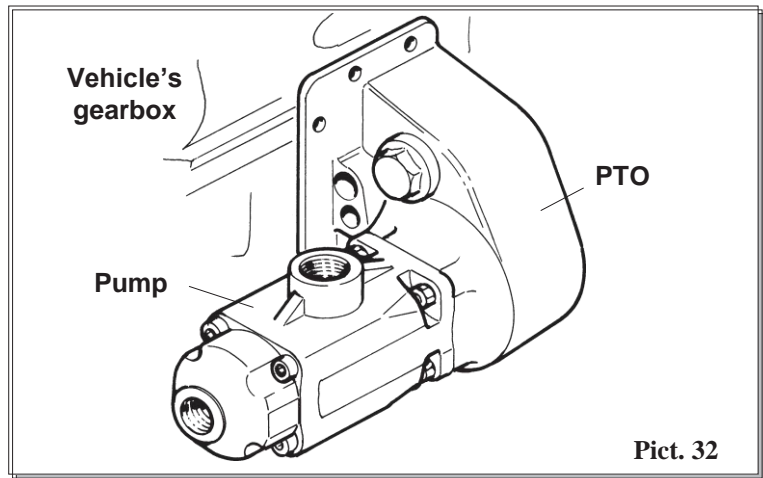
△ ATTENTION

During the installation always follow "INSTALLATION MANUAL" instructions of the vehicle's Manufacturer and PTO Pump Manufacturer.

- Installation with direct coupling (Pict. 32)

In this system, pump and PTO coupled by a stiff joint form one only body, and such unit is directly flanged on the proper gearbox lid. Without exhausting the matter, we hereby recall some points worthy of particular attention:

- a - before opening the PTO lid on the gearbox, remove the oil inside of it
- b - screw the pump + PTO unit on the flange, tightening well the bolts with the recommended torque.

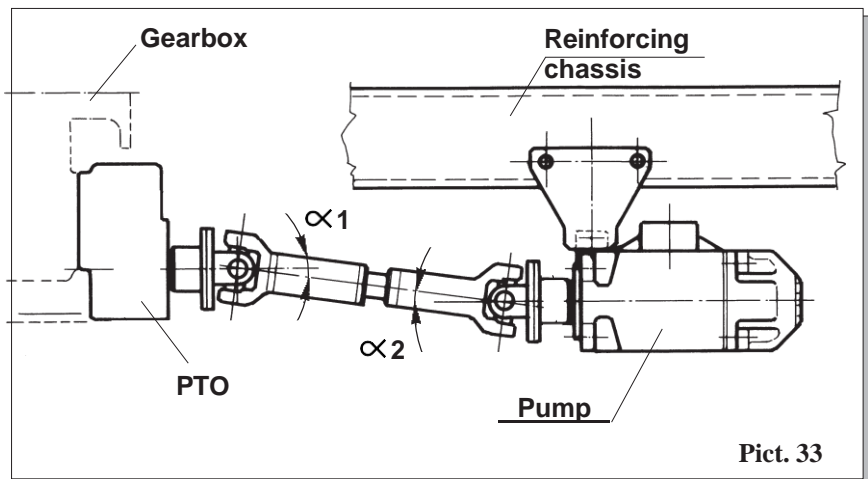


- c - check that the box gears and the PTO gears engage with a correct clearance, by making turn dry, for a very short time, gear and PTO
- d - make sure that the pump + PTO unit has a weight that does not compromise the endurance of the bolts or some other parts of the gearbox
- e - after the work is finished, restore the oil level inside the gearbox.

- Installation with indirect flanging (Pict. 33)

The PTO is flanged on the gearbox lid, but the motion is transmitted to the pump, at a distance, by cardan shaft.

The pump is fixed to the vehicle's reinforcing chassis on a proper support. You resort to this sort of installation when there is not enough space for the installation with direct flanging, or when the pump + PTO unit is too heavy.



△ ATTENTION

When choosing and mounting the cardan shaft, follow the data and the prescriptions of the shaft's manufacturer.

We hereby recall some basic points:

- the pump is to be fixed to the reinforcing chassis in a way that its shaft has the same slope, referring to the horizontal line, of the gear outlet shaft
- when preparing the installation consider that, in order to prevent the pump damaging, the max. slope of the cardan shaft compared with the pump axle must not exceed 9-10 degrees
- the end forks of the cardan shaft are to lie on the same level (ALIGNED JOINTS), and to be leaning of the same angle compared with the horizontal line (with reference to Pict. 30: ALFA1 angle = ALFA2 angle).

General instructions concerning the installation of pumps and PTO's

- 1 - The pump inlet must always be installed <under oil level>, that is, its suction plug is to lie always at a lower level than the hydraulic oil MINIMUM one in the tank
- 2 - While mounting, make sure that the outlet shaft of the PTO is subject only to a torsional stress. Avoid to mount on such shaft gears or pulleys, which would cause bending. Use grooved joints axially sliding, in order to prevent axial loads
- 3 - Make sure that the insertion times in full service given by the pump and PTO manufacturers are compatible with the working periods foreseen for the crane
- 4 - While connecting the pump to the hydraulic system, follow the warnings mentioned in following paragraph.

5.2.4 Controls of the pump-PTO operation



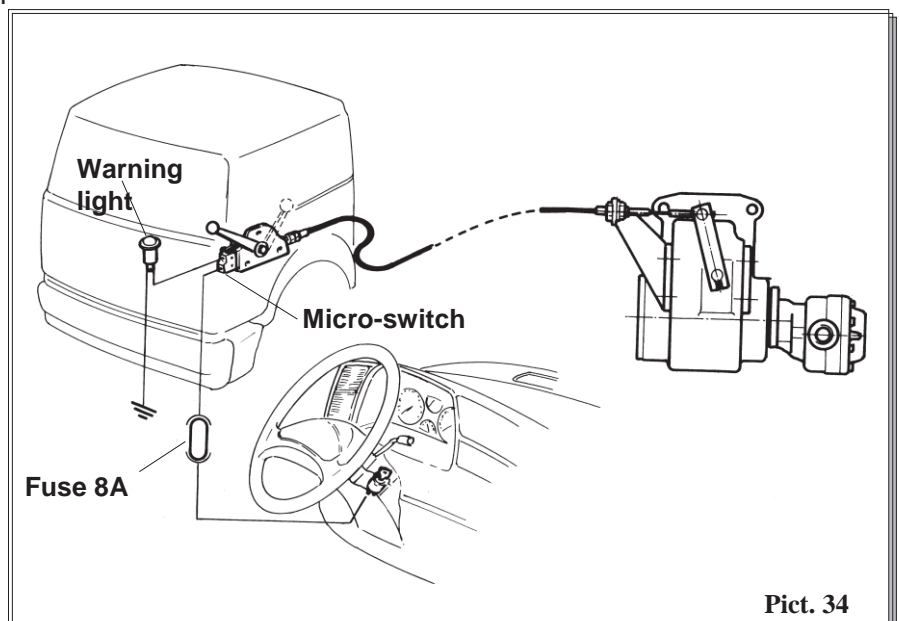
Pump and PTO must stay engaged exclusively for the only period of time strictly required for operating the crane.

This is in order to prevent overheating of the hydraulic oil and the pump and PTO gears, early wear and tear of such parts and useless energy absorption from the vehicle's motor.

Therefore, it is always necessary to install a control device for the engagement and release of the clutch, and must be possible for the vehicle's driver to check easily whether it is active or not.

There are 3 kinds of devices generally used:

Mechanical clutch (Pict. 34):
it controls the coupling of the PTO and gearbox gears by a flexible cable operated by a lever placed in the vehicle's cab.



Pict. 34

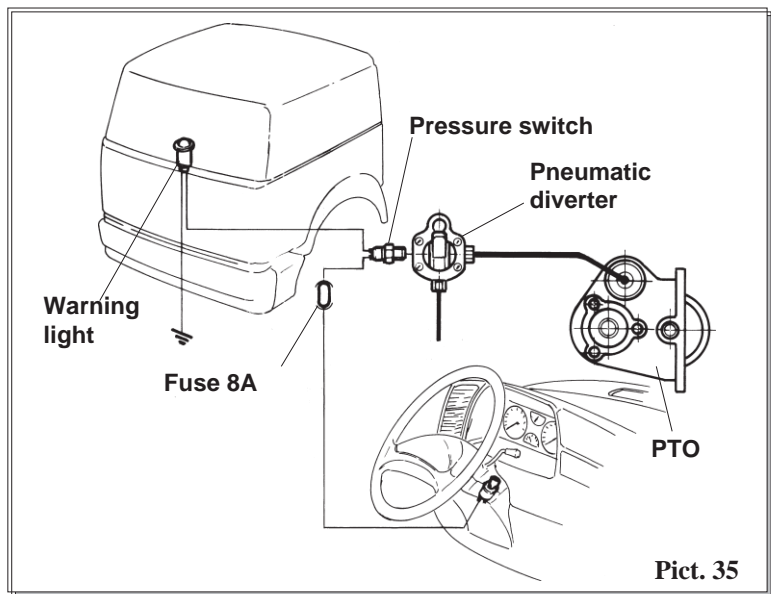
Air clutch (Pict. 35):

the coupling is made by a pneumatic cylinder with an operating push button placed in the cab.

The air required is to be drawn exclusively by the compressed air tank of the vehicle, paying attention not to compromise in any way the functioning of the braking system.

Some rules to follow while preparing such plant:

- a - the air from the tank is NOT to be drawn by the condensation exhaust plug, rather from the hole already arranged on one of the bottoms
- b - prepare the connection piping only with connected pipes (and NOT welded)
- c - the pipes' fixing and their way is to be carefully decided and carried out, in order to prevent eventual losses which could compromise the correct working even of the other pneumatic services.



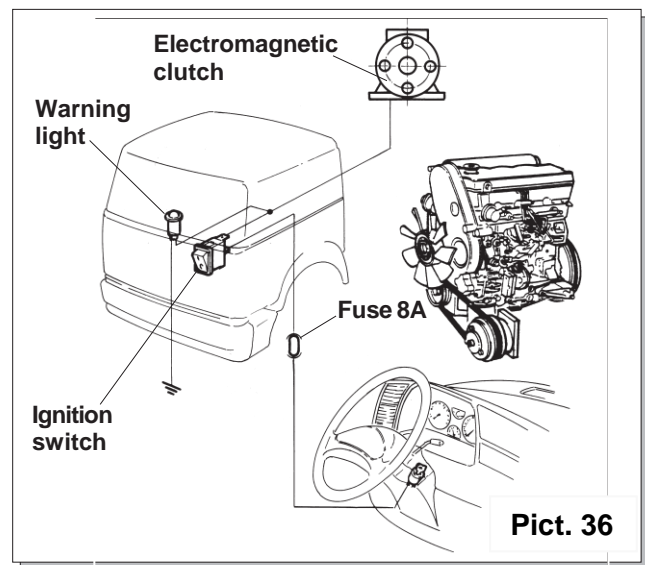
⚠ DANGER

Absolutely avoid each tampering of the braking system.

