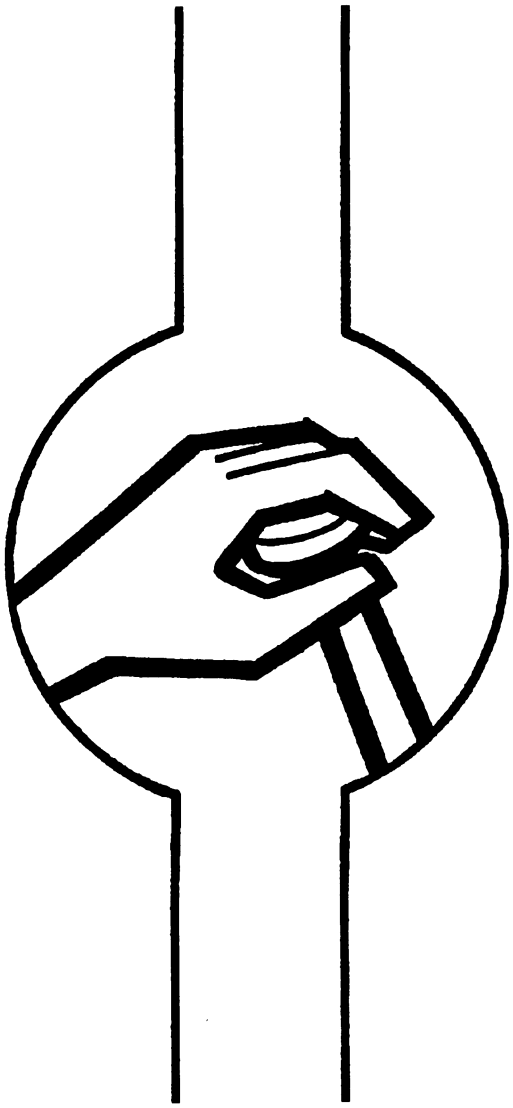
TEREX CRANES



# ATT400-3
# OPERATION & MAINTENANCE MANUAL

C. Boom length, jib, parts of line, and operating area (side, rear).

**Use the next lower rated capacity when working at boom lengths or radii between the figures on the rated lifting capacity chart. It is dangerous to guess the capacity for boom lengths or radii between those listed on the rated lifting capacity chart.**

**Trying to lift a load without knowing whether it is within the rated capacity while expecting the crane to start to tip to warn of an overload is very dangerous. Cranes may suddenly tip over or collapse if the load is too heavy.**

**Crane mounted boom hoist upper angle limit switches, boom angle indicators, backup alarms, anti two-block warning devices, load moment or load indicator devices and other operator aids are no substitute for following the rated lifting capacity chart, operating instructions and safe operating practices.**

**Always stay within rated lifting capacity. The operator must reduce the load under adverse field conditions until, in his judgment, the machine can safely handle the lift.**

(See Operating Precautions No. **4, 13, 15, 19, 22, 30 and 31**).

2. Never operate with anything other than a PPM Cranes, Inc. recommended counterweight.

29. As with all heavy equipment, care must be taken when cranes are driven (traveled) whether on or off the jobsite.

**Watch for people, power lines, low or narrow clearances, bridge or road load limits, and steep hills or uneven terrain. Use a signalperson in close quarters. Know the height, width, and weight of the machine. Retract and lock the outriggers, de-energize the outrigger controls with the outrigger master switch, place the boom in the cradle, and set the swing brake or lock before traveling. Store or tie empty hook to prevent swinging.**

30. Rated lifting capacities for cranes are based on the machine being stationary and level. Traveling a crane with a suspended load (pick and carry operation) or with the boom erected involves special hazards, including the possibility of side loading or tipping over.

**Because of the many variables involved, the user must evaluate conditions and take precautions such as these:**

- Watch for people, power lines, low or narrow clearances, bridge or road load limits, steep hills or uneven terrain. Use a signalperson in close quarters. Know the height, width and weight of the machine. Set the swing brake or lock before traveling. Store or tie empty hooks to prevent swinging.

- The job supervisor must specify a person to determine

# CAUTION

THE GUARANTEE WILL BE NULL AND VOID WHERE THERE HAS BEEN NEGLIGENCE, FAULTY MAINTE-NANCE, INAPPROPRIATE USE OF THE EQUIPMENT BY THE PURCHASERS OR THEIR EMPLOYEES, AND/OR FAILURE TO RESPECT TECHNICAL INSTRUCTIONS ABOUT THE GUARANTEE.

# ATT 400/3

## PRINCIPALES CARACTERISTIQUES TECHNIQUES

| | |
|---|---|
| ● **TYPE** | - Routière tout-terrain 2 essieux |
| ● **CAPACITÉ** | - 35 tonnes sur 360° ( CE ).40 tonnes sur 360° (85%) |
| ● **FLECHE** | - Longueur : 30,40 mètres en 4 éléments |
| ● **HAUTEUR** | - 31,60 mètres sous crochet de flèche principale<br>- 47 mètres sous crochet d'extension double (15 mètres) |
| ● **HYDRAULIQUE** | - PPM FLOWMATIC : distribution load sensing 2ème génération avec circuit indépendant pour l'orientation |
| ● **CHASSIS** | - 4 x 4 x 4 depuis les deux cabines |
| ● **MOTEUR** | - MERCEDES 205 KW (279 Ch) Turbo |
| ● **SUSPENSION** | - PPM HYDROSTABLE : hydropneumatique avec amortissement contrôlé. |

## POIDS

| Essieu | 1 | 2 | Poids total |
|---|---|---|---|
| Poids(1) | 12 | 12 | 24 |
| Poids(2) | 13 | 12,5 | 25,5 |

(1) Avec moufle, pneus 1400 x 25, contrepoids 2,5 tonnes
(2) Avec extension, moufle, pneus 1600 x 28, contrepoids 3,8 tonnes

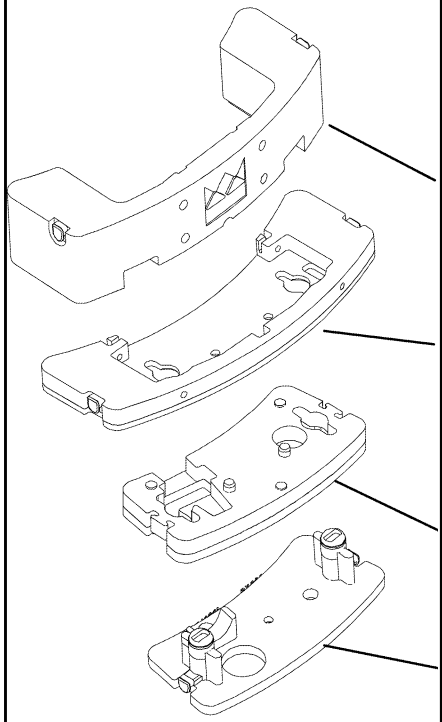
## VITESSES

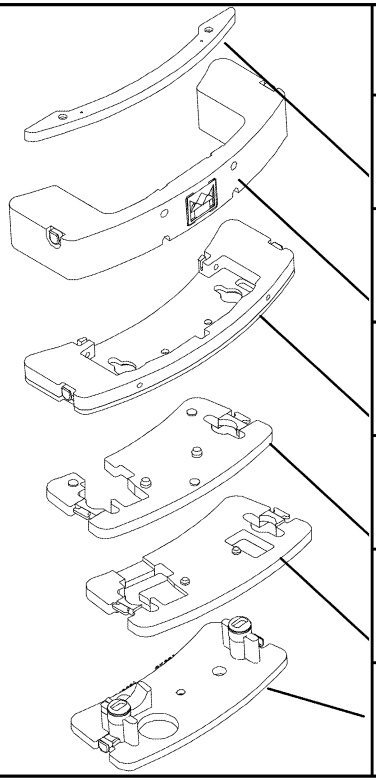
| Rapport de vitesses (AV I AR) | 1 | 2 | 3 | 4 | 5 | 6 | 1 | 2 |
|---|---|---|---|---|---|---|---|---|
| Vitesse sur route (km/h) | 10 | 15 | 24 | 38 | 60 | 75 | 10 | 24 |
| Rampe maximale franchissable | 58 % | | | | | | 58 % | |

| | | |
|---|---|---|
| Levage | Treuil principal : effort maximal (1ère couche / 4 ème couche) | 5,55 / 4,5 tonnes |
| | Treuil principal : vitesse maximale au brin simple | 115 m/mn |
| Relevage | Temps du mouvement de - 4° à 80° | 36 secondes |
| Télescopage | Temps du mouvement de 9,40 m à 30,4 m | 55 secondes |
| Orientation | Vitesse du mouvement | 0 à 2,2 tr/mn |
| Calage | Temps de sortie des poutres horizontales | 25 secondes |
| | Temps de sortie des vérins verticaux | 35 secondes |

# ATT 400/3

## 2.5 t COUNTERWEIGHT CONSTITUTION

| Machine 2 x 12 t | | ALL TIRES |
|---|---|---|
|  | Weight /Ref. | Fitted ? |
| | N90038–22<br>2500 kg | YES |
| | P9003823<br>1300 kg | NO |
| | R900038–25<br>1100 kg | NO |
| | S90038–26<br>600 kg | NO |
| Total counterweights | | 2500 kg |

| Machine 2 x 12 t + 3% | | ALL TIRES |
|---|---|---|
|  | Weight /Ref. | Fitted ? |
| | V03137–39<br>250 kg | YES |
| | N90038–22<br>2500 kg | YES |
| | P9003823<br>1300 kg | NO |
| | X03137–41<br>550 kg | NO |
| | Z03137–42<br>550 kg | NO |
| | S90038–26<br>600 kg | NO |
| Total counterweights | | 2750 kg |

*Pad lifting :*

If a pad lifts from the ground when the load passes over the diagonally opposite outrigger pad it does not mean that the machine is going to overbalance.

However, if this does arrive under normal outrigging conditions, the following points should be checked :

– That the outrigger beam on the load side is correctly extended.

– That the wheels are clear of the ground as indicated in the outrigger capacity chart.

– That the handled load does not exceed the authorized limit.

– That the outrigger pad has not sunk into the ground under the load.

– That the outrigger lifting rams' anti–return valves are not faulty.

– That the chassis is not twisted through bad chocking.

### *1.4/ Determination of the wear rate based on the theoretical length of use of the winches*

For the inspection interval "$i$" (one year maximum under ISO 9927 – 1 or VGB8) the wear rate of the theoretical length of use of the winches "$Si$" is calculated according to the following formula:

$$Si = \frac{Kmi}{Km} \times Ti$$

$Si$ = wear % of the theoretical length of use

$Kmi$ = spectrum factor in the inspection interval "i" in accordance with §1.2

$Km$ = spectrum factor on which the winch calculations are based.

$Ti$ = actual hours of use in the inspection interval "i" in accordance with §1.3.

This rate of use "$Si$" is subtracted from the theoretical remaining length of use "$Di$" .

– If the remaining theoretical length of use for the coming period of use is insufficient, the winches must undergo a general overhaul.
– If the theoretical length of use "$D$" is reached, the winches must undergo a general overhaul before being used.

**In all cases, a general overhaul of the winch becomes necessary at the latest 10 years after the crane is first put into service.**

**The general overhaul must be ordered by the user and carried out by the manufacturer (or any other person authorised by the manufacturer) and must be recorded in the maintenance log.**

**After the general overhaul, the manufacturer or the persons authorised by the manufacturer should establish a new theoretical length of use "$D$" .**

**The maximum period up to the next service should not exceed 10 years.**

### *Operator's safety check*

The operator must make a safety check before starting to work each day to see that the machine is in proper order. Some things to check are :

– Check the machine log book to see that periodic maintenance and inspections have been performed and all necessary repairs made.
– Check the operation of boom hoist limiter device, boom angle indicator, reversing alarms, and other safety devices.
– Carefully inspect load bearing parts such as wire rope, (load lines, boom hoist cable, suspension lines), boom, outriggers, and hooks.
– Be sure no unauthorized field modifications have been made, such as added counterweights and booms that have been improperly repaired.
– Check for air and hydraulic oil leaks.
– After starting the engine, check all gauges for proper readings.
– Test all controls for proper operation.
– Check brakes and clutches. Test load brakes by lifting a load a few inches off the ground and holding it.

### *Operating precautions*

1. Mistakes in calculating lifting capacity can cause accidents.

Several factors must be considered, including :

A. Load radius is the distance between the center line of the crane's upper structure rotational axis and the center line of the boom head pullies. Note that the radius will increase when the load is lifted due to the flexion of the boom.

B. Weight of the load, hook, and rigging.

C. Boom length, jib, parts of line, and operating area (side, rear).

Use the next lower rated capacity when working at boom lengths or radii between the figures on the rating chart. It is dangerous to guess the capacity for boom lengths or radii between those listed on the rating chart.

Trying to lift a load without knowing whether it is within the rated capacity while expecting the crane to start to tip to warn of an overload is very dangerous. Cranes may suddenly tip over or collapse if the load is too heavy.

Always stay within rated capacity. The operator must reduce the load under adverse field conditions until, in his judgment, the machine can safely handle the lift. (Refer to precautions 3, 10, 12, 16, 19,27 et 28).

*Danger*

Any operator must become acquainted with the operating instructions described in this manual before using the machine.The operator is wholly responsible for machine operation.No liability will be accepted by the manufacturer if the instructions contained in this manual are not strictly respected.

Never drive the machine, or let it be driven by third parties, unless all the instructions contained in this manual have been perfectly understood and remembered.Failure to follow these instructions may result in serious accidents causing damage to equipment and injury to personnel.Do not hesitate to contact your local PPM Dealer or Agent who is authorized to offer formal training or can give sound advice.

Never drive this machine before you have read and fully understood the instructions given in the OPERATOR'S MANUAL. Any failure to strictly followthese instructions may cause serious accidents.

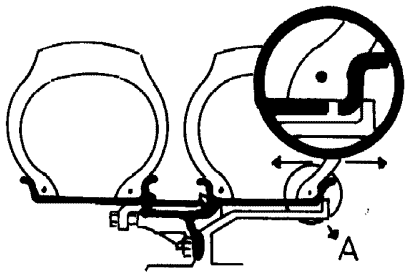
THE OPERATOR'S MANUAL must always be left in the driver's cab.Contact your local PPM Dealer to obtain another copy if required.

## Safety instructions with the tyres

*Before any take of tyres of the machine and in all cases*

Be sure that the wheel rim is not split and that there is nothing trapped.

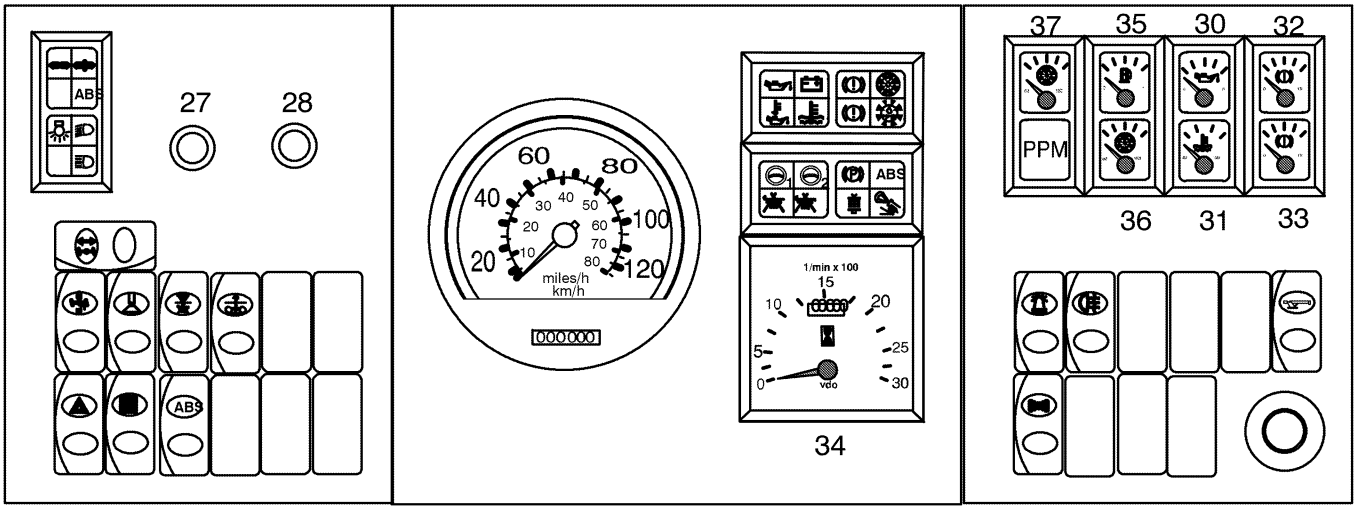
Start by loosening wheel nuts by two or three turns only.
Free the wheel rim in such a manner that the remaining nuts stop the rim being ejected – avoid standing in front of the during removal.
When the rim is freed continue unscrewing the nuts.




*1/ Deflation*

Take of the internal part of the inner tube valve and wait until there is no more air whistleling.In winter, check that there is no ice plugged in the inner tube valve.Make sure that the tire is totally deflated

# Right control panel




*30 / Engine oil pressure gauge*

*31 / Engine water temperature gauge*

*32 / Front brake air pressure gauge*

*33 / Rear brake air pressure gauge*

*34 / Hour meter – R.p.m. counter*

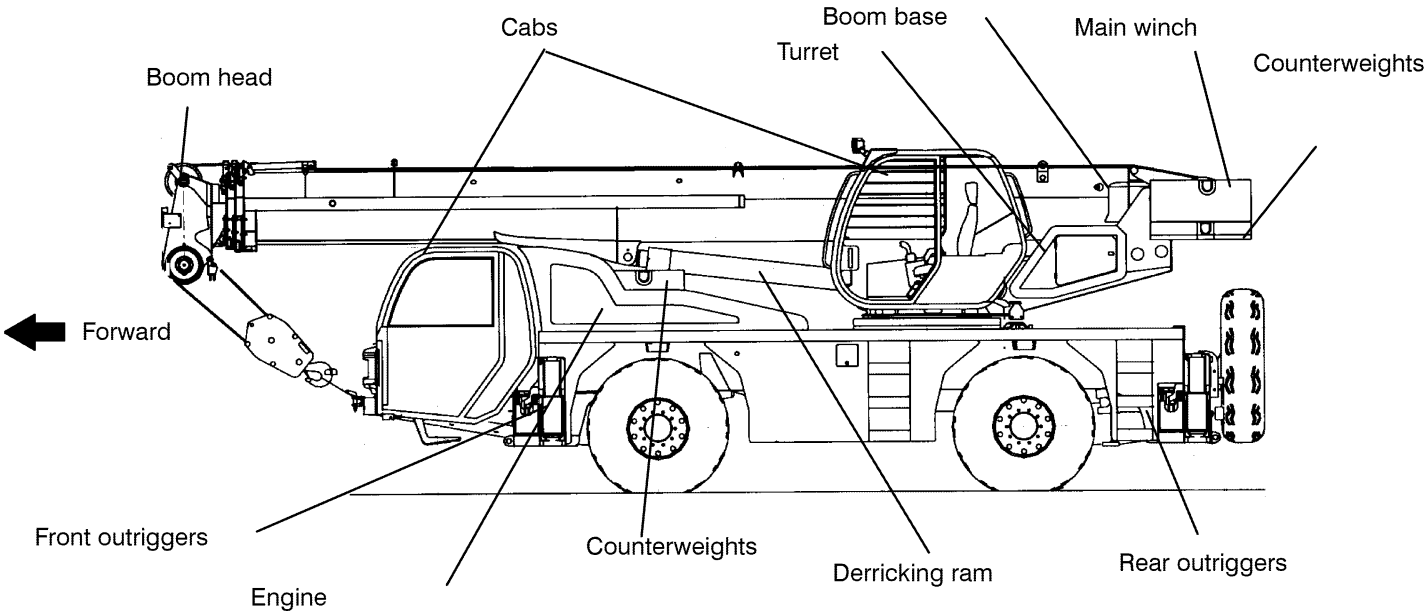
*35 / Fuel gauge*

*36 / Converter oil temperature indicator*

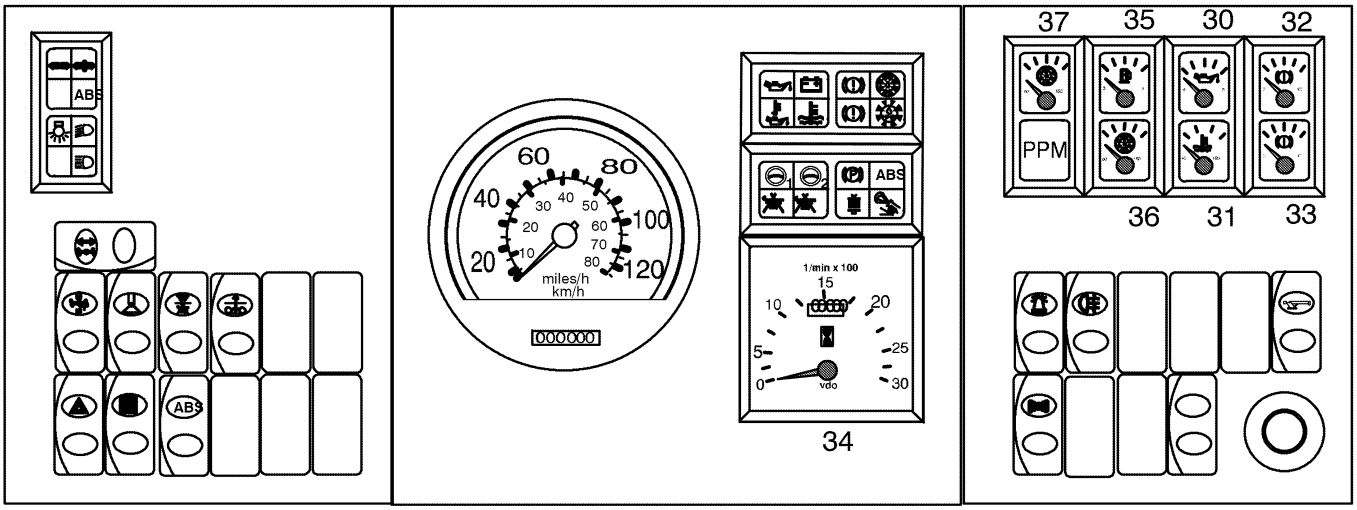
*37 / Clutch oil pressure gauge*

# Upper cab controls

# Driving controls



# Carrier cab controls




*30 / Engine oil pressure gauge*

Normal pressure : 5 bar at tickover speed. If pressure drops abnormally minimum (mini. : 0,25 bar or 3.6 PSI), stop the engine and look for the reason.

**If the temperature reaches 100° C, slow down if the temperature does not drop, stop the engine immediately, and check the cooling circuit .**

*31 / Engine water temperature gauge*

Normal working temperature is between 70°C (158 °F) and 95°C (203 °F).The temperature of the coolant liquid must not exceed 100°C (212°F).

*32 / Front brake air pressure gauge*

Do not use the machine until this minimum pressure has been reached

The normal pressure of the brakes is higher than 5.2 bar (75.30 PSI). indicator 53 goes out when the minimum pressure of 5.2 bar 75.30 PSI) has been reached.

*33 / Rear brake air pressure gauge*

The normal pressure of the brakes is more than 5.2 bar (75.30 PSI). Warning light 54 goes out when the minimum pressure of 5.2 bar (75.30 PSI) has been reached.

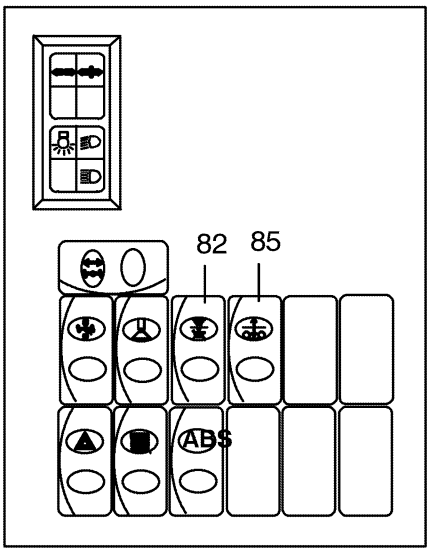
*34 / Time meter – R.p.m. counter*

The time meter works at the same time as the engine.

MERCEDES engine speeds.

