INNOVATIVE PILING EQUIPMENT

HYDRAULIC PILING HAMMERS
EXCAVATOR MOUNTED VIBRATORS
EXCAVATOR MOUNTED DRILLS
QUIET, VIBRATIONLESS PUSH-FULL PILING
PILE EXTRACTION
SHEET PILE GUIDE FRAMES
SHEET PILE CAPPING SYSTEMS
CFA CLEANERS
PILE POINTS & SPLICERS
HANDLING / LIFTING

HPH 1200
HYDRAULIC HAMMER
DAWSON
CONSTRUCTION PLANT LIMITED

HPH 1200 HYDRAULIC
HAMMER AND POWER PACK
- USER'S MANUAL

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V8  05/06/06
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EC DECLARATION OF CONFORMITY

Description: 1. Hydraulic Piling Hammer
2. Power Pack - 93kW

Type: 1. Hyd Piling Hammer - HPH 1200
Hydraulic

Serial Number: 1. HPH1200 –
2. Power Pack -


Signed for and on behalf of
Dawson Construction Plant Limited: ..............................................................

Name: .................................................................................................

Position: ............................................................................................... 

Date: ............../............./.............
1.0 INTRODUCTION

The D.C.P. Hydraulic Hammer has been designed and manufactured to meet the demands of today's contractor. The hammer has many advantages over traditional piling hammers, including other hydraulic hammers:-

- The hammer fits all British and most foreign single sheet piles as well as numerous 'H' piles using one set of legs and inserts. It will also fit pairs of sheet piles and open bent corners with the same configuration. This significantly improves productivity and reduces costs.

- The hammer does not have a single electrical component on it. This means no vulnerable electrical cable running across the site and no delicate electronics on the hammer. All competent fitters can understand this hammer.

- Hydraulic hammers are inherently efficient, typically 80-90% of the potential driving energy being transferred into the pile as opposed to 25-35% for diesel hammers.

- Rapid blow rate. The hammer is double acting, not only giving high energy output, but increasing the speed of operation. This inevitably increases production and keeps the pile on the move.

- Infinitely variable stroke controlled, between limits, at the touch of a button. This enables precise energy control which is very important when commencing piling or when coping with delicate operations.

- Robust construction. The hammer has been designed with full knowledge of what is required of piling equipment. A quick look at the hammer sitting on a pile will confirm this.

- With the hammer weighing only 3 tonnes, it lends itself to being used on long reach jobs where there are few economic alternatives.

- Noise levels are considerably lower than that of diesel or air hammers.

- Transmitted ground vibrations have been measured lower than that of a vibrator.

1.1 Basic Safety Points

- Ear protection should be worn when in close proximity of the hammer.

- Keep clear of the hammer and/or power pack when they are being lifted.

- Avoid standing directly below the hammer when it is piling.

- Adhere to maintenance requirements set out in this manual.

- Lift equipment using lifting points specified only (see figures over).

1.2 Transportation and laying down hammer

- BEFORE operating hammer first time AND after each lay-down use inspection holes to ensure dolly is seated correctly in anvil before striking.

- WHEN LAYING DOWN HAMMER, support top of hammer at higher level than bottom of hammer.

- TRANSPORTATION, support top of hammer at higher level than bottom of hammer.
PILE CONFIGURATIONS
ALL LARSSON SHEET PILES IN SINGLES/PAIRS WITH STD. LEG INSERTS
ALL PRODINGHAM SHEET PILES IN SINGLES/PAIRS WITH STD. LEG INSERTS
H-PILES 305x305 UPWARDS WITH STD. LEG INSERTS
H-PILES SMALLER THAN 305x305 WITH SPECIAL LEG INSERTS
CONCRETE & TIMBER PILES UP TO 350x350 WITH STD. LEGS
TUBULAR PILES UP TO Ø40 WITH STD. LEGS
SPECIAL LEGS & INSERTS AVAILABLE ON REQUEST

PERFORMANCE SUMMARY
MAX. ENERGY INTO PILE 1200 Kgm
BLOW RATE AT MAX. STROKE 70 bpm
BLOW RATE AT MIN. STROKE 120 bpm
TOTAL WEIGHT 3000 Kg
WEIGHT OF RAM 1040 Kg
WEIGHT OF ANVIL 250 Kg
OPERATING HYDRAULIC PRESSURE 240 bar
HYDRAULIC FLOW RATE REQUIREMENT 75 l/min
DIESEL ENGINE POWER 40 Kw

DAWSON CONSTRUCTION PLANT LTD.
BASIC SPECIFICATION OF HPH1200

<table>
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Date

Drawn by

Check by

Printed by

Project

Rev

Dwg

Spec
LIFTING POINT

WEIGHT OF HAMMER 3000 Kgs
USE A DOUBLE LEG SLING & SHACKLES TO SUIT

LIFTING POINT

WEIGHT OF POWER PACK 2000 Kgs
2.0 HOW DOES THE HAMMER WORK? (See fig. 1)

The D.C.P. Hydraulic Hammer consists of a 'drop weight' driven up and down by a 'hydraulic ram' inside a 'casing.' The hydraulic ram is double acting which means the drop weight is accelerated both on the upstroke and on the downstroke. This gives the hammer its very efficient energy output and high blow rate.

The oil supplied to the hydraulic ram comes from the power pack via a 'control valve' mounted inside the top of the hammer. This control valve switches the oil supply on or off at the upstroke side of the hydraulic ram i.e. oil supply 'on' lifts the drop weight and oil supply 'off' drops it.

The control valve itself has to be switched from one position to another at precisely the right times for optimum performance. The control valve is switched by hydraulic pilot signals from two mechanically actuated sensors mounted on the hammer casing. The 'bottom sensor,' when actuated by the drop weight, switches the control valve to the on (lift) position and the 'top sensor' switches the control valve to the off (drop) position. The stroke of the drop weight is adjusted by moving the position of the top sensor e.g. moving the sensor down reduces the stroke or vice versa.

The position of the top sensor is altered by a small 'height adjusting ram' mounted inside the top of the hammer. This is adjusted as required by the operator who can view an indicator on the side of the hammer.