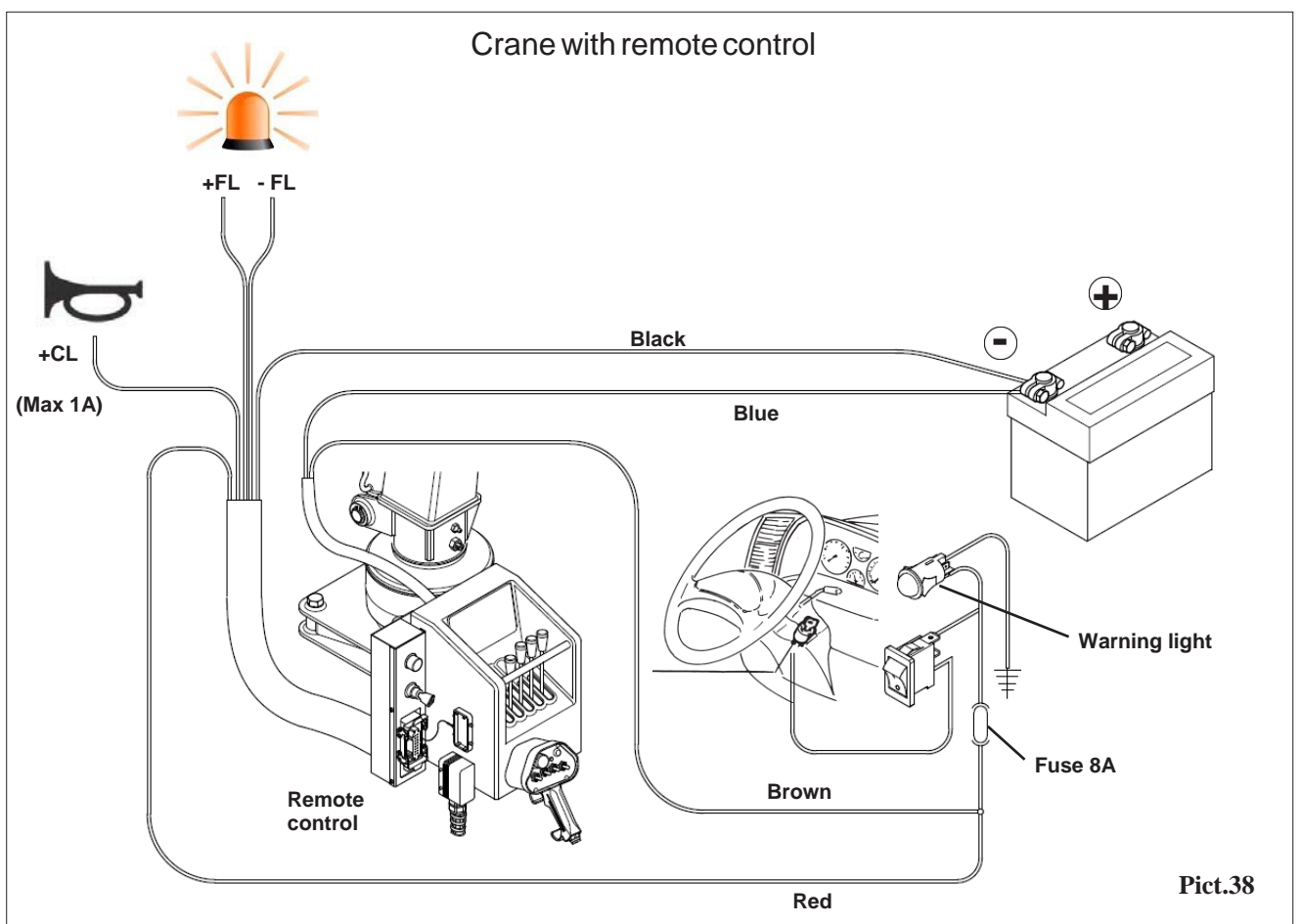
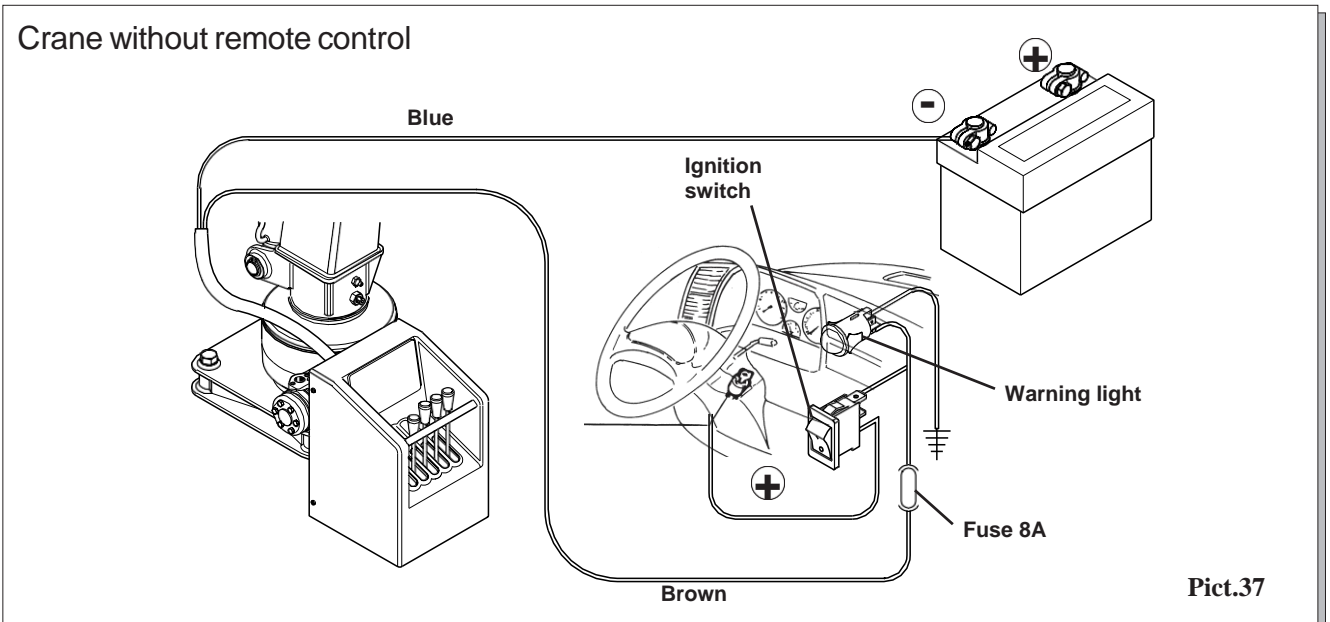
Electromagnetic clutch (Pict. 36):

It is used in case of pump operated by the vehicle's motor by belt drive. In the picture is shown a typical control circuit.

As a general rule, valid for all sorts of clutches, the control is to be connected to a warning light placed in a good visible position on the vehicle driver's seat. This is (see what said before) in order to avoid that the vehicle remains with the pump and the PTO engaged while travelling on the road.



5.2.5 Electric connection for "H" version crane (Picts. 37-38)



Yellow/Green and -TL (brown): Cut and insulate



5.3 CRANE WITH WORKING CYCLE LIMITED TO SHORT PERIODS OF TIME

(crane in electro-hydraulic version)

In this case the crane is supplied already fitted with an electro-hydraulic power pack, consisting of an integrated hydraulic pump and electric motor, therefore the installation is completed by properly carrying out the electric and hydraulic connections. For the hydraulic connections refer to the following paragraph.



ATTENTION

Make sure that the application foreseen for the crane is compatible with the presence of the electric circuit which it is connected to. E.g. no fuel vapours, chemical vapours or fumes, corroding substances.



ATTENTION

When working on the electric system of the vehicle, refer to the relevant OEM Bodybuilder Manual “INSTALLATION INSTRUCTIONS”.

5.3.1 General advice

a - On some PH crane models the power pack is integral to the crane and all relevant connections already operating. However, in most cases, the electro-hydraulic power pack is delivered loose. They are all designed for horizontal mounting in the most suitable area with openings and threaded holes, which we recommend you use for install to the vehicle’s chassis or chassis reinforcement frame. Check the horizontal position of the unit after the mounting. Bear in mind vibrations, vehicle’s bumps during transport can cause the detachment of such support, if not sturdy enough. Avoid the installation of the power pack in positions where it could be used as a step, or where metal tools or other parts could fall on it.



DANGER

Poor connections to the electro-hydraulic unit on the vehicle could cause damage to the electric cables connected to the battery, short circuits and fires.

b - The wiring between the battery terminals and the power pack’s motor connections are to be carried out **USING ONLY** electric cables of proper section. It is forbidden to carry out the return from the motor negative terminal to the battery’s negative by using the vehicle’s chassis/reinforcing chassis. **ONLY USE** the cable pair supplied along with each crane; such cables have a length suitable for most installations. Keep their length as short as possible, in order to minimize voltage drop. Should their length be insufficient, contact Penny Hydraulics’ Technical Department, stating the length required.