- Road : 2200rpm
- site: 2000rpm
- idling speed: 600 rpm
- maximum: 2600 rpm

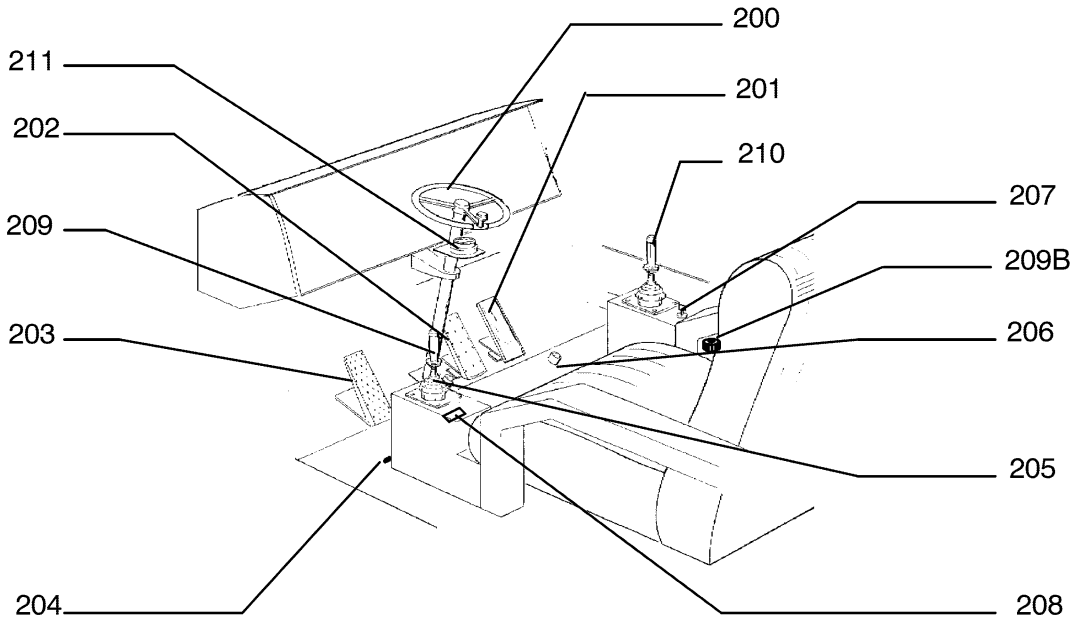
# Carrier cab controls

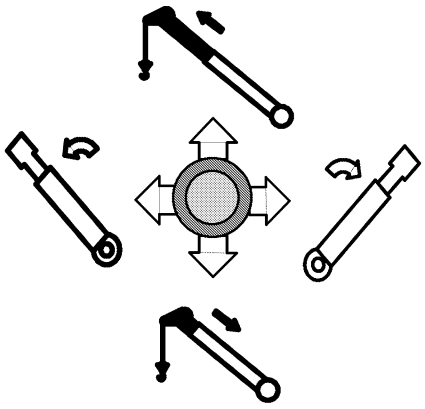



**WARNING : IT IS FORBIDDEN TO UNLOCK THE SUSPENSION when the machine is in a working position on outriggers.**
**The axles may drop suddenly and damage the suspension correctors**

*85 / Suspension up / down control*

This control is used:
– to reduce the height of the machine by 80 mm if height clearance is insufficient.
– to lift the wheels higher under exceptional outrigger conditions.
– to refresh the oil in the suspension hydraulic circuit.
This operation should be carried out daily before leaving the machine.
Operation:
– engine running, suspension unlocked, hold the "Lower suspension" control on. Indicator light on.
– to return the suspension to normal position, start the engine, suspension unlocked, then operate the control briefly in reverse direction. The lowering indicator goes off and the machine returns to nominal position.
(Time required: about 2 minutes 30 seconds.)

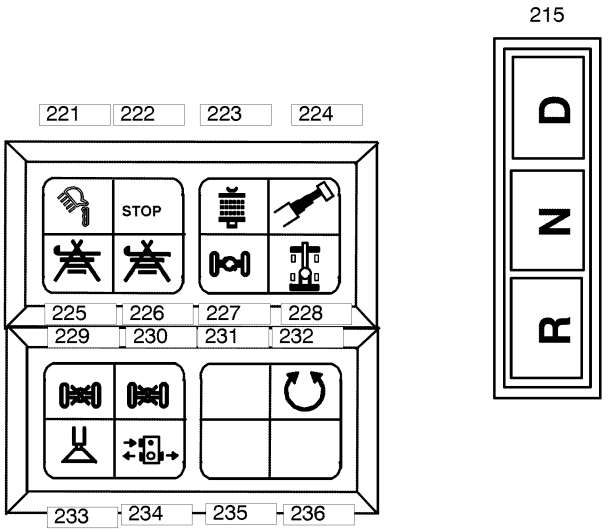


*209 / Slewing / telescoping joystick*

Telescoping.
Pushed forwards : boom extension
Pulled backwards: boom retraction
Slewing.
Pushed to the left : left hand slewing
Pushed to the right : right hand slewing
When the joystick is in between any two of these positions (i.e. diagonally positioned) the two concerned functions operate simultaneouslyNote:
FOR CORRECT USE OF THE MACHINE:
1 – only make handling operations with the engine at idling speed if these involve low speed handling over short distances.
2 – work with the engine at higher speeds when handling functions are to be performed more quickly.

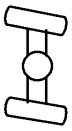
CARE
During inwards and outwards telescoping of the boom to less than 40°, telescoping section synchronisation may not work because of the design of the telescoping cylinder and slider pad friction.
Should this happen, the boom should be re–synchronised using the synchronisation key (see page IV–C–40, item 220).





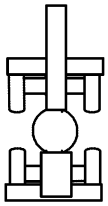
*226 / Rear suspension locking warning light*

When this warning light is on, it indicates that the front suspension is locked (using switch 281 located on the side panel of upperstructure or switch 82 located on the carrier instrument panel).



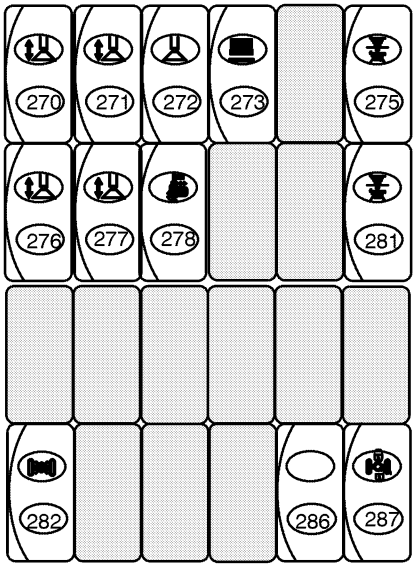
*227 / Rear steering locking warning light*

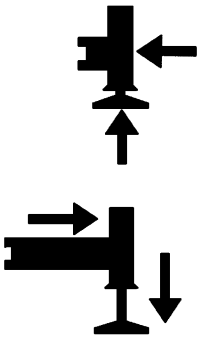
When the warning light is on, it indicates that the rear wheels are unlocked by action on the switch 287 located on side instrument panel.



*228 / Over the rear indicator light*

This indicator light comes on when the upperstructure is in the centreline of the machine, with the boom pointing towards the rear and the upper locked in position on the chassis. The machine can then be used with the corresponding load chart.
(SEE LOAD CHARTS)



*271 / Front right ground pad and front right outrigger beam control*

– flip the switch backwards to extend the outrigger beam or set down the ground pad (following memorized function)
– flip the switch forwards to retract the outrigger beam or to raise the ground pad (following memorized function)
Raising the machine should be done with the outriggers :

- completely retracted
- completely extended
- intermediately extended

The machine must never be raised with the outrigger beams situated between the retracted and the intermediate positions. A load must never be set down on an outrigger beam, even if this is only partially extended.

*Highway driving*

Preliminary operations :

Check the external dimensions of the machine with the machine configured for road circulation.

1 – Make sure that the engine complies with all applicable road regulations.

2 – Set down the counterweights on the chassis, retract the boom, position it over the front and set it down on the above mentionned counterweights.

In the 3 x 12T EUROPEAN CODE version, set down the chassis counterweights on the ground.

3 – Attach the hook block to its cradle on the front of the carrier.

4 – Make sure that :

- the turret to chassis locking device is in place.
- the slewing function is braked.
- rear wheel steering is disactivated.
- the boom retainer sling is in place.

5 – Make sure that the suspension is free (indicator light out).

6 – Make sure that the outrigger ground pads are locked away in their storage position, and also the outrigger beams.

7 – Check that all road lights work correctly.

8 – Check tyre pressures (10 bar or 14.5 PSI).

9 – Position the rear view mirrors and make sure that the driver, once in a seated position in the cab, can survey the full volume of his machine.

10 – Make sure that all hoods are firmly closed.

11 – Make sure that access ladders are folded away and secured.

12 – To facilitate manoeuvres, always drive the machine with the boom in a lowered horizontal position and the hook block attached.

13 – Never road drive the machine with a suspended load.

14 – Never travel while carrying people on the upper.

15 – Axle loading must not exceed 12.5 tons (13.8 US Tons) per axle.

16 – Don't let the machine gather too much speed.

17 – Stopping on slopes : Apply the parking brake and chock the wheels if necessary.

18 – Maximum speeds : 70 kph (43.5 mph) with 1400 x 25 tires.
76 kph (47 mph) with 1600 x 25 tires
76 kph (47 mph) with 20.5 x 25 tires

19 – Make sure that all the roads on the itinerary accept the machine's road dimensions and weight.

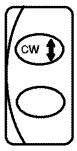
WARNING :Whenever highway driving is undertaken, it is essential that the driver makes certain that he has good all round visibility.

# A2 / Removing counterweights to obtain a 2 x 12 t + 3% machine configuration. (Machine without extension)

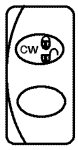
To obtain a machine configuration of 2 x 12 t + 3%, the 1 300 kg counterweight and one of the 550 kg counterweight must be put down on the ground. Only the 2 500 kg + 250 kg counterweights remain on the turret. the 550 kg + 600 kg counterweights remain on the chassis.

Visual indicators and controls used for this operation are :

– Ref. 260: Counterweight cylinders raise/lower control .




– Ref. 261: Counterweight locking hooks lock / release control.




– Locked/unlocked indicator flag.
Colour red/green.

– Ref. 259 : Upperstructure slewing lock control.

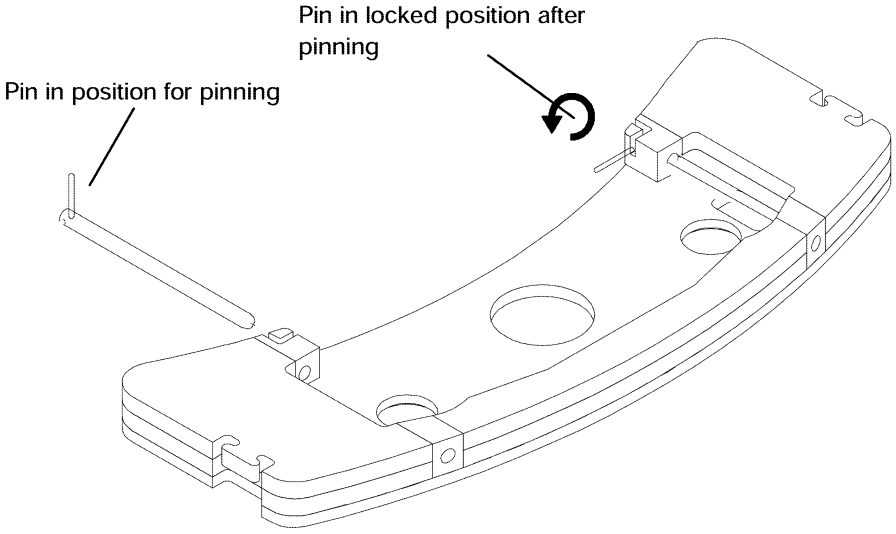
When the table is pressed firmly against the turret, pin the 600 kg or 1,300 kg counterweight, as the case may be, to the turret counterweight and give a quarter turn to the pins to make them safe against slipping out.

The locking indicator flag shows green.

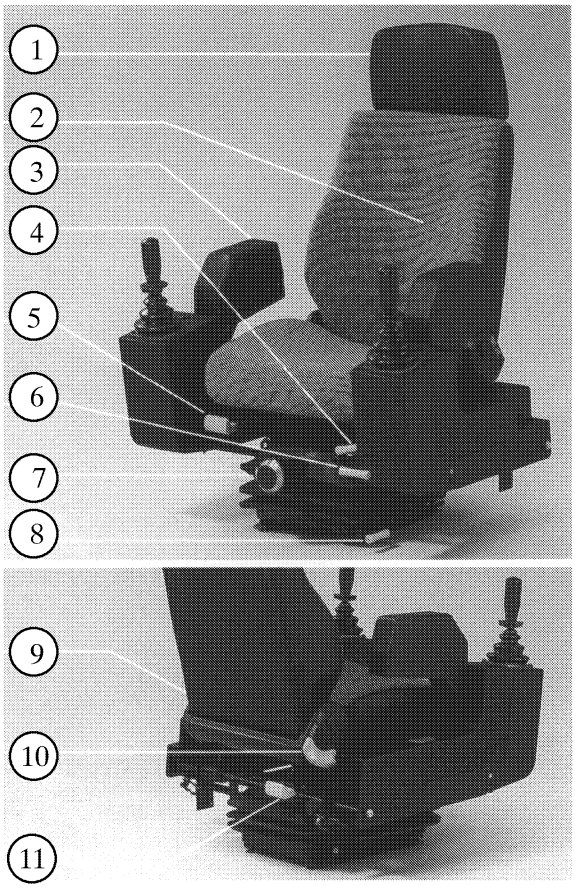
Use control no. 260 to lower the lifting table with the 1,100 kg + 600 kg counterweight assembly.

Hold this control in position until the lifting table has come all the way down.An audible warning will continue to sound until the table reaches low position.

Unlock turret slewing.



# Seat




*1 / Headrest, adjustable*

*2 / Seat and backrest*

*3 / Armrest*

*4 / Horizontal adjustment (upper part )*

*5 / Heigt and slope (front)*

*6 / Locking system for console*

*7 / Weight adjustment*

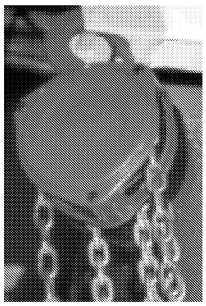
*8 / Horizontal adjustment ( complete seat )*

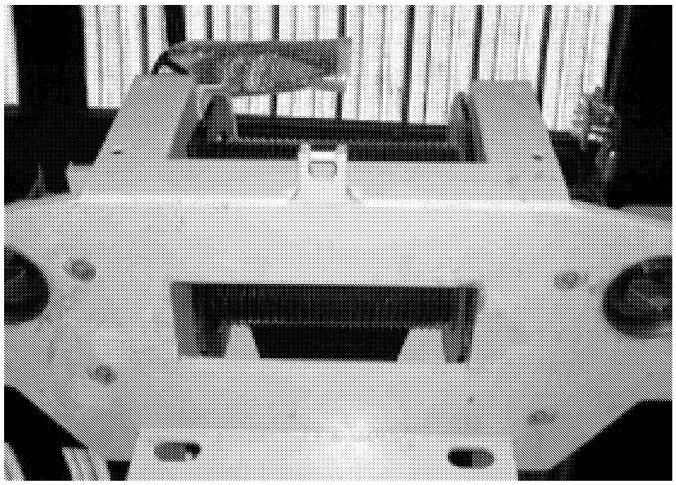
*9 / Automatic lapbelt*

*10 / Backrest adjustment*

*11 / Height and slope ( rear )*

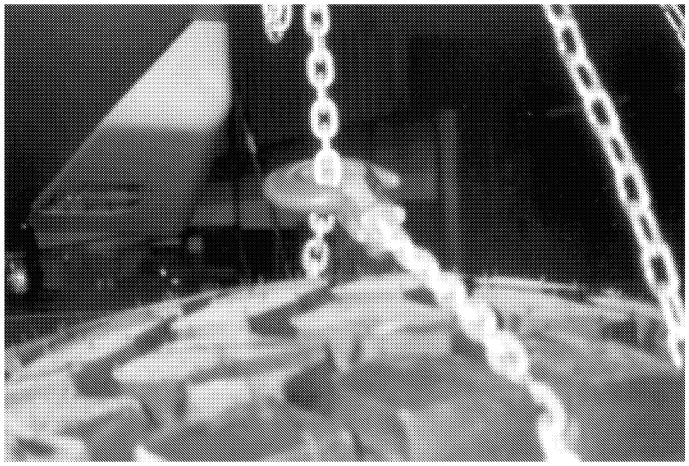
## Fitting the spare wheel to its stand.





· Attach the hoist hook to the bracket.

· Hook up the spare wheel using the hoist chain.



· Lift the spare wheel using the hoist to bring it to the same level as its stand.

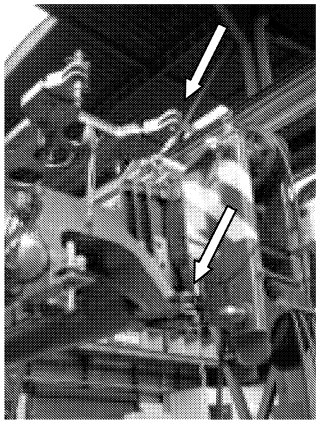
· Put the spare wheel on its stand.

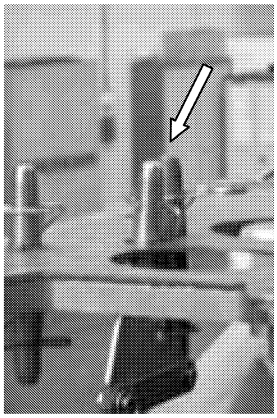
· Attach the spare wheel to the undercarriage using the two screws.

· Remove the chain from the spare wheel.

*C -Pinning the foot of the 8 m extension to the boom head*

Remove the two pins from the upper and lower forks and place them in readiness on the top plate.

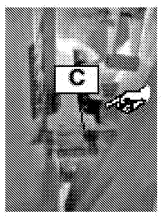


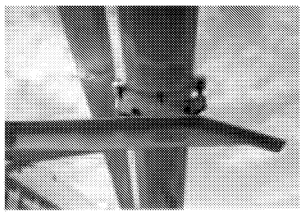


*D - Releasing the 8 m extension.*

Attach the rope to control deployment.

Pivot the extension around the pivot (C) to align the forks of the 8 m extension with the lugs of the boom head.
For safety reasons, attach the rope to the chassis. The extension must remain on its support.



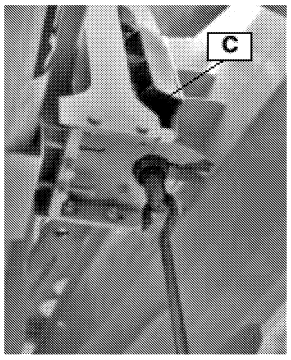



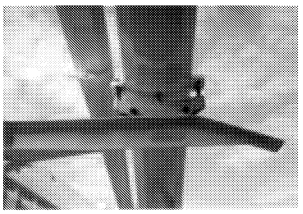
**DANGER:**

**Before the square of the pivot is moved to lock the extension, it is vital that the extension should be fixed to the boom head by the pins E and D.**

**If this instruction is not obeyed, the extension may fall.**

Using the crank stored against the 8 m extension, manipulate the square of pivot (C) to lock the 8 m extension on to the pivot fitted to the boom foot. Replace the crank in storage position.



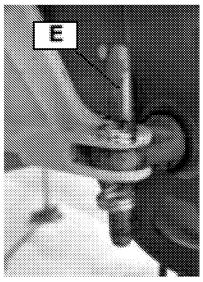



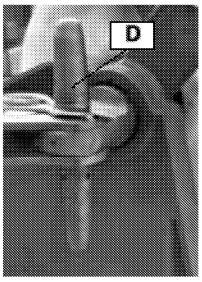
**Removal of the crank from the pivot is strictly prohibited.**

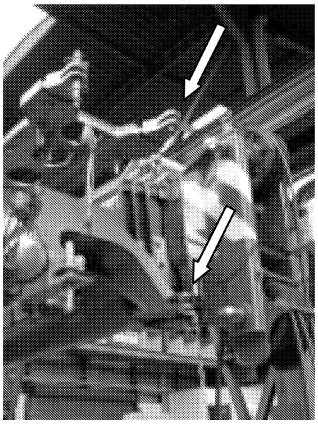
### *G - Unpinning the 8 m extension from the boom head*

Remove pin (D). (Coupling at top of boom head.)

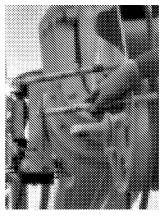
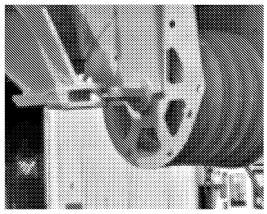
Remove pin (E). (Coupling at bottom of boom head.)



Put the rope guides at the boom head back in position.

The 8 m extension is deployed.

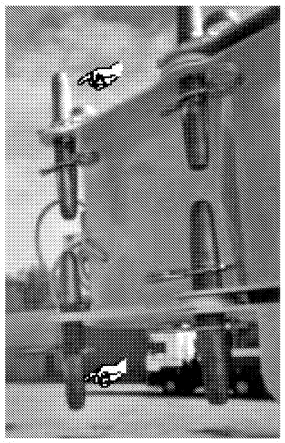
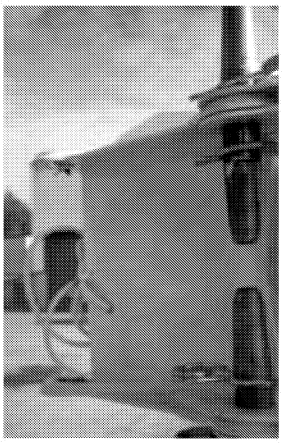
### *F- Deploying the 7 m extension*

At the head of the 7 m extension:

Attach the rope to control movement when deploying the 7 m extension.

At the foot of the 7 m extension:

Remove the two locking pins to release the forks.

Unlock the 7 m extension using the pin.

Deploy the 7 m extension, using the rope to restrain its movement.

## UNFOLDING THE EXTENSIONS.

*Machine equipped with 15m (8m+ 7m)*

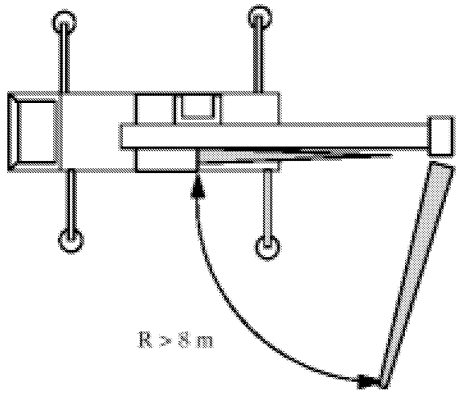
### Unfolding the 8m extension.

**DANGER:**
**Always use a safety harness when performing assembly work more than 3 m (10 ft) above ground level.**
**A single ladder may be used provided that it is secured in place and the top 4 rungs are not used.**
**Use an extendable ladder, a stepladder or a pod that meets applicable safety standards.**

*A - Positioning the machine*

Choose a manoeuvring area large enough to deploy the 8 m extension.

**DANGER : It is strictly forbidden to telescope the boom whilst the extension is being unfolded.**
**The boom should be fully retracted and must be horizontal.**
**Failure to follow these instructions may cause the extension to be deployed accidentally while it is being unlocked and so increase the risk of an accident.**




Machine fixed with outriggers fully extended, on flat, firm, level ground, with wheels raised off the ground.

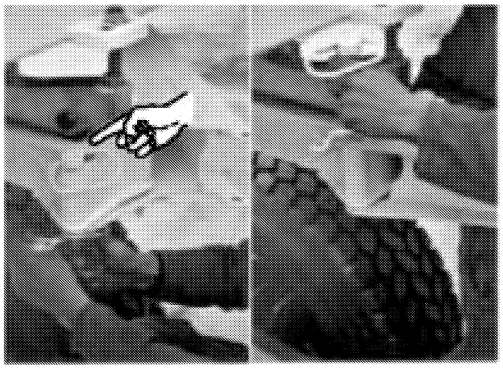
Raise the boom and slew the turret over the rear of the machine.