The hammer is fully controlled using a hand-held control pendant. This unit enables the hammer to be started/stopped, run on single/automatic blows and have its stroke varied. The controller may be used from a remote position.
3.0 POWER PACK AND HAMMER OPERATION

3.1 Connecting the hydraulic hoses and control pendant

(The power pack must be turned off at this time to enable correct installation of the hoses)

There are four hydraulic hoses running between the power pack and the hammer, viz:

1. Pressure line (1" BSP) carries the main high pressure oil supply to the hammer.

2. Return line (1¼" BSP) returns low pressure oil from the hammer to the power pack.

3. Height adjusting lines (3/8" BSP) used to deliver oil to the height adjusting ram, as required.

The pressure/return hoses have the same specification. However, the return hose ends have larger fittings than the pressure hose to avoid possible confusion. Similarly, the height adjusting hoses have different end types. The hoses should be left connected to the hammer at all times - this reduces the likelihood of oil contamination and reduces leakage problems. The hoses should be connected/disconnected at the outlets of the power pack. All these connectors are of the 'quick-release' type. The hoses should be disconnected from the power pack when moving the power pack around to avoid straining the connectors.

Make sure that the connectors are thoroughly cleaned when making a connection

Having connected the hoses, next fit the hand control pendant connector block to the multi-pin outlet from the power pack. This is positioned below the instrumentation panel of the unit. Check that a clean connection is made and that no water is present in either half of the connection. The 'power' switch on the controller should be turned off.

3.2 Checking the power pack before starting

Having connected the hydraulic hoses and hand control pendant, as described in section 3.1, next check fluid levels on the power pack. Check:

a. engine oil level
b. diesel fuel level
c. hydraulic oil level, and fill if required

Notes:

1. The diesel fuel and hydraulic oil tanks have sight gauges on the side of the tanks.

2. The power pack will not run if the hydraulic oil level is too low.

3. The hammer will not run if the hydraulic oil temperature is too low. The auto warm-up routine must be used to pre-warm the oil. See section 3.3.1.
3.3 Starting the power pack (see fig. 2)

Prior to starting the power pack, check that the hand control pendant is turned 'off.' Set the throttle control lever to half of full throttle (2). Turn 'on' the battery isolator (1). Push the engine start push button (4) until the engine starts.

Allow the engine to reach working temperature by running it at 1500 r.p.m. under zero load for 10-15 minutes. Check all gauges and diagnostic lights for correct function of unit (diagnostic lights should be off.)

Notes:-

1. If any of the following L.E.D.’s (7, 8, 9 or 10) are 'on' when the isolator switch (1) is turned 'on,' the power pack will not start. Rectify problem immediately.

2. If L.E.D. (12) is on, the power pack will start but the pendant will be ‘dead’ until the hydraulic oil warm up procedure is carried out.

3.3.1 Hydraulic Oil Warm-up Procedure

If the hydraulic oil temperature is less than +25ºC, L.E.D. (12) will be on and the oil will require warming prior to using the hammer.

The hand control pendant will be ‘dead’ for as long as L.E.D. (12) is on.

To warm the oil:-

a) Run the engine at 1800 r.p.m.

b) Turn the ‘warm-up/run’ selector switch (13) to ‘warm-up’. (The engine should go under load and the high pressure gauge (5) should read approx. 200 bar).

c) Leave the pack in this condition until the L.E.D. (12) goes off. (The engine should come off load at the same time the L.E.D. goes out and gauge (5) return to zero bar).

d) Turn the ‘warm-up/run’ selector switch (13) to ‘run’. The power pack is now ready for use.

3.4 Using the hammer

3.4.1 Installing hammer on the pile

The hammer must be sat correctly on the pile to avoid hammer or pile damage. The pile tops should be as level and square cut as possible. The hammer anvil must be in good condition.

Lift the hammer onto the pile(s) to be driven. Lower the hammer down until the handling slings lose their tension. At this point, the anvil should be seated correctly i.e. the rubber ring around the anvil should be compressed between the casing and the anvil. If it is not and there is a gap here, re-site the hammer.

Note: Before using the hammer (and particularly after transportation) check that the dolly is fitted correctly in the anvil.
3.4.2. **Bleeding air from the hammer hydraulic system - only required when running hammer after initial connection or following a repair**

When running the hammer for the first time after initial connection to the power pack, there will be air in the hydraulic system. The hammer will 'bleed' this air automatically but the following procedure must be applied:-

a. Run the power pack at 2300 r.p.m.

b. Turn on the control pendant 'power' button.

c. Adjust the stroke height indicator to minimum using the '↓' push button.

d. Set the 'Auto/Man' turn button to 'Man.'

e. Hold the 'start' push button down for 2-3 seconds.

f. Repeat (e) three or four times until the hammer consistently gives one or two small blows each time. Providing the hammer does not 'jump' on the pile, hold the 'start' push button down, so that the hammer gives several consistent blows, on the next operation. (Approximately 120 blows per minute.) If the hammer 'jumps' on the pile, because the drop weight is hitting the top of the hammer casing, the hammer will stop automatically. To reset see section 3.4.4.

g. Commence the piling operation using the hammer as required.

3.4.3 **Pile driving with the hammer**

Having the hammer sited on the pile and removed air from the hydraulic system (if necessary) as described above, the hammer is ready for pile driving:-

a. Increase the power pack engine speed to 2300 r.p.m. (having followed - "Starting the power pack" section 3.3)

b. Turn the hand control pendant 'power' button on.

c. Adjust the 'stroke height indicator' on the side of the hammer to minimum stroke by pressing the '↓' push button.

d. Set the 'Auto/Man' selector button to the required position:

   'Auto' - hammer will continue running automatically when the 'start' push button is pressed once.

   'Man' - hammer will only run whilst the 'start' push button is held down.

e. Depress the 'start' push button as required by 'Auto/Man.'

f. During operation the hammer stroke may be altered using the '↑' or '↓' push buttons to adjust the stroke height indicator.

g. To stop the hammer whilst it is running on 'Auto,' turn the 'Auto/Man' selector to 'Man' or turn the 'power' selector off.
It is good practice to start piling with the hammer set on minimum stroke, this limits unnecessary damage to both the hammer and the pile when the pile can be driven easily. The stroke may then be adjusted to suit the changing driving resistance.

On certain piling jobs, it may be possible to start driving on pairs of sheet piles, changing over onto a single sheet pile as the driving resistance increases (this will give maximum productivity.)

3.4.4 Cold running/overtravel

The hammer 'jumps' on the pile top when trying to achieve full stroke if the hydraulic system is 'cold.' If this happens, the hammer will stop automatically. (Thus preventing internal damage to the unit.) The power pack will continue to run and the 'pressure' gauge will read approximately 240 bar.