ATTENTION

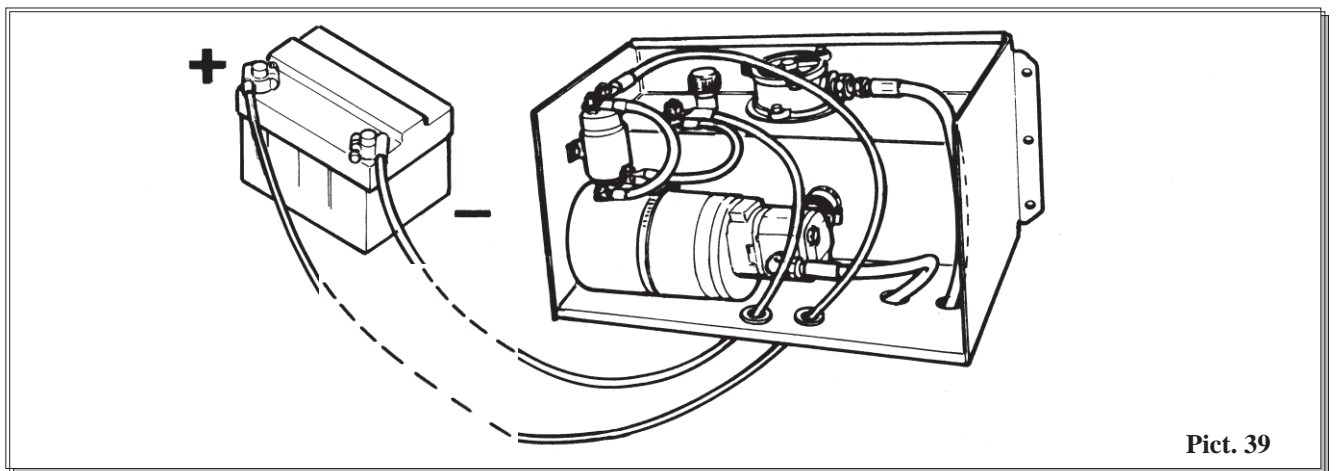
Serious damage can occur if the previous point 5.3.1 is not followed. This will invalidate the warranty on all of electric parts.

c - Electric connections of the electro-hydraulic power packs: follow the connection scheme shown below for the different crane models. Each power pack is delivered complete with attached copy of relevant connection scheme.



The power packs are to be connected as per the instructions below. Failure to comply with these instructions can cause serious damage to the circuit parts.

In particular, **Penny Hydraulics** does not acknowledge warranties on components damaged by polarity inversion when connecting the cables.



Power pack “metal case” type

Remove the cover, connect the battery cables as shown in Pict. 39.

To lead the cables inside the case, do not make any further holes, use those already existing on the case bottom itself, by piercing the rubber grommets fitted on them.

- Put the cover back on the case, making sure that no cable is crushed during such operation.
- Tighten the cover stop bolts, and check that it is well closed.

d - With reference to the schemes shown in Picts. 41 – 42 – 43, it is strongly recommended to fit a switch for the crane in the vehicle cabin, and a relevant warning light placed in a visible position. Also, this general switch for the crane should be operated by the vehicle ignition key.

e - We recommend the fitting of a “battery-cut off” device in the electric circuit, to be placed as close as possible to the battery and in an accessible position.

f - The battery terminals are to be kept well cleaned, greased with vaseline, with connections well tightened and protected by the proper boots.

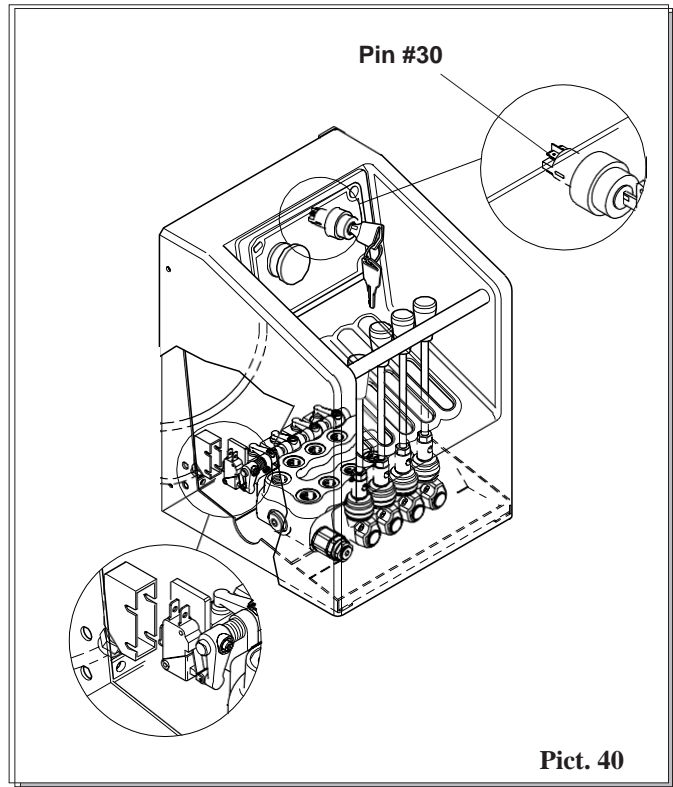
g - **The crane performance is proportional to the battery performance.**

Especially for 12V vehicles we recommend the additional installation of a second battery with the same or greater A/hr rating as the original one, connected in parallel (or replace the existing battery with a heavy “traction” type). For the above reasons, the battery is to be kept in perfect working order. During crane operation, check that the voltage to the terminals never drops below 10.5 V (for 12V vehicles), or 19 V (for 24V vehicles), both for reducing the current in the motor and its overheating, and because below this rate the electro-valves’ solenoids will not operate.

h - Check the efficiency of the vehicles alternator considering the crane install. In many cases it is advisable to replace the original alternator with one with a greater output.

i - Avoid overflow of oil while filling the power pack tank. In particular, avoid oil spilling onto the electric motor’s brushes, this will damage them.

j - The electro-hydraulic units supplied along with the **PH** Cranes are fitted with a protection against the atmospheric conditions. We advise against the arrangement of further protection or casings, as a proper ventilation is required for the electric motor. However, it is necessary to avoid subjecting the units and other electric boards to strong direct jets of water or steam under pressure, in order to prevent water seepage, for instance inside the electric motor. Any holes or cracks in the protective casings of the electro-hydraulic units are to be promptly eliminated, by restoring or, if necessary, replacing the parts concerned.