The tools required to stow the extension are:
A hammer, a rope and the unlocking crank located against the 8 m extension.

### *B - Deploying the boom head-member support.*

Deploy the boom head-member support arm and fix it with the locking pin.

**DANGER : Always refit the safety clips on the pins after reinsertion.**



### *C - Dismantling the top lifting end-of-travel unit and unreeving the pulley block..*

Disconnect the electrical connection between the boom head and the foot of the extension.

At the head of the extension, remove the end-of-travel counterweight by unscrewing the shackle attaching the counterweight chain to the unit cable.

At the head of the boom, use the shackle to fix the lifting end-of-travel counterweight chain to the cable of the end-of-travel unit.

Unreeve the pulley block.

Release the lifting rope from the extension.

To return to 0°, unreeve the pulley-block and fix the terminator wedge socket to the fork situated on the upper side of the 7 m extension using the 30mm pin. Tension the cable slightly.

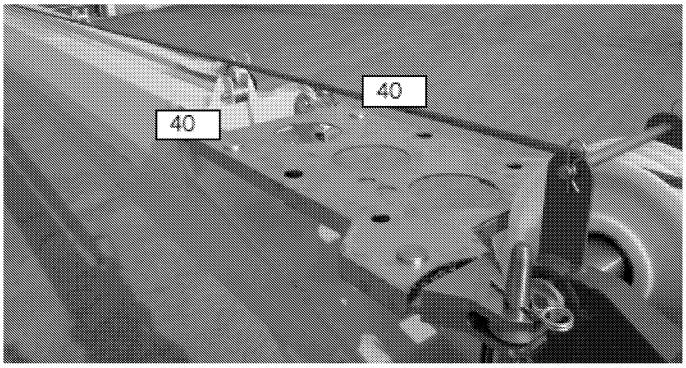
Raise the extension using the LIFTING UP control.
Go slowly and take the utmost care.

Once the extension is near to 0°, bring the boom to horizontal using the derricking down control and let out some cable if necessary.

Tension the rope slightly until the LMI shows a residual load of 0.1 tonnes.

Pull out the pins to obtain a 40° angle and stow them in the two storage holes provided.
Raise the boom to 45° in order to leave enough room to incline the extension. While being lowered, the extension must not strike the ground.

Let out some rope (using the derricking down control) to incline the extension. Proceed slowly and cautiously, avoiding jerks.




As cable is played out, the extension inclines, and the inclining system arrives at a stop.
Lower the boom to refit the hook to the wedge socket.

# Maintenance general features

WHEN MAKING THE PRE–DELIVERY INSPECTION, CARRY OUT INITIAL COMPLETE MAINTENANCE OF THE MACHINE, WITH THE P P M EXPERT (OIL CHANGES, LUBRICATION, REPLACING FILTERS), THEN REFER TO THE MAINTENANCE INTERVALS SHOWN IN THE FOLLOWING TABLES.

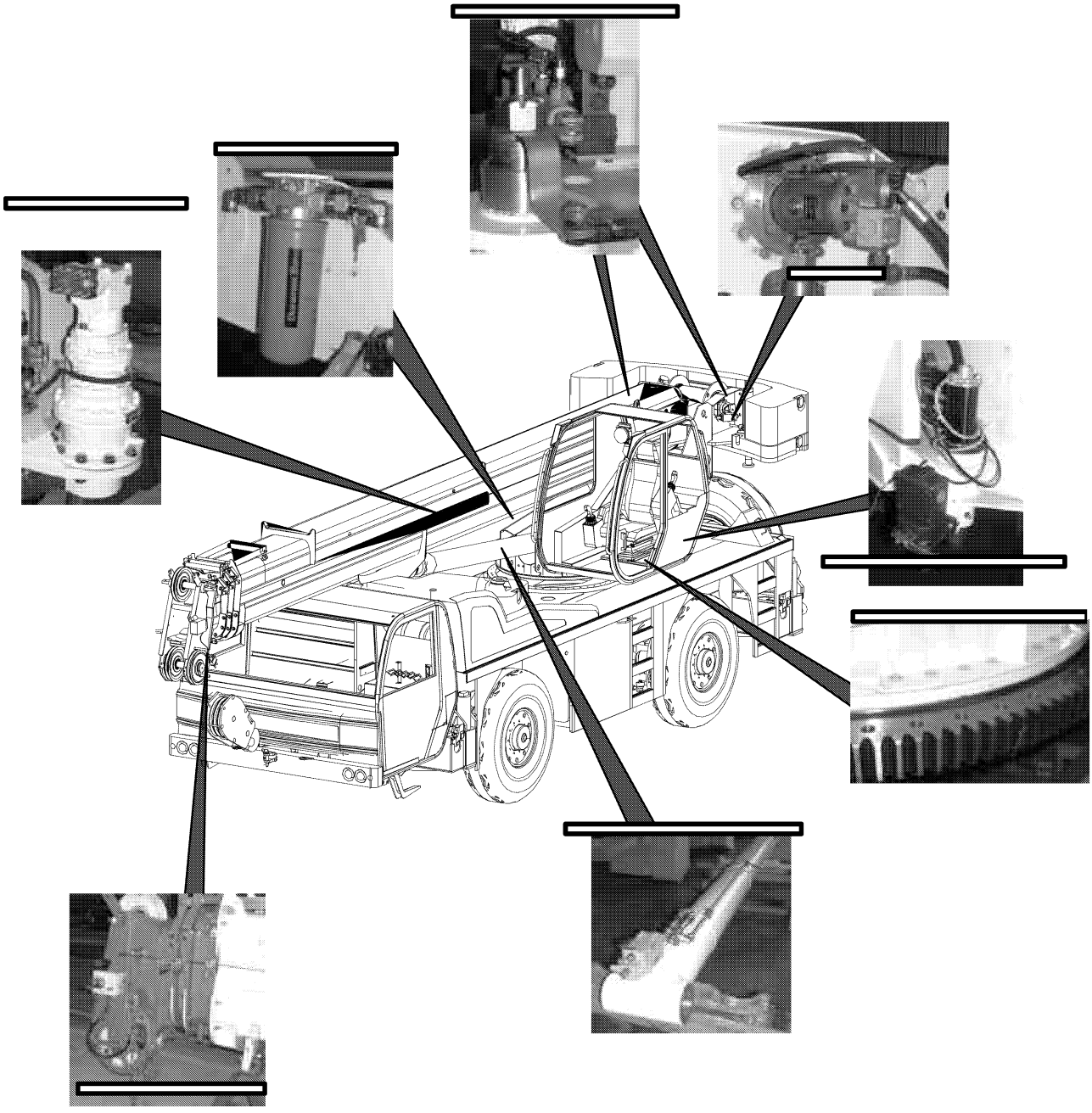
IN THE EVENT OF PROLONGED STORAGE OR USE AT A FIXED SITE, IT IS IMPERATIVE TO CARRY OUT 500 HOURS MAINTENANCE AFTER EACH 6 MONTH PERIOD AT THE MAXIMUM, ESPECIALLY THE FOLLOWING COMPONENTS :

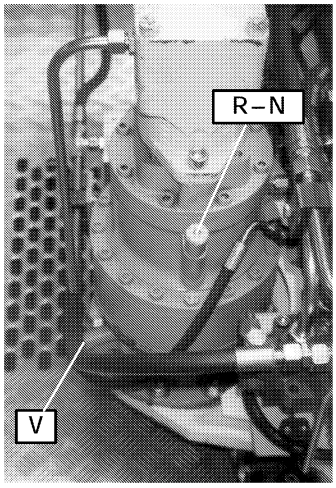
ENGINE – AXLES – GEARBOXES – SUSPENSION – STEERING.

**IMPORTANT :**

**The intervals shown in the following tables are deemed to apply to machines used under normal conditions .**

**For intensive use or under conditions (heat – dampness – dust) it is necessary to carry out maintenance more frequently.**






## Slewing reducer gear motor

Check level: every 100 hours (on dipstick)
Capacity: 2.6l.

## Combustion engine radiator

Clean the cooling matrix.

## Ancillary component belt tensions and conditions

Check the condition of all belts, and replace them if necessary.

Cables must be visually inspected everyday in order to pinpoint any signs of deterioration or deformation.Particular attention should be paid to cable attachment points.

In any case, when an incident occurs which may have caused damage to cable strands and wires or to attachment points, or when a cable is going to be reused after having been removed and refitted, then it should be closely examined.

If the machine has not been used for quite a long period, the cable should be inspected before restarting work.

Particular attention should be paid to :
– Attachment points at each end of the cable.
– The sections of the cable which pass over pulley block pullies and return pullies.

Reasons for removing the cable:
– Broken wires (reason and number)

– Packets of broken wires
– Gradual increase in number of broken wires
– Broken cable strands– Broken cable core
– Reduced elasticity. . cable diameter reduction . lengthening of cable . tightening of individual wires and strands . appariton of fine brown dust between strands.
– General wear of the cable by abrasion
– External and internal corrosion
– Deformed cable (under load) spiral form deformation stretche d wires slackening of certain wires and strands knots contracti ons flattened areas loops buckles bends
– Deterioration induced by heat

## Boom

Check the telescoping chain attachments.

## Counterweight

Every 2000 hours or every 6 months

Check the tightness of fixation bolts

Torque setting : +5mdaN
0

## Brakes

Every 2000 hours or once a year.

Change all flexible hoses on the brake circuit

## Electrical circuit

Check all wiring loom attachments

# Air conditioning unit

Once year :
It is recommended to ask a specialist to check your installation.

*Peroid of idleness*

It is recommended to operate the equipment for at least 10 consecutive minutes once every fortnight.

# LES HUILES MOTEUR



| | |
|---|---|
| Falcon Super XMD Oil | Falcon Oil Co. Ltd., Sharjah/U.A.E. |
| Fina Kappa Supra | Fina Europe S.A., Brüssel/Belgien |
| Fina Kappa Turbo DI | Fina Europe S.A., Brüssel/Belgien |
| Formula TX Turbo Multitec 3000 | BFT, Bonn |
| Frankoline | Beckmann Mineralölhandel GmbH, Osnabrück |
| Fuchs Titan Universal HD 1540 | Fuchs Mineraloelwerke GmbH, Mannheim |
| Galp Camius | Petroleos de Portugal Petrogal S.A., Lissabon/ Portugal |
| Genol Multigrade 1540 | GENOL Gesellschaft m.b.H., Wien/Österreich |
| Genol Multigrade 1540 PL | GENOL Gesellschaft m.b.H., Wien/Österreich |
| Genol Uni-Syn 1040 EC | GENOL Gesellschaft m.b.H., Wien/Österreich |
| Gold Star Testa LL | Bremin Mineraloel GmbH + Co., Mülheim an der Ruhr |
| Gulf Superfleet (GIL) | Gulf Oil International, London/England |
| Gulf Superfleet 200 (GB) | Gulf Oil (GB) Ltd., Cheltenham/England |
| Gulfleet Multi-Trailer (EP) | SAEL, Madrid/Spanien |
| Gulfleet Vantage (GB) | Gulf Oil (GB) Ltd., Cheltenham/England |
| Hafa Multigrade TD | Hafa, Paris/Frankreich |
| Hai Pai 2288 | Sinopec Shanghai Gao Qiao Refinery, Shanghai/ China |
| Hessol Superior | Hessische Oelwerke, Bad Vilbel |
| Homberg-Multi-Oel HDC | J. & A. Homberg, Wuppertal |
| Homberg-Turbo UFE | J. & A. Homberg, Wuppertal |
| Hunold Turbo Star | Hunold Schmierstoffe GmbH, Eching |
| ICCS Megatron Sport | Kuttenkeuler GmbH, Köln |
| ICPA Extra Universal | ICPA, Dordrecht/Niederlande |
| Ideal Chimic T.P. 1000 | Ideal Chimic, Carouge/Schweiz |
| Igol MS Turbo | Igol France, Paris/Frankreich |
| Igol Rallye Turbo 4E | Igol France, Paris/Frankreich |
| Imexco CEP Diesel Engine Oil | Imexco Ltd., Singapur |
| Inter TRX 2 | Ets A. Mauran & Fils S.A., Odars/Frankreich |
| Intercooler | Unil-Opal SA, Rueil-Malmaison/Frankreich |
| IP Superaxia Plus | Italiana Petroli S.p.A., Genua/Italien |
| Irokal plus CX | elf Mineralölwerk Osnabrück, Osnabrück |
| Irokal Super MGL | elf Mineralölwerk Osnabrück, Osnabrück |
| Jet Basic Level | Conoco Mineralöl GmbH, Hamburg |
| Jet High Level-D | Conoco Mineralöl GmbH, Hamburg |
| Kennoco Supreme SHPD Motor Oil | Handel-Mij Noviol B.V., Nijmegen/Niederlande |
| Kluth Mehrbereichsmotorenöl HDC | Oswald Kluth, Bargfeld-Stegen |
| Kompressol FE | Kompressol-Oel Verkaufs GmbH, Köln |
| Kroon-Oil Multifleet SF/CE SHPD | Kroon Oil B.V., Almelo/Niederlande |
| Label 100 Fardex 3 C | Label 100, Salon de Provence/Frankreich |
| Labo Megalub AC5M | Huiles Labo, Nanterre Cedex/Frankreich |
| Labo Rush Td | Huiles Labo, Nanterre Cedex/Frankreich |
| Latol SHPDO Turbotex | Oliehandel, Rotterdam/Niederlande |
| Liqui Moly Formula 3 Protech | Liqui Moly GmbH, Ulm |
| Liqui Moly Formula Super HD Motoröl | Liqui Moly GmbH, Ulm |
| Liqui Moly MB Service Fill Motor Oil | Liqui Moly GmbH, Ulm |
| Liqui Moly Nova Super HD Motoröl | Liqui Moly GmbH, Ulm |
| Liqui Moly Profi Touring | Liqui Moly GmbH, Ulm |
| Liqui Moly Touring High Tech Diesel Spezialoil | Liqui Moly GmbH, Ulm |

# LES HUILES MOTEUR

**228.3**
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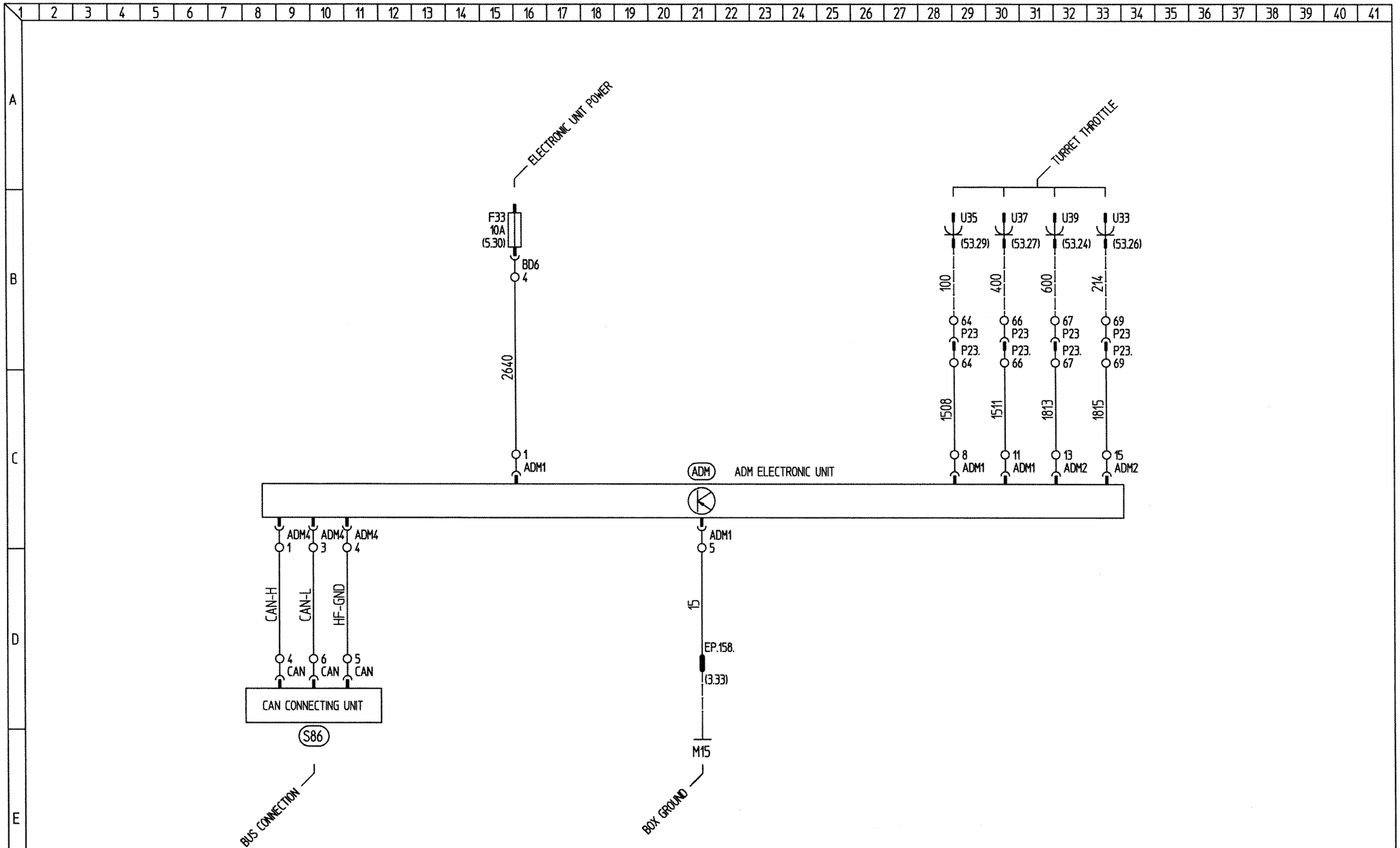
|---|---|
| Saarberg Turbo Gold | Saarberg Brennstoffhandel GmbH, Saarbrücken |
| Sadol S-600 Multigrade | Sonol Israel Ltd., Haifa/Israel |
| Sarol SHPD Lorry | Sarol Chemicals, Metamorfossi, Athen/Griechenland |
| Sasol Zircon | Sasol Oil (Pty) Ltd, Johannesburg/Südafrika |
| Saturn | Rom Madeni Yag, Izmir/Türkei |
| Schwabenöl Turbo Super SHPD | Schwabenöl, Stuttgart |
| Selectol Turbo SHP-D | Karl Käppler, Stuttgart |
| Selectol Uniturbo LL | Karl Käppler, Stuttgart |
| Shell Motorenöl DO | Deutsche Shell AG, Hamburg |
| Shell Myrina M | Shell International, London/England |
| Shell Myrina X | Shell International, London/England |
| Shell Rimula Plus | Shell International, London/England |
| Shell Rimula Super | Shell International, London/England |
| Shell Special MB | Shell Mexico, Leon/Mexico |
| Sips Record Turbo T | Sips-Dieter Döcker GmbH, Viersen |
| Sips-TSL 3 Extra | Sips-Dieter Döcker GmbH, Viersen |
| Sopral SHPD | Soprograsa S.A., Madrid/Spanien |
| Special Turbo LD | Americol B.V., Zaandam/Niederlande |
| Speedwell Dispersol SHPD | Bakker & Versteegen, Zwijndrecht/Niederlande |
| Staroil 25 – Super Turbo 45 | Silver Industrial S.A., Madrid/Spanien |
| Statoil MaxWay | Statoil, Stavanger/Norwegen |
| Statoil TruckWay | Statoil, Stavanger/Norwegen |
| Steel SHP – Diesel Turbo | Borgh Italia S.r.l., Camerano/Italien |
| STP Turbo Diesel Oil | Sisco Japan Co. Ltd., Tokio/Japan |
| Südöl Multilight | Südöl GmbH, Eislingen |
| Südöl SHPD | Südöl GmbH, Eislingen |
| Sunoco MB 8.3 – 15W40 | Aceites y Parafinas Industriales, Guadaljara/Mexico |
| Sunoco Super HPD | Sun Oil Co. N.V., Aartselaar/Belgien |
| Super Diesel Engine Oil | Conoco Inc., Ponca City, OK/Amerika |
| Super Diesel Oil MB-3 | Bardahl de México, México D.F./Mexico |
| Supercat S.H.P.D. | Batoyle Limited, Huddersfield/England |
| Superdiesel Turbo | ROLOIL, Cologno-Mailand/Italien |
| SVG Uniplus Turbo SHPD | Handelsges. für Kfz-Bedarf, Düsseldorf |
| Syneco Multirange | Syneco S.p.A., S. Giuliano Mil./Italien |
| Tamoil Super Diesel Turbo | Tamoil Italia S.p.A., Mailand/Italien |
| Teboil Super HPD | Suomen Petrooli Oy, Hamina/Finnland |
| TERRA REC Turbo Super | Mineralöl-Raffinerie Dollbergen GmbH |
| Tor Synfleet SHPD | De Oliebron B.V., Zwijndrecht/Niederlande |
| Tor Turbofleet SHPD | De Oliebron B.V., Zwijndrecht/Niederlande |
| Total Rubia FE | Total Deutschland GmbH, Düsseldorf |
| Total Rubia TIR 8200 | Total Raffinage Distr., La Defense/Frankreich |
| Total Rubia TIR Max | Total Raffinage Distr., La Defense/Frankreich |
| Total Rubia TIR XLD | Total Deutschland GmbH, Düsseldorf |
| Trans-Diesel 3 | Slasky Zaklady Refinery, Czechowice-Dziedzice/ Polen |
| Trek SHPD Oil | Engen Petroleum Ltd., Kapstadt/Südafrika |
| Truckmaster XHPD | Millers Oils Ltd., Brighouse West Yorkshire/England |
| Trysk Global UHPD | Paramo, Pardubice/Tschechische Republik |
| Trysk Top Tir | Paramo, Pardubice/Tschechische Republik |
| Tunlub-Diesel-Spezial SHPD | Tunap Industrie, Wolfratshausen |
| Turbo Leichtlauföl SH | Turbotank Bösche & Bodeker GmbH, Bremen |
| Turbo-HD Motorenöl SHPD Plus | Turbotank Bösche & Bodeker GmbH, Bremen |
| Turbogrado | Repsol Distribucion S.A., Madrid/Spanien |
| Turbolene ‚D' Plus | Fuchs Lubricants (UK) PLC, Belper/England |
| Turdus 1 SHPD | Rafineria Gdanska S.A., Gdansk/Polen |
| Turdus SHPD | Rafineria Gdanska S.A., Gdansk/Polen |