In order to reset the hammer, turn off the 'power' selector on the hand control pendant and stop the power pack. Allow the engine to stop for approximately 10 seconds then restart the unit. Reduce the stroke of the hammer to minimum. Run the hammer at this lower setting until the oil is warm enough to allow correct full stroke setting. If reducing the stroke does not cure the problem, warm the hydraulic oil as described in section 3.3.1.

If the hammer overtravels again, refer to the Troubleshooting section 6.0.

THE HAMMER WILL NOT RUN IF IT IS NOT ALLOWED TO RESET CORRECTLY

3.4.5 Refusal

Piling must stop with this hammer when the rate of driving reaches 10 blows per 25mm.

Continued use will result in hammer and/or pile damage
3.5 Using the hammer underwater

It is possible to drive piles with this hammer underwater. However, the hammer must be prepared correctly in order to do so - it cannot be used underwater in standard format.

The work involved is briefly as follows:-

a) The stroke adjuster ‘slot’ in the leg guide must be sealed with a cover.

b) The insides of the hammer should be suitably greased to minimise the effects of corrosion.

c) The gaps between hammer casing, leg guides and top cover must be sealed with silicone mastic.

d) The inspection holes near the bottom of the hammer casing must be plugged.

e) A threaded compressed airline port must be added in the bottom end of the hammer casing or leg guide.

f) The hammer must be run in conjunction with a 35/70 c.f.m. (100 psi) air compressor.

g) The hammer grease nipples must be greased after every pile drive to ensure ample lubrication.

NOTE: FOR DETAILED ASSISTANCE WITH THIS TYPE OF WORK PLEASE CONTACT THE MANUFACTURER.

3.6 Wider or special pile sections.

The HPH 1200 hammer in standard format will drive a considerable range of steel piles. In some applications, however, where sheet piles are particularly wide or perhaps boxed together it is possible to use simple leg insert modifications and/or spreader plates to give improved pile coverage reducing pile head stress and improving productivity rates.

A good example of this is with B.S.C. LX or Arbed PU type sheet piles. The standard leg inserts can have “wing extensions” bolted on to correctly centralise the hammer on a single sheet pile. Then either a special anvil can be used to give wider coverage, or, by dropping the inserts to a lower set of location holes, a ‘spreader plate’ can be added below the standard anvil to give improved pile coverage. This is a tried and tested technique (see figure 3).

With tubular piles, for example, the standard inserts can be removed and in place some simple bolt on plates added to centralise the hammer on the tube (see figure 4). A further refinement, if necessary, is to weld a ring onto the underside of the anvil to give correct location on the tube.

PLEASE CONTACT THE MANUFACTURER IF YOU HAVE A SPECIFIC PILE DRIVING PROBLEM - IT MAY HAVE BEEN DONE BEFORE!
NOTE:
"WING EXTENSIONS" WILL BE REQUIRED ON LEGS INSERTS TO CENTRALISE THE HAMMER CORRECTLY.
NOTE: FOR DETAIL OF INSERT PLATES SEE DRG.1355tube3
### Preventative Maintenance Guidelines for HPH 1200 & 2400 Hydraulic Hammers, and Diesel Engine Pump Packs

#### Daily or Refuelling
- **Check:**
  - Oil Level
  - Coolant Level
  - Fan - Inspection
  - Drive Belt - Inspect
  - Fuel Water Trap - Drain

#### Every 125 Hours
- **Change:**
  - Lube Oil
  - Lube Filter
- **Check:**
  - Air Cleaner
  - Intake System
  - Charge Air Cooler

#### Every 250 Hours
- **Check:**
  - Oil Level
  - Coolant Level
  - Fan - Inspection
  - Drive Belt - Inspect
  - Fuel Water Trap - Drain

#### Every 500 Hours
- **Change:**
  - Fuel Filter
- **Check:**
  - Anti Freeze

#### Every 1000 Hours
- **Adjust:**
  - Valve Lash Clearance
- **Check:**
  - Fan Hub
  - Belt Tensioner Bearing
  - Belt Tension

#### Every 2000 Hours
- **Check:**
  - Condition of Quick Release Couplings

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**Power Pack**

#### Check:
- Hydraulic Oil Level
- Air Inlet/Outlets Free from Obstruction
- Condition of Lifting Points & Slings/Shackles
- Test Diagnostic LEDs
- Inspect Gauges
- Condition of Quick Release Couplings

#### Change:
- Battery Charging
- Hydraulic Oil/Fuel Filler Filters

#### Check:
- Battery Charging
- Pressure Output of Pump
- Flow Output of Pump
- Pressure/Return Hydraulic Filters

#### Change:
- Condition of Wiring
- Drive Coupling for Wear
- Condition of Exhaust
- Hydraulic Oil and Clean Out System

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**Hammer**

#### Check:
- All External Fasteners for Tightness
- Dolly Condition
- Suspension Block & Suspension Ring Condition
- Lifting Point Condition
- Serviceability of Slings/Shackles

**MUST:**
- Grease Hammer Frequently

#### Change:
- Resilient Washers between Drop Weight and Hydraulic Ram on HPH 2400 Only

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**Test Run on Pile**

- 15 Minutes Before and After Checking

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(For full details see Sections 4 and 5 in the Hammer Manual and the Cummins Service Manual)
4.0 HAMMER MAINTENANCE (SEE APPENDIX 7.1)

4.1 Daily maintenance checks (or every 10 hours)

a. Apply Lithium based general purpose grease to hammer through each one of five grease points (part 1-057-00-01). Ten operations of a grease gun on each grease point every shift will be adequate. If the hammer is working particularly hard grease more frequently.

b. Check all external fasteners for tightness and re-tighten where necessary.

c. Check that the dolly (part 1-006-00-06) has not been damaged or worn beyond its serviceable limit. If the dolly is replaced, ensure that the O’ ring is replaced with it (part 1-067-00-01.)

To inspect the dolly, remove eight screws (part 1-034-00-01) and drop the leg inserts (1-019-00-01 and 1-020-00-01) down far enough to view the dolly. If the dolly is compressed past it’s serviceable limit i.e. 30mm of wear, or if the dolly is cracked or melted replace it.

To replace the dolly insert a steel bar through one of the holes in the bottom of the anvil (part 1-005-00-01) and drive the old dolly out using a hammer. Insert a new dolly (complete with O’ ring) ensuring that it is pushed fully home.

d. Check the suspension blocks (part 1-025-00-01) and suspension ring (part 1-024-00-05) for wear/damage and replace if necessary. These must be in good condition at all times. These items act as the hammers ‘suspension system’ reducing the shock transmitted from the blow to the hammer and its components - very important for keeping the hammer functioning correctly.

e. Check the condition of lifting tackle and lifting points prior to being taken into service.