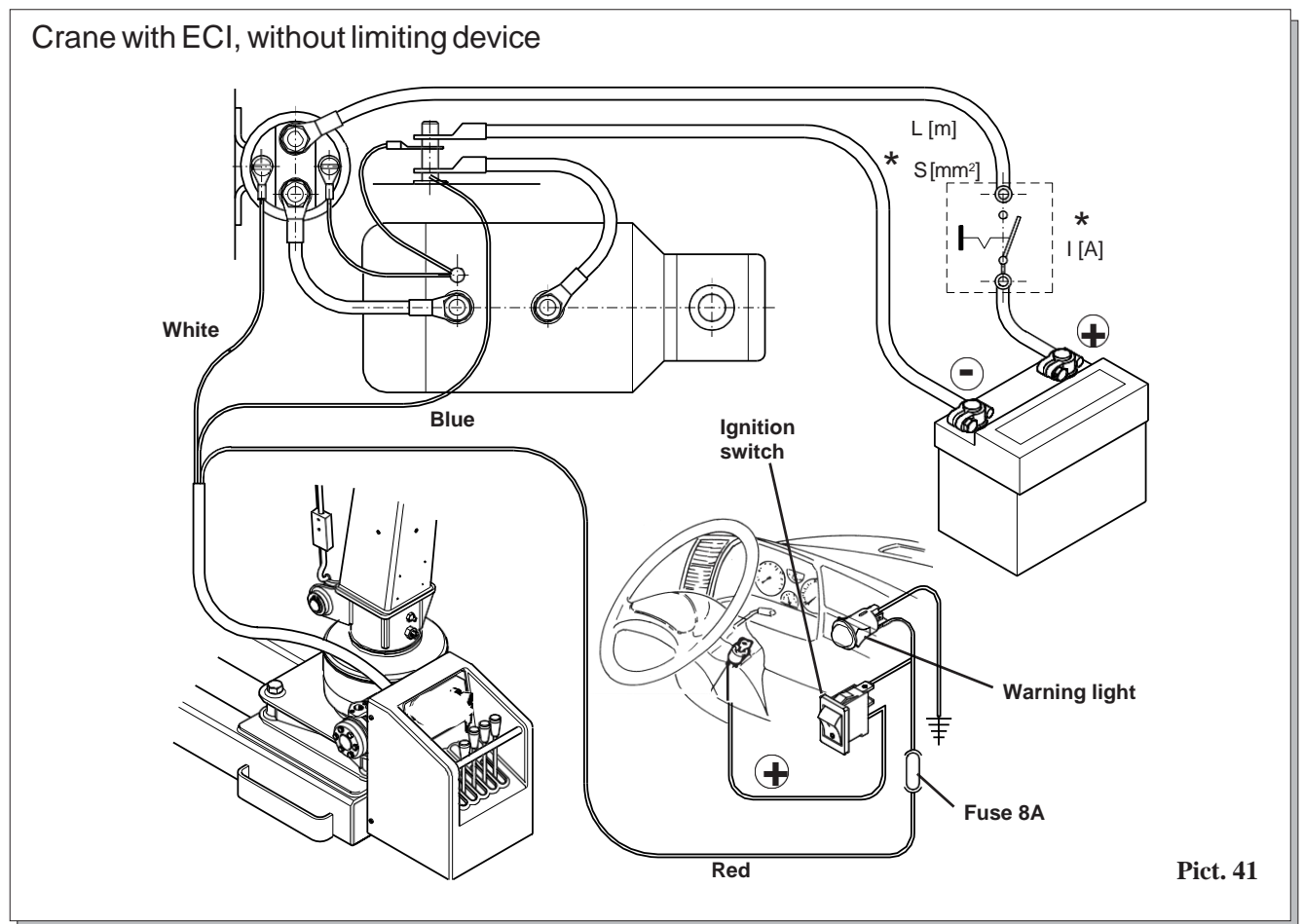


Pict. 40

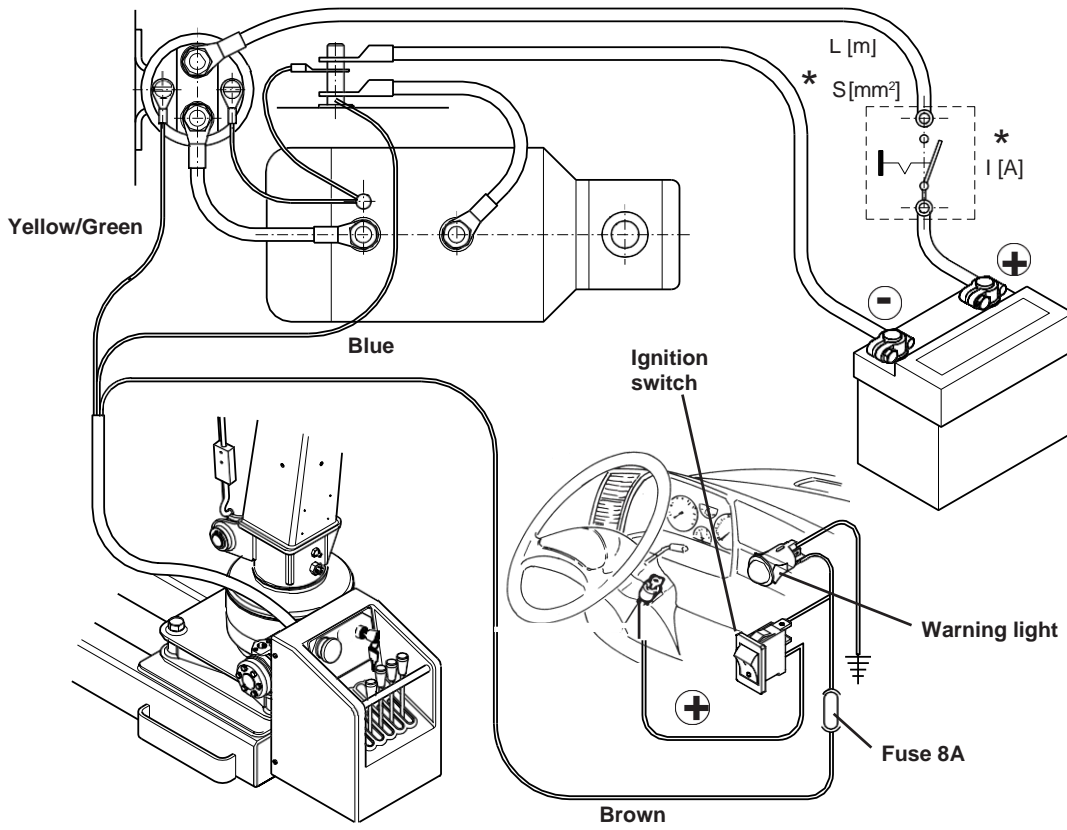
△ ATTENTION

Water ingress inside the motor is obviously due to an oversight in the instructions previously given, therefore Penny Hydraulics does not acknowledge any warranty on electric motors damaged because of ingress.

5.3.2 Electric connection for cranes “E” version without remote control (Picts. 41-42)



Crane with limiting device



Pict. 42

*

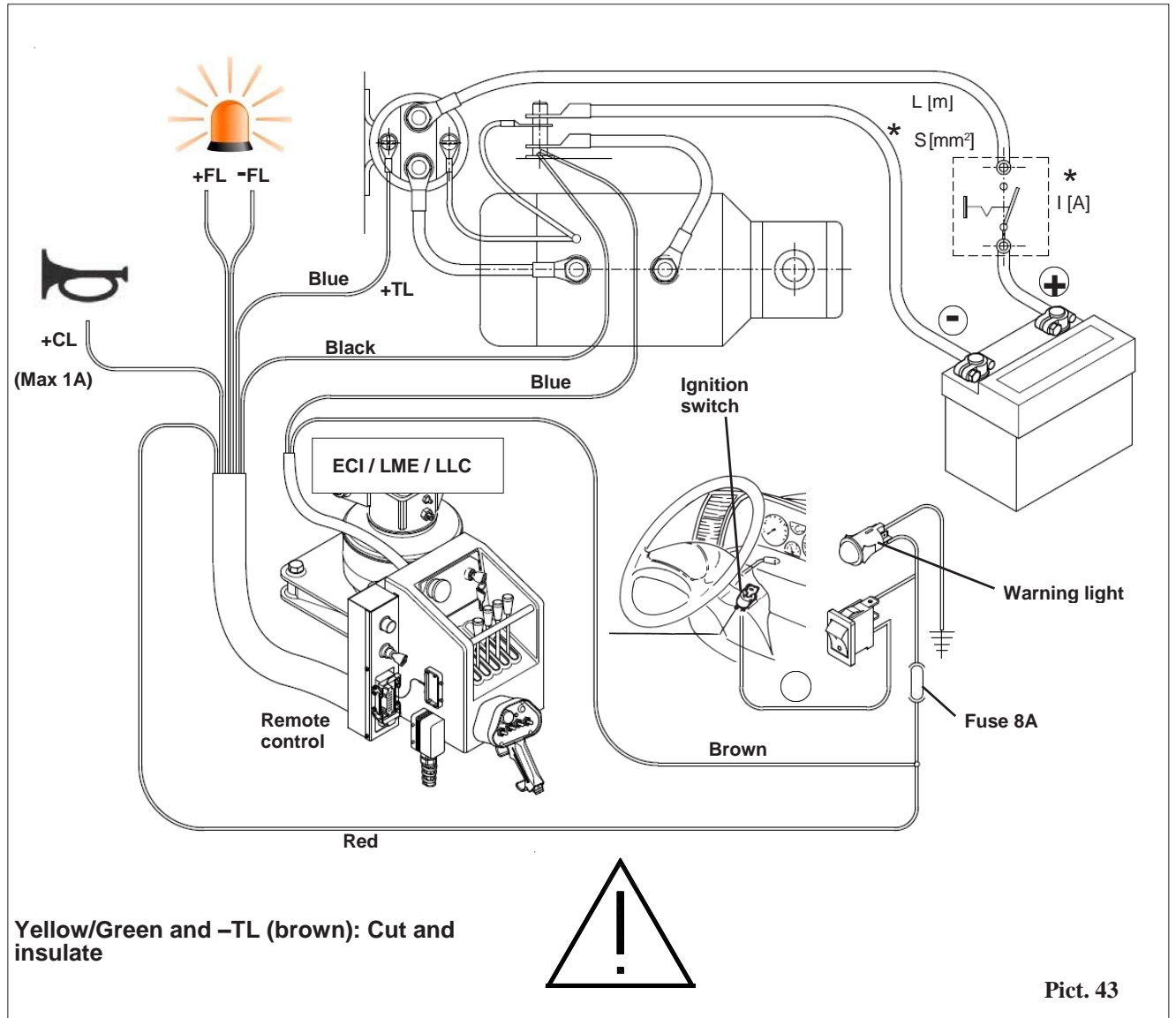
PH 150 12V		
L [m]	S [mm ²]	I [A]
2 ÷ 5	35	200
5 ÷ 6.8	50	
6.8 ÷ 9.9	70	
9.9 ÷ 13.8	95	

PH 180 – 230 – 270 – 330 – 380 12V		
L [m]	S [mm ²]	I [A]
2 ÷ 3.2	35	300
3.2 ÷ 4.4	50	
4.4 ÷ 6.4	70	
6.4 ÷ 8.8	95	
8.8 ÷ 11.2	120	

PH 150 24V		
L [m]	S [mm ²]	I [A]
2 ÷ 20	35	100

PH 180 – 230 – 270 – 330 – 380 24V		
L [m]	S [mm ²]	I [A]
2 ÷ 11.2	35	180

5.3.3. Electric connection for cranes "E" version with remote control (Pict. 43)



5.4 CONNECTION OF CRANE'S HYDRAULIC SYSTEM

The correct operation of the crane relies on the correct installation of its hydraulic system.

5.4.1 Hydraulic oil

The PH Crane is delivered with cylinders and piping filled up with oil and plugged. We employ hydraulic oil **ISO 46** grade, with additives against emulsion and wear and tear, suitable for use in temperate climates. After the work, fill up the system through the proper plug on the tank, adding only new hydraulic oil, of the same grade.



Look up the lubricants table on the crane's operation and maintenance manual.

In case of special requirements or applications consult **Penny Hydraulics**.

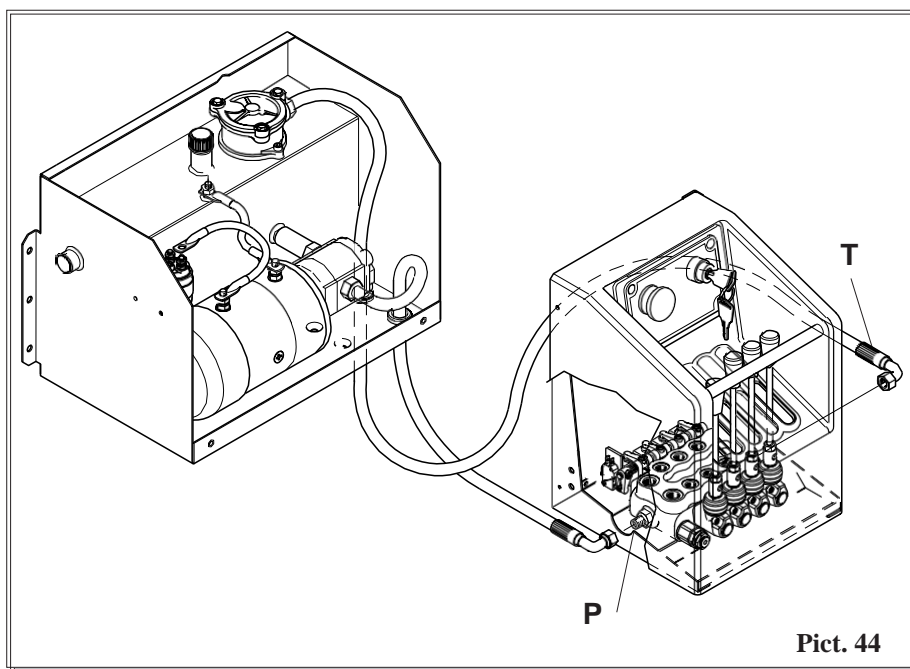
5.4.2 Installation of the hydraulic system

The system to be installed may be more or less complicated, depending on crane version or other hydraulic equipment present on the vehicle for instance, tipper bodies, etc.

