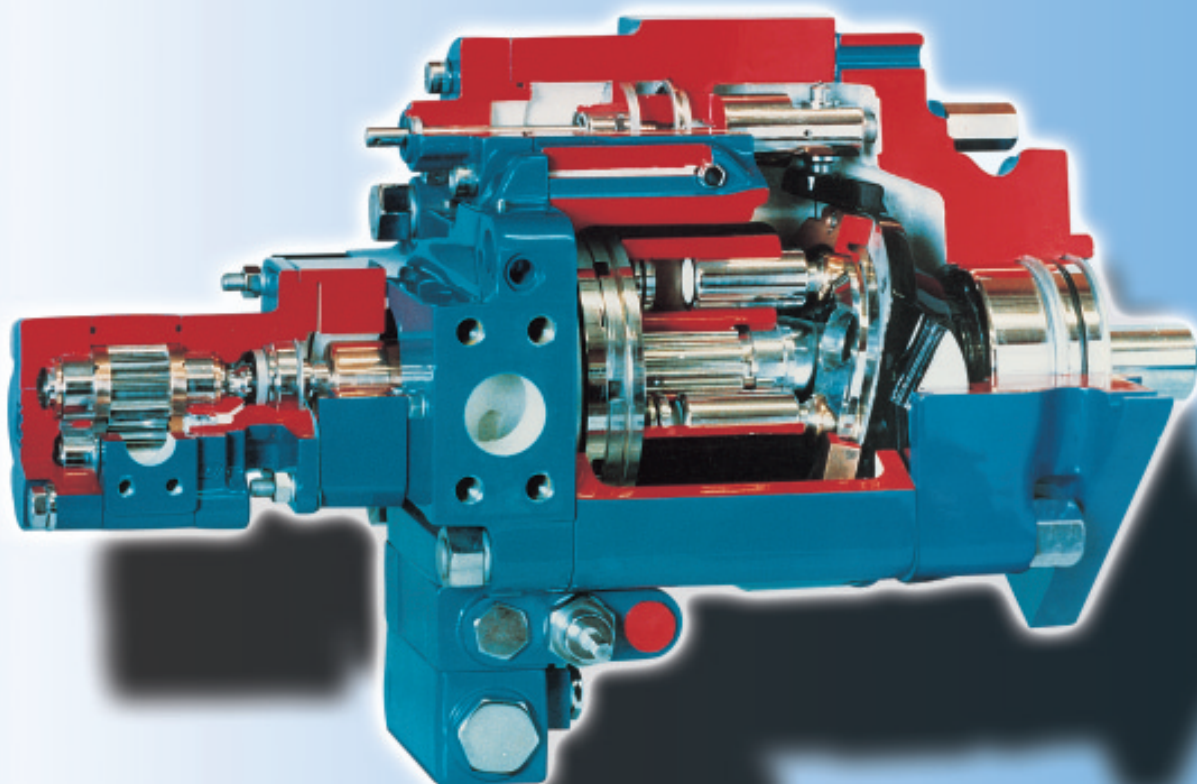


Pumps & Motors

Series HD2 Axial Piston

Catalogue HY16-8002/UK
June 2001



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Note: In line with our policy of continuing product improvement, specifications in this catalogue are subject to change without notice. There is always a possibility of errors.

Introduction

The HD2 range of fixed and variable displacement axial piston units are designed for heavy duty, closed circuit applications where high performance and reliability are required. The units are available with a wide range of control options and circuit valves offering greater flexibility to system designers in cost effective packages.

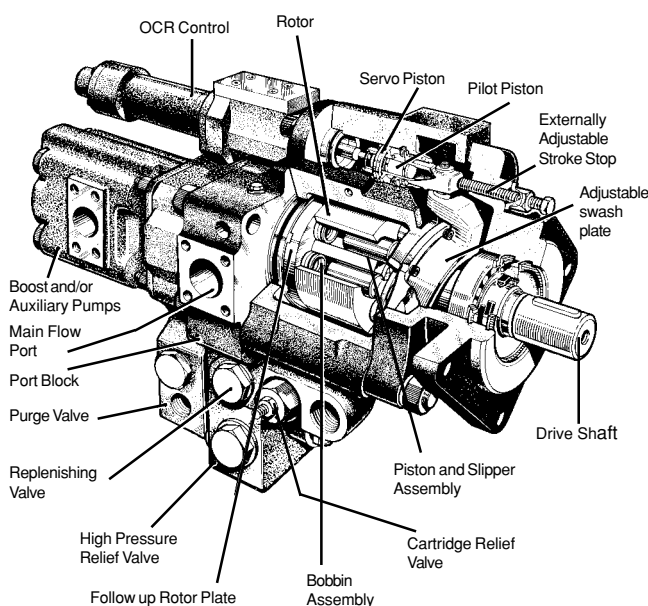
The body materials are steel and cast iron enabling units to be used underground when fitted with Parker's cast iron bodied auxiliary pumps.