4.2 Planned 125 hour maintenance checks (run the hammer for 15 minutes before and after this maintenance work)

Every 125 hours the following work should be carried out in addition to that described in 4.1 above:-

a. Remove each hammer leg guide in turn and check the condition and tightness of: all hydraulic hoses and fittings; bolts; locking rings, and visually check all components for condition.

b. Check the condition of each sensor assembly paying particular attention to cam wear, roller operated valve travel and tightness of fixing bolts. Each roller valve should have a travel of 4mm through full actuation of its associated cam. This measurement is critical and if it is not achieved the hammer will not run correctly (as with the ignition timing on a motor car). Travel can be lost through excessive cam wear or with wear on the roller or roller pin at the end of the valve.

c. Check the condition of leg inserts to ensure correct fitting on pile sections. The inner faces of each insert should touch the opposite insert. If not, the wear faces may require building up with hard facing.
4.3 Planned 250 hour maintenance checks (run the hammer for 15 minutes before and after this maintenance work)

Every 250 hours the following work should be carried out in addition to the work described in 4.1 and 4.2 above:

a. Check the accumulator (part 1-048-00-04) precharge pressures using the gas pressure checking kit and a bottle of nitrogen gas. The high pressure accumulator is situated on the side of the hammer that the supply hoses come in.

The precharge pressures are:

High pressure - 100 bar
Low pressure - 3 bar

To gain access to the accumulators it is necessary to remove the top cover (part 1-017-00-02.) To check the precharge pressures see appendix 7.2 in this manual.

b. Check the hammer filter (part 1-079-00-02) for cleanliness. First remove the top cover (part 1-017-00-02.) Then unscrew the filter bowl and remove the filter element. Check the filter for damage and any unusual debris. Wash the filter with clean diesel and blast through from inside the filter with compressed air. Alternatively throw the element away if it is a non-metallic filter.

PAY EXTRA CARE NOT TO ALLOW DIRT INTO THE FILTER ASSEMBLY ON RE-FITTING

c. Check the function and condition of the bottom trip device.

d. Check the function of the hammer’s overtravel valve by intentionally overstroking the hammer when cold.

4.4 Planned 500 hour maintenance checks (run the hammer for 30 minutes before and after this maintenance work)

Besides work mentioned in 4.1, 4.2 and 4.3 above the following work should be carried out:

4.4.1 Change the Resilient Washers

The flexible coupling between the main hydraulic ram and the drop weight must be changed. The procedure is quite straightforward (see figure 5). Failure to do this will result in an expensive repair.

a. Lay the hammer on stable level ground on its Front Leg Guide packed on timbers. Remove the Rear Leg Guide (part 1-002-00-02).

b. Remove the 3 no. Nyloc Nuts, Dog Point Grub Screws and Anti-Vibration Washers (parts 1-334-00-01, 1-349-00-01 and 2-089-00-01) from the Connector Nut (part 1-011-00-02). It may require a little heat to melt the Loctite on the grub screws.

c. Unscrew the Connector Nut from the Ram Connector (part 1-009-00-02) and remove the Nut together with 2 no. Buffer Spacers (part 1-012-00-02) and the Resilient Washer 2 (part 1-016-00-02).
d. Retract the piston rod of the Hydraulic Ram from the Drop Weight by hand and remove the other Resilient Washer (part 1-016-00-01), Buffer Washer (part 1-010-00-01).

e. Inspect the removed steel components for wear and replace those with signs of fretting or bruising. Dispose of the old Resilient Washers irrespective of their condition - do not reuse them!

f. Ensure the Connector Nut threads are clean and fully degreased. Pay particular attention to degreasing the Grub Screws threads and the Grub Screws as this will ensure the Loctite adhesive works correctly. **Failure to do this correctly may result in the assembly working loose!**

g. Re-assemble the connection as in figure 5 ensuring the new Resilient Washers are installed in their correct positions. Tighten the Connector Nut until it is hand tight (there should be no free play on any component). Tighten the Connector Nut further using a socket until the nut bottoms out. Align a Dog Point Grub Screw hole in the Connector Nut with one of the axial slots in the Ram Connector thread. This may require the Nut to be slightly backed off.

h. Install the 3 no. Dog Point Grub Screws using some Loctite 270 Studlock thread adhesive, and fully tighten each in turn to the torque quoted on Figure 5. Next install the pairs of anti-vibration washers onto each grub screw and lock the grub screws using new Nyloc nuts.

i. Re-assembly the Rear Leg Guide on the hammer. The unit is now ready for running.

**4.4.2 Other items**

Check the following:-

a. Condition and function of the Height Adjusting Ram.

b. Tightness of the Accumulator assemblies.

c. Condition of the main feed hoses between the hammer and power pack. Hoses with excessive amount of “braiding” exposed or damaged should be replaced.

**4.5 Planned 1000 hour maintenance checks (run the hammer for 30 minutes before and after this maintenance work)**

Check the following:-

a. Play in the main ram anchorage assembly.

b. Condition of the Anvil.

c. Play between the Drop Weight and Casing bore.

Note: It is strongly recommended that in order to achieve thorough and correct maintenance of this equipment that customer’s service personnel should be fully trained by the manufacturer.
NOTES:

FIT THE RAM CONNECTOR ITEM 89 TO THE HYDRAULIC RAM ITEM 8.

DRILL THROUGH THE RAM CONNECTOR # 8 AT 45° TO THE M10 HOLES AT A DISTANCE OF 85 MILLIMETERS FROM THE TAPERED END OF THE RAM CONNECTOR. ENSURE THE SLOTS OF THE TWO PINS ITEM 41 ARE STAGGERED BY 30 DEGREES.

CLEAN THE M10 HOLES OF THE RAM CONNECTOR AND THE TWO CONE POINT GRUB SCREWS ITEM 41 WITH LOCTITE 742. ALLOW TO DRY FOR 2-3 MINUTES.

APPLY LOCTITE ACTIVATOR 742 TO THE AREAS PREVIOUSLY CLEANED AND ALLOW TO DRY FOR 2-3 MINUTES.

APPLY LOCTITE STUDBLOCK 270 TO THE M10 HOLES IN THE RAM CONNECTOR AND INSTALL THE CONE POINT SET SCREWS TIGHTENING TO A TORQUE OF 36 Nm. REMOVE ANY EXCESS LOCTITE.