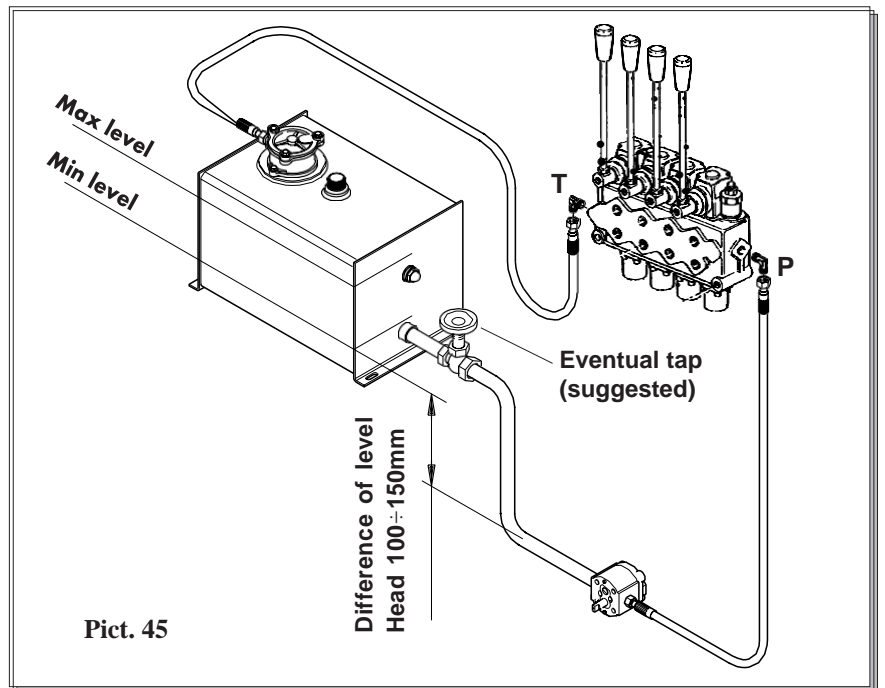
1 Crane in electro-hydraulic version 12/24 V DC: the system is very simple; it is only necessary to carry out the connection of hydraulic hoses:

- inlet, from port **P** of the pump to port **P** of the control valve bank
- outlet, from port **T** of the control valve bank to the oil tank

Pict. 44 - In case of electro-pump unit metal-case type, once the cover is removed, the pump port **P** is directly accessible, the control valve outlet to the tank is to be connected to the filter on the tank. The hoses are to be routed through the holes on the case bottom and protected by rubber grommets.



- 2 - Crane in hydraulic version, PTO-driven: the piping parts to carry out are (Pict. 45):
- hose from pump port P to port P on control valve bank
 - connection hose from control valve outlet port T to filter on tank
 - hose from inlet pump port T to tank intake.
- When the space is enough, it is advisable to mount a tap on the tank intake, in order to make the system maintenance easier.



5.4.3 Piping

The hoses are to allow the oil to flow freely. Hoses should be kept as short as possible, sudden bends and localized restrictions should be avoided. Maximum attention is to be paid in cleaning all the parts and components used. Before assembling the different parts and components, clean and carefully blow them by compressed air.

Absolutely avoid:

- Twisting hoses
- Circuits conformed, so that they present parts where solid particles and other impurities (which can then become free and re-enter the circulation owing to pressure blows or turbulences) are at a standstill.
- Dirt ingress into the hydraulic circuit.

PIPING TYPES AND THEIR MATERIALS

You can use steel pipes or hydraulic hoses. For the circuit stretches under pressure it is always advisable, for their higher intrinsic safety, to use steel piping, using the **St 37.4** type certified for hydraulic employment according to **DIN 1630** (or equivalents). The pipe is to be properly protected against corrosion. Such piping is to be solidly fastened by proper collars to the fixed vehicle structure and not subject to vibrations.



When cutting and bending the steel pipes, follow the instructions of the pipe manufacturer.



For steel pipe-fittings follow the instructions of the fittings' manufacturers.

The steel piping minimum recommended sizes to be used for the circuit parts under pressure are the following:

- Diameter 10 thickness 1.5 mm
- Diameter 12 thickness 1.5 mm
- Diameter 16 thickness 2 mm

The choice of the size is to be made in conformity to the oil capacity, according to that stated in the following paragraph 5.4.4.

The hose type must be suitable for hydraulic circuits, and meet the following requirements:

- for the parts under pressure: **SAE 100 R2** types, or **SAE 100 R2T**, or **COMPACTFLEX DIN 20022**, all with steel double string
- for the inlet or outlet parts: **SAE 100 R4**.

The choice of the diameter is to be made in conformity to the oil capacity, according to what is stated in the following paragraph 5.4.4.

Concerning the correct mounting systems, refer to the manufacturers' manuals.

NOTE: Prevent abrasions, contact or close exposure to heat sources.

Ensure the hose is not crushed or flattened.



On connection and mounting of the hoses, follow the instructions of the hose manufacturer.

5.4.4 Piping sizing

The inner diameters of the hoses must be adequate to the circulating oil flow, to prevent the oil over heating, and to limit counter-pressures (or cavitations) which can affect the functioning of some components of the system. Recommended oil speeds:

- intake line 0.6-1.5 mt/sec
- inlet line 3-6 mt/sec
- outlet line 1.2-1.8 mt/sec.

The hose manufacturers supply the diagrams from which you draw the diameter required to achieve such speeds according to the capacity.

As a first reference, the following sizes can be used (*):

line	oil capacity lt/min	pipes or hoses diameter
intake	0 - 15	3 /4 "
	15 - 30	1"
inlet	0 - 15	12 x 1.5 or 3/8"
	15 - 30	16 x 2 or 1/2"
outlet	0 - 15	16 x 2 or 1/2"
	15 - 30	3/4 "

(*) Attention! Sizes valid for most common crane fittings. When oil piping is very long, consult **Penny Hydraulics**.

5.4.5 General advice

- The oil temperature, after a normal working period, must not exceed 70°C with environmental temperatures around 20°C. Higher oil temperatures can mean that the hose diameters are insufficient, or that there are localized narrowing's. In case of special requirements (very high environmental temperatures, very complicated hose routes, continuous pump working for long periods), which need further adjustments to keep the oil temperature within the foreseen limits, pass to the immediately higher hose diameter. It could be necessary to install an oil tank with bigger capacity. Consult Penny Hydraulics.
- When you expect to use the crane often in temperatures below –5/-10°C, replace the oil by one with proper ISO grade. Consult **Penny Hydraulics** about this, in order to make sure of its compatibility with the seals. It could be necessary to apply a heater with electric resistance, in order to heat the oil to a sufficient temperature before operation. This heater is to be disconnected as soon as the purpose is achieved.
- Oil tank position: even with minimum oil level, the intake pump port must always be minimum 100-150 mm below this level; its position must allow for easy level checking and maintenance (topping up and filter replacement on the outlet line, if present).
- Keep the intake piping as short and straight as possible. We advise against the installation of a filter on such line.
- The counter-pressure on the outlet line, gauged by applying a **T**-shaped fitting on the port **T** of the hydraulic control valve must not exceed 15 bar. If required, modify the line to obtain this.



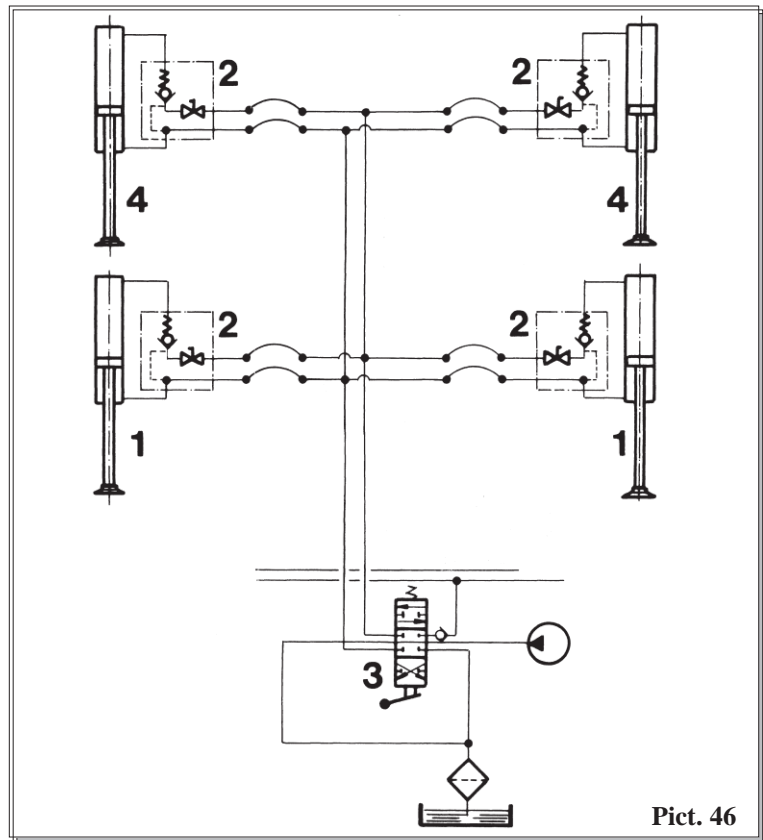
When the installation is finished, check the arrangement and route of the hoses in all of the crane's conditions and working positions. In particular, check the hoses lying within 1 meter of the user's position are properly shielded, in order to protect the operator from pressure oil leaks.

5.5 CIRCUITS

The hydraulic circuits of every crane version are shown in the relevant operation and maintenance manual. We hereby give some advice concerning some particular cases.

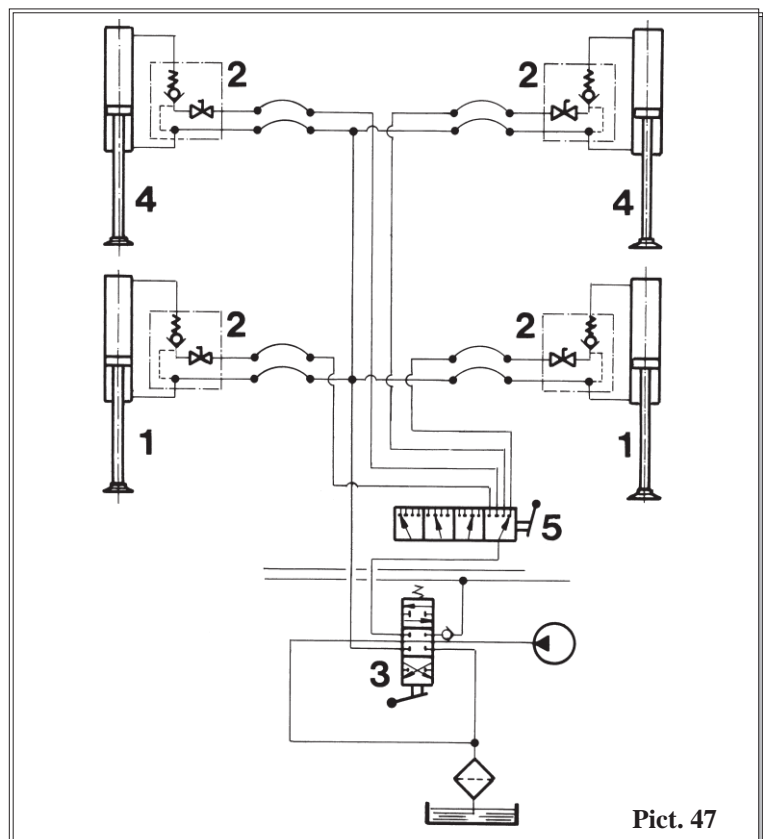
1 - Hydraulic connection of supplementary outrigger beam

- 1st solution (Pict. 46).
The oil is drawn by the line supplying the main crane stabilisers. All the legs are lifted/lowered by the same valve bank lever. The selection is made by operating the valves with tap mounted on each leg.