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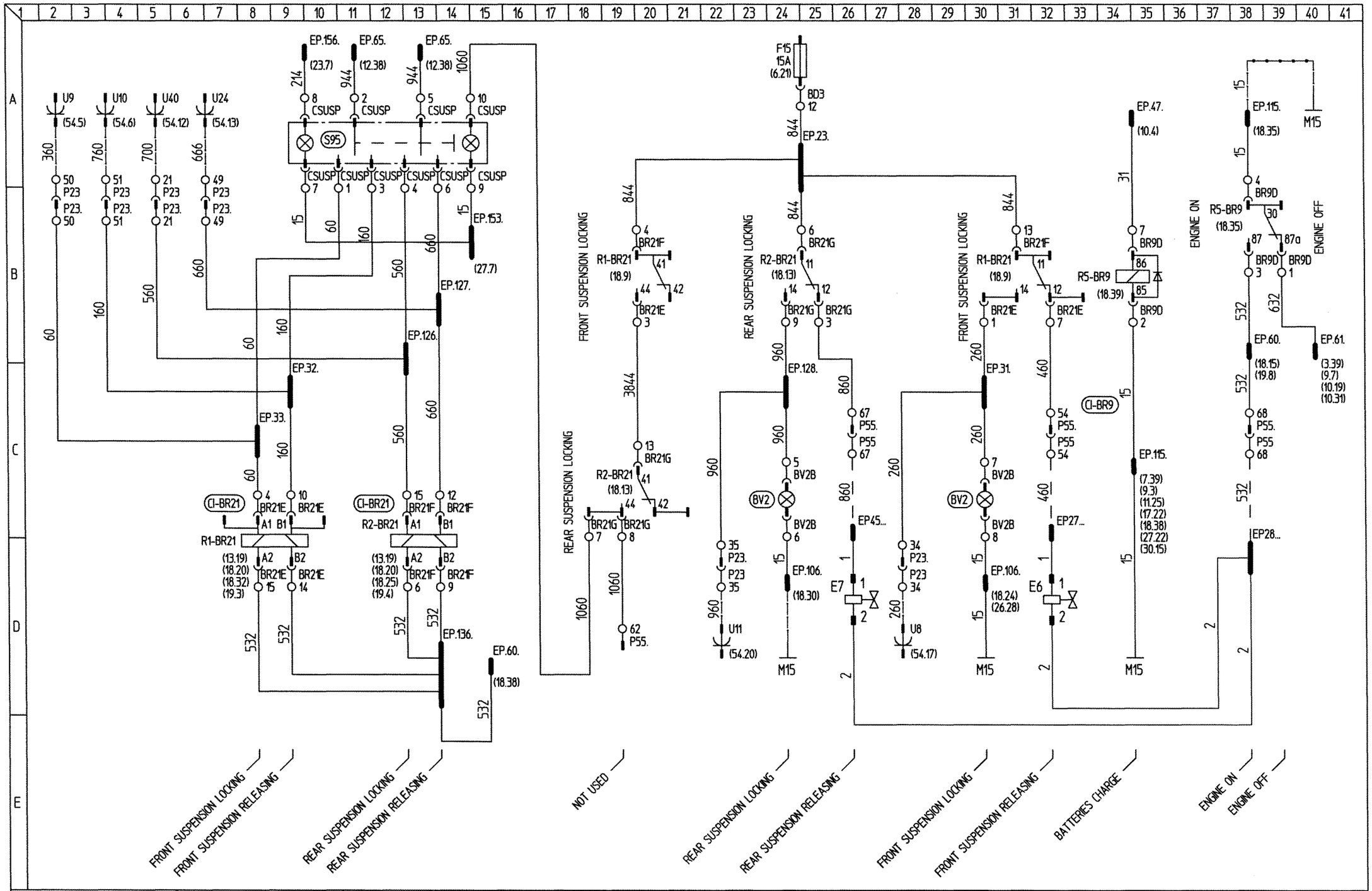
|---|---|---|---|---|---|---|
| PPM TEREX | ETUDE : 1371 | DOSSIER ELECTRIQUE ATT400/3 | ALIMENTATION BOITIER ADM / ACCELERATION TOURELLE | ATT400/3 | PORTEUR *CARRIER* | INDICE : A |
| | E.P.S. : | *ATT400/3 ELECTRIC FILE* | *ADM UNIT POWER / TURRET THROTTLE* | Dessinateur : B.C. | Date : 27/10/00 | PAGE : 8 |
| CR 107366 | MACHINE : 241210 --> | | | Vérificateur : R.P. | Date : 18/03/2002 | |

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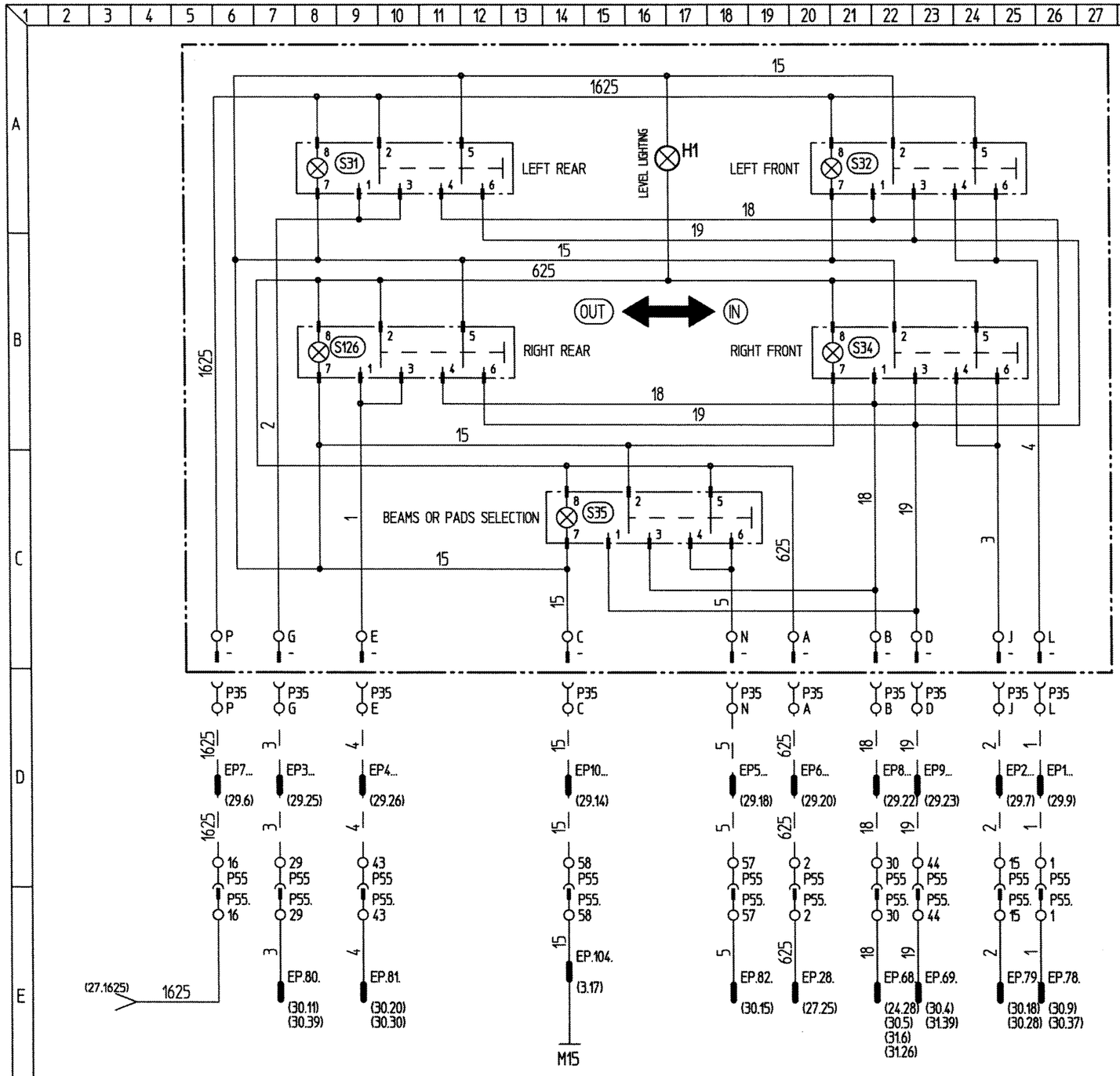
|---|---|---|---|---|---|---|
| PPM TEREX | ETUDE : 1371 | DOSSIER ELECTRIQUE ATT400/3 | BLOCAGE-DEBLOCAGE SUSPENSIONS | ATT400/3 | PORTEUR *CARRIER* | INDICE : A |
| CR 107366 | E.P.S. : | *ATT400/3 ELECTRIC FILE* | *SUSPENSIONS LOCKING-RELEASING* | Dessinateur : B.C. | Date : 27/10/00 | PAGE : 18 |
| | MACHINE : 241210 --> | | | Vérificateur : R.P. | Date : 18/03/2002 | |




| FUNCTIONS | PILOTED SOLENOÏDES VALVES |
|---|---|
| BEAMS / PADS OUT | E190 E191 E192 E193 E194 E195 E196 E197 E200 E201 E206 |
| FRONT RIGHT BEAM | ● ● ● |
| REAR RIGHT BEAM | ● ● |
| FRONT LEFT PAD | ● ● ● |
| FRONT RIGHT PAD | ● ● ● |
| REAR LEFT PAD | ● ● ● |
| REAR RIGHT PAD | ● ● ● |

| FUNCTIONS | PILOTED SOLENOÏDES VALVES |
|---|---|
| BEAMS / PADS IN | E190 E191 E192 E193 E194 E195 E196 E197 E200 E201 E206 |
| FRONT RIGHT BEAM | ● ● ● |
| REAR RIGHT BEAM | ● ● |
| FRONT LEFT PAD | ● ● ● |
| FRONT RIGHT PAD | ● ● ● |
| REAR LEFT PAD | ● ● ● |
| REAR RIGHT PAD | ● ● ● |

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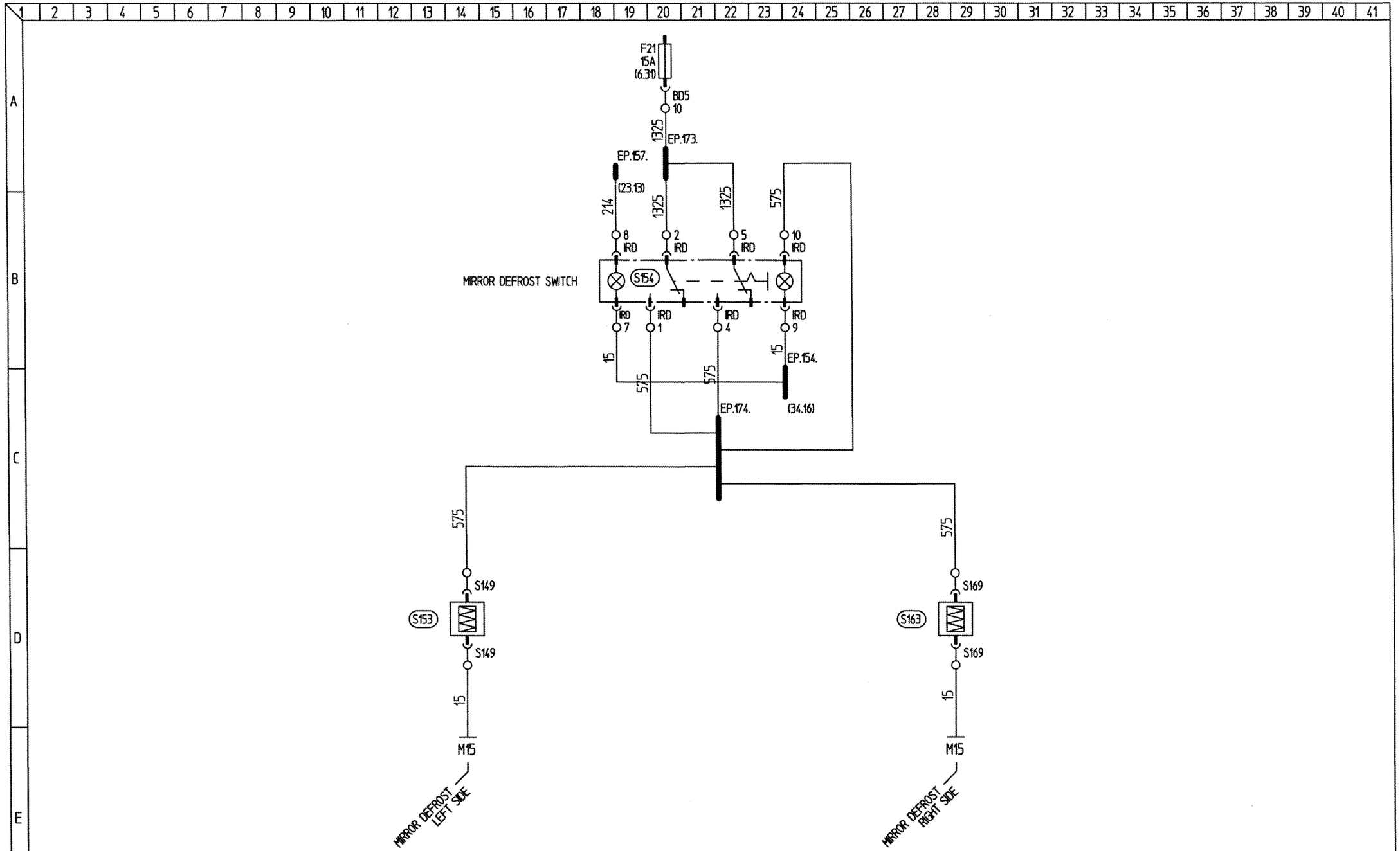
|---|---|---|---|---|---|
| PPM TEREX | ETUDE : 1371 | DOSSIER ELECTRIQUE ATT400/3 | BOITIER STABILISATEURS COTE DROIT | ATT400/3 | PORTEUR *CARRIER* |
| CR 107366 | E.P.S. : | *ATT400/3 ELECTRIC FILE* | *RIGHT HAND OUTRIGGERS BOX* | Dessinateur : B.C. | Date : 27/10/00 |
| | MACHINE : 241210 --> | | | Vérificateur : R.P. | Date : 18/03/2002 |



INDICE : A

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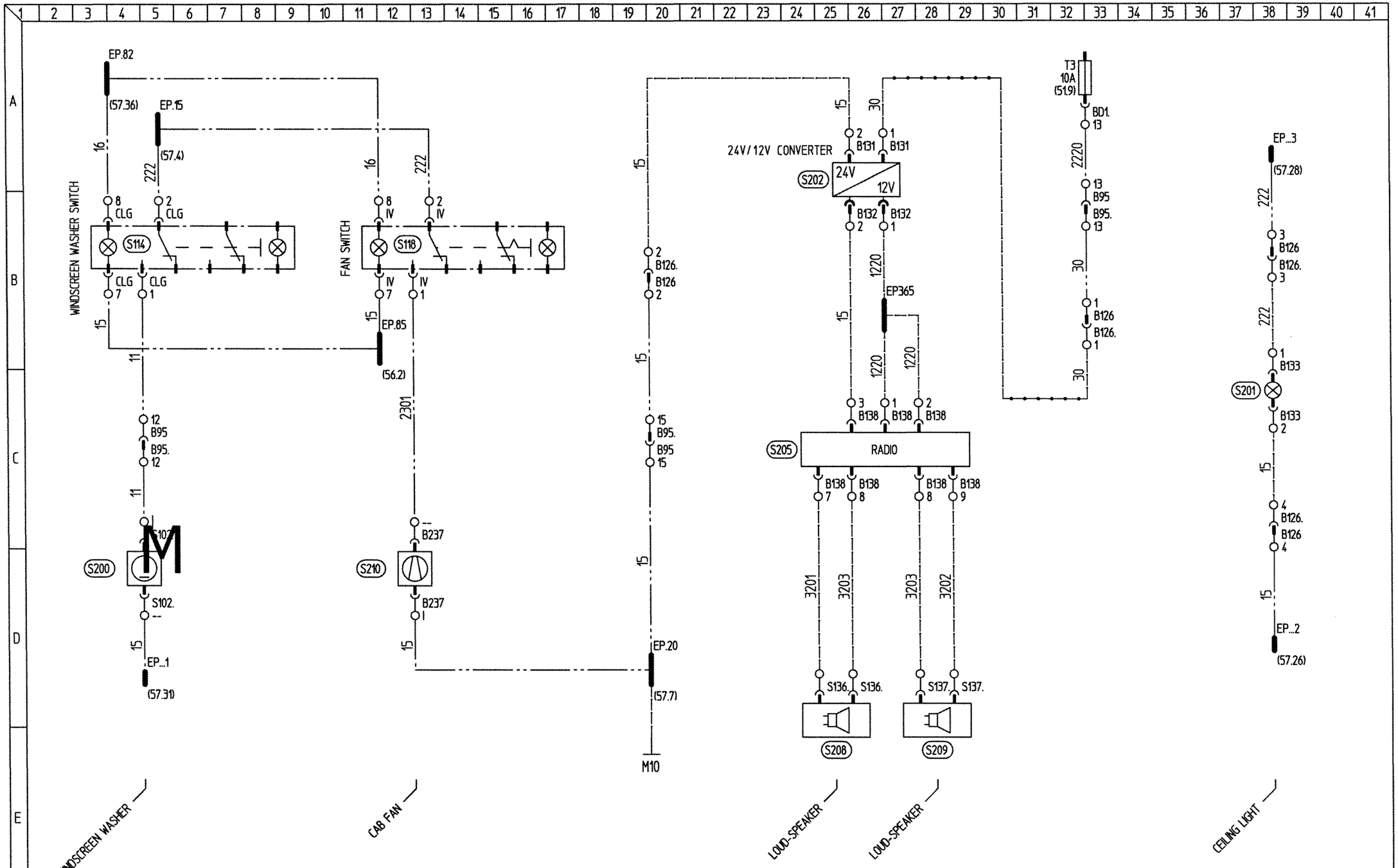
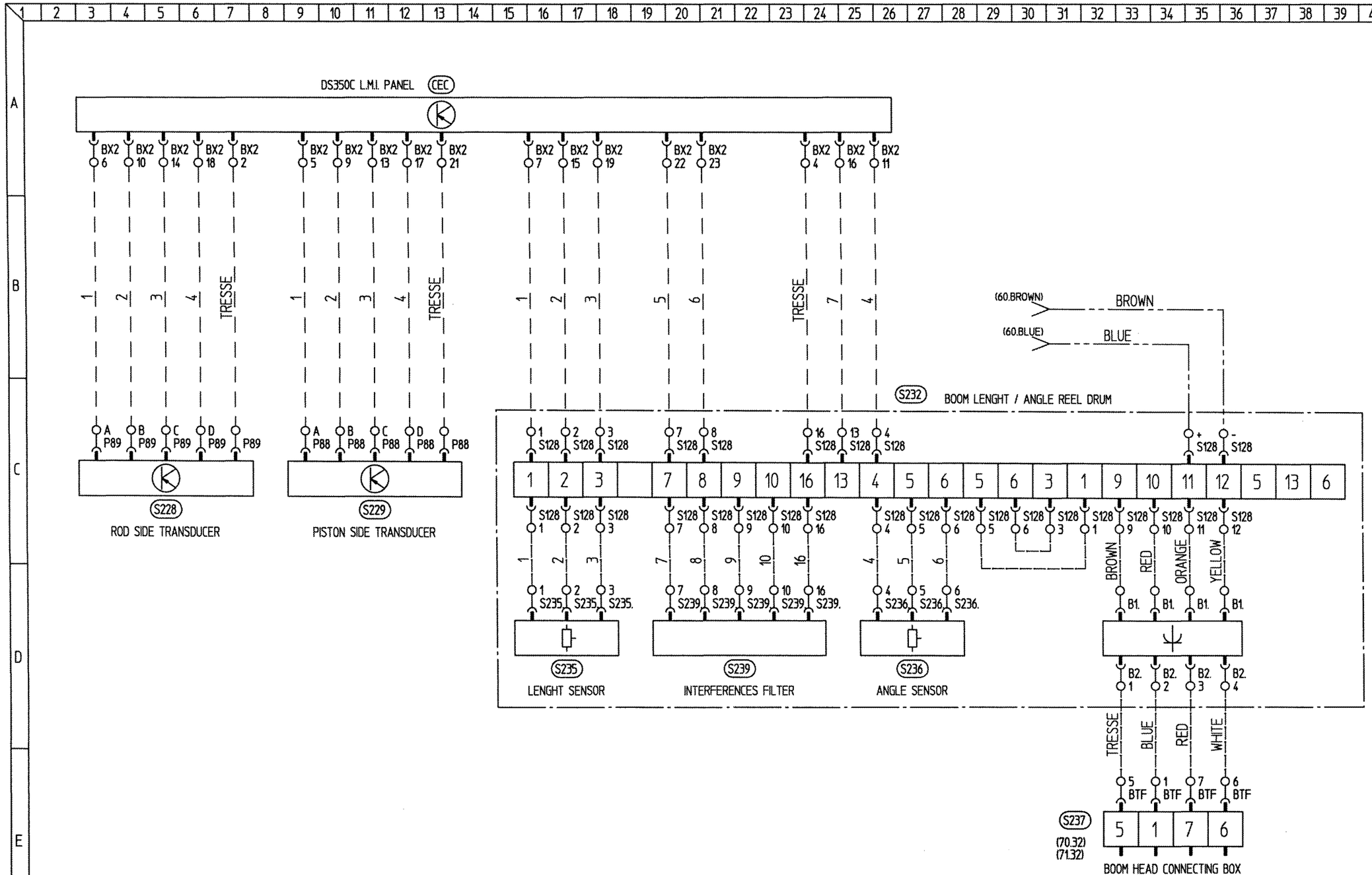
|---|---|---|---|---|---|---|
| PPM TEREX | ETUDE : 1371 | DOSSIER ELECTRIQUE ATT400/3 | OPTION RETROVISEURS DEGIVRANTS | ATT400/3 | PORTEUR *CARRIER* | INDICE : A |
| | E.P.S. : | *ATT400/3 ELECTRIC FILE* | *MIRRORS DEFROST OPTION* | Dessinateur : B.C. | Date : 07/03/01 | |
| CR 107366 | MACHINE : 241210 --> | | | Vérificateur : R.P. | Date : 18/03/2002 | PAGE : 38 |




| | | | | | | |
|---|---|---|---|---|---|---|
| PPM TEREX | ETUDE : 1371 | DOSSIER ELECTRIQUE ATT400/3 | LAVE-GLACE / VENTILATION / AUTO-RADIO / PLAFONNIER | ATT400/3 | TOURELLE *TURRET* | INDICE : A |
| | E.P.S. : | | | | | |
| CR 107366 | MACHINE : 241210 --> | *ATT400/3 ELECTRIC FILE* | *WINDSCREEN WASHER / FAN / RADIO / CEILING LIGHT* | Dessinateur : B.C. | Date : 27/11/00 | PAGE : 58 |
| | CE PLAN EST LA PROPRIETE DE PPM. IL NE PEUT ETRE NI REPRODUIT, NI COMMUNIQUE SANS NOTRE AUTORISATION. / THIS DRAWING IS THE PROPERTY OF PPM. IT IS NOT BE USED OR REPRODUCED WITHOUT OUR AUTHORIZATION. | | | Vérificateur : R.P. | Date : 18/03/2002 | |

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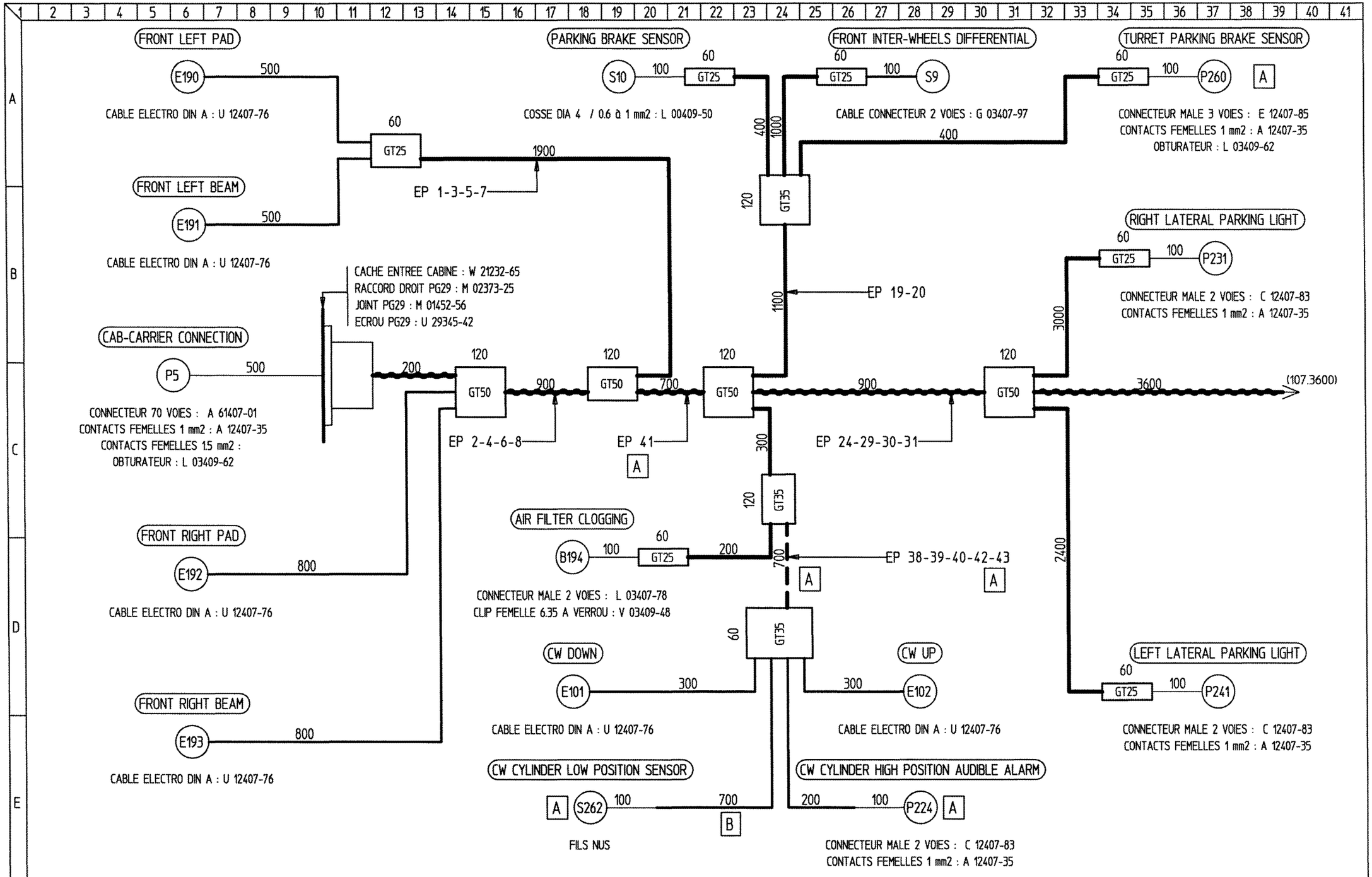
|---|---|---|---|---|---|
| PPM TEREX | ETUDE : 1371 | DOSSIER ELECTRIQUE ATT400/3 | CONTROLEUR ETAT DE CHARGES TYPE DS350C | ATT400/3 TOURELLE *TURRET* | INDICE : D |
| | E.P.S. : | *ATT400/3 ELECTRIC FILE* | *DS350C S.L.I.* | Dessinateur : B.C. Date : 30/11/00 | |
| CR 107366 | MACHINE : 241210 --> | | | Vérificateur : R.P. Date : 18/03/2002 | PAGE : 68 |




| | | | | | | |
|---|---|---|---|---|---|---|
| PPM TEREX | ETUDE : 1371 | DOSSIER ELECTRIQUE ATT400/3 | ARAIGNEE FAISCEAU STABS / ECLAIRAGE E 80522-35 | ATT400/3 | PORTEUR *CARRIER* | INDICE : B |
| CR 107366 | E.P.S. : | *ATT400/3 ELECTRIC FILE* | *OUTRIGGERS / LIGHTING LOOM LAYOUT* | Dessinateur : B.C. | Date : 26/10/00 | PAGE : 106 |
| | MACHINE : 241210 --> | | | Vérificateur : R.P. | Date : 18/03/2002 | |