TIGHTEN CONNECTOR NUT DOWN UNTIL IT LOCKS ON THE RAM CONNECTOR. LOOSEN THE CONNECTOR NUT UNTIL THE SLOTS IN THE RAM CONNECTOR ALIGN WITH THE HOLES IN THE NUT.

CLEAN, ACTIVATE AND APPLY STUDBLOCK AS PREVIOUSLY WHEN ASSEMBLING ITEMS 89, 88 AND 89.

TORQUE TIGHTEN ITEM 8 TO 18 Nm ON ASSEMBLY.

TORQUE TIGHTEN ITEM 89 TO 36 Nm ON ASSEMBLY.

THE RAM CONNECTOR AND CONNECTOR NUT ARE NOT INTERCHANGEABLE WITH EARLIER VERSIONS I.E. 1-005-00-01 AND 1-011-00-01.

THE RAM CONNECTOR AND CONNECTOR NUT MUST BE INSTALLED AS A PAIR.

FIGURE 5
5.0 POWER PACK MAINTENANCE

5.1 Power pack specification

5.1.1 Basic specification

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
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<tr>
<td>Engine power output</td>
<td>55 kW (74 hp) @ 2300 rpm</td>
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<tr>
<td>Engine maximum r.p.m.</td>
<td>2300</td>
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<tr>
<td>Hydraulic flow output</td>
<td>75 l/min</td>
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<tr>
<td>Max hydraulic pressure output</td>
<td>240 Bar</td>
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<tr>
<td>Dimensions (l x w x h)</td>
<td>1900 x 1400 x 1800mm</td>
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<td>Weight</td>
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5.1.2 Lubrication specification

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<td>Hydraulic oil type</td>
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<td>Hydraulic oil capacity</td>
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<tr>
<td>Diesel engine oil type</td>
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<td>Diesel engine oil capacity</td>
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<tr>
<td>Diesel fuel capacity</td>
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5.2 Daily maintenance checks (for full details of diesel engine maintenance see Cummins service manual)

a. Check hydraulic oil level - must be visible in sight glass, but not over half way in sight.

b. Check diesel lubrication oil level.

c. Ensure pump isolator valve is fully open.

d. Ensure air inlet/outlet panels are free from obstruction.

e. Drain water from diesel water trap.

f. Inspect lifting tackle and lifting points before being put into service.

g. Check function of diagnostic L.E.D.’s by pressing test button.

h. Check function of gauges.

i. Check condition of quick release couplings.

j. Check engine coolant level.

k. Check condition of fan and drive belt.
Overworked 6500 dolly stuck in anvil body must be replaced or it can cause the anvil body to break. If dolly is not replaced when it has been overworked, the anvil body can break due to expansion of dolly material. Debris embedded in dolly, remove debris and continue. Severely cracked 6500 dolly should be replaced. 4500 dolly starting to show signs of cracks after 150 hrs of piling. O.K. but if cracks extend to the outer edge or the underside of the dolly, it must be changed.

View showing underside of 4500 dolly after 150 hrs of work. No signs of cracking. O.K.
5.3 Planned maintenance checks

For full details of diesel engine maintenance see Cummins service manual and for power pack maintenance procedures see section 5.4.
5.3.1 Every 125 hours

Check the following:-

a. Hoses, pipework and fittings for any hydraulic oil leaks and rectify as required.

b. Tightness of all fasteners.

c. Condition of body panels and paintwork. Touch-up where necessary.

d. Battery water level.

e. Condition and function of hand control pendant.

5.3.2 Every 250 hours

Check the following:-

a. Engine air cleaner.

b. Engine intake system

c. Engine charge air cooler.

d. Battery charging rate.

Change the following:-

e. Engine oil.

f. Engine oil filter.

g. Hydraulic oil filling filter.

h. Diesel fuel filling filter.

5.3.3 Every 500 hours

Check the following:-

a. Anti freeze in engine coolant.

b. Pump output flow rate and working pressure.

Change the following:-

c. Fuel filter.

d. Hydraulic oil pressure and return filters.
5.3.4 Every 1000 hours

Check the following:-

a. Engine fan hub.

b. Engine belt tensioner bearing.

c. Engine belt tension.

d. Adjust valve lash clearance on engine.

e. Condition of all wiring and tightness of electrical connectors.

f. Wear on hydraulic pump flexible coupling.

g. Condition of exhaust.

Change the following:-

h. System hydraulic fluid.

5.4 Maintenance procedures

NOTE: Before any of the following procedures are undertaken, the battery isolator switch must be switched off.


   (i) Replacement element
   (ii) Remove filter bowl
   (iii) Remove and discard filter element (do not clean)
   (iv) Wash bowl thoroughly
   (v) Fit replacement element into bowl
   (vi) Re-assemble filter
   (vii) Prime hand pump

b. Changing hydraulic pressure filter element.

   (i) Replacement element
   (ii) Remove filter bowl
   (iii) Remove and discard filter element (do not clean)
   (iv) Wash bowl thoroughly
   (v) Fit replacement element onto spigot
   (vi) Fill filter bowl with clean hydraulic oil
   (vii) Replace bowl O’ring if necessary
   (viii) Re-assemble filter
c. Change hydraulic return filter element.
   (i) Replacement element
   (ii) Remove filter bowl
   (iii) Remove and discard filter element (do not clean)
   (iv) Wash bowl thoroughly
   (v) Fit replacement element onto spigot
   (vi) Fill filter bowl with clean hydraulic oil
   (vii) Replace bowl O’ring if necessary
   (viii) Re-assemble filter

d. Pump removal/re-fitting.
   (i) **IMPORTANT NOTE** - the hydraulic pump should be returned to the manufacturer for repair/overhaul. This item **must not** be stripped or tampered with.
   (ii) Isolate pump from hydraulic oil reservoir using pump isolator valve
   (iii) Remove hoses (3 off) from pump body
   (iv) Remove 2 off mounting screws from front flange of pump
   (v) Withdraw pump from coupling towards oil reservoir
   (vi) Remove bellhousing from engine mounting flange
   (vii) Reverse procedure for re-assembly
   (viii) Fill case drain of pump with clean hydraulic oil prior to start up following removal from the system (port located on the top of the pump with adaptor fitted)

e. Cooler removal/re-fitting.
   (i) Close pump isolator valve to prevent system syphoning
   (ii) Remove 2 off flexible hoses from cooler
   (iii) Remove mounting bolts from cooler
   (iv) To remove matrix, remove top and bottom retaining strips from front of cooler and withdraw matrix from front of cooler assembly
   (v) To remove fan remove matrix and withdraw fan from motor shaft
   (vi) To remove motor remove matrix and fan, unbolt motor from back of cooler

f. Control valve assembly.
   (i) Close pump isolator valve to prevent system syphoning
   (ii) To replace solenoid coils remove plastic retainer from end of coil and withdraw coil from retaining tube
   (iii) To replace valve assemblies remove 4 off retaining screws from top of valve and replace component as necessary
g. Pipework.