Pict. 46

- 2nd solution (Pict. 47)
The installation of a 4 ways flow divider is required. The extension/re-entry of all the legs is operated by the control valve lever, the leg selection is made from the control place by properly operating the flow divider.

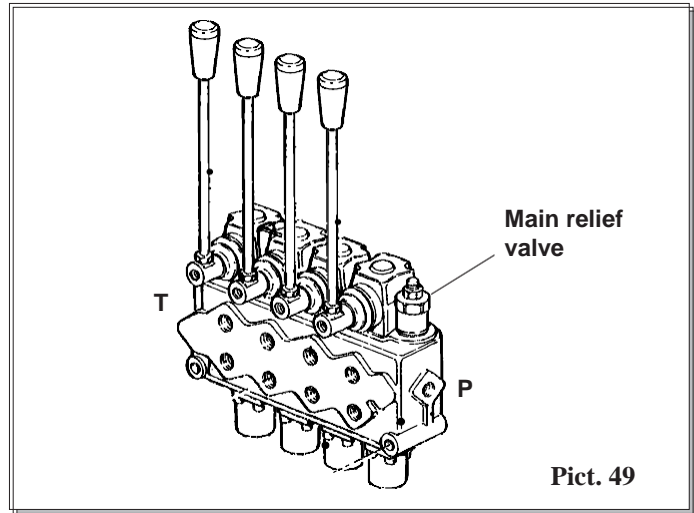


Pict. 47

5.6 INFORMATION ON VALVES

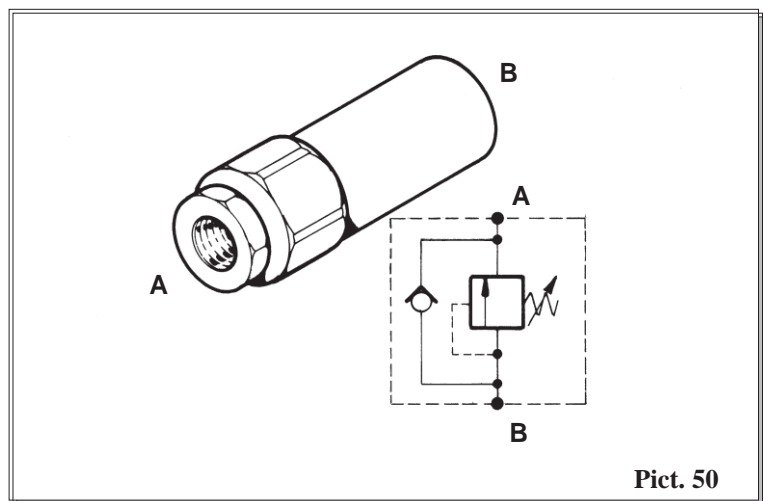
We hereby give some information on functioning and (when possible) setting the crane valves within the hydraulic circuit.

Pict. 49 Main relief valve: it can be seen by removing the control valve casing. It is on the inlet head (port **P**) of the control valve bank, and it is sealed by Next Hydraulics before the delivery. It must not be tampered with in any way.



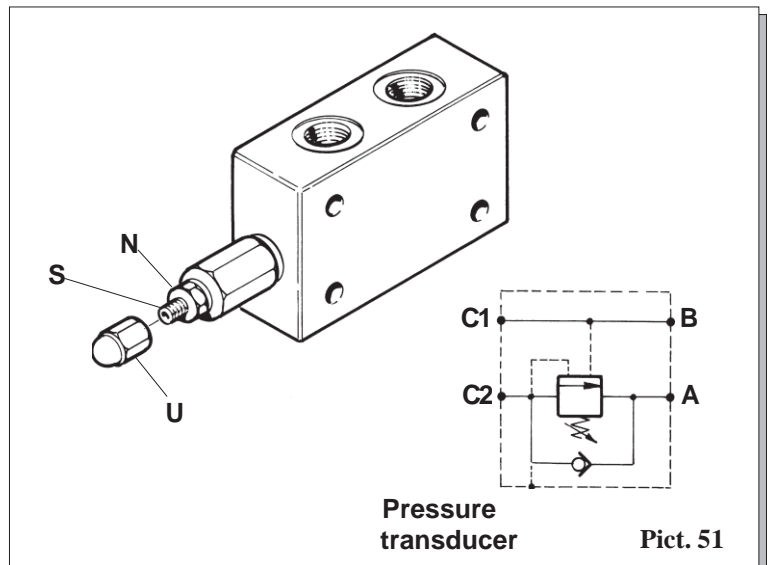
Tampering with the main relief valve is considered a serious alteration of the hydraulic circuit, and invalidates the manufacturers' warranty.

Pict. 50 - Sequence valve (only fitted to versions with multiple hydraulic extensions): it is mounted in-line with the hydraulic circuit on the boom extension cylinder piping, and allows their correct extension sequence. It is not adjustable.

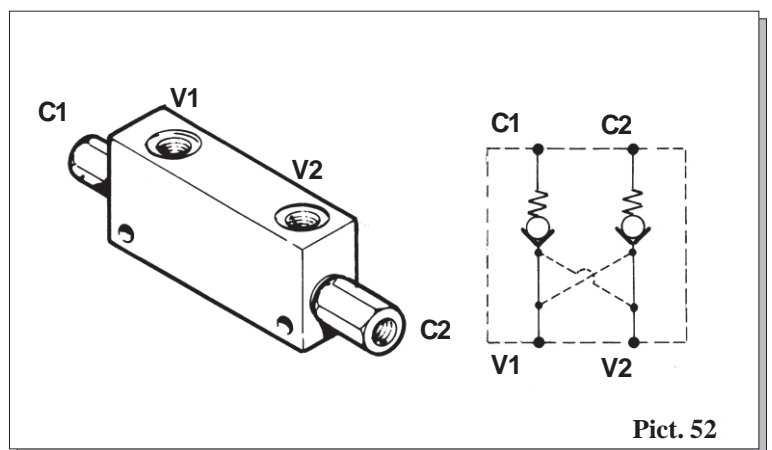


Pict. 51 Lifting cylinder's over centre valve

The valve is already set by Next Hydraulics before the delivery, so that it correctly opens slowly and progressively when the crane overloading exceeds 30% of the nominal rate.

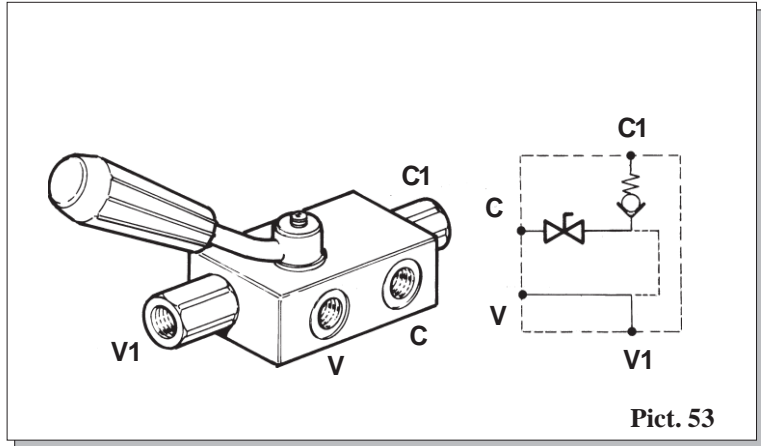


Pict. 52 Extension cylinder's holding valve. The valve fulfils safety functions on the extension cylinders, but it is not adjustable.



Pict. 53 Outrigger cylinders' holding valve with tap.

The holding valve tap closes and locks the hydraulic line.
The valve is not adjustable.

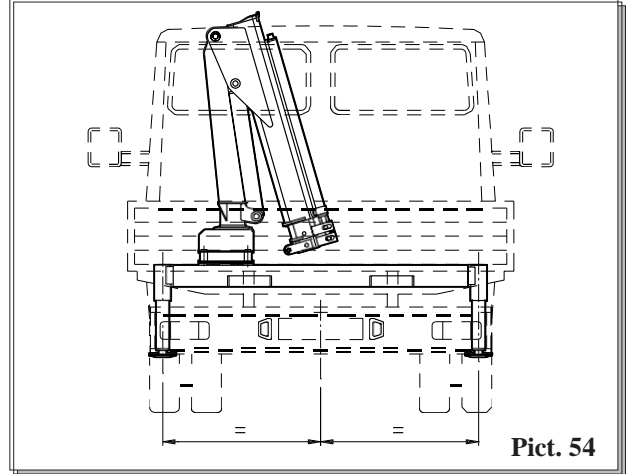


6 – DIFFERENT WAYS OF INSTALLING PH CRANES

All **PH** cranes are suitable to be installed in the following ways:

**MOUNTING IN THE BODY, or
MOUNTING ON THE CHASSIS FRAME.**

In both cases, once a specific position for the crane on the vehicle is chosen, as previously explained in paragraph 4, mass and dimensions of the crane should be checked to ensure compliance with all relevant legislation.



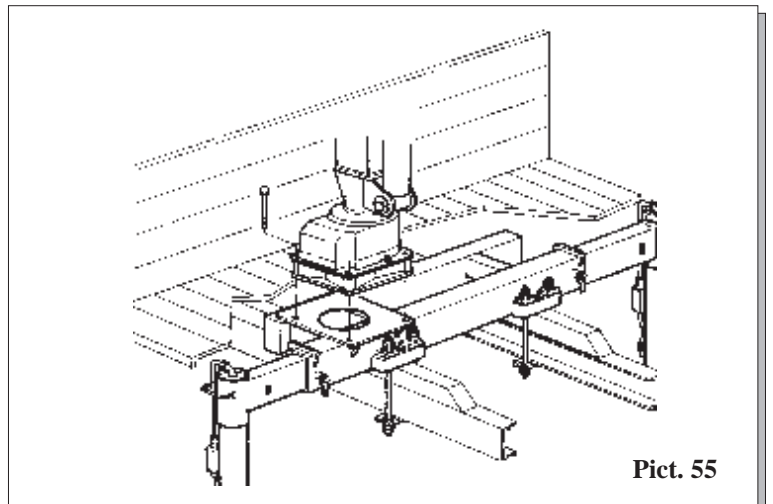
When carrying out any dismantling and reassembling of the crane assembly or sub-frame always ensure that the correct strength of bolts are used and tightened correctly using a torque wrench.