Closed circuit HD2 units are bi-rotational but boost or auxiliary pumps are sometimes suitable for one direction only.

The HD2 range is designed with a B10 bearing life (less than 10% failures) of 10,000 hours at continuously rated speed and pressure at maximum capacity on 21 centistokes mineral oil.

Operation of HD2 Units

The axial piston design is simple in concept allowing a compact, fixed or variable capacity unit to be produced capable of being operated as a pump or motor in either direction of rotation. Output flow of the variable capacity units is controlled by tilting the swashplate.



Pumps

Multiple pistons are positioned axially in a rotor, which is connected to the prime mover via a drive shaft. Each piston carries a "slipper" running against the inclined swashplate, both rotor face and slippers are pressure balanced and lubricated to minimise power losses.

The HD2 "floating" rotor face allows a rigid shaft with two high capacity bearings to be used and ensures a uniform running clearance, which reduces contamination sensitivity to a minimum.

As the rotor revolves, the cylinders follow the path of the inlet kidney port, the angle of the swashplate causes the pistons in the cylinder bores to move away from the kidney port thus drawing fluid into the cylinder. Further rotation past "top dead centre" brings the cylinder on to the path of the outlet port and causes the pistons to move downwards expelling the fluid through the outlet port.

Careful design and manufacture ensures hydraulic balancing of internal forces and excellent lubrication of all bearing surfaces in the pumps and motors to give long trouble-free life with high overall efficiency.

Motors

The construction of motors is identical to pumps; the fixed and certain types of the variable capacity units can be used as either pump or motor. As a motor, fluid enters the cylinders positioned over the high pressure kidney port, the pistons in these cylinders are forced away from the kidney port and reaction between the slipper pad on the piston and the inclined swashplate results in a rotary movement of the rotor and, hence, the output shaft.

A particular feature of the HD2 range is the excellent low speed and static performance made possible by the floating rotor face.

Controls

In the case of the fixed angle swashplate the outlet flow is determined only by the pump size and rotational speed. With the variable capacity units the angle of the swashplate can be altered and the output flow varied proportionally. If the swashplate is moved over centre the direction of the flow is reversed.

Control of the swashplate is through an integral servo arrangement using fluid at delivery pressure for control power and rapid response. With the basic variable pump or motor a manually operated follow-up servo control (MS) positions the swashplate in response to linear movements of the servo control rod. In this way reaction loads are eliminated from the external mechanical connections and the forces required are minimised. With the various automatic controls, additional features are incorporated which adjust swashplate angle in accordance with pressure or other control parameters. Further details of the control options available are given on pages 10 to 14.

Circuit Valves

Integral valves are available for the following:-

Cross line high pressure relief.

Replenishing valve to supply boost or make up oil into closed circuit systems.

Purge valve (hot oil valve) to remove excess oil from closed circuits so cooling and filtering the main oil flow.

Valves can be fitted to pumps or motors.

Hydraulic Axial Piston Pumps/Motors

Basic Data			HD2-900	HD2-1400	HD2-2200	HD2-3000	HD2-4000	HD2-6600
Displacement	cc/rev		68	106	166	227	303	500
	cu ins/rev		4.2	6.5	10.2	13.9	18.5	30.5
Flow at 1000 rpm								
	lit/min		68	106	166	227	303	500
	Imperial gallons/min		15.0	23.3	36.7	50.0	66.6	110
	US galls/min		18.0	28.0	44.0	60.0	80.0	132
Speed	Maximum	rpm	4000	3600	2500	2500	2500	2300
	Continuous	rpm	3000	3000	2000	2000	2000	2000
Pressure	Maximum	bar	410	410	410	410	410*	345*
		psi	6000	6000	6000	6000	6000*	5000*
	Continuous	bar	345	345	345	345	345*	280*
		psi	5000	5000	5000	5000	5000*	4000*
Minimum Pump Inlet Pressure (measured at port gauge tapping) For viscosity up to 300cS (1400 SUS)								
for continuous rpm	bar		5.5	10	14	14	14	21**
	psi		80	150	200	200	200	300
at maximum rpm	bar		8.3	13	17.5	17.5	17.5	28
	psi		120	190	250	250	250	400
Motor Running Torque	Nm		444	690	1080	1500	2000	2750***
at maximum pressure	lbft		327	510	795	1100	1465	2035***
Maximum Case Pressure	bar		4.2	4.2	4.2	4.2	4.2	4.2
	psi		60	60	60	60	60	60
Seal Temperature Range			-40° C to 135° C					
Weights kg's								
Basic fixed capacity unit (F)			98	116	190	190	190	300
Basic variable capacity unit (MS)			98	116	190	190	190	300
Replenishing valve			6	6	6	6	6	6
High pressure relief valve			7	7	7	7	7	7
Purge valve			20	20	20	20	20	20
Auxiliary pump mounting and drive (confirm with factory for actual weights)			7	7	7	7	7	7
Polar moment of rotating parts	kgf m sec² x 10 ⁻³		1.73	4.13	12.88	12.88	12.88	34.56
	lbf in sec²		0.15	0.359	1.118	1.118	1.118	3.0
Shock Loads			The HD2 range can withstand shock loads up to 70g.					

* Continuous input power limits
HD2-4000 225kW (300HP)
HD2-6600 375kW (500HP)

** Increase to 25 bar (360psi) for pressures over 280 bar (4000psi).

*** Up to output speed of 1000rpm.

When boost pumps are included, the direction of rotation may need to be specified.

The data presented in this catalogue is typical for pumps and motors operating with mineral oil at 50 °C and 21 cS, (103 SUS). Please contact the Company for other fluids and conditions.

Fluids

The HD2 range is primarily designed to operate on hydraulic mineral oils with a viscosity of approximately 21 centistokes at normal operating temperatures.

Fully Approved Fluids

Hydraulic mineral oils to ISO 32 have passed the Company's Qualification Test Procedure to full specification and can therefore be confidently recommended to ensure long trouble free running with the HD2 Series.

This test procedure was introduced some years ago to provide a guarantee of satisfactory operation, and is now widely recognised by both industry and oil companies as providing a reference for oil performance with Axial Piston Pumps. Based on the endurance of a standard pump with the fluid concerned, the Company Procedure has been used to evaluate a wide range of oils and provides a practical basis for complete fluid approval.

Other Hydraulic Oils

Any good quality mineral oil should be suitable for use with HD2 Pumps and Motors. For full duty operation –

Recommended *minimum* viscosity 15 cS (78 SUS).
Recommended *maximum* viscosity 500 cS (2400 SUS).
2000 cS (9500 SUS) allowable at cold start.

Other Fluids

Although designed for use on mineral oils the standard HD2 Pumps and Motors are also suitable for operation at specified conditions on a wide range of alternative fluids.

Field and Laboratory operating experience has been obtained on the following:

Phosphate Esters	Naptha Distillate
Rolling Mill Oils	Kerosene
Gas Oil	Diesel Oil

Careful consideration must be given to operating conditions, circuit standard and pump seal standards when using these fluids.

Water Based Fire Resistant Fluids

ISO HFB (water in oil emulsions 60/40) and ISO HFC (water glycol) can be used with HD2 pumps up to a maximum speed of 1500 rpm, maximum pressure of 200 bar and maximum temperature of 50 °C.

Higher pressures and speeds may be achieved with certain fluids on intermittent duties.

Filtration

The HD2 units have special features to minimise the effects of contamination, however, the importance of proper and adequate filtration cannot be over emphasised. All fluid passing through the units should be filtered to 15 micron (0.0006ins/ 0.015mm) or better. The required cleanliness standard is 18/13 or better. Reference BS5540-ISO/ DIS4406-CETOP RP 70H.

Noise

The noise level of a complete hydraulic system is determined by the pump or motor mounting and drive, the interconnecting pipework, the enclosure (if any around the equipment) and the basic noise level of the unit. As a general rule increasing speed and increasing pressure tend to increase the noise level.

It is preferable to eliminate metal to metal contact in drive couplings and to use short lengths of flexible hose between any solid piping and the units. On some applications it is possible to mount the HD2 on flexible mountings and this can reduce the noise transmitted to the machine structure.

Noise reduction features have been incorporated into the HD2 range. As an example the basic HD2-900 has a noise level of 83dBA at 1500 rpm and 210 bar (3000 psi).

Mounting and Drive

HD2 units can be mounted in any attitude but with very solid drives it is essential that the shaft is aligned to normal engineering practices, ie 0.075mm (0.003in) T.I.R.

Torsionally flexible drives are preferred when the prime mover is an internal combustion engine.

It is advisable to use anti-fretting paste on splined shafts.

The case drain should be arranged to keep the body full of oil if it is mounted vertically and at least half full if it is horizontal.

The mounting flange, drive shaft and main port flanges conform to SAE standards with the exception of the HD2-900 ports which are tapped with a BSP thread.

The shafts will accept side loading, the amount depending on the speed, pressure and swashplate angle. Maximum side loads for a pump running on full displacement on mineral oil at 1500rpm, 210 bar (3000psi) for a B10 bearing life of 10,000 hours are:

HD2-900	360kg
HD2-1400	544kg
HD2-2200	770kg
HD2-3000	590kg
HD2-4000	360kg
HD2-6600	1600kg

Please consult the Company if you intend to operate a unit with greater loads than these, or with any end load.

Boost Pumps

The inlet side of the HD2 pumps must be pressurised to reduce noise, prevent cavitation, give a cooling flow, and allow a good standard of filtration, all of which help to achieve a long trouble free life.

A wide range of boost pumps are available for mounting on the HD2 pumps but the majority of applications can be met by either a small make up pump to replace leakage from a **closed circuit system** or a full flow boost pump with a capacity of 10 to 15% above the axial piston pump for **open circuit systems** in which all the return flow goes directly to tank.

Typical make up boost pumps for use at the continuous rated conditions with 21 centistokes mineral oils are as follows:

	Min. Boost Capacity (cc/rev)	Standard Boost Pump (Gear Width)
For Closed Loop Operation		
HD2-900	27.2	P31 (1")
HD2-1400	27.2	P31 (1")
HD2-2200	42.2	P31 (1.5")
HD2-3000	42.2	P31 (1.5")
HD2-4000	42.2	P31 (1.5")
HD2-6600	56.7	P31 (2")

The above pumps have the following features:

Bi-rotational
SAE Splined Shaft
Equal SAE Split Flange Ports Both Sides
(flanges not supplied)
Suitable for both Mineral Oils and 60/40 Water Oil Emulsions
ISO HFB

The make up boost pump capacity for any particular system must be determined by the total system leakage and the pump drive speed.

Please contact our Technical Department or our overseas distributors for further advice.

Power Take Off Shafts

The through shaft design of HD2 units enables them to be mounted in tandem together with single or multiple gear pumps for boost and auxiliary duties. See separate data sheets for rear mounting flange and gear pump details.

On many systems this can eliminate the need for bulky and expensive splitter gearboxes or separate drives giving significant overall cost savings **N.B.** The power input to the complete assembly should not exceed the maximum stated for the first HD2 unit.

HD2-900 to 4000**Standard PTO**

Shaft capable of transmitting a continuous torque of 200 Nm equivalent to 62kW (84 hp) at 3000 rpm (31 kW (42 hp) at 1500 rpm).

High Power PTO

Available as an optional extra with a torque rating of 740 Nm equivalent to 229kW (307 hp) at 3000 rpm (114 kW (153 hp) at 1500 rpm).

The PTO shafts are not sealed and have a SAE 1.25 inch involute male spline with 14 teeth.

HD2-6600**Standard PTO**

Shaft capable of transmitting a continuous torque of 740 Nm equivalent to 153kW (206 hp) at 2000 rpm.

The PTO shaft is not sealed and has an SAE 1.25 inch involute male spline with 14 teeth.

High Power PTO

Shaft available as an optional extra with a torque rating of 2750 Nm equivalent to 570 kW at 2000 rpm. This facility allows the mounting of any HD2 unit, including another 6600 in tandem to give a total capacity of 1000 cc/rev.

The PTO shaft is not sealed and has an SAE 2 inch involute male spline with 15 teeth.

Use SAE "E" or "F" auxiliary Pump Mounting only with this PTO shaft.

Auxiliary Pump Mountings (see separate data sheet)
Without pump mounted purge valve

Pump Size	Standard PTO	High Power PTO
HD2-900	SAE 'B', 'C' or 'D', 2 bolt & 4 bolt	Not Available
HD2-1400	SAE 'B', 'C' or 'D', 2 bolt & 4 bolt	Not Available
HD2-2200	SAE 'B', 'C' or 'D', 2 bolt & 4 bolt	SAE 'E'
HD2-3000	SAE 'B', 'C' or 'D', 2 bolt & 4 bolt	SAE 'E'
HD2-4000	SAE 'B', 'C' or 'D', 2 bolt & 4 bolt	SAE 'E'
HD2-6600	SAE 'B', 'C' or 'D', 2 bolt & 4 bolt	SAE 'E' or 'F'

With pump mounted purge valve

SAE 'B' (HD2-900) or SAE 'C' (HD2-1400 to 6600) 4 bolt mounting auxiliary pumps must be used. SAE '6 bolt' mounting flanges can be fitted provided that only four bolts are used.

Pump Mounted Purge Valve Codes 53 (HD2-900 only) Code 54 (All other sizes)

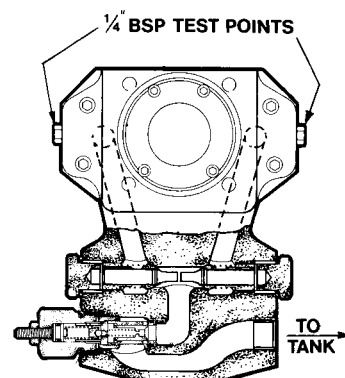
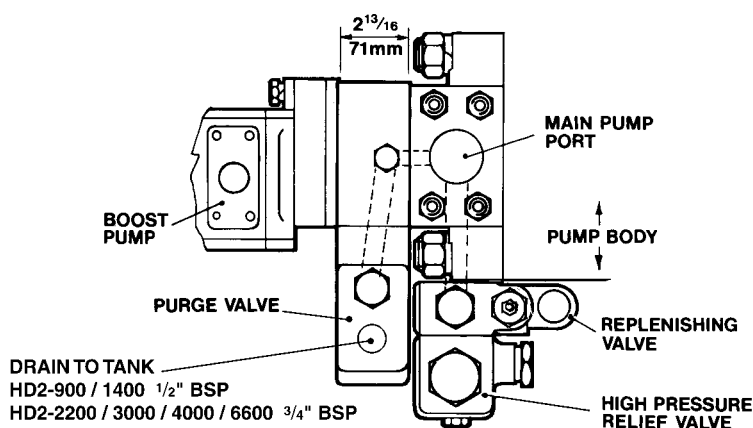
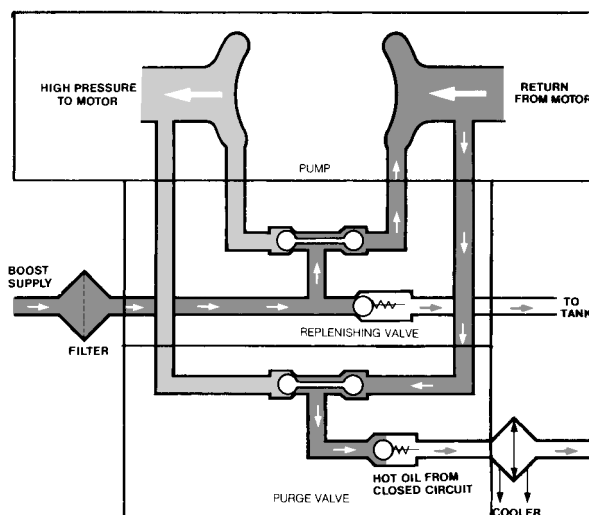
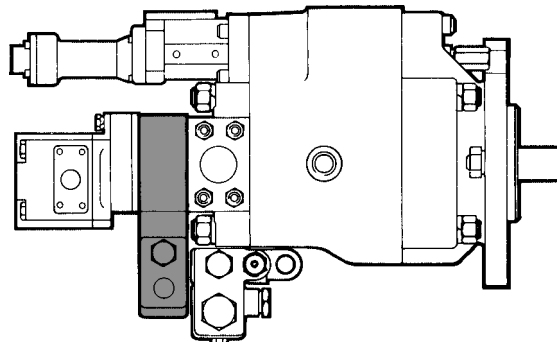
Parker offers an integral purge valve on all five sizes in the HD2 range, giving the following benefits in closed loop hydrostatic transmissions.

- Continuously bleeds hot oil from the closed loop circuit for filtering and cooling.
- All circuit valves are mounted on the pump.
- Manifold construction minimises the need for external pipework.
- Only one low pressure drain needed, reducing assembly costs and the number of pipe joints.
- Ideal for use with high torque low speed motor drives.
- Factory tested assembly reduces commissioning time.
- Built in protection for cold starts with high viscosity oils.
- Internal valves are pilot operated to minimise pressure drop losses.
- Only 15 mm (0.6 inch) increase in length over the boost pump mounting adaptor.

In systems where the pump and motor are permanently close coupled and the closed circuit is properly cleaned before start up, this valve can eliminate the need for permanent full flow filters in the closed loop, cutting both initial equipment and long term maintenance costs.

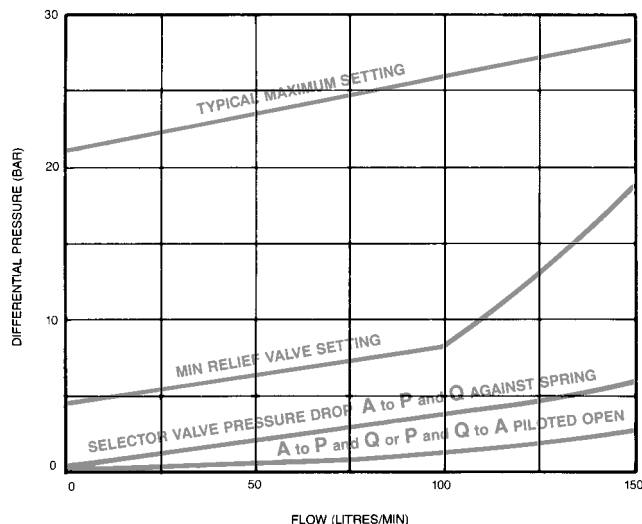
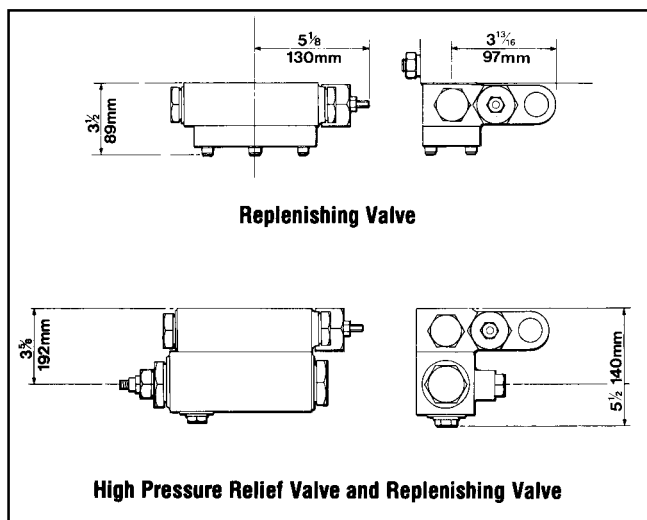
How it Works

Oil from the tank passes from the make up boost pump through an external filter and into the closed loop transmission circuit via the replenishing valve (code 31) on the main port block. The replenishing relief valve is set 3.5 bar (50 psi) above the boost pressure required so that all the boost oil normally enters the main pump. Excess oil returning from the motor enters the purge valve through a drilling in the main pump port block before the remainder merges with the new boost oil. The low pressure side of the main circuit is connected to the purge relief valve by the pilot operated selector valves allowing the excess hot oil to pass via the drain connection to the cooler, if fitted, and back to the tank. The purge valve and its pump should be ordered together. The valve is incorporated in the boost pump mounting bracket and two types are available depending on pump size.

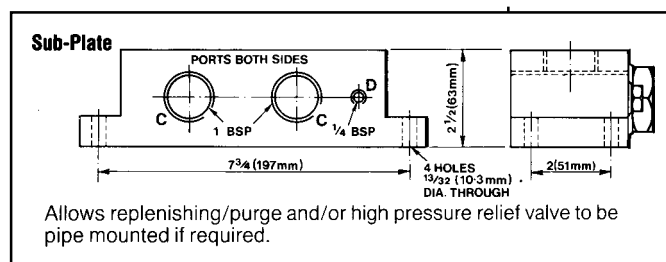


Pump Replenishing or Motor Purge Valve Code 31

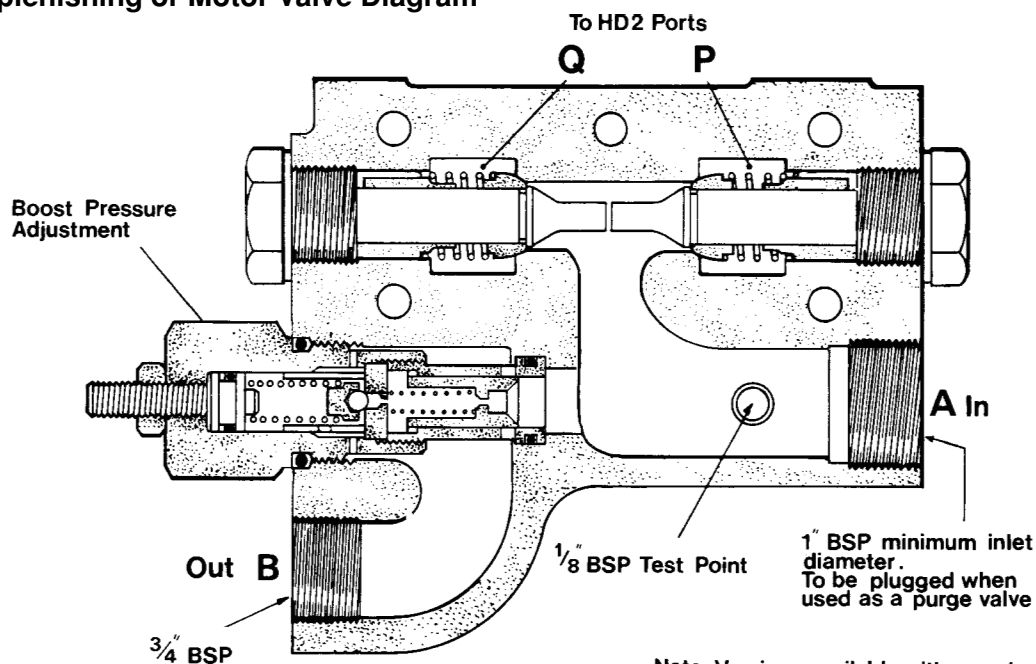
An adjustable low pressure relief valve for pump/motor transmission "make-up" and pilot operated low pressure selector valves are contained within a bolt-on-block. Two of these blocks can be used for purged closed loop systems, one on the pump with its relief valve set to 3.3 bar (50 psi) higher than the second one fitted to the motor. For higher make-up flows additional low pressure selectors and an additional low pressure relief valve are needed. The opening pressure of the low pressure relief valve is adjustable up to 70 bar (1000 psi).



Valve performance with an oil viscosity of 21 cS. This valve can be used with or without the high pressure relief valve.



Pump Replenishing or Motor Valve Diagram



$$\frac{\text{Valve Area}}{\text{Pilot Area}} = \frac{2}{1}$$

Note. Versions available with one check valve omitted to give overrun bypass for one way drives. See order codes page 21

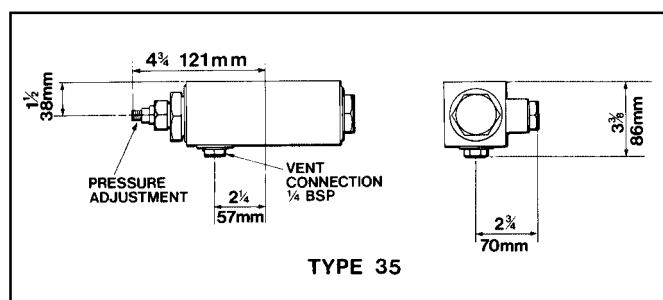
High Pressure Relief Valve Code 35

A high pressure, pilot operated, crossline relief valve for intermittent circuit protection is also available as a bolt-on feature. This valve is adjustable up to 410 bar (6000 lbf/in²) and has a facility to provide low pressure by-pass by venting pilot pressure to tank.

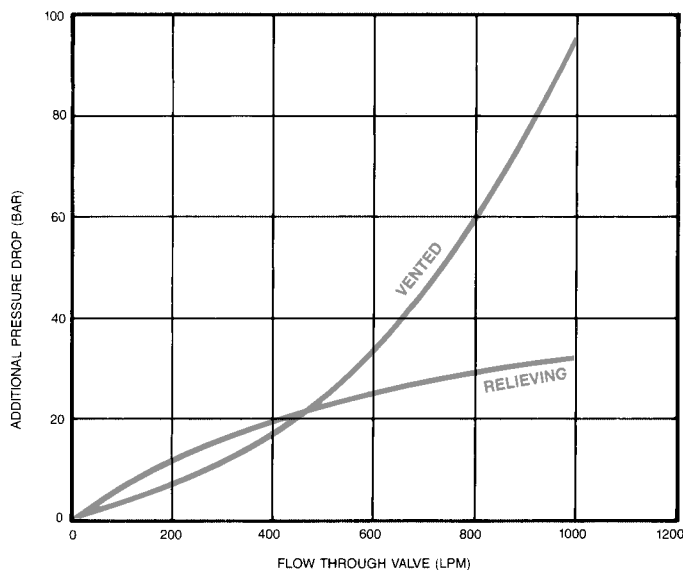
Dual pressure settings are also possible by adding an external pilot valve to the vent connection. The pilot line and venting valves should be capable of passing a flow of 4.5 l/min (1 gpm).

One turn of the relief valve adjusting screw is equivalent to approximately 70 bar (1000 psi).

When despatched the valve is set to 70 bar (1000 psi) unless a specific setting is ordered.

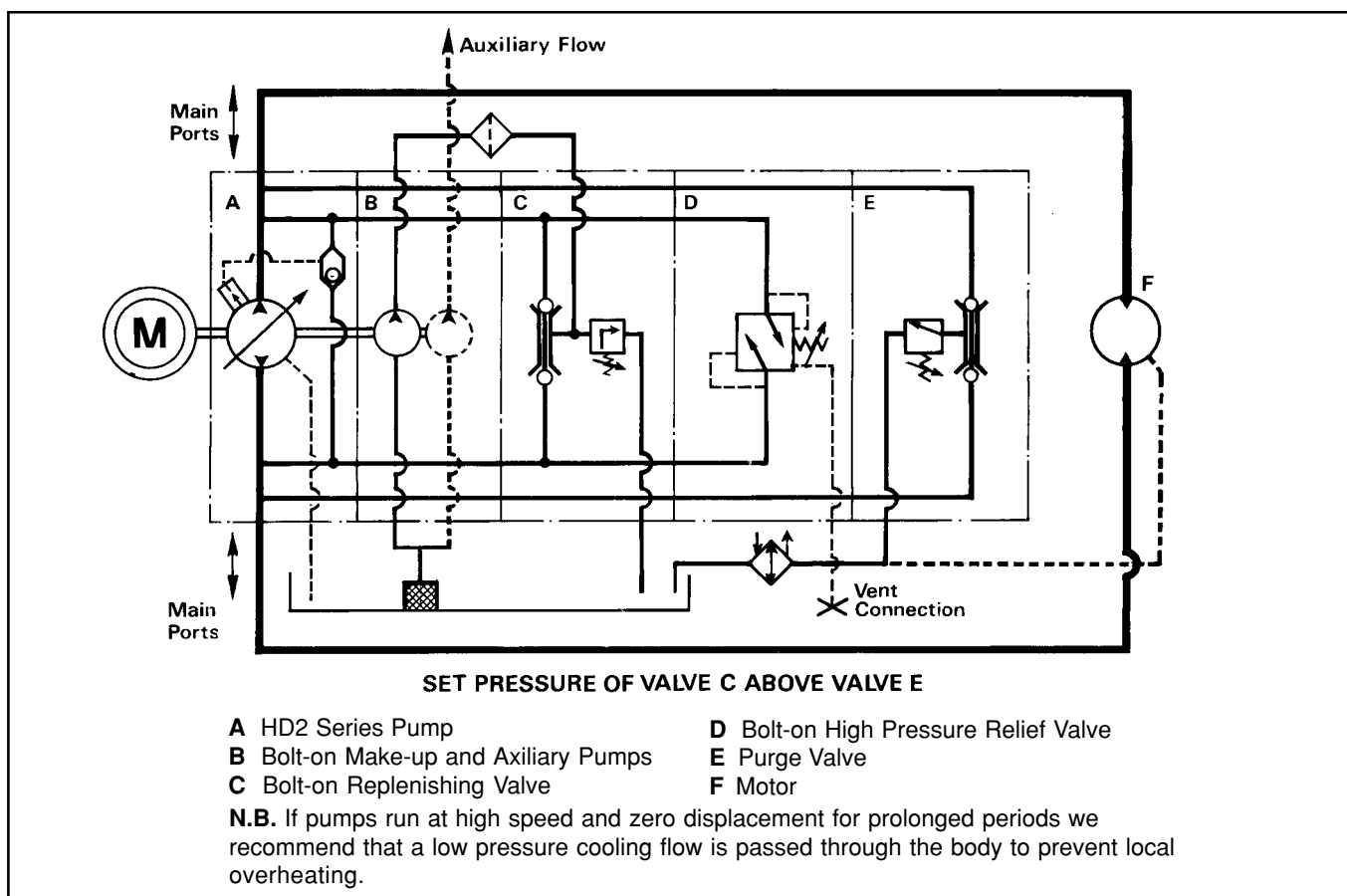


Valve performance with an oil viscosity of 21 cS :-



This valve can be used with or without the replenishing valve.

Typical Circuit Diagram for Make-up Boost and Auxiliary Hydraulic Pumps



Control Options

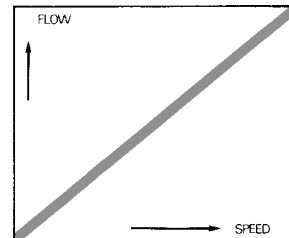
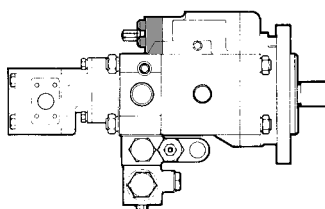
The HD2 swashplate is controlled by a servo piston which is powered by high pressure oil for rapid response. The oil passes from the main ports through a high pressure selector valve and internal drillings to the piston. Movement of the piston is controlled by the various alternatives shown below.

Fixed Capacity**F (Code 1A)**

A fixed swashplate unit producing an output flow which is a function of swept volume and rotational speed.

Screw Adjustable**SA (Code 1)**

As fixed but with the capacity externally adjustable.

**Variable Capacity****With Manual Control****MS (Code 2)**

Fully overcentre swashplate control for reversible flow.

Smooth infinitely variable output with continuous power transmission.

Force required to operate MS control 67N (15 lbf). Response time is normally less than 0.2 seconds.