(i) For details of hose assemblies see hydraulic schematic drawing Appendix 7.4.1
(ii) In the event of steel pipe failure, 25mm 3 series fittings should be utilised in conjunction with 25mm bore x 3mm wall thickness tube
(iii) Welded pipe ends are currently utilised and should it become necessary to disturb these fittings a replacement 'O' ring should be used

h. Changing system hydraulic fluid

(i) Change hydraulic fluid
(ii) Remove cleanout cover and clean reservoir
(iii) Replace fuel inlet and hydraulic fluid inlet filter elements
(iv) Replace hydraulic pressure line filter element
(v) Replace hydraulic return line filter element
(vi) Blow through cooler matrix to clear
(vii) Replace solid pipe fitting 'O' rings as necessary
(viii) Replace tank cover gasket
(ix) Check all electrical connections for tightness
(x) Check drive coupling for wear and replace or adjust if necessary

5.5 Setting procedures

a. Re-setting pressure

The pressure regulating adjuster is situated on the main control valve assembly.
To adjust:

(i) Loosen the lock nut and wind the centre spigot counter clockwise to reduce pressure
(ii) Press the test button on the control panel to load the system
(iii) Turn the centre spigot clockwise to raise the system pressure
(iv) When the required pressure has been achieved (max 240 bar) tighten the lock nut

NOTE: Should the required pressure be exceeded, wind the adjuster back and increase again. **Never** wind the pressure downwards to set

b. Engine gauges replacement.

(i) There is a resistor fitted to all gauge power lines. This must be replaced after maintenance to prevent damage to the gauges.
6.0 TROUBLESHOOTING

6.1 Power pack engine will not start

a. Check battery condition.

b. Check diagnostics panel for fault LED showing (see fig. 2.)

6.2 Engine cuts out during running

a. Check diagnostics panel for fault LED showing and rectify (see fig. 2.)

6.3 Power pack does not generate any pressure

a. Check L.E.D. (12) to see if hydraulic oil is up to temperature (see figure 2). If not perform warm-up operation described in section 3.3.1.

b. Check operation of main valve in power pack by turning selector switch (13) to ‘warm-up’ on the instrumentation panel (fig. 2.) This gives 200 bar reading on pressure gauge.

c. Check fuses or electrical connections to valve block if no reading from (b).

d. Check operation of relief valve if no reading from (b).

e. Check operation of hand control pendant and fuses in electrical box if reading is O.K. in (b).

6.4 Power pack generates pressure but hammer does not run

a. Anvil not pushed fully up into hammer casing (see section 3.4.1.) or the dolly is not sitting correctly in the anvil (especially after transportation or laying on its side - see also section 1.2).

b. Check oil flow rate gauge reading - 75 l/min minimum. (Note: this figure will be much higher whilst the hydraulic oil is cold).

c. Air in hammer hydraulic system - see section 3.4.2.

d. Hammer has been allowed to overtravel - see section 3.4.4. to reset.

e. Damaged hose on control side of hammer - check by removing front leg guide for inspection.

f. Faulty bottom sensor assembly - lay the hammer on timber blocks on level stable ground on its rear leg guide then remove front leg guide and check bottom sensor as follows:-

   (i) Cam/spring operation - does the cam rotate/return freely and is the spring in good order.
   (ii) Check for correct lift on valve roller (4mm)
   (iii) Check 'trip' arrangement for correct function (part 1-083-00-05 & 1-36-00-05)
(iv) It is possible to work the hammer for diagnostic purposes whilst it is laying on the ground. However, extreme caution must be exercised when doing so as incorrect operation will cause hammer damage. Always ensure the pendant is in MANUAL mode and NOT automatic mode. The anvil must be in the ‘up’ position so as to ensure the trip device is ‘off’. The hammer can be pressurised by ‘tapping’ the ‘start’ push button on the pendant (power pack running) very gradually building up enough pressure to move the drop weight. If the button is held for too long the drop weight will possibly impact the inside top of the hammer - not a good idea!

However, by careful application of this method it is possible to check pressure is reaching the relevant sensor. If it is not, then the problem may be with the overtravel valve (part 1-084-00-02) not allowing oil flow to the control side of the hammer. This can be confirmed by removing the main pressure feed to either sensor - no oil flow when pressurising the system indicates overtravel valve problems and this item should be removed for inspection. (The overtravel valve can be removed through the wide slot in the side of the hammer encased by the rear leg guide and the hammer will require turning over to do this). Turn the power pack off before removal.

When checking the overtravel valve first check the small restrictor/dowel on its top face for any blockage. The valve is unlikely to be faulty inside and if this is suspected the unit should be returned to the manufacturer for checking.

If pressure is reaching the sensor check that the pilot signal from the sensor is reaching the main control valve block at the top of the hammer when the roller valve is operated. If not, remove and inspect the roller valve.

g. If this all appears to be in order check the top sensor mechanism in a similar manner to that described in f. (i) and (ii) above as it may be that the top sensor is jammed on.

Note: The spool inside the roller valve and the roller shaft are not connected so even though the roller returns when operated it does not follow that the spool has returned. Check the tension on the roller shaft, if there is none the spool may be stuck open.

h. If all appears well the problem may be with the load holding valve (part 1-073-00-02) or the main control valve spool. Contact the manufacturer for further details.

6.5 Hammer will lift but not drop

   a. Has the hammer been allowed to overtravel. Check reset - see section 3.4.4.

   b. Air in hammer hydraulic system - see section 3.4.2.

   c. Damaged 'looped' hose from sensor assembly - check by removing front leg guide for inspection.

   d. Faulty top sensor assembly - see 6.4.e. as diagnosis is similar to faulty bottom sensor assembly.

   e. Faulty bottom sensor assembly i.e. valve is staying on (see section 6.4.f. for similar diagnosis)
6.6 Hammer runs erratically

a. Air in hydraulic system - see section 3.4.2.

b. 'Cold' hydraulic oil - see section 3.4.4.

c. Accumulator pressures incorrect or bladders damaged.
   See Appendix 7.2.
   - High pressure accumulator: 100 bar (2 off)
   - Low pressure accumulator: 3 bar (2 off)

d. Blocked filter on hammer - see section 4.2.b.

e. Not enough hydraulic flow/pressure from power pack - check flow rate gauge and pressure gauge.

f. One or both sensors damaged/contaminated - see sections 6.4 and 6.5.