6.1 MOUNTING IN THE BODY

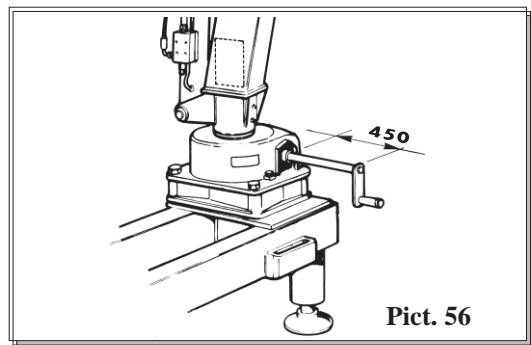
This installation exploits the limited overall dimensions of the slewing supports, leaving the remaining part of the body clear for loading. The crane can be placed in any point of the body, preferably in one of the 4 corners, depending on axle loadings and stability calculations.

6.1.1 Crane fitted with base (Pict. 55)

Position the crane with its base on the vehicle fitted with the sub-frame. Leave the crane hooked to the lifting equipment, keeping it slightly in traction, in order to prevent its possible overturning. Separate the crane from the base by unscrewing the 4 bolts.



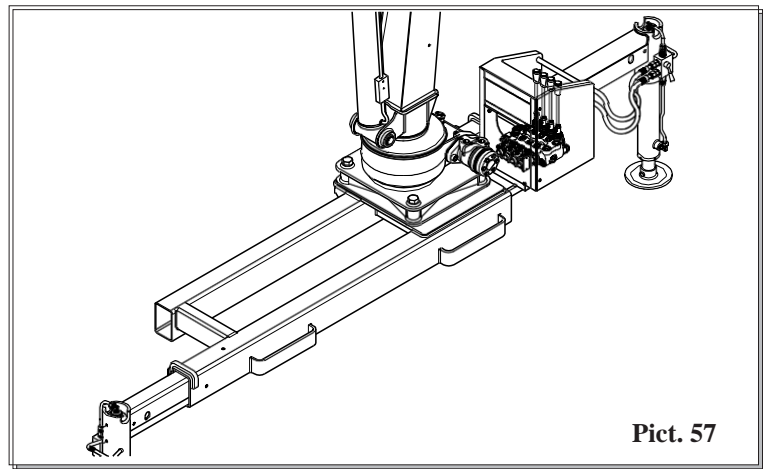
Then lift crane and valve bank clear of the vehicle. Put the body on the surface formed by the reinforcing chassis and crane base (before carrying out the mounting, you should ensure that the crane sub-frame and body frame are at the same height). Put the crane in the position required on the body, then adjust as far as possible the position of the base, by lining up the holes of the slewing base to coincide with those of the stabiliser base below. Drill 4 corresponding holes through the body using the tie bolts, torque up the frame to the sub-frame.



Pict. 56

Then position the valve bank support, checking that neither the valve bank nor the crane interfere with the body edges, and allow its easy opening and closing.

For cranes with manual rotation (Pict. 56), check that the crank rotation is possible with the edge down.



Pict. 57

IMPORTANT

The working space of the crane operator is to be carried out with care and attention, keeping to the instructions of the “Machine Directive”.

Generally, the control levers should be at a height between 1100 and 1400 [mm], in an easily accessible position, without risk of clothes' entangling. The crane use and additional load capacity stickers supplied separately by **Penny Hydraulics** are to be applied in a clearly visible position.

Moreover, the operator position whilst working is not to involve risks of inhalation of exhaust gas from the vehicle's motor, or crushing risks for any part of his body.

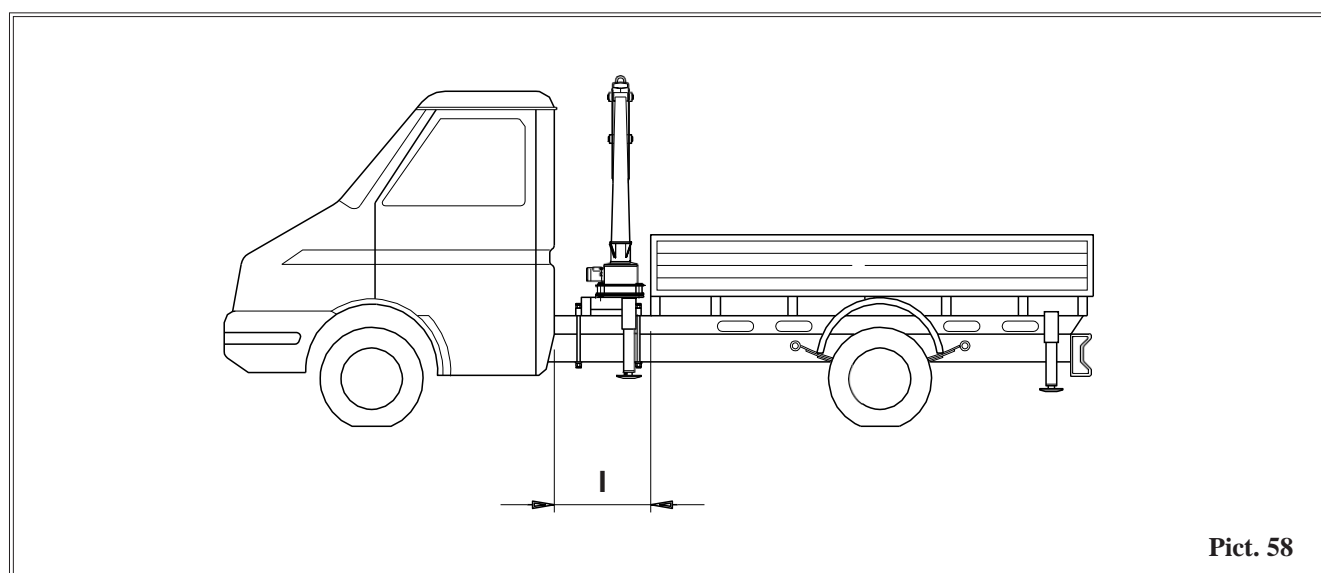
6.2 MOUNTING ON THE CHASSIS

Directly mounting on the chassis allows for the installation of the crane between cab and body, or on the rear overhang. In both cases it could be necessary to shorten the body. Proceed as described in previous par. 6.1, referring to the below table Tab. [L] concerning the room which is to be left available for the crane (cross volume).

Tab. [L] Indicative sizes I = Cross volume PH crane [mm]					
Crane model	PH 110-150	PH 180-230-270	PH 330-380	PH 400-500	PH 510
Dimension I	320/500	400/500	450/500	440/480	530/600

Note: (1) the space “I” required for the crane is always larger than the crane supporting width on the reinforcing chassis, that is $I > B$ (it is marked by B in Pict. 7 – 8 – 9 par. 3.5).

Note: (2) the space required for the crane (cross volume) varies according both to the shape of the truck cab (see par. 4 - Pict. 17), and to the position chosen for the slewing dead point (see par. 4 – Pict. 18-19-20-21)



Pict. 58

7 – CRANE FASTENING ON THE VEHICLE

7.1 GENERAL ADVICE

The crane is to be solidly and safely fixed to the vehicle by using the tie bolts kits included in the supply. With reference to Pict. 59, in following Tables [M] - [N] are listed the materials composing the tie bolts kit according to crane model and version.

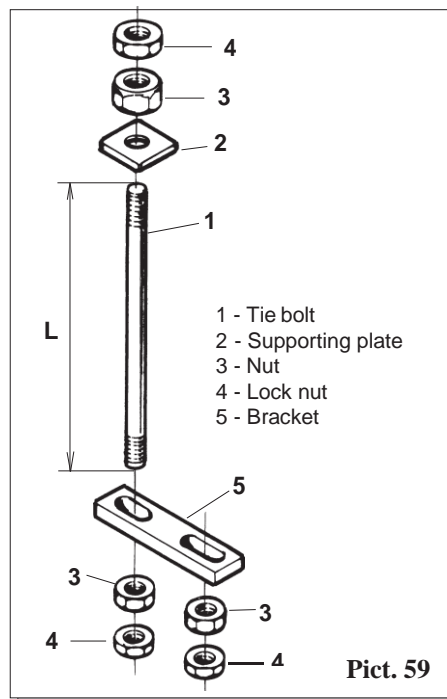


Table [M] Tie bolt kit PH standard crane

Pos.	Description	Material	PH 50	PH 150	PH 180 - PH 230	PH 510
			PH 110		PH 270 - PH 330 PH 380	
			Qty			
1	Tie bolt M16x2 L. 250	8.8	4	4		
1	Tie bolt M20x1.5 L. 250	10.9			4	
1	Tie bolt M27x3 L. 250	8.8				4
2	Plate	Fe 360				
3	Hex. nut M16x2	8G	8	8		
3	Hex. nut M20x1.5	8G			8	
3	Hex. nut M27x3	8G				8
4	Hex. nut M16x2	6S	8	8		
4	Hex. nut M20x1.5	6S			8	
4	Hex. nut M27x3	6S				8
	Washer 16x28	Fe 360		8		

Table [N] Tie bolt kit PH version fitted with outriggers base

			PH 110	PH 150	PH 180 - PH 230 PH 270 - PH 330 PH 380	PH 510
Pos.	Description	Material	Qty			
1	Tie bolt M16x2 L. 500	8.8	6	6		
1	Tie bolt M20x1.5 L. 500	8.8			8	
1	Tie bolt M20x1.5 L. 800	10.9				8
2	Plate 50x40 th. 10	Fe 360	2	2	8	8
	Bushing D.28 th. 6	Fe 360	6	6		
3	Hex. nut M16x2	8G	12	12		
3	Hex. nut M20x1.5	8G			16	16
4	Hex. nut M16x2	6S	12	12		
4	Hex. nut M20x1.5	6S			16	16
5	Bracket 50 th. 25	Fe 510			4	4
5	Bracket 65 th. 30	StE460				4



DANGER

Never carry out any welding operation on the tie bolts.



DANGER

The tie bolts must always be only tensioned or compressed. It is absolutely forbidden any curving or bending operation, even if carried out with the aid of heating.