# LISTING DE FILS

| FAISCEAU | FIL | SECTION / TYPE | TENANT | ABOUTISSANT |
|---|---|---|---|---|
| ALIMMASSES | 640 | 1 mm2 | EP1. | P1:16 |
| ALIMMASSES | 640 | 1 mm2 | EP2. | P1:29 |
| ALIMMASSES | 640 | 1 mm2 | EP2. | P1:30 |
| ALIMMASSES | 640 | 1 mm2 | EP2. | P1:43 |
| ALIMMASSES | 640 | 1 mm2 | EP2. | P1:44 |
| ALIMMASSES | 640 | 1 mm2 | EP3. | P1:3 |
| ALIMMASSES | 640 | 1 mm2 | EP3. | P1:17 |
| ALIMMASSES | 640 | 1 mm2 | EP3. | P1:31 |
| ALIMMASSES | 640 | 1 mm2 | EP3. | P1:45 |
| ALIMMASSES | 640 | 7 mm2 | EP1. | S11:30a |
| ALIMMASSES | 640 | 7 mm2 | EP2. | S11:30a |
| ALIMMASSES | 640 | 7 mm2 | EP3. | S11:30a |
| | | | | |
| BOITIERCOM | V/J | - | B320.:12 | S216 |
| BOITIERCOM | 1 | - | B320.:12 | S216 |
| BOITIERCOM | 2 | - | B320.:14 | S216 |
| BOITIERCOM | 3 | - | B320.:14 | S216 |
| BOITIERCOM | 4 | - | B320.:1 | S216 |
| BOITIERCOM | 5 | - | B320.:2 | S216 |
| BOITIERCOM | 6 | - | B320.:6 | S216 |
| | | | | |
| CABINEPORT | | | FMR3:1 | R2:/ 680 ohms / 1.4W |
| CABINEPORT | | | FMR3:3 | R2:/ 680 ohms / 1.4W |
| CABINEPORT | | | FMR3:3 | R3:/ 150 ohms / 1.4W |
| CABINEPORT | | | FMR3:11 | R3:/ 150 ohms / 1.4W |
| CABINEPORT | BLACK | Câble type D | EP.116. | S194 |
| CABINEPORT | BLUE | Câble type D | EP.41. | S194 |
| CABINEPORT | CAN-H | 0.6 mm2 | ADM4:1 | CAN:4 |
| CABINEPORT | CAN-H | 0.6 mm2 | CAN:1 | FMR2:18 |
| CABINEPORT | CAN-H | 0.6 mm2 | CAN:7 | W1-X4:1 |
| CABINEPORT | CAN-L | 0.6 mm2 | ADM4:3 | CAN:6 |
| CABINEPORT | CAN-L | 0.6 mm2 | CAN:3 | FMR2:16 |
| CABINEPORT | CAN-L | 0.6 mm2 | CAN:9 | W1-X4:2 |
| CABINEPORT | HF-GND | 0.6 mm2 | ADM4:4 | CAN:5 |
| CABINEPORT | HF-GND | 0.6 mm2 | CAN:2 | FMR2:17 |
| CABINEPORT | HF-GND | 0.6 mm2 | CAN:8 | W1-X4:4 |
| CABINEPORT | 1 | 1 mm2 | B60:1 | EP.78. |
| CABINEPORT | 1 | 1 mm2 | B150:1 | EP.78. |
| CABINEPORT | 1 | 1 mm2 | EP.78. | P23.:5 |
| CABINEPORT | 1 | 1 mm2 | EP.78. | P55.:1 |
| CABINEPORT | 2 | 1 mm2 | B60:3 | EP.79. |
| CABINEPORT | 2 | 1 mm2 | B150:3 | EP.79. |
| CABINEPORT | 2 | 1 mm2 | EP.79. | P23.:19 |
| CABINEPORT | 2 | 1 mm2 | EP.79. | P55.:15 |
| CABINEPORT | 3 | 1 mm2 | B61:1 | EP.80. |

| FAISCEAU | FIL | SECTION / TYPE | TENANT | ABOUTISSANT |
|---|---|---|---|---|
| CABINEPORT | 3 | 1 mm2 | B151:1 | EP.80. |
| CABINEPORT | 3 | 1 mm2 | EP.80. | P23.:33 |
| CABINEPORT | 3 | 1 mm2 | EP.80. | P55.:29 |
| CABINEPORT | 4 | 1 mm2 | B61:3 | EP.81. |
| CABINEPORT | 4 | 1 mm2 | B151:3 | EP.81. |
| CABINEPORT | 4 | 1 mm2 | EP.81. | P23.:47 |
| CABINEPORT | 4 | 1 mm2 | EP.81. | P55.:43 |
| CABINEPORT | 5 | 0.6 mm2 | B60:2 | EP.82. |
| CABINEPORT | 5 | 1 mm2 | EP.82. | P23.:61 |
| CABINEPORT | 5 | 1 mm2 | EP.82. | P55.:57 |
| CABINEPORT | 10 | 0.6 mm2 | CDEVAR:10 | EP.27. |
| CABINEPORT | 10 | 1 mm2 | BR22F:3 | EP.27. |
| CABINEPORT | 10 | 1 mm2 | BR22G:9 | EP.27. |
| CABINEPORT | 10 | 1 mm2 | CDIRAR:2 | EP.27. |
| CABINEPORT | 10 | 1 mm2 | EP.27. | P23.:60 |
| CABINEPORT | 14 | 0.6 mm2 | BR10C:2 | EP.30. |
| CABINEPORT | 14 | 1 mm2 | ADM1:15 | EP.30. |
| CABINEPORT | 14 | 1 mm2 | EP.30. | FMR2:3 |
| CABINEPORT | 14 | 1 mm2 | EP.30. | P15.:64 |
| CABINEPORT | 14 | 1 mm2 | EP.30. | P55.:34 |
| CABINEPORT | 15 | 0.6 mm2 | BR7E:15 | EP.114. |
| CABINEPORT | 15 | 0.6 mm2 | BR7F:6 | EP.114. |
| CABINEPORT | 15 | 0.6 mm2 | BR8C:4 | EP.114. |
| CABINEPORT | 15 | 0.6 mm2 | BR8D:2 | EP.114. |
| CABINEPORT | 15 | 0.6 mm2 | BR8D:15 | EP.114. |
| CABINEPORT | 15 | 0.6 mm2 | BR9C:4 | EP.115. |
| CABINEPORT | 15 | 0.6 mm2 | BR9D:2 | EP.115. |
| CABINEPORT | 15 | 0.6 mm2 | BR9D:8 | EP.115. |
| CABINEPORT | 15 | 0.6 mm2 | BR10C:4 | EP.115. |
| CABINEPORT | 15 | 0.6 mm2 | BR10D:2 | EP.115. |
| CABINEPORT | 15 | 0.6 mm2 | BR20F:6 | EP.113. |
| CABINEPORT | 15 | 0.6 mm2 | BR20F:9 | EP.113. |
| CABINEPORT | 15 | 0.6 mm2 | BR20G:13 | EP.113. |
| CABINEPORT | 15 | 0.6 mm2 | BR22E:14 | EP.113. |
| CABINEPORT | 15 | 0.6 mm2 | BR22E:15 | EP.113. |
| CABINEPORT | 15 | 0.6 mm2 | BR22F:6 | EP.113. |
| CABINEPORT | 15 | 0.6 mm2 | BR25C:4 | EP.163. |
| CABINEPORT | 15 | 0.6 mm2 | BR25C:12 | EP.163. |
| CABINEPORT | 15 | 0.6 mm2 | BR25D:2 | EP.163. |
| CABINEPORT | 15 | 0.6 mm2 | BR25D:15 | EP.163. |
| CABINEPORT | 15 | 0.6 mm2 | BUZ1 | EP.109. |
| CABINEPORT | 15 | 0.6 mm2 | BVFD | EP.107. |
| CABINEPORT | 15 | 0.6 mm2 | BVGO | EP.107. |
| CABINEPORT | 15 | 0.6 mm2 | BV2A:6 | EP.106. |
| CABINEPORT | 15 | 0.6 mm2 | BV2B:6 | EP.106. |

# LISTING DE FILS

| FAISCEAU | FIL | SECTION / TYPE | TENANT | ABOUTISSANT |
|---|---|---|---|---|
| CABINETOUR | 15 | 0.6 mm2 | BV51A:2 | EP.29 |
| CABINETOUR | 15 | 0.6 mm2 | BV51A:4 | EP.29 |
| CABINETOUR | 15 | 0.6 mm2 | BV51A:6 | EP.29 |
| CABINETOUR | 15 | 0.6 mm2 | BV51B:2 | EP.29 |
| CABINETOUR | 15 | 0.6 mm2 | BV51B:4 | EP.29 |
| CABINETOUR | 15 | 0.6 mm2 | CACC.:2 | EP.83 |
| CABINETOUR | 15 | 0.6 mm2 | CACC.:7 | EP.83 |
| CABINETOUR | 15 | 0.6 mm2 | CDEAR:7 | EP.84 |
| CABINETOUR | 15 | 0.6 mm2 | CDIAR:7 | EP.43 |
| CABINETOUR | 15 | 0.6 mm2 | CIRAV:7 | EP.84 |
| CABINETOUR | 15 | 0.6 mm2 | CLG:7 | EP.85 |
| CABINETOUR | 15 | 0.6 mm2 | CMDCP:7 | EP.85 |
| CABINETOUR | 15 | 0.6 mm2 | CPARD:5 | EP.83 |
| CABINETOUR | 15 | 0.6 mm2 | CPARD:7 | EP.83 |
| CABINETOUR | 15 | 0.6 mm2 | CPARG:5 | EP.83 |
| CABINETOUR | 15 | 0.6 mm2 | CPARG:7 | EP.83 |
| CABINETOUR | 15 | 0.6 mm2 | CPAV:7 | EP.84 |
| CABINETOUR | 15 | 0.6 mm2 | CPAVD:5 | EP.83 |
| CABINETOUR | 15 | 0.6 mm2 | CPAVD:7 | EP.83 |
| CABINETOUR | 15 | 0.6 mm2 | CPAVG:5 | EP.83 |
| CABINETOUR | 15 | 0.6 mm2 | CPAVG:7 | EP.83 |
| CABINETOUR | 15 | 0.6 mm2 | CPP:5 | EP.83 |
| CABINETOUR | 15 | 0.6 mm2 | CPP:7 | EP.83 |
| CABINETOUR | 15 | 0.6 mm2 | CSAV:7 | EP.83 |
| CABINETOUR | 15 | 0.6 mm2 | CVDCP:7 | EP.85 |
| CABINETOUR | 15 | 0.6 mm2 | EP.24 | FFG.:1 |
| CABINETOUR | 15 | 0.6 mm2 | EP.24 | FFG.:3 |
| CABINETOUR | 15 | 0.6 mm2 | EP.83 | EP.84 |
| CABINETOUR | 15 | 0.6 mm2 | EP.83 | EP.85 |
| CABINETOUR | 15 | 0.6 mm2 | EP.83 | ISTA.:7 |
| CABINETOUR | 15 | 0.6 mm2 | EP.85 | IDOR:7 |
| CABINETOUR | 15 | 0.6 mm2 | EP.85 | IEGAV:7 |
| CABINETOUR | 15 | 0.6 mm2 | EP.85 | IEGT:7 |
| CABINETOUR | 15 | 0.6 mm2 | EP.85 | IPT:7 |
| CABINETOUR | 15 | 0.6 mm2 | EP.85 | ITFL:7 |
| CABINETOUR | 15 | 0.6 mm2 | EP.85 | ITFL:9 |
| CABINETOUR | 15 | 0.6 mm2 | EP.85 | IV:7 |
| CABINETOUR | 15 | 0.6 mm2 | EP.85 | IVOR:7 |
| CABINETOUR | 15 | 0.6 mm2 | EP.85 | IVOR:9 |
| CABINETOUR | 15 | 1 mm2 | BX1.:2 | M5 |
| CABINETOUR | 15 | 1 mm2 | B94:1 | EP.24 |
| CABINETOUR | 15 | 1 mm2 | B95:3 | EP.20 |
| CABINETOUR | 15 | 1 mm2 | B95:10 | EP.20 |
| CABINETOUR | 15 | 1 mm2 | B95:15 | EP.20 |
| CABINETOUR | 15 | 1 mm2 | B134:1 | EP.20 |

| FAISCEAU | FIL | SECTION / TYPE | TENANT | ABOUTISSANT |
|---|---|---|---|---|
| CABINETOUR | 15 | 1 mm2 | B135:15 | EP.30 |
| CABINETOUR | 15 | 1 mm2 | B237:1 | EP.20 |
| CABINETOUR | 15 | 1 mm2 | CDIAR:5 | EP.43 |
| CABINETOUR | 15 | 1 mm2 | EP.24 | P124:2 |
| CABINETOUR | 15 | 1 mm2 | EP.29 | M5 |
| CABINETOUR | 15 | 1 mm2 | EP.36 | P123.:41 |
| CABINETOUR | 15 | 1 mm2 | EP.36 | P123.:42 |
| CABINETOUR | 15 | 1 mm2 | EP.36 | P123.:55 |
| CABINETOUR | 15 | 1 mm2 | EP.36 | P123.:56 |
| CABINETOUR | 15 | 1 mm2 | EP.39 | M5 |
| CABINETOUR | 15 | 1 mm2 | EP.54 | P60.:13 |
| CABINETOUR | 15 | 1 mm2 | EP.54 | P60.:14 |
| CABINETOUR | 15 | 1 mm2 | EP.54 | P60.:27 |
| CABINETOUR | 15 | 1 mm2 | EP.54 | P60.:28 |
| CABINETOUR | 15 | 1 mm2 | EP.55 | P60.:41 |
| CABINETOUR | 15 | 1 mm2 | EP.55 | P60.:42 |
| CABINETOUR | 15 | 1 mm2 | EP.55 | P60.:55 |
| CABINETOUR | 15 | 1 mm2 | EP.55 | P60.:56 |
| CABINETOUR | 15 | 1 mm2 | EP.62 | P123.:13 |
| CABINETOUR | 15 | 1 mm2 | EP.62 | P123.:14 |
| CABINETOUR | 15 | 1 mm2 | EP.62 | P123.:27 |
| CABINETOUR | 15 | 1 mm2 | EP.62 | P123.:28 |
| CABINETOUR | 15 | 1.5 mm2 | EP.24 | M5 |
| CABINETOUR | 15 | 1.5 mm2 | EP.25 | M5 |
| CABINETOUR | 15 | 1.5 mm2 | EP.30 | M5 |
| CABINETOUR | 15 | 1.5 mm2 | EP.42 | M5 |
| CABINETOUR | 15 | 1.5 mm2 | EP.43 | M5 |
| CABINETOUR | 15 | 1.5 mm2 | EP.83 | M5 |
| CABINETOUR | 15 | 2.5 mm2 | B104: | M5 |
| CABINETOUR | 15 | 2.5 mm2 | EP.20 | M5 |
| CABINETOUR | 15 | 7 mm2 | EP.36 | M5 |
| CABINETOUR | 15 | 7 mm2 | EP.54 | M5 |
| CABINETOUR | 15 | 7 mm2 | EP.55 | M5 |
| CABINETOUR | 15 | 7 mm2 | EP.62 | M5 |
| CABINETOUR | 16 | 0.6 mm2 | BV51A:5 | EP.68 |
| CABINETOUR | 16 | 0.6 mm2 | CACC.:8 | EP.80 |
| CABINETOUR | 16 | 0.6 mm2 | CDEAR:8 | EP.81 |
| CABINETOUR | 16 | 0.6 mm2 | CIRAV:8 | EP.81 |
| CABINETOUR | 16 | 0.6 mm2 | CLG:8 | EP.82 |
| CABINETOUR | 16 | 0.6 mm2 | CMDCP:8 | EP.82 |
| CABINETOUR | 16 | 0.6 mm2 | CPARD:8 | EP.80 |
| CABINETOUR | 16 | 0.6 mm2 | CPARG:8 | EP.80 |
| CABINETOUR | 16 | 0.6 mm2 | CPAV:8 | EP.81 |
| CABINETOUR | 16 | 0.6 mm2 | CPAVD:8 | EP.80 |
| CABINETOUR | 16 | 0.6 mm2 | CPAVG:8 | EP.80 |

# COMPONENTS PART NUMBER OUT OF CONNECTORS

| ITEM | PPM P/N | FUNCTION | TECHNICAL DESCRIPTION | SUPPLIER / PART NUMBER | SUPPLIER / PART NUMBER | PAGE |
|---|---|---|---|---|---|---|
| ABS | F6641623 | ABS ELECTRONIC UNIT | BOITIER ELECTRONIQUE ABS | | | 21 |
| ADM | B6541822 | ADM ELECTRONIC UNIT | BOITIER ELECTRONIQUE ADM | | | 3 |
| A1 | S6541860 | ZF ELECTRONIC UNIT | BOITIER ELECTRONIQUE EST 37 | | | 39 |
| A2.1 | D6341678 | TRANSMISSION CONTROL | SELECTEUR DE VITESSES D7 | | | 39 |
| A2.2 | E6341679 | TRANSMISSION CONTROL | SELECTEUR DE VITESSES D9 | | | 53 |
| A3 | X | GEAR BOX | | | | 39 |
| A5 | X | ZF DIAGNOSTIC PLUG | PRISE DIAGNOSTIC ZF | | | 39 |
| A6 | Q6641609 | DISPLAY | AFFICHEUR | | | 39 |
| BAT1 | N6441852 | 12V BATTERY | BATTERIE 12V - 170 AH CHARGEE | | | 3 |
| BAT2 | N6441852 | 12V BATTERY | BATTERIE 12V - 170 AH CHARGEE | | | 3 |
| BV1 | R6851531 | 8 LIGHTS PANEL | COMBINE 8 VOYANTS MOTEUR | | | 10 |
| BV2 | R9351516 | 8 LIGHTS PANEL | COMBINE 8 VOYANTS DIVERS | | | 10 |
| BV3 | T9351518 | 8 LIGHTS PANEL | COMBINE 8 VOYANTS ECLAIRAGE | | | 14 |
| BV50 | U6851534 | 8 LIGHTS PANEL | COMBINE 8 VOYANTS HORIZONTAL | | | 54 |
| BV51 | M2451558 | 8 LIGHTS PANEL | COMBINE 8 VOYANTS HORIZONTAL | | | 53 |
| B1 | E8441349 | ENGINE SPEED SENSOR | GENERATEUR D'IMPULSIONS | | | 39 |
| B2 | E8441349 | TURBINE SPEED SENSOR | GENERATEUR D'IMPULSIONS | | | 39 |
| B3 | E8441349 | TRANSMISSION SPEED SENSOR | GENERATEUR D'IMPULSIONS | | | 39 |
| B4 | D8441348 | OUTPUT SPEED SENSOR | GENERATEUR D'IMPULSIONS | | | 39 |
| CEC | H6141651 | DS350C L.M.I. PANEL | CONSOLE CONTROLEUR ETAT DE CHARGES | | | 68 |
| CEC_1 | J6741607 | MEGACOMP L.M.I. PANEL | CONSOLE CONTROLEUR ETAT DE CHARGES | | | 69 |
| CI-BR7 | A6252274 | 2 RELAY BOARD | CIRCUIT IMPRIME 2 RELAIS | | | 12 |
| CI-BR8 | Z6252273 | 5 RELAY BOARD | CIRCUIT IMPRIME 5 RELAIS | | | 16 |
| CI-BR9 | Z6252273 | 5 RELAY BOARD | CIRCUIT IMPRIME 5 RELAIS | | | 27 |
| CI-BR10 | Z6252273 | 5 RELAY BOARD | CIRCUIT IMPRIME 5 RELAIS | | | 11 |
| CI-BR20 | A6252274 | 2 RELAY BOARD | CIRCUIT IMPRIME 2 RELAIS | | | 30 |
| CI-BR21 | A6252274 | 2 RELAY BOARD | CIRCUIT IMPRIME 2 RELAIS | | | 18 |
| CI-BR22 | A6252274 | 2 RELAY BOARD | CIRCUIT IMPRIME 2 RELAIS | | | 24 |
| CI-BR23 | A6252274 | 2 RELAY BOARD | CIRCUIT IMPRIME 2 RELAIS | | | 21 |
| CI-BR24 | A6252274 | 2 RELAY BOARD | CIRCUIT IMPRIME 2 RELAIS | | | 19 |
| CI-BR25 | Z6252273 | 5 RELAY BOARD | CIRCUIT IMPRIME 5 RELAIS | | | 25 |
| CI-BR51 | A6252274 | 2 RELAY BOARD | CIRCUIT IMPRIME 2 RELAIS | | | 54 |
| CI-BR52 | A6252274 | 2 RELAY BOARD | CIRCUIT IMPRIME 2 RELAIS | | | 64 |
| CI-BR55 | Z6252273 | 5 RELAY BOARD | CIRCUIT IMPRIME 5 RELAIS | | | 67 |
| CI-BR60 | Z6252273 | 5 RELAY BOARD | CIRCUIT IMPRIME 5 RELAIS | | | 64 |
| CI1 | S2440615 | DIODE BOARD | CIRCUIT IMPRIME 18 DIODES | | | 30 |
| CI2 | K2440608 | DIODE BOARD | CIRCUIT IMPRIME 18 DIODES | | | 9 |
| CI4 | S2440615 | DIODE BOARD | CIRCUIT IMPRIME 18 DIODES | | | 30 |
| CI7 | Q7552248 | FUSE BOARD | CIRCUIT IMPRIME 34 FUSIBLES | | | 5 |
| CI8 | Q7552248 | FUSE BOARD | CIRCUIT IMPRIME 34 FUSIBLES | | | 50 |
| EL1D | K6643674 | WINCH DOWN | VALVE DE COUPURE TYPE FTWE4 / 24V-14.4W | | | 64 |
| EL1M | K6643674 | WINCH UP | VALVE DE COUPURE TYPE FTWE4 / 24V-14.4W | | | 65 |
| ERD | K6643674 | BOOM HOIST DOWN | VALVE DE COUPURE TYPE FTWE4 / 24V-14.4W | | | 65 |
| ERM | K6643674 | BOOM HOIST UP | VALVE DE COUPURE TYPE FTWE4 / 24V-14.4W | | | 65 |
| ETR | K6643674 | TELESCOPE RETRACTION | VALVE DE COUPURE TYPE FTWE4 / 24V-14.4W | | | 64 |

# CONNECTORS PART NUMBER OUT OF COMPONENTS

| ITEM | FUNCTION | CONNECTOR | TERMINALS AND SPLICES | TERMINALS AND SPLICES | PAGE |
|---|---|---|---|---|---|
| BR55D | 5 RELAY BOARD | CONNECTEUR MALE 15 VOIES : F 03407-50 | CONTACTS 0.6 à 1.5 mm2 : L 03409-39 | CONTACTS 2.5 mm2 : M 03409-40 | 67 |
| BR60C | 5 RELAY BOARD | CONNECTEUR MALE 15 VOIES : F 03407-50 | CONTACTS 0.6 à 1.5 mm2 : L 03409-39 | CONTACTS 2.5 mm2 : M 03409-40 | 64 |
| BR60D | CONNECTEUR EXISTANT | CONNECTEUR MALE 15 VOIES : F 03407-50 | CONTACTS 0.6 à 1.5 mm2 : L 03409-39 | CONTACTS 2.5 mm2 : M 03409-40 | 61 |
| BTF | BOOM HEAD CONNECTING BOX | | X | | 68 |
| BUZ | ENGINE WARNING LIGHT | | CLIP FEMELLE 6.35 / 0.6 à 1 mm2 : K 03409-15 | | 10 |
| BUZ1 | REAR FOG LIGHT AUDIBLE ALARM | | CLIP FEMELLE 6.35 / 0.6 à 1 mm2 : K 03409-15 | | 17 |
| BVFD | RED FUEL INDICATOR | | CLIP FEMELLE 6.35 / 0.6 à 1 mm2 : K 03409-15 | | 37 |
| BVGO | WHITE FUEL INDICATOR | | CLIP FEMELLE 6.35 / 0.6 à 1 mm2 : K 03409-15 | | 37 |
| BV1A | 8 LIGHTS PANEL | CONNECTEUR 8 VOIES : Z 12407-80 | CONTACTS : C 03409-77 | | 10 |
| BV1B | 8 LIGHTS PANEL | CONNECTEUR 8 VOIES : Z 12407-80 | CONTACTS : C 03409-77 | | 10 |
| BV2A | 8 LIGHTS PANEL | CONNECTEUR 8 VOIES : Z 12407-80 | CONTACTS : C 03409-77 | | 9 |
| BV2B | 8 LIGHTS PANEL | CONNECTEUR 8 VOIES : Z 12407-80 | CONTACTS : C 03409-77 | | 10 |
| BV3A | 8 LIGHTS PANEL | CONNECTEUR 8 VOIES : Z 12407-80 | CONTACTS : C 03409-77 | | 14 |
| BV3B | 8 LIGHTS PANEL | CONNECTEUR 8 VOIES : Z 12407-80 | CONTACTS : C 03409-77 | | 15 |
| BV50A | 8 LIGHTS PANEL | CONNECTEUR 8 VOIES : Z 12407-80 | CONTACTS : C 03409-77 | | 54 |
| BV50B | 8 LIGHTS PANEL | CONNECTEUR 8 VOIES : Z 12407-80 | CONTACTS : C 03409-77 | | 66 |
| BV51A | 8 LIGHTS PANEL | CONNECTEUR 8 VOIES : Z 12407-80 | CONTACTS : C 03409-77 | | 53 |
| BV51B | 8 LIGHTS PANEL | CONNECTEUR 8 VOIES : Z 12407-80 | CONTACTS : C 03409-77 | | 66 |
| BX1 | ENGINE ELECTRONIC UNIT | CONNECTEUR 16 VOIES : E 61407-97 | CONTACTS : P 61409-21 | | 3 |
| BX1. | L.M.I. PANEL | CONNECTEUR 24 VOIES : S 61407-17 | CONTACTS 0.32 à 0.5 mm2 : L 03409-85 | CONTACTS 0.75 à 1.5 mm2 : M 03409-86 | 63 |
| BX2 | L.M.I. PANEL | CONNECTEUR 24 VOIES : S 61407-17 | CONTACTS 0.32 à 0.5 mm2 : L 03409-85 | CONTACTS 0.75 à 1.5 mm2 : M 03409-86 | 68 |
| B1. | BOOM LENGHT / ANGLE REEL DRUM | | X | | 68 |
| B2. | BOOM LENGHT / ANGLE REEL DRUM | | X | | 68 |
| B2.. | BOOM LENGHT / ANGLE REEL DRUM | | X | | 69 |
| B30 | BLINKERS UNIT | CONNECTEUR 8 VOIES : L 03407-55 | CLIP FEMELLE 6.35 A VERROU : V 03409-48 | | 14 |
| B32 | SPEEDOMETER | X | X | | 9 |
| B35 | IGNITION-STARTING SWITCH | CONNECTEUR 5 VOIES : P 12407-94 | CLIP FEMELLE A VERROU : F 03409-80 | | 3 |
| B37 | DIODE BOARD | CONNECTEUR MALE 15 VOIES : F 03407-50 | CONTACTS 0.6 à 1.5 mm2 : L 03409-39 | | 9 |
| B38 | DIODE BOARD | CONNECTEUR MALE 15 VOIES : F 03407-50 | CONTACTS 0.6 à 1.5 mm2 : L 03409-39 | | 9 |
| B39 | SPEEDOMETER | X | X | | 9 |
| B42 | ROOF CAB FUNCTIONS | CONNECTEUR FEMELLE 15 VOIES : G 03407-51 | CONTACTS 0.6 à 1.5 mm2 : N 03409-41 | CONTACTS 2.5 mm2 : P 03409-42 | 32 |
| B42. | ROOF CAB FUNCTIONS | CONNECTEUR MALE 15 VOIES : F 03407-50 | CONTACTS 0.6 à 1.5 mm2 : L 03409-39 | CONTACTS 2.5 mm2 : M 03409-40 | 32 |
| B53 | FUEL GAUGE / CONVERTER OIL TEMPERATURE | CONNECTEUR 5 VOIES : X 12407-79 | CONTACTS : C 03409-77 | | 10 |
| B54 | BRAKING AIR PRESSURE | CONNECTEUR 5 VOIES : X 12407-79 | CONTACTS : C 03409-77 | | 9 |
| B55 | CAB FAN | CONNECTEUR MALE 3 VOIES : E 12407-85 | CLIP FEMELLE 6.35 A VERROU : V 03409-48 | | 36 |
| B56 | OIL PRESSURE/ENGINE COOLANT TEMPERATURE | CONNECTEUR 5 VOIES : X 12407-79 | CONTACTS : C 03409-77 | | 9 |
| B60 | DIODE BOARD | CONNECTEUR MALE 15 VOIES : F 03407-50 | CONTACTS 0.6 à 1.5 mm2 : L 03409-39 | | 30 |
| B61 | DIODE BOARD | CONNECTEUR MALE 15 VOIES : F 03407-50 | CONTACTS 0.6 à 1.5 mm2 : L 03409-39 | | 30 |
| B68 | CONVERTER OIL TEMPERATURE | CONNECTEUR MALE 2 VOIES : R 03407-83 | CLIP FEMELLE 6.35 A VERROU : V 03409-48 | | 10 |
| B94 | TRANSMISSION CONTROL | CONNECTEUR MALE 12 VOIES : S 03407-61 | CONTACTS 0.6 à 1.5 mm2 : L 03409-39 | | 53 |
| B95 | X | CONNECTEUR MALE 15 VOIES : F 03407-50 | CONTACTS 0.6 à 1.5 mm2 : L 03409-39 | CONTACTS 2.5 mm2 : M 03409-40 | 57 |
| B95. | X | CONNECTEUR FEMELLE 15 VOIES : G 03407-51 | CONTACTS 0.6 à 1.5 mm2 : N 03409-41 | CONTACTS 2.5 mm2 : P 03409-42 | 57 |
| B104 | HEATER | CONNECTEUR MALE 2 VOIES : L 03407-78 | CLIP FEMELLE 6.35 A VERROU : V 03409-48 | | 59 |
| B123 | ROOF WINDSCREEN WIPER | CONNECTEUR MALE 4 VOIES : M 03407-79 | CLIP FEMELLE 6.35 A VERROU : V 03409-48 | | 57 |
| B125 | TURRET GENERAL WARNING | | CLIP FEMELLE 6.35 / 0.6 à 1 mm2 : K 03409-15 | | 53 |
| B126 | X | CONNECTEUR MALE 4 VOIES : M 03407-79 | CLIP FEMELLE 6.35 A VERROU : V 03409-48 | | 58 |
| B126. | X | X | x | | 58 |
| B128 | X | CONNECTEUR MALE 15 VOIES : F 03407-50 | CONTACTS 0.6 à 1.5 mm2 : L 03409-39 | | 66 |
| B128. | X | CONNECTEUR FEMELLE 15 VOIES : G 03407-51 | CONTACTS 0.6 à 1.5 mm2 : N 03409-41 | | 66 |
| B131 | 24V/12V CONVERTER | CONNECTEUR MALE 2 VOIES : R 03407-83 | CLIP FEMELLE 6.35 A VERROU : V 03409-48 | | 58 |

FOR OTHER INFORMATIONS REFER TO LOOM LAYOUT PAGES

# 1 – General information

The purpose of the load moment indicator PPM (LMI) DS 350 is to give the crane driver the essential information he needs to use his machine in complete safety.

Using the information from the various sensors, the load moment indicator oversees all the various crane functions and provides the driver with a continuous display of crane lifting capacity. The display varies constantly in relation to the different crane movements needed for load–handling.

The LMI (load moment indicator) gives the driver information about the length and angle of the boom, useable reach and the total weight calculated and lifted by the crane.

When the load limit is being approached, the load moment indicator tells the driver that this is so by an audible warning, a warning signal lights up and all crane functions are cut off if the situation gets worse.

The LMI is an additional means of control which warns the crane driver about imminent overload conditions and the end of lifting which could well cause damage to goods and to people.

The device does not and must not replace the sound judgement and experience of the driver nor his carrying out safe manoeuvres within the rules.

The crane driver is responsible for the crane handling; it is his responsibility to ensure that all the warnings and instructions are completely understood and observed.

Before using the crane the driver must carefully read and understand the information in this manual. He must know how to handle both the LMI and the crane and their limits.

For the LMI to work well, it should be inspected daily and the instructions given in this manual must be observed.

We draw your specific attention to section 5 of the manual.

**WARNING**
**The display unit (1) can only help the crane driver if the crane's configuration operating code has been chosen correctly in relation to the type of work being carried out. In order to avoid serious accident, it is necessary for the LMI programming to be correctly carried out before the crane is used.**

### *4.2/ Adjusting the number of lines*

Adjusting the LMI for the number of lines used on the crane is done in the same way as 'adjusting operating mode' described in 4.1:

### *4.2.1 / Activating 'number of lines' control*

Once control (10) is pressed it lights up to show that the 'enter a new number of lines' has been started.

### *4.2.2 / Selecting the number of lines*

The two controls 'forwards' (6) and 'backwards' (11) are used to increase or decrease the number of lines in order to select the desired number of lines.

### *4.2.3 / Using control 'number of lines'*

When the desired number of lines is displayed, validate it by pressing 'number of lines' control (10).

E38: System program wrong in the LMI,
System program does not match the programs in the data EPROM 1,
Replace the system program EPROM 1

E39: System program wrong in the LMI,
System program does not match the programs in the data EPROM 2,
Replace the system program EPROM 2

E41: Error in the read/write internal memory (RAM),
– Replace the read/write memory
– Replace the CPU board

E42: Error in part 1 of the read/write external memory (RAM),
– Replace the read/write memory
– Replace the CPU board

E43: Error in part 2 of the read/write external memory (RAM),
– Replace the read/write memory
– Replace the CPU board

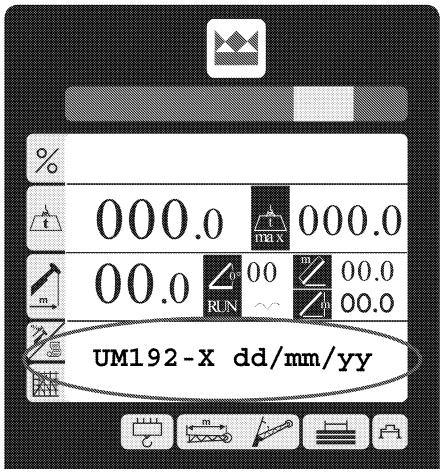
E45: Addressing error in the A/D converter of the LMI's CPU board,
– Replace the CPU board

E49: Transmission data wrong,
Having loaded the data, the read/write memory on the memory extension contains no valid data,
– replace the memory extension
– replace the on–line interface
– replace the LMI's system board

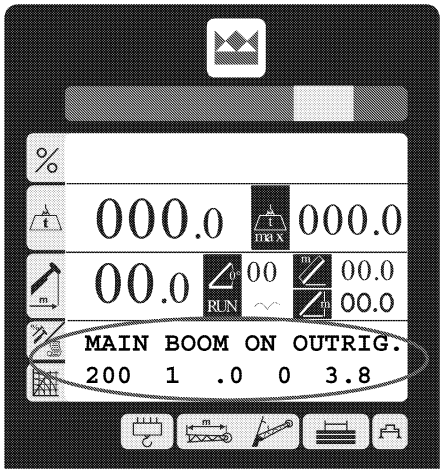
*The system gets activated and automatically proceeds to its self test mode giving information to the Operator.*

# SWITCHING THE MACHINE ON

Starting the machine the system automatically goes on and, for a few seconds, the software version and the software date of development shows up ( dd.mm.yy)




Afterwards, the display shows the last operating mode setted prior to the system switching off.




During this phase, the system performs the self test and automatically puts itself in shut off condition. If the machine operating mode is correct, please confirm by pressing twice the red button.

If the operator needs to change the operating mode, please refer to the instruction reported on page 13 “HOW TO SELECT THE OPERATING MODE”

*Through codes automatically shown on the display.*
*Here follows the list including some hints to solve them.*

| Alarm code | Description | What to do |
|---|---|---|
| 13 | Reading pressure of the main cylinder (rod side) lower than the minimum. | •Verify that the wiring and the connectors are not in short circuit<br>If the alarm persists, please, contact Technical Assistance :<br>•Verify the pressure transducer integrity |
| 23 | Reading pressure of the main cylinder (rod side) higher than the maximum. | • Verify that the cable or the connector wiring are not open<br>If the alarm persists, please, contact Technical Assistance :<br>•Verify the pressure transducer integrity |
| 11 | Reading of the boom length sensor lower than the minimum value | • Verify that the wiring and the connectors are not in short circuit<br>If the alarm persists, please, contact Technical Assistance:<br>Verify the length transducer integrity |
| 21 | Reading of the boom length sensor higher than the maximum value | • Verify that the cable or the connector wiring is not open<br>If the alarm persists, please, contact Technical Assistance :<br>• Verify the length transducer integrity |
| E01 MINIMUM RADIUS | The boom's angle has overtaken the maximum value | • Lower the boom |
| E02 MAXIMUM RADIUS | This message appears when the boom is positioned in a way that, referring to the load charts, there isn't any load charts table applicable | •Lift or close the crane boom until a load chart table can be applied. |

**And more, to make things easier, the internal operating conditions can be displayed directly on the display as follows.**

**NOTE :**
**All personnel who carry out maintenance operations on this machine must be aware of all instructions contained in the operator's manual, and respect all safety regulations before any intervention.**

IMPORTANT :
The intervals shown in the following tables are deemed to apply to machines used under normal conditions .
For intensive use or under conditions (heat – dampness – dust) it is necessary to carry out maintenance more frequently.

# Maintenance list "G"
# Yearly or 2000 hourly maintenance

*Company:*_____

*Adress:*_____

*Person responsible for the maintenance:*_____

_____

*Date of maintenance:*_____

*Serial number:*_____

| *MAINTENANCE OPERATIONS* | *DONE BY* |
|---|---|
| Perform lists "A", "B", "C", "D", "E" and "G" | _____ |
| Do oil change on hydraulic tank | _____ |
| Exchang brake circuit flexible hosing | _____ |
| Change hydraulic filters | _____ |
| Check condition of counterweight attachments | _____ |
| Do oil change on front axle differential unit and reducer gears | _____ |
| Do oil change on rear axle differential unit and reducer gears | _____ |
| Check condition of telescoping chain attachments | _____ |
| Check wiring loom attachments | _____ |
| Check tightness of all fasteners | _____ |
| Check for leaks on all flexible hosing | _____ |

This publication is a cooperative effort of THE WIRE ROPE TECHNICAL BOARD and the companies which make up the wire rope manufacturing industry in the United States.

THE WIRE ROPE TECHNICAL BOARD (WRTB) is an association of engineers representing companies that account for more than 90 percent of the wire rope produced in the United States; it has the following objectives:

- To promote development of engineering and scientific knowledge relating to wire rope:
- To assist in establishing technological standards for military, governmental and industrial use;
- To promote development, acceptance and implementation of safety standards;
- To help extend the uses of wire rope by disseminating technical and engineering information to equipment manufacturers; and
- To conduct and/or underwrite research for the benefit of both industry and user.

Data specifications, architectural/engineering information and drawings presented in this publication have been delineated in accordance with recognized professional principles and practices, and are for general information only Suggested procedures and products should not, therefore, be used without first securing competent advice with respect to their suitability for any given application.

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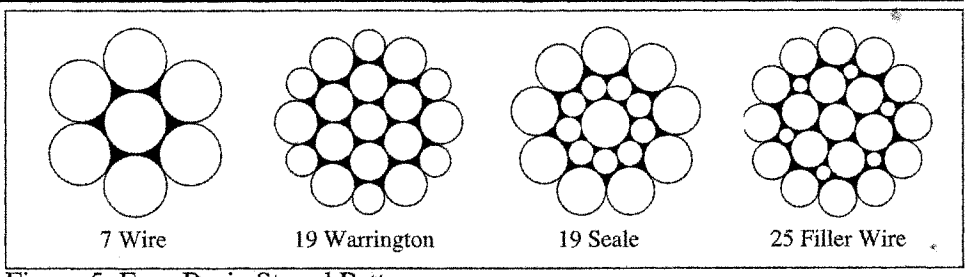



Figure 5. Four Basic Strand Patterns

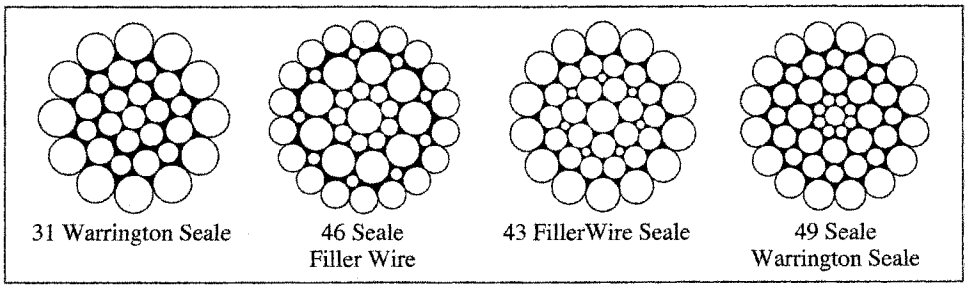



Figure 6. Combination Strand Patterns

The nomenclature used to identify a wire rope indicates: 1) the number of strands in the rope, 2) the number (nominal or exact) of wires in each strand, and 3) a descriptive word or letter indicating the type of construction, i.e., the geometric arrangement of wires.

Figure 5 shows cross sections of four basic strand constructions; Figure 6 shows several possible combinations of these constructions.

At this point, it would be useful to discuss wire rope nomenclature in detail because the subject may generate some misunderstanding. The reason for this stems from the practice of referring to rope either by classification or by its specific construction.

Rope classifications indicate the number of strands as well as the number of wires in each strand, e.g., 6 x 7, 6 x 19, 6 x 36, 8 x 19, 19 x 7, 35 x 7 etc. However, these are nominal classifications that may or may not reflect the actual construction. For example, the 6 x 19 classification includes constructions such as 6 x 21 Filler Wire, 6 x 25 Filler Wire, and 6 x 26 Warrington Seale. Despite the fact that none of the three constructions named have 19 wires, they are in the 6 x 19 classification.

As an example, a supplier receiving an order for 6 x 19 rope may assume this to refer to the classification, and could furnish any construction within this classification. But, if the job requires the special characteristics of a 6 x 26 Warrington Seale, and a 6 x 25 Filler Wire is supplied, shorter service life may result.

To avoid such misunderstandings, the safest procedure is to order a specific construction. In the event that the specific construction is not known or is in doubt, the rope should be ordered by classification along with a description of its end use.

## FLATTENED (TRIANGULAR) STRAND WIRE ROPE

Each strand of a flattened strand wire rope is comprised of a layer or layers of wire around a triangular shaped center. The center consists of either a triangular shaped wire element, or wires in a triangular configuration. The triangular strand shape provides a high strength rope with high metallic area which is resistant to crushing. Abrasion resistance is enhanced by an increased bearing surface, in comparison to round strand ropes. Various flattened strand constructions are illustrated in Figure 14. Minimum breaking forces for flattened strand ropes are found in Tables 29 and 30.

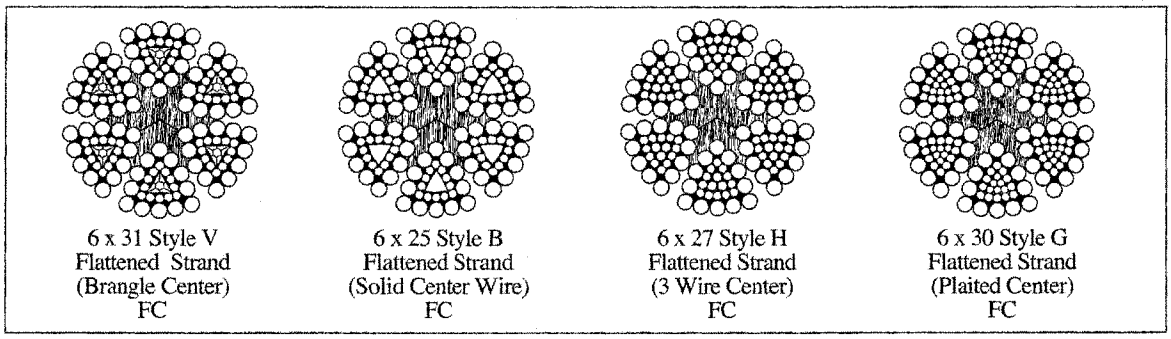



Figure 14. Flattened Strand Wire Rope Cross Sections.

## PLASTIC COATED WIRE ROPE

Various wire rope constructions are available with a plastic coating applied to the exterior of the rope. Small diameter galvanized and stainless steel wire ropes with plastic coating are common. The plastic coating can provide protection against corrosion and in some cases reduce wear of the rope and other rigging components. Plastic coated ropes can be difficult to inspect. Minimum breaking forces for plastic coated ropes are based on the diameter and grade of the rope prior to coating.

Plastic coated wire ropes are typically not used as operating ropes, but mostly as standing or stationary ropes. There are exceptions such as can conveyor ropes, some aircraft cables and other small diameter ropes.

## PLASTIC FILLED WIRE ROPE

Plastic filled wire ropes are wire ropes in which internal spaces are filled with a matrix of plastic. The plastic extends to, or slightly beyond, the outer circumference of the rope. Plastic filling may improve bending fatigue life by reducing internal and external wear. Minimum breaking forces for plastic filled ropes are based on the diameter and grade of the rope prior to plastic filling.

Plastic filled wire ropes are used in many demanding applications and require special handling and inspection techniques. Consult the rope manufacturer for specific instructions and recommendations. The Inspection section of this manual provides detail on inspection of plastic filled ropes.

## CUTTING WIRE ROPE

Wire rope is cut after being properly seized (Fig. 26). Cutting is a reasonably simple operation provided appropriate tools are used. There are several types of cutters and shears commercially available, which are specifically designed to cut wire rope.

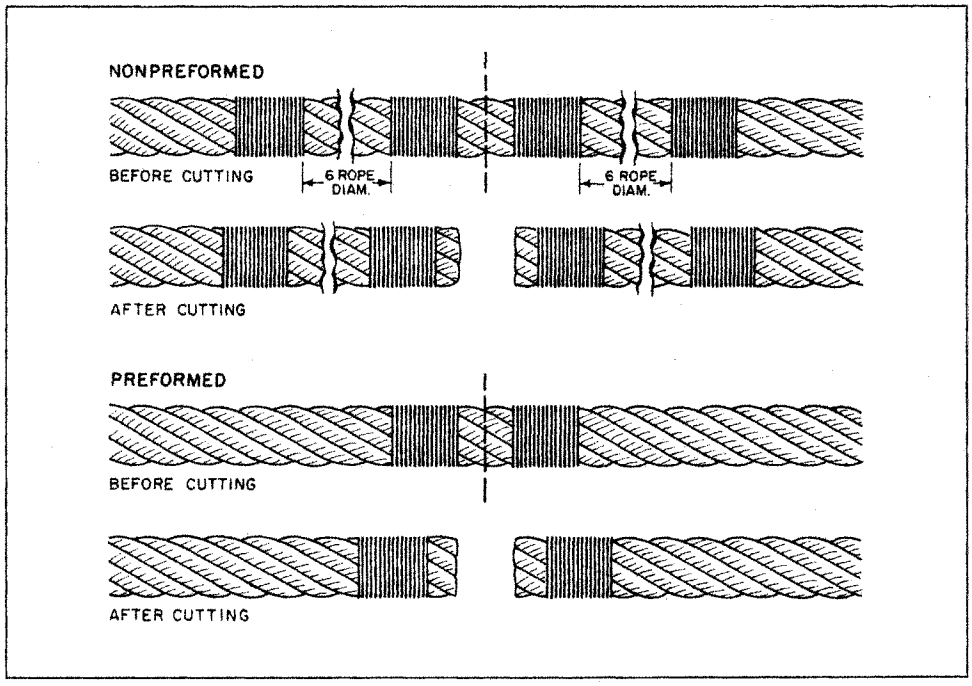
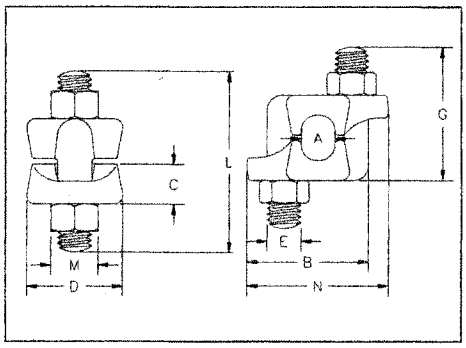



Figure 26. Seizings are applied *before* cutting.




Dimensions in inches

## TABLE 7 DOUBLE – SADDLE CLIPS*

| Clip Size | A | B | C | D | E | G | L Approx. | M | N | Min. No. of clips | Amount of rope to turn back | Torque in ft/lb | Weight lb/100 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3/16-1/4 | .25 | 1.25 | .34 | .94 | .38 | 1.28 | 1.63 | .69 | 1.47 | 2 | 4 | 30 | 18 |
| 5/16 | .31 | 1.34 | .44 | 1.06 | .38 | 1.47 | 1.94 | .69 | 1.56 | 2 | 5 | 30 | 28 |
| 3/8 | .38 | 1.59 | .50 | 1.06 | .44 | 1.81 | 2.38 | .75 | 1.88 | 2 | 5 1/4 | 45 | 40 |
| 7/16 | .50 | 1.88 | .56 | 1.25 | .50 | 2.19 | 2.75 | .88 | 2.19 | 2 | 6 1/2 | 65 | 70 |
| 1/2 | .50 | 1.88 | .56 | 1.25 | .50 | 2.19 | 2.75 | .88 | 2.19 | 3 | 11 | 65 | 70 |
| 9/16 | .63 | 2.28 | .69 | 1.50 | .63 | 2.69 | 3.50 | 1.06 | 2.63 | 3 | 12 3/4 | 130 | 100 |
| 5/8 | .63 | 2.28 | .69 | 1.50 | .63 | 2.69 | 3.50 | 1.06 | 2.63 | 3 | 13 1/2 | 130 | 100 |
| 3/4 | .75 | 2.69 | .88 | 1.81 | .75 | 2.94 | 3.75 | 1.25 | 3.06 | 3 | 16 | 225 | 175 |
| 7/8 | .88 | 2.97 | .97 | 2.13 | .75 | 3.31 | 4.13 | 1.25 | 3.14 | 4 | 26 | 225 | 225 |
| 1 | 1.00 | 3.06 | 1.19 | 2.25 | .75 | 3.72 | 4.63 | 1.25 | 3.53 | 5 | 37 | 225 | 300 |
| 1 1/8 | 1.13 | 3.44 | 1.28 | 2.38 | .88 | 4.19 | 5.25 | 1.44 | 3.91 | 5 | 41 | 360 | 400 |
| 1 1/4 | 1.25 | 3.56 | 1.34 | 2.50 | .88 | 4.25 | 5.25 | 1.44 | 4.03 | 6 | 55 | 360 | 400 |
| 1 3/8 | 1.50 | 4.13 | 1.56 | 3.00 | 1.00 | 5.56 | 7.00 | 1.63 | 4.66 | 6 | 62 | 500 | 700 |
| 1 1/2 | 1.50 | 4.13 | 1.56 | 3.00 | 1.00 | 5.56 | 7.00 | 1.63 | 4.66 | 7 | 78 | 500 | 700 |

If a pulley (sheave) is used for turning back the wire rope, add one additional clip.

If a greater number of clips are used than shown in the table, the amount of turnback should be increased proportionately.

The tightening torque values shown are based upon the threads being clean, dry, and free of lubrication.

Above values do not apply to plastic coated wire rope.

*From the Crosby Group

## TABLE 9 SUGGESTED SHEAVE AND DRUM RATIOS

These D/d ratios are based on sheave and drum diameters being approximately 400 times the outer wire diameter of the rope. For rope constructions not listed, consult the rope manufacturer.

| Construction | Suggested D/d Ratio* |
|---|---|
| 6 x7 | 42 |
| 19 x 7 or 18 x 7 Rotation Resistant<br>6 x 19 S | 34 |
| 6 x 25 B Flattened Strand<br>6 x 27 H Flattened Strand<br>6 x 30 G Flattened Strand<br>6 x 31V Flattened Strand<br>6 x 21 FW<br>6 x 26 WS | 30 |
| 8 x 19 S<br>7 x 21 FW<br>6 x 25 FW<br>6 x 31 WS<br>6 x 37 FWS | 26 |
| 7 x 25 FW<br>6 x 36 WS<br>6 x 43 FWS<br>7 x 31 WS | 23 |
| 6 x 41 WS<br>6 x 41 SFW<br>6 x 49 SWS<br>7 x 36 WS<br>8 x 25 FW<br>19 x 19 Rotation Resistant<br>35 x 7 Rotation Resistant | 20 |
| 6 x 46 SFW<br>6 x 46 WS<br>8 x 36 WS | 18 |

* D=Pitch diameter of sheave
d=nominal diameter of rope

To find any pitch diameter from this table, the diameter for the rope construction to be used is multiplied by its nominal diameter (d). For example, the minimum sheave pitch diameter for a 1/2" 6 x 21 FW rope would be 1/2" (nominal diameter) x 30 (minimum ratio) or 15".

## THE "X-CHART"—ABRASION RESISTANCE VS BENDING FATIGUE RESISTANCE

Two compelling factors that govern most rope selection decisions are: *abrasion resistance, and resistance to bending fatigue*. Striking a proper balance with respect to these two important characteristics demands careful consideration. A graphic presentation of this comparison of qualities, between the most widely used rope constructions and others, is given by means of the *X-chart* (Fig. 40).

Referring to this chart when selecting a rope, the mid-point (at the X) comes closest to an even balance between abrasion resistance and resistance to bending fatigue. Reading up or down along either leg of the X, the inverse relationship becomes more apparent as one quality increases and the other decreases.

The term *flexibility* is frequently thought of as being synonymous with *resistance to bending fatigue*. This is not true. Flexibility refers to the capability of *flexing* or *bending*. While a high degree of fatigue resistance may sometimes accompany the flexibility characteristic, it does not necessarily follow that this is so. A fiber core rope, for example , is more *flexible* than an IWRC rope. Yet, when the IWRC rope is bent around sheaves at relatively high loads, it will usually perform better than the more flexible fiber core rope. The reason for this lies in the ability of IWRC rope to better support the outer strands, retain its roundness and maintain freedom of internal movement. Under the same conditions, a fiber core rope will flatten and inhibit free internal adjustment, thereby reducing fatigue life.

As with all engineering design problems, feasible solutions demand compromise to some degree. At times, it becomes necessary to settle for less than optimum resistance to abrasion in order to obtain maximum fatigue resistance, the latter being a more important requirement for the given job. A typical example of this kind of trade-off would be in selecting a highly fatigue resistant rope on an overhead crane. Conversely, in a haulage installation, a rope with greater resistance to abrasion would be chosen despite the fact that such ropes are markedly less fatigue resistant. Ultimately, what is sought is an efficient, economical solution, hence whatever the compromise, it should assist in achieving this goal.

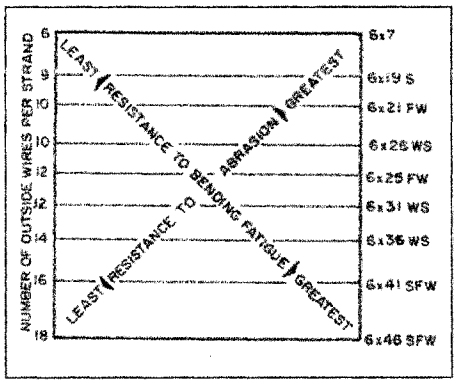



Figure 40. The wire rope industry refers to this as the X-chart. It serves to illustrate the inverse relationship between abrasion resistance and resistance to bending fatigue in a number of the commonly used wire rope constructions.

IWRC or strand core protrusion between outer strands, commonly called bird caging or popped core, usually results from shock loading during operation, but can also be caused by improper handling. The damage is irreparable and the affected area must be cut out or the entire rope taken out of service.

Crushing or flattening of the strands or rope is caused by various factors, including poor spooling on a drum, heavy loading and even poor installation procedures. This can result in broken wires or the accelerated deterioration of the rope.

Abrasion (metal loss) and peening (metal deformation) occur when the rope contacts another metallic or abrasive surface, or from passing over the drum or sheaves. These result in the reduction of diameter and broken wires.

Corrosion is most often the result of a lack of lubrication. It may result in premature fatigue failure of individual wires. It is especially important to inspect ropes at end terminations.

Heat damage comes from any heat source such as welding, fire, power line strikes, or lightning. The damage is irreparable and the affected area must be cut out or the entire rope taken out of service.

Protruding broken wire is a condition where one outer wire is broken at the point of contact with the core of the rope and has worked its way out of the rope structure and protrudes or loops out from the rope structure. The damage is irreparable and the affected area must be cut out or the entire rope taken out of service. There are occasions when a valley break (at strand to strand contact point) will protrude or raise above the surface of the rope. This also is a condition of serious concern and somewhat difficult to differentiate from a wire break at the strand to core contact point. When there are two or more valley breaks in a rope lay the affected area must be cut out or the rope taken out of service.

## INSPECTION RECORDS

Periodic inspections require a permanent record of each rope on the equipment. The sample form included in this brochure may be copied and completed by the inspector for the permanent record. This form is designed to provide a road map for recording pertinent data as an inspection proceeds.

Any wire rope manufacturer that is a member of the Wire Rope Technical Board can provide inspection criteria, including recommendations and requirements of OSHA, ASME, ANSI, and other industry and governmental regulations.

Permanent records of inspections are required by OSHA and other governmental regulations, and will be used for reference at the next inspection. These can be kept with the operator and maintenance manuals for the application, or in permanent office files.

Figure 59. This rope was subjected to repeated bending over sheaves while under normal loads. Fatigue breaks in the individual outer wires resulted. The wire breaks are square-end and the majority are found on the crown of the strands.

Figure 60. An example of fatigue fractures in a wire rope that was subjected to heavy loads while over small sheaves. Most wires are breaking in the valleys between the strands. These valley breaks are a result of strand-to-strand nicking. See Figures 44A and B.

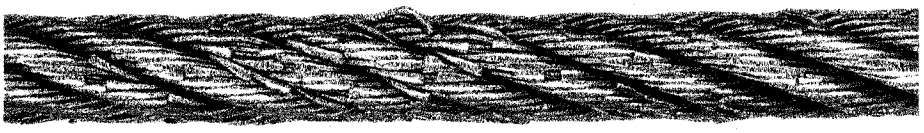


Figure 61. A typical example of localized wear. The cumulative effect can be minimized and the rope life extended if a suitable cut-off practice was employed.

In this instance, the problem would be worked out in two parts: the first follows the above equation, and in the second part, the load starts at 5,230 lb and ends at 79,310 lb, and 15,000,000 psi is used as the modulus. Thus:

$$\text{Change in length} = \frac{(9{,}310 - 5{,}320) \times 200.65}{.121 \times 15{,}000{,}000} = .44 \text{ ft (5.3 inches)}$$

Note that because the length of the rope used was in feet, the answer (change in length) is also in feet.

To this figure, the previously determined 7.8 inches must be added.

Hence, elastic stretch of this rope at 35% of its minimum breaking force would be approximately:

Elastic stretch:

| | |
|---|---|
| @ 0 through 20% = | .65 ft (7.8 inches) |
| @ 21%-35% = | .44 ft (5.3 inches) |
| TOTAL STRETCH = | 1.09 ft (13.1 inches) |

Where it is necessary to have precise data on elastic characteristics, a load vs. elongation test must be performed on a representative sample of the rope under consideration.

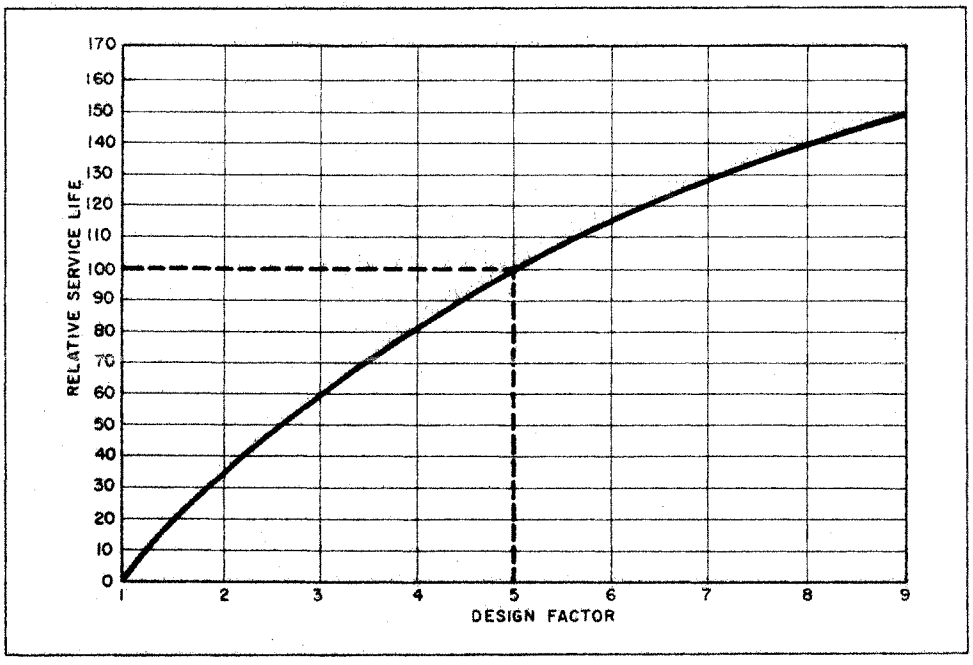



Figure 66. This graph is called the *Relative Service Life Curve*. It relates the service life to operating loads. A design factor of 5 is chosen most frequently.

## TABLE 27 MINIMUM BREAKING FORCE OF WIRE ROPE
## 6 x 25 B, 6 x 27 H & 6 x 30 G Flattened Strand/Bright (Uncoated), Fiber Core

| Nominal Diameter | | Approximate Mass | | Minimum Breaking Force* | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Improved Plow Steel** | | Extra Improved Plow Steel** | | Extra Extra Improved Plow Steel** | |
| inches | mm | lb/ft | kg/m | tons | metric tonnes | tons | metric tonnes | tons | metric tonnes |
| 1/2 | 12.7 | 0.45 | 0.67 | 11.8 | 10.8 | 13.0 | 11.8 | 14.3 | 13.0 |
| 9/16 | 14.3 | 0.57 | 0.85 | 14.9 | 13.5 | 16.4 | 14.9 | 18.0 | 16.3 |
| 5/8 | 15.9 | 0.70 | 1.04 | 18.3 | 16.6 | 20.1 | 18.2 | 22.1 | 20.0 |
| 3/4 | 19.1 | 1.01 | 1.50 | 26.2 | 23.8 | 28.8 | 26.1 | 31.7 | 28.8 |
| 7/8 | 22.2 | 1.39 | 2.07 | 35.4 | 32.1 | 38.9 | 35.3 | 42.8 | 38.8 |
| 1 | 25.4 | 1.80 | 2.68 | 46.0 | 41.7 | 50.6 | 45.9 | 55.7 | 50.5 |
| 1-1/8 | 28.6 | 2.28 | 3.39 | 57.9 | 52.5 | 63.7 | 57.8 | 70.1 | 63.6 |
| 1-1/4 | 31.8 | 2.81 | 4.18 | 71.0 | 64.4 | 78.1 | 70.9 | 85.9 | 77.9 |
| 1-3/8 | 34.9 | 3.40 | 5.06 | 85.5 | 77.6 | 94.1 | 85.4 | 103 | 93.4 |
| 1-1/2 | 38.1 | 4.05 | 6.03 | 101 | 91.6 | 111 | 101 | 122 | 111 |
| 1-5/8 | 41.3 | 4.75 | 7.07 | 118 | 107 | 130 | 118 | 143 | 130 |
| 1-3/4 | 44.5 | 5.51 | 8.20 | 138 | 123 | 152 | 138 | 167 | 151 |
| 1-7/8 | 47.6 | 6.33 | 9.42 | 155 | 141 | 171 | 155 | 188 | 171 |
| 2 | 50.8 | 7.20 | 10.7 | 176 | 160 | 194 | 176 | 213 | 193 |

* To convert to Kilonewtons (kN), multiply tons (minimum breaking force) by 8.896;
1 lb = 4.448 newtons (N).

** Minimum breaking forces listed above apply to ropes with bright or drawn galvanized wires. Minimum breaking forces are 10% lower for ropes with wires galvanized at finish size.

## TABLE 37 MINIMUM BREAKING FORCE OF WIRE ROPE
### Compacted Strand Wire Rope
### 6 x 19 and 6 x 36 Classification/Bright (Uncoated) FC & IWRC

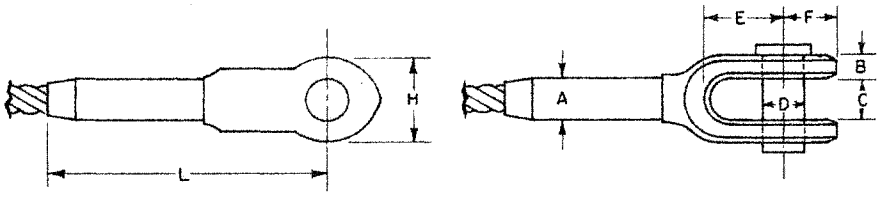
| Nominal Diameter | | Approximate Mass | | | | Minimum Breaking Force* | | | |
|---|---|---|---|---|---|---|---|---|---|
| inches | mm | lb/ft | | kg/m | | tons | | metric tonnes | |
| | | FC | IWRC | FC | IWRC | FC | IWRC | FC | IWRC |
| 3/8 | 9.5 | .26 | .31 | .39 | .46 | 7.39 | 8.3 | 6.7 | 7.53 |
| 7/16 | 11.1 | .35 | .39 | .52 | .58 | 10.0 | 11.2 | 9.07 | 10.2 |
| 1/2 | 12.7 | .46 | .49 | .68 | .73 | 13.0 | 14.6 | 11.8 | 13.2 |
| 9/16 | 14.3 | .57 | .63 | .85 | .94 | 16.4 | 18.5 | 14.9 | 16.8 |
| 5/8 | 15.9 | .71 | .78 | 1.06 | 1.16 | 20.2 | 22.7 | 18.3 | 20.6 |
| 3/4 | 19.1 | 1.03 | 1.13 | 1.53 | 1.68 | 28.8 | 32.4 | 26.1 | 29.4 |
| 7/8 | 22.2 | 1.40 | 1.54 | 2.08 | 2.29 | 39.0 | 43.8 | 35.4 | 39.7 |
| 1 | 25.4 | 1.82 | 2.00 | 2.71 | 2.98 | 50.7 | 56.9 | 46.0 | 51.6 |
| 1-1/8 | 28.6 | 2.31 | 2.54 | 3.44 | 3.78 | 63.6 | 71.5 | 57.7 | 64.9 |
| 1-1/4 | 31.8 | 2.85 | 3.14 | 4.24 | 4.67 | 78.2 | 87.9 | 70.9 | 79.7 |
| 1-3/8 | 34.9 | 3.45 | 3.80 | 5.13 | 5.65 | 94.1 | 106 | 85.4 | 96.1 |
| 1-1/2 | 38.1 | 4.10 | 4.50 | 6.10 | 6.70 | 111 | 125 | 101 | 113 |
| 1-5/8 | 41.3 | 4.80 | 5.27 | 7.14 | 7.84 | 130 | 146 | 118 | 132 |
| 1-3/4 | 44.5 | 5.56 | 6.12 | 8.27 | 9.11 | 150 | 169 | 136 | 153 |
| 1-7/8 | 47.6 | 6.38 | 7.02 | 9.49 | 10.4 | 171 | 192 | 155 | 174 |
| 2 | 50.8 | 7.26 | 7.98 | 10.8 | 11.9 | 193 | 217 | 175 | 197 |

* To convert to Kilonewtons (kN), multiply tons (minimum breaking force) by 8.896;
1 lb = 4.448 newtons (N).

# Appendix B

## OPEN WIRE ROPE SWAGED SOCKETS

**TABLE 45 DIMENSIONS (inches)**




| Rope diam. | After Swaging A | B | Jaw opening C | Pin diam. D | E | F | H | L | Approx. wt/lb |
|---|---|---|---|---|---|---|---|---|---|
| 1/4 | 7/16 | 3/8 | 11/16 | 11/16 | 1 1/2 | 13/16 | 1 3/8 | 4 | .52 |
| 5/16 | 11/16 | 15/32 | 13/16 | 13/16 | 1 3/4 | 15/16 | 1 5/8 | 5 5/16 | 1.12 |
| 3/8 | 11/16 | 15/32 | 13/16 | 13/16 | 1 3/4 | 15/16 | 1 5/8 | 5 5/16 | 1.07 |
| 7/16 | 7/8 | 9/16 | 1 | 1 | 2 | 1 1/8 | 2 | 6 11/16 | 2.08 |
| 1/2 | 7/8 | 9/16 | 1 | 1 | 2 | 1 1/8 | 2 | 6 11/16 | 2.08 |
| 5/8 | 1 1/8 | 19/32 | 1 1/4 | 1 3/16 | 2 1/4 | 1 3/8 | 2 3/8 | 8 1/8 | 4.28 |
| 3/4 | 1 3/8 | 21/32 | 1 1/2 | 1 3/8 | 2 3/4 | 1 9/16 | 2 3/4 | 10 | 7.97 |
| 7/8 | 1 1/2 | 3/4 | 1 3/4 | 1 5/8 | 3 1/4 | 1 25/32 | 3 1/8 | 11 5/8 | 11.3 |
| 1 | 1 3/4 | 7/8 | 2 | 2 | 3 3/4 | 2 3/32 | 3 11/16 | 13 3/8 | 17.8 |
| 1 1/8 | 2 | 1 | 2 1/4 | 2 1/4 | 4 1/4 | 2 5/16 | 4 1/16 | 15 | 26.0 |
| 1 1/4 | 2 1/4 | 1 1/8 | 2 1/2 | 2 1/2 | 4 3/4 | 2 9/16 | 4 1/2 | 16 1/2 | 34.9 |
| 1 3/8 | 2 1/2 | 1 1/8 | 2 1/2 | 2 1/2 | 5 1/4 | 2 13/16 | 5 | 18 1/8 | 44.4 |
| 1 1/2 | 2 3/4 | 1 3/16 | 3 | 2 3/4 | 5 3/4 | 3 1/8 | 5 1/2 | 19 3/4 | 58.0 |
| 1 3/4 | 3 | 1 9/16 | 3 1/2 | 3 1/2 | 6 3/4 | 3 5/8 | 6 1/4 | 23 | 87.5 |
| 2 | 3 1/2 | 1 61/64 | 4 | 3 3/4 | 8 | 4 9/16 | 8 | 26 7/8 | 150 |

Note: Dimensions are for reference only. Consult your supplier of the specific fittings for exact details.