6.7 Excessive hose 'jumping'

Check accumulator pressures/condition - see Appendix 7.2.

6.8 Hammer 'jumping' excessively on pile top - reduce stroke immediately and/or stop piling

a. Too much hydraulic oil input - set to 75 l/min.

b. 'Cold' hydraulic oil - see section 3.4.4 and reduce stroke. To warm the oil see section 3.3.1.

c. Stroke adjuster set too high - reduce immediately to continue working.

d. Suspension blocks (1-025-00-01) and ring (1-025-00-05) damaged. Inspect and replace immediately, if necessary.

e. Incorrect operation of top sensor assembly i.e. cam wear and/or incorrect roller travel.

6.9 Stroke height indicator will not move

a. With the power pack running and control pendant connected, check pressure gauges when ↑ and ↓ are pressed. If no readings, check relevant valve and wiring/fuses in power pack.

b. If readings are O.K., check hoses to hammer. If these are O.K., check restrictor orifices for blockages - these are the male/male adaptors located on the inlet manifold.

c. If these are clear remove front leg guide and check height adjusting ram (1-026-00-01) and top sensor assembly.
6.10 Smoke from bottom end of hammer

a. Most likely to be a worn or partially damaged plastic dolly. This does not mean the dolly has to be thrown away!

   Inspect the dolly as described in section 4.1. The dolly may only require dressing up and rotation prior to being re-used.

b. Early signs of hydraulic oil leak. Investigate further.
APPENDIX 7.1 -

HPH 1200 HYDRAULIC HAMMER

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Design by M.LEE
DAWSON CONSTRUCTION PLANT LTD.
HPH 1200 WITH LEG GUIDES
GENERAL ASSEMBLY MK2

Replace

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Drawing no: 1-000-00-06
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GENERAL: IF THE WING EXTENSIONS ARE USED, IT WILL BE NECESSARY TO EITHER ADD A SPREADER PLATE OR INSTALL A SPECIAL "WIDE" ANVIL. IN THE CASE OF A SPREADER PLATE THE LEG INSERTS MUST BE MOVED DOWN TO THEIR LOWER MOUNTING POSITION. BOTH THE SPREADER PLATE & THE WIDE ANVIL IMPROVE PILE HEAD COVERAGE ON WIDE SECTIONS.

NOTE:
- NO WING EXTENSIONS = STANDARD MULTI-TASKING HPH/1200
- WING EXTENSION 1 = USED ON BSC FX OR HOECHT L660 RANGES
- WING EXTENSION 2 = USED ON BSC FX OR APPLIED AT RANGES
- WING EXTENSION 3 = USED ON BSC LARSEN W SECTIONS

<table>
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Design: M.R.E. Drawn of: David Plant: Dubeck Standard: 43 Printed: 1 10

Optional Wing Extensions for HPN/1200 on wider sheet pile sections.

DUBAY CONSTRUCTION PLANT LTD
NOTES:

BEFORE ASSY. OF MECHANISM COMPONENTS CLEAN
THE M6 HOLE IN ITEM 3 & ITEM 4 WITH LOCTITE 7063.
APPLY ACTIVATOR 7471 TO THE FOREMENTIONED ONLY IF
THE ASSY. IS TO BE USED WITHIN 24 HRS. OF ASSY.

USE A SOFT FACED HAMMER TO HIT ITEM 6.
APPLY A COPPER BASED ANTI-SEIZE COMPOUND SUCH AS ROCOL 166.
TO SPACER WASHERS ITEM 6 AND TORSION SPRING ITEM 13

APPLY LOCTITE STUBLOCK 220 TO SOCKET HEAD CAP SCREW ITEM 14 AND
TIGHTEN TO A TORQUE OF 15 Nm.
GROUP ITEM 14 TO BE INSTALLED AS SHOWN SO THAT THE GAP IS NOT
COINCIDENT WITH THE SLOT IN THE CAM CENTRE SHAFT ITEM 6.

THIS DRAWING MUST NOT BE REPRODUCED BY ANY MEANS
WITHOUT PRIOR PERMISSION OF THE COPYRIGHT OWNER.
PATENTS APPLIED FOR.
**Mechanism Components**

Before Assy of mechanism components clean the 1/16 hole in Item 2 & Item 8 with Loctite 7063.

Apply activator 7771 to the aforementioned only if the Assy is to be used within 24 hrs of Assy.

Use a soft faced hammer to fit Item 3.

Apply a copper based anti-seize compound such as rocol 1166 to spacer washers Item 5 and torsion spring Item 7.

Apply loctite studlock 270 to socket head cap screw Item 8 and tighten to a torque of 16 in.

CircuP. Item 4 to be installed as shown so the cap is not coincident with the slot in the cam centre shaft Item 3.

**FLANGED BUSH ASSEMBLY - Item 6**

Apply loctite cleaner 7650 to surfaces to be bonded.

Wipe off cleaner with a clean rag and allow to dry 2-3 minutes.

Do not use cleaner 7650 as it is solvent based and will attack the nylon flanged bushes.

Apply loctite activator 7771 to surfaces to be bonded.

Allow activator to evaporate for 2-3 minutes until surfaces are dry.

Apply loctite 697 to both surfaces to be bonded.

Install flanged bush into cam carriage until surfaces are flush.

Apply any excess loctite from the joint whilst it is still wet.
**DETAIL A**

**SEAL INSTALLATION INSTRUCTIONS**

**PART SEAL ITEM 19**

**ASSEMBLY NOTES**

1. Plunge item 14 and seal item 19 to be fired before assy. Pierce to approximate cap to the end cap as possible during assy as the plunger pad is the seal.

2. Assemble 17, 15, and 12 to position 12. Cap item 12 using clean oil.

3. Loosely fit a 1/4" nonferrous bushing or assembly into bore 3. Secure end cap assy to previous assy with 12, 15, and 18 locating 24 and thread fit 50 Nm.