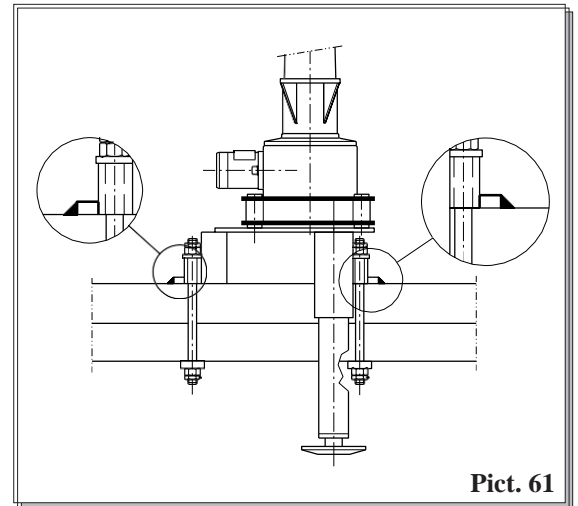
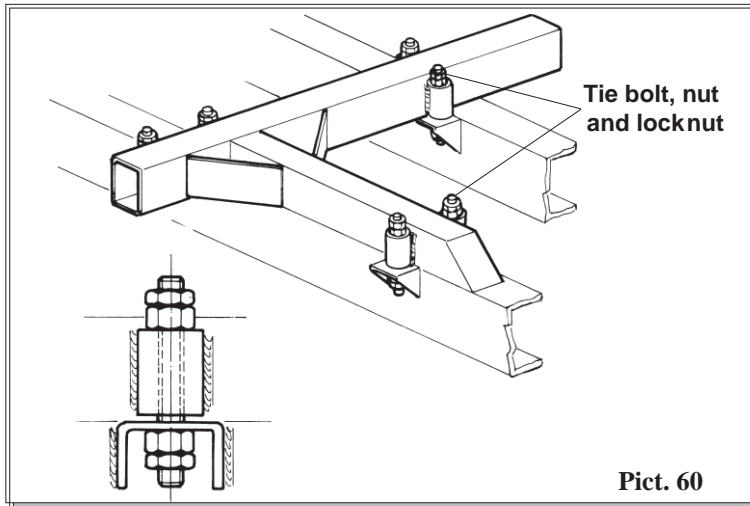
7.2 BOLTING PROCEDURE

7.2.1 Crane fitted with outrigger base

Once the crane fixing position has been settled according to that described in the previous chapter, the crane is simply placed on the reinforcing chassis in the proposed position, before fastening. It is necessary to weld steel base plates on the upper side of the reinforcing chassis, as shown in Pict. 61, to prevent sliding and slewing.

Then, the tie bolts are to be slipped into the proper openings made in the base, with following care:

- **Always use two tie bolts for each opening**



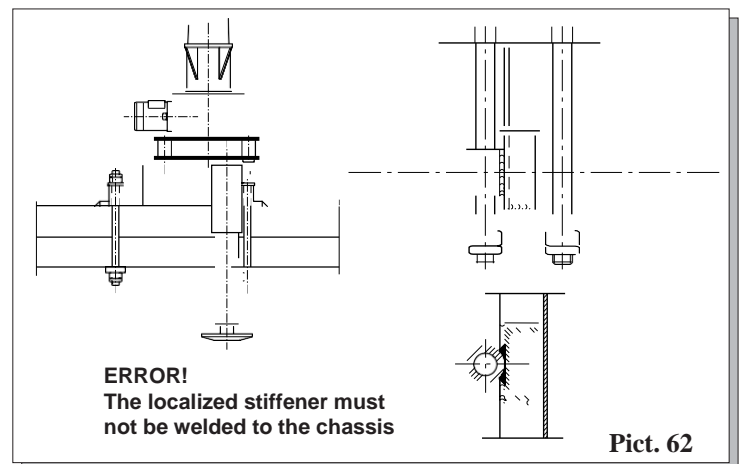
- **In case of fastening on three points (PH 110-150 only) you can use two tie bolts for each point (see Pict. 60) and as lower brackets two steel plates Fe360, 40mm width with 15mm thickness properly drilled.**

The tie bolts should be tightened using the nuts and lock nuts, as shown in Pict. 61 using the relevant plates on the openings' side, and on the drilled brackets on the lower side.



For the tie bolts torque, follow the rates mentioned in table. [O].

Depending on the position chosen and the vehicle, the fastening can be carried out in one of the following ways.

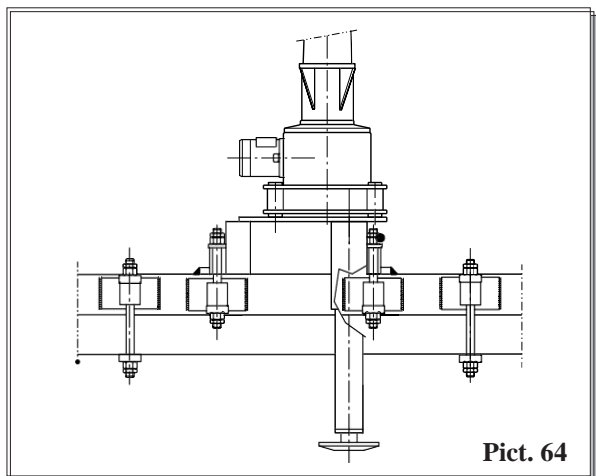
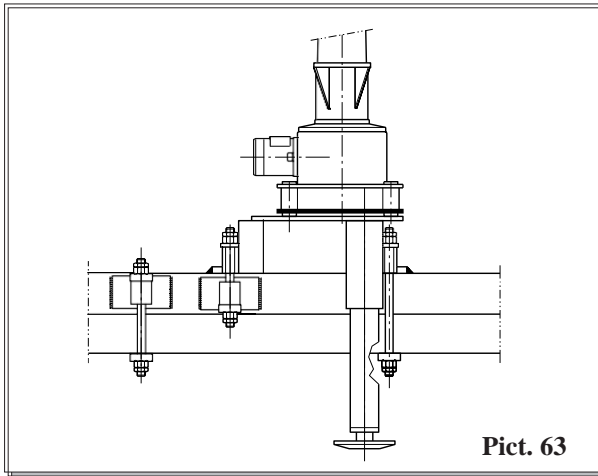


7.2.2 Direct fastening

The tie bolts join and tighten together the crane chassis, the reinforcement chassis frame and the crane. In order to prevent the brackets bending due to the tie bolt tightening, it is essential to fit in the vehicle's chassis a localised stiffener of such shape and thickness that it can precisely slip inside the chassis. Then the stiffener is to be fixed in, for instance by a guide bush as shown in Pict. 62.

7.2.3 Indirect fastening (Picts. 63 and 64)

The fastening of the crane to the reinforcement chassis frame, and the reinforcement chassis frame to the crane are carried out independently. This is more complicated but it could become



essential when space is limited on the vehicle due to ancillary parts.

Instructions:

- the chassis/ reinforcement chassis frame tie bolts must always be external in comparison with the crane/reinforcing chassis ones
- always use 2 tie bolts for each opening when connecting crane and reinforcement chassis frame
- any additional part (additional tie bolts, nuts, bushings, etc.), and also welds are to be calculated.

Table [O] Tightening torque for crane's bolts.

IMPORTANT

Nominal tightening torques, that is, drawn in the following conditions: threads slightly lubricated and dry nut's and screw's support areas.

Crane model	Threading	Position	Torque daN*m
PH 110 - 150	M16x2 - 8.8	Bolts or tie bolts basic flange to base or base to sub-frame	12
PH 180-230-270-330-380	M20x1.5 - 10.9	Tie bolts for basic flange	25
PH 180	M20x1.5 - 8.8	Bolts basic flange to base	20
PH 180-230-270-330-380	M20x1.5 - 8.8	Tie bolts crane base to sub-frame	18
PH 230-270-330-380	M20x1.5 - 10.9	Tie bolts basic flange or bolts basic flange to base	25
PH 510	M20x1.5 - 10.9	Tie bolts crane base to sub-frame	25
PH 510	M27x3 - 8.8	Tie bolts for basic flange or bolts basic flange to base	55

7.3 STABILISER LEG EXTENSION

When required because of the height of the chassis from the ground, it is possible to apply an extension to the stabiliser cylinder rod.



Stabiliser leg extensions are available from stock. Special leg extensions can be supplied. Contact Penny Hydraulics.

Before carrying out any welding on the stabiliser cylinder rod, completely extend the rod up to its stroke end, in order to prevent seals burning.

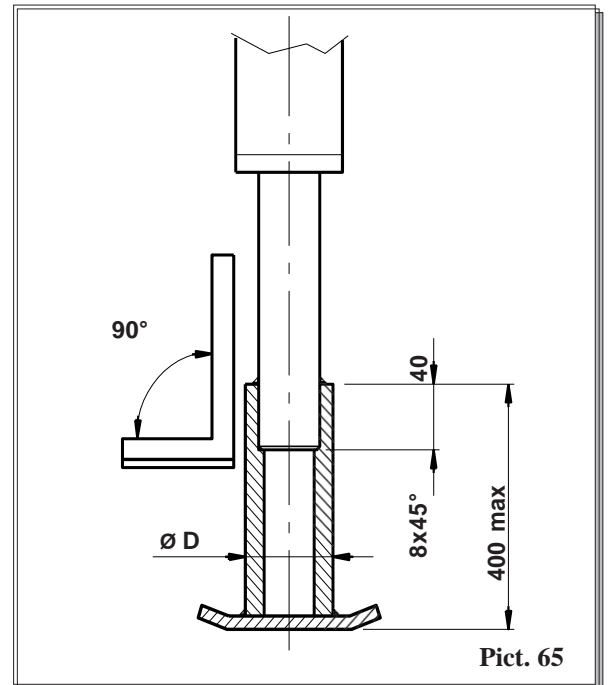
Penny Hydraulics does not acknowledge any warranty on cylinders leaking because of burned seals due to the non-fulfilment of such elementary caution.

It is possible to extend the leg rod by welding to its free tip an extension prepared according to the following features (see Pict. 65):

- its length must not exceed 400 mm for stabiliser with rod D=40 and 300 mm for stabiliser with rod D.30
- it is to be carried out preferably by using a tube of at least 54 mm outer diameter and at least 14 mm thickness for rod D.40, and a round bar of at least 40 mm in case of rod D.30.

Always make sure that the material is able to be welded

- draw in the extension a guide chamfer entrance for the rod for a length of at least 30-40 mm
- draw a chamfer of about 8 mm at the other end for the welding of the plate.



The plate is to be welded with 8 mm fillet weld, checking by means of a proper tool that it is aligned with the rod.

Design | Manufacture | Installation | Training | Service

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