# Appendix D A GLOSSARY OF WIRE ROPE TERMS

**ABRASION** Frictional surface wear on the wires of a wire rope.

**ACCELERATION STRESS** The additional stress that is imposed on a wire rope as a result of an increase in the load velocity.

**AGGREGATE STRENGTH** The calculated strength derived by totalling the individual breaking strengths of the elements of the strand or rope. This strength does not give recognition to the reduction in strength resulting from the angularity of the elements in the rope, or other factors that may affect efficiency.

**AIRCRAFT CABLES** Strands, cords and wire rope made of special-strength wire, designed primarily for use in various aircraft industry applications.

**ALTERNATE LAY** See LAY, TYPES.

**AREA, METALLIC** Sum of the cross-sectional areas of all the wires either in a wire rope or in a strand.

**BACK-STAY** Wire rope or strand guy used to support a boom or mast; or that section of a main cable, as on a suspension bridge, cableway, etc., leading from the tower to the anchorage.

**BAIL** a) U-shaped member of a bucket, or b) U-shaped portion of a socket or other fitting used on wire rope.

**BASKET OF SOCKET** The conical portion of a socket into which a broomed-rope-end is inserted and then secured.

**BECKET** An end attachment to facilitate wire rope installation.

**BECKET LOOP** A loop of small rope or strand fastened to the end of a larger wire rope; its function is to facilitate wire rope installation.

**BENDING STRESS** Stress that is imposed on the wires of a strand or rope by a bending or curving action.

**BIRDCAGE** A colloquialism descriptive of the appearance of a wire rope forced into compression. The outer strands form a *cage* and, at times, displace the core.

**BLOCK** A term applied to one or more wire rope sheaves (pulleys) enclosed in side plates and fitted with some attachment such as a hook or shackle.

**BOOM HOIST LINE** Wire rope that operates the boom hoist system of derricks, cranes, draglines, shovels, etc.

**BOOM PENDANT** A non-operating rope or strand with end terminations to support the boom.

**BREAKING FORCE**
*Breaking force* is the ultimate load at which a tensile failure occurs in the sample of wire rope being tested.
*Minimum Acceptance Strength* is that strength which is 2-1/2% lower than the nominal strength. This tolerance is used in some specifications (i.e. RR-W-410) to offset variables that occur during sample preparation and actual physical test of a wire rope.
*Minimum Breaking Force (Nominal Strength in RR-W-410)* is the published strength calculated by a standard procedure that is accepted by the wire rope industry. The wire rope manufacturer designs wire rope to this value, and the user should consider this value when making design calculations.

rope strands. But even rotation resistant ropes twist due to the greater torque applied by the outer strands over the core strands.

With rotation resistant ropes, the torque factors vary according to the number and lay length of outer strands, the construction and lay length of the core and the lay type (Regular or Lang) of the rope and core.

Bands are used to cover the rotational properties of the various ropes. The bands on the graph in figure E1 display the approximate limitations of the four rope types in a multi-part system. Four independent variables are used as parameters and are used in pairs to locate a reference point on the graph. They are grouped as follows:

**L/S= Length of fall per unit rope spacing**

**D/d= Average pitch diameter of block and crown sheaves per unit rope diameter.**

(For 2-fall system, with parallel falls, the ratio is the pitch diameter of the sheave divided by the nominal rope diameter.)

Various constructions of rope shown in the graph indicate the limited conditions for torsional stability with the angular displacement of the hoist block to maximum of 90 degrees. When the operating conditions for a particular installation lie above the appropriate wire rope construction band, then cabling of the falls most likely will occur. If the operating conditions lie below any particular band, then cabling of the falls will most likely not occur. If the operating conditions for any particular installation fall within the band, cabling is unpredictable.

EXAMPLE

A 2-fall crane uses 3/4" diameter hoist rope and a block with a pitch diameter of 18 inches. The rope spacing is assumed to be parallel and the height of lift required is 100 feet. Based upon these conditions we would have the following values:

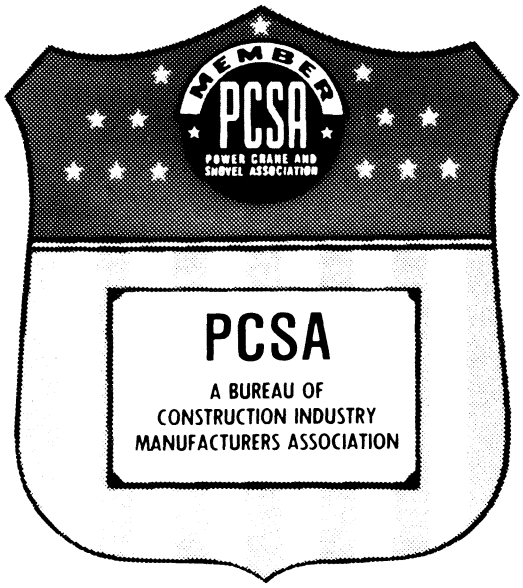
d=.75 inches
D=18 inches
S=1.5 feet
L=100 feet

L/S=66.7
D/d=24

Using these numbers and entering the graph, we find that it would be a borderline condition for six-stranded, regular lay rope; however, there should be no trouble using one of the Rotation Resistant ropes.

"L" is the length of fall (feet) and is measured from the centerline of point sheave to the centerline of the sheave in the traveling block. "S" is the spacing of the outer

# NOTES




The Power Crane and Shovel Association, formed in 1943 by United States manufacturers of power cranes and shovels, is one of the oldest and most respected manufacturer groups in the Construction Industry.

In 1962, the decision was made to operate under the sponsorship of the Construction Industry Manufacturers Association. The companies which made up the Power Crane and Shovel Association already were members of CIMA and this move resulted in closer contact with other segments of the Construction Industry. It also resulted in greater economy of operation without diminishing the benefits to its members.

PCSA has become recognized as the spokesman for the Industry in domestic and overseas activities and liaison with the Federal Government. Foremost among its activities has been the promotion of members' products on an overall Industry basis. Related to this has been the establishment and updating of Industry standards in keeping with the advances of technology in newer materials and methods to give the manufacturer, the owner and the operator meaningful guidelines

The publishing of Technical Bulletins and Manuals is an important function of the Association. Not only have these been well received by those directly connected with the Industry, but colleges and universities in this country and abroad have found them very desirable as technical reference books for classes being conducted in engineering studies. Many have been published in foreign languages.

This Publication which is one of a series, is an example of how the members of the Power Crane and Shovel Association have combined their efforts in a worthwhile project.

**PCSA**

### 4.03.3 Allowable Rope Loading

See Paragraph 4.01.3.

### 4.03.4 Sheave Diameters

See Paragraph 4.01.4.

### 4.03.5 Magnet Rating Chart

A load rating chart shall be located on the machine available to the operator from his position at the controls. It shall include:

Rated magnet loads for recommended boom lengths at recommended radii.

Basis of magnet rating: firm, level, and uniform supporting surface; rating percentage (Paragraph 4.03.2); and practical working load definitions (Paragraph 6.02.2).

Maximum weight of magnet and load (Paragraph 4.03.2).

Notes on the crane rating chart may be used in lieu of a separate chart.

## 4.04 DRAGLINE

### 4.04.1 Dragline Equipment

(See "22" in Figure 6, SAE J958 MAR81.) Machines with dragline attachments are generally used to excavate material from below the grade on which the machine is placed.

**4.04.1.1** A dragline bucket is loaded by the drag rope pulling it toward the machine, is lifted and carried by the hoist rope reeved over the boom point sheave, and is balanced by the dump rope interconnecting the drag and hoist ropes. Buckets are supplied in various weight classes ranging from light for loose formations to heavy for compact to cemented formations.

**4.04.1.2** Boom — see Paragraph 4.01.1.

**4.04.1.3** Fairlead — A device to guide wire rope for proper spooling.

### 4.04.2 Dragline Load Rating

Shall be the lesser value as determined by Paragraphs 4.04.2.1, 4.04.2.2 or 4.04.2.3.

#### 4.04.2.1 Rated Loads

(See Paragraph 6.02.1.) The combined weight of dragline bucket and contents shall not exceed 100% of Crane Rated Load.

#### 4.04.2.2 Maximum Dragline Load

**The combined weight of bucket and contents shall not exceed the limits imposed by allowable rope loading (Paragraph 4.02.3).**

A. Mechanical Drive Machines — For normal operation, the combined weight of bucket and contents should not exceed 70% of the available hoist line pull. [Paragraphs 3.01.8.3(A) and 5.03.4.]

B. Multi Prime Power Source and/or Other Type Drive Machines — For normal operation, the combined weight of bucket and contents should not exceed the permissible hoist line pull [Paragraph 3.01.8.3(B)].

**4.04.2.3** The manufacturer should state any other limitations on bucket size that apply to particular machines and, when requested, to particular operations.

### 4.04.3 Dragline Rating Chart

A load rating chart shall be located on the machine, available to the operator from his position at the controls. It shall include:

Rated dragline loads for recommended boom lengths at recommended radii.

Basis of dragline rating: firm, level and uniform supporting surface; rating percentage (Paragraph 4.04.2); and practical working load definitions (Paragraph 6.02.2).

Maximum weight of dragline bucket and contents (Paragraph 4.04.2).

Notes on the crane rating chart may be used in lieu of a separate chart.

### 4.04.4 Dragline Bucket Capacity Rating

See SAE J67 OCT80.

## 4.05 PILE DRIVER

### 4.05.1 Pile Driver Equipment

(See "23" Figure 6, SAE J983 OCT80.) Machines with pile driver attachments are used to drive or extract piling.

#### 4.05.1.1 Pile Drive Units

These units include the following:

A. Drop Hammer — A simple weight sliding in leads, which is raised by the hoist machinery and allowed to drop on the upper end of the pile. It can be used to drive both vertical (plumb) and off-vertical (batter) piling.

B. Power Hammer — A unit, usually guided by leads, that rests on the upper end of the pile and which contains within itself a member (ram) which is caused to reciprocate either by means of externally supplied air, steam, hydraulic fluid under pressure, or by internal combustion within the unit. It can be used to drive both plumb and batter piling.

C. Vibrator — A unit which normally is firmly clamped or fixed to the upper end of the pile and which contains elements that produce vibratory forces, usually longitudinal, in the pile. The weight of the unit, in some cases supplemented by counterweight or other downward forces, when added to the vibratory forces, drives the pile. It can be used to drive both plumb and batter piling.

STABILITY. The ability to resist tipping. Also see Par. 6.01.13 and 6.01.14.

STABILIZER. See "OUTRIGGER."

STAY. See "PENDANT."

STEAM HAMMER. Steam driven pile hammer.

STRIPPER. Machine used for excavating overburden in open cut mining. The term is usually applied to a dragline modified or designed for greater reach, than the manufacturer's rating for the particular standard size of machine. A stripping dragline usually has an extra long boom with a correspondingly smaller bucket than one of nominal rated capacity as furnished with a boom of base rating length.

STRUCTURAL COMPETENCE. The ability of the machine and its components to withstand the stresses imposed by rated loads.

SUPERSTRUCTURE. See "UPPERSTRUCTURE," Par. 3.01.

SWING. Rotation of the upperstructure about the axis of rotation.

SWING BEARING. See Par. 3.02.1.3.

SWING BRAKE. See Par. 3.01.6.

SWING CIRCLE. See "SWING BEARING."

SWING CLEARANCE. The maximum radial distance from the axis of rotation to the outermost extension of the upperstructure.

SWING GEAR. External or internal gear that meshes with the swing pinion to provide swing motion.

SWING LOCK. See Par. 3.01.6.1.

SWING MECHANISM. The power train providing bi-directional rotation of the upperstructure.

SWING SPEED. See Par. 5.01.1.

TACKLE (HOIST). Assembly of ropes and sheaves arranged for lifting.

TAGLINE. See Par. 4.02.1.4.

TAIL SWING. See "SWING CLEARANCE."

TELESCOPING BOOM. See Par. 4.01.1.

THIRD DRUM (AUXILIARY). A hoist drum in addition to two main hoist drums, often used in pile driving.

TIPPING CONDITION. See Par. 6.01.13.

TIPPING LOAD. See Par. 6.01.13.3.

TOOTH ADAPTER. Main part of bucket or dipper to which a removable tooth is fastened.

TOOTH BASE. See "TOOTH ADAPTER."

TOOTH POINT. Removable and replaceable point for dipper or bucket tooth.

TOPPING SPEED. See "Boom Hoisting Time," Par. 3.01.9.3.

TOWER ATTACHMENT. The tower attachment consists of a luffing boom of variable length mounted on a vertical fixed tower of variable length. A mast is mounted on the tower to provide boom suspension. All tower attachment functions are provided with power from the basic crane.

TRACK ASSEMBLY. An assembly of track shoes and connecting members.

TRACK BELT. See "TRACK ASSEMBLY."

TRACK CARRIER ROLLERS. Rolling elements in/on a track frame which support and guide the upper track shoes or chain.

TRACK FRAME. The structure that supports the rollers, sprockets, or tumblers, and adjusting means in a track assembly.

TRACK ROLLERS. Rolling elements in a track frame which transfer the machine weight to the track assembly.

TRACK SHOES. The members of the track assembly that distribute the load to the supporting surface.

TRAVEL. The function of the machine moving under its own power from one location to another.

TRAVEL MECHANISM. The power train transmitting power to produce travel.

TREAD. See "TRACK SHOES."

TUMBLER. See "DRIVE TUMBLER" and "IDLER TUMBLER."

TURNING DIAMETER. See Figure 1, SAE J958 MAR81 and SAE J695b.

TURNTABLE. See "UPPERSTRUCTURE," Par. 3.01.

UNDERCARRIAGE. See Par. 3.02.

UNDERCARRIAGE FRAME. The principal structural frame of the undercarriage.

UPPERSTRUCTURE. See Par. 3.01.

UPPERSTRUCTURE FRAME. See Par. 3.01.1.

WHEELED UNDERCARRIAGE. See Par. 3.02.2.

WHEELED UNDERCARRIAGE CLEARANCE DIAMETER. See SAE J695b.

WHIP LINE. Secondary hoist line. Also see "LOAD HOIST LINE."

WIRE ROPE. A flexible, multi-wired member usually consisting of core member around which a number of multi-wired strands are "laid" or helically wound.

WORKING EQUIPMENT. See Section 4.

WORKING WEIGHT. Weight of machine in working order with complete front end equipment and one-half tank of fuel. Machine configuration shall be specified.

# Follow a Safety Program

## Protect Yourself

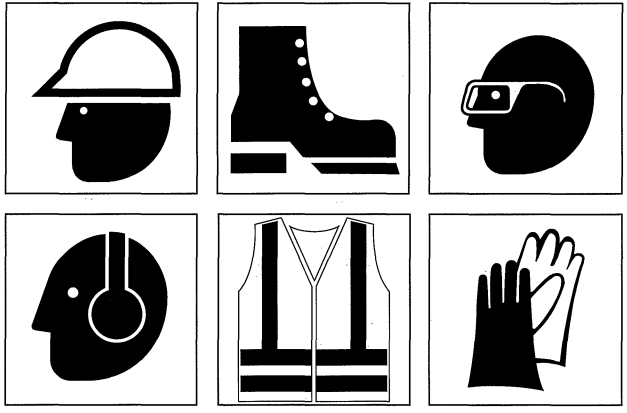
Wear all the personal protective clothing and Personal Protective Equipment (PPE) issued to you or called for by job conditions.

You may need:

- Hard hat
- Safety shoes
- Safety glasses, goggles, or face shield
- Heavy duty gloves
- Hearing protection
- Reflective clothing
- Wet weather gear
- Respirator or filter mask

Wear whatever is needed to protect yourself — don't take chances.

⚠ **WARNING!** Avoid death or serious injury from entanglement. **Do not wear loose clothing or accessories that could catch on moving parts or controls.** Examples of items to avoid include: flopping cuffs, dangling neckties and scarves, wallets attached to chains, jewelry and wrist watches.



## Be Careful!

Human error is the result of many factors: carelessness, fatigue, sensory overload, preoccupation, unfamiliarity with the machine or attachments, or drugs and alcohol, to name a few. You can avoid death or serious injury caused by these and other unsafe work practices. Be careful; never assume accidents cannot happen to you.

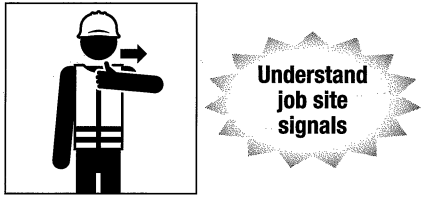
For your safety and the safety of others, act safely and encourage your fellow workers to act safely as well.

# Prepare for Safe Operation

### Hand Signals

A legible chart depicting and explaining the system of signals used should be located on the outside of the crane and/or at the job site.

Confirm that the crane operator and signal person clearly understand and agree on all hand signals.




The operator shall respond to operating signals only from the appointed signal person but shall obey a stop signal at any time from anybody. A signal person, fully qualified by training and experience, shall be provided when the point of operation is not in full and direct view of the operator, unless an effective signaling or control device is provided for safe direction of the operator.

The signal person must be in a sufficiently lit area and clearly visible to the operator during nighttime operation.

Signal systems used in place of hand signals shall be protected against unauthorized use, breakage, weather, or obstruction which will interfere with safe operation.

A complete set of hand signal illustrations can be found later in this manual. (See page 49, **Hand Signals Chart.**)

## Know the Working Area

Learn as much about your working area as possible.

Be sure the area is safe for operation and blocked off to keep bystanders and other employees clear of the crane during operation. Follow OSHA guidelines for barricading the swing radius of the crane.

### Plan Your Work

Make sure you know where you will make your pickups, lifts, and turns. Before you raise any load, know where you will place it.

### Check Overhead

Be aware of power lines, buildings, canopies, and all overhead obstructions.

## Watch Out for Hazardous Working Conditions

### Boom Kickback

⚠ **WARNING!** Avoid Serious injury or death! **Keep load on boom when a loaded pendant suspended boom or jib is near boom stops.** Otherwise kickback can occur which can cause the boom and/or the jib to bend backwards and collapse.

When a loaded pendant suspended boom or jib is near boom stops, do not relieve boom of load. Pendants stretch when loaded and return to original length when unloaded. They have been known to pull booms backwards against boom stops when unloaded. In severe conditions, a kickback can cause the boom and/or jib to collapse. Both hoist machinery and boom mechanism must be used in setting down a load in this position.

The load block and/or ball hook may move closer to the boom/jib tip as the boom is raised or lowered.

Use power lowering whenever possible. When power lowering loads, keep drum brake as reserve.

The boom hoist pawl must be engaged on wire rope suspended booms, except when raising or lowering boom.

### Two-Blocking

ANSI/ASME B30.5 requires that cranes be equipped with a fully functional anti-two-block device or two-block damage prevention device to avoid two-blocking.

Two-blocking is when the hook block or weight ball makes contact with the sheaves at the boom or jib tip. This is a very dangerous situation. The hoist rope can break causing the hook and load to fall, the boom can be pulled over backwards over the operator's cab, or the jib can be pulled back over the boom.

⚠ **WARNING! Avoid two-blocking by making sure the anti-two-block device or two-block damage prevention device is working properly.** The machine can collapse or break if two-blocking occurs, causing serious injury or death.

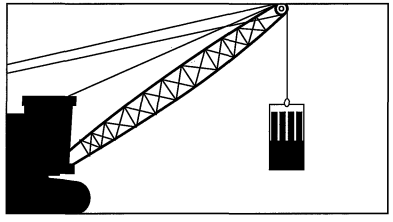
Two-blocking occurs when the hook block contacts the boom point, this can be caused by:

- Extending the boom or jib point without lowering load blocks.
- Lowering boom without lowering hook blocks.
- Raising hook blocks into boom point.

Such contact between the hook block and boom point can break the cable and cause the hook and weight ball to fall.

# Operate Safely

- Load and boom hoist drum brakes, swing brakes, and locking devices shall be engaged when the occupied platform is in a stationary working position
- The load line hoist drum shall have controlled load lowering. Automatic brake shall apply in neutral position. Free fall is prohibited
- The crane shall be uniformly level within one percent of level grade and on firm footing. Cranes equipped with outriggers shall have them all fully deployed, following the manufacturer's specifications, and on firm footing
- The total weight to include personnel platform, rigging, occupants, and tools or materials shall not exceed fifty percent of the rated crane capacity for the radius and configuration used. Do not lift or suspend a second load while handling personnel
- The use of cranes having live booms (those in which lowering is controlled by a brake only) is prohibited
- Cranes with variable angle booms shall be equipped with a boom angle indicator
- Cranes with telescoping booms shall be equipped with a device to indicate the boom's extended length
- An accurate determination of the load radius to be used during lift shall be made prior to hoisting personnel
- An anti-two-blocking device shall be used
- Hooks shall be of a type that can be closed and locked, eliminating the hook throat from opening.



**Perform a trial lift before hoisting personnel**

## Trial Lifts

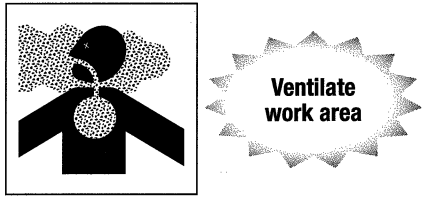
- Perform a trial lift with the unoccupied personnel platform loaded with ballast 125% the intended load, including personnel, at each location at which the personnel platform is to be hoisted and positioned
- The operator shall ensure the crane is reeved such that the crane's hoist is under fifty percent (50%) of its capacity
- A trial lift shall be performed for each location that is to be reached from a single setup position
- The trial lift shall be repeated prior to hoisting employees whenever the crane is moved, set up in a new location, or returned to a previously used location

# Operate Safely

## Exhaust Fumes in a Closed Space Can Kill

Vent exhaust and assure a flow of fresh air when an internal combustion engine is used in a closed space.

⚠ **WARNING!** Exhaust fumes from diesel, gasoline or LP gas engines can kill. **Do not breath exhaust fumes from any kind of engine.**




## Operating in Flammable/Explosive Atmospheres

⚠ **WARNING!** Do not operate a standard machine equipped with a spark arrestor/spark arresting muffler in flammable or explosive atmospheres. Using them in explosive atmospheres can result in fires and/or explosions which could cause serious injury or death.

**Use only an approved crane with a label designation of G, GS, D, DS, DY, LP, LPS, G/LP, or GS/LPS.** See Code of Federal Regulations (OSHA) 29 CFR Part 1910.178 to determine permissible areas where these machines can be operated.


# Perform Maintenance Safely

## Prepare the Work Area

- Position the machine in a level area out of the way of other working equipment
- Ensure there is adequate light, ventilation, and clearance
- Remove oil, grease, and water to eliminate any slippery surfaces


- Clean around the area to be serviced to minimize contamination. Remove all flammable material in the vicinity of welding and/or burning operations.
- Wear fall protection when working at elevation.

## Prepare the Machine

Stored energy sources (electrical, mechanical, hydraulic, pneumatic, chemical, thermal, etc.) must be controlled or reduced to a practical minimum before performing any maintenance, repair or service procedures.

Safety practices to prevent potential injuries from energy-releasing sources include:

- Place controls in NEUTRAL or LOCKED position before shutting off engine
- Set parking brake or block wheels
- Allow all moving parts to stop
- Shut off engine
- Relieve hydraulic system pressure, see manufacturers instructions for proper procedure
- Lock ignition, remove key (if equipped), and take it with you
- Look and listen for evidence of moving parts before dismounting
- Shut off master electrical switch, if equipped
- Securely support or block up machine before working underneath machine or other lifted components
- Securely support, block up, or lock up other components with approved locking devices before working near or underneath them
- Relieve pressure before disconnecting or disassembling any pressurized system
- Block or relieve spring pressure before disassembling any spring-loaded mechanism