4. Physically test-see test procedure.

5. Static pressure test-see test procedure.

6. Mask grooves 4, 8, 12, 15, 18. Depress and then paint with grey paint smooth.

7. Ensure hole in item 14 is clear of locate before fitting cap at 19.

**SERVICE SEAL KIT**

**PT NUMBER: 1-264-50-01**

**INCLUDES WIPING FOR PREVIOUS BUILD LEVEL**

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<th>Description</th>
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## HYDRAULIC HOSE DETAILS FOR HPH 1200

### Control Side of Hammer (Sensor Side) - Assy Number 1.110.00.02

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<td>3 off</td>
<td>Hose Assy 900mm 3/8” R2T c/w 20 x 1.5 heavy 12s fem E/E</td>
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<td>Hose Assy 814mm 3/8” R2T c/w 20 x 1.5 heavy 12s fem E/E</td>
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<td>Hose Assy 990mm ¼” R2T c/w 16 x 1.5 heavy 8s fem E/E</td>
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<tr>
<td>6 off</td>
<td>GE8 PSR ED 8s x 3/8” BSP Stud</td>
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24 off  GE12 PSR ED 12s x 3/8” BSP Stud  1.111.14.02

2 off  RHZ 12 PSR ED 12s x 3/8” BSP Stud  1.100.03.02

4 off  Hose Assy 665mm 3/8” R2T c/w 20 x 1.5 heavy 12s fem E/E  1.110.06.01

### Height Adjusting Ram Hoses

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<td>GE8 PSR ED 8s x ¼” BSP Stud</td>
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### Power Side of Hammer (Supply Side) - Assy Number 1.111.00.05

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<td>Hose Assy 1335mm (Flange to Cone) 1” R13 c/w 42 x 2 heavy 30s fem to 1” SAE 6000 Straight Flange - Interlock type</td>
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<tr>
<td>1 off</td>
<td>Hose Assy 2320mm (Flange to Flange) 1¼” R13 c/w 1¼” SAE 6000 Straight Flange each end - Interlock type</td>
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<tr>
<td>1 off</td>
<td>Voss Flanged Elbow 195241</td>
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<td>1” SAE 6000 Split Flange Clamp Halves - metric bolt holes</td>
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<td>1¼” SAE 6000 Split Flange Clamp Halves - metric bolt holes</td>
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### Fittings for underside of Inlet Manifold

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<td>1 off</td>
<td>1¼” BSP M/M Adaptor</td>
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Important Safety Notes for Bladder Accumulators

1. Use nitrogen gas only
2. All accumulators are supplied precharged to 100bar (1450 psi) unless sent via air-freight – in which case they will be shipped unprecharged
3. Always use the gas filling apparatus supplied by Dawson. This equipment includes a regulator valve specifically designed for use with hammer accumulators where the precharge pressure is less than the supply cylinder pressure.
4. Read the instructions below fully before attempting to adjust the precharge in any accumulator
5. Routine maintenance on the accumulator in-situ or removal of the accumulator must only be carried out when the hydraulic system pressure has been completely removed.

Accumulator Precharge Pressure

High pressure accumulator – 100 bar
Low Pressure Accumulator – 3 bar

Pre-charge Procedure

1. Remove protective cap (1) and sealing cap (2) – see figure 1.
2. Attach the Regulator Valve to the nitrogen cylinder – see figure 2.
3. Attach the charging set (5) to the accumulator gas valve assembly (6) and connect charging hose (7) between the regulator and the charging set connection.
4. Back off handle (8) anticlockwise until loose. Check gas bleed valve (9) on charging set is closed and screw hand wheel (10) clockwise to open gas valve.
5. Open nitrogen cylinder valve by turning key (11), cylinder pressure will register on right hand gauge (12). This pressure should be checked against the required precharge pressure.
6. Turn handle (8) clockwise until outlet pressure on left hand gauge (13) registers 10% higher than required precharge pressure (110 bar or 3.5 bar). When pressure on the charging set and outlet gauges are equal, close nitrogen cylinder valve.
7. Turn hand wheel (10) anticlockwise to seal gas valve.
8. Crack bleed valve (9) to exhaust gas from charging hose and remove hose from charging set and replace hose connection sealing cap.
9. Close bleed valve, turn hand wheel (10) clockwise to open gas valve and crack bleed valve (9) to vent down to required precharge pressure. Close bleed valve.
10. Turn hand wheel (10) anticlockwise to reseal gas valve, crack bleed valve and remove charging set from the accumulator.
11. Test accumulator gas valve for leaks using soapy water or similar.
12. Replace sealing cap (2) and tighten with pliers. Replace protective cap using a wrench.
Inspection and repair of Accumulators

Due to the nature of the design and specific assembly procedures, it is recommended that the accumulators should only be inspected and repaired by a competent person. Dawson Construction Plant Limited or their approved dealers will be happy to undertake this work as required. Please note the Important Safety Notes at the beginning of this section.

To change a bladder the following procedure should be adopted:

a. Isolate accumulator from system fluid pressure and release accumulator fluid pressure by opening bleed valve.

b. Remove accumulator from control valve.

c. Position accumulator, ensuring easy accessibility and clamp securely.

d. Remove protective cap (C) and sealing cap from the gas valve (D) and fit the charging set to the accumulator gas valve.

To charge gas valve by turning hand-wheel clockwise and vent gas by opening bleed screw on side of charging set. When gauge reads zero screw up hand-wheel and remove charging set.

e. Remove gas valve assembly (D) and bleed adapter (B) from fluid port body.

f. With a suitable spanner A.P. remove locking ring (E) and flanged washer (F).

g. Push fluid port body into shell, remove back-up ring (G) and 'O' ring (H) and fold anti-expansion ring (I) until it is sufficiently collapsed to allow removal from shell.

h. The fluid port can then be removed from inside the accumulator shell.

i. Remove bladder locknut (J) and flange and withdraw bladder (K) through fluid port end of shell.

j. Clean inside of shell and all components.

k. To fit a new bladder, first remove gas valve assembly and locknut, then roll up bladder longitudinally, edges towards the centre, to expel air and lightly cover with system fluid.

l. Enter gas valve stem of the bladder through fluid port end of accumulator and push bladder completely into shell until the gas valve stem emerges through hole at opposite end. Fit locknut and locknut and replace gas valve assembly.

m. Pour into shell approximately 90% of accumulator volume of system fluid to act as lubricant during bladder expansion within shell.

n. To complete the assembly reverse the procedure followed in steps d to h. Locking and torque.

o. Precharge accumulator to required pressure.
### APPENDIX 7.5 -
**HPH 1200 TOOL KIT**
(S/NO 1011 ONWARDS)
(PART NO. 1.150.00.02)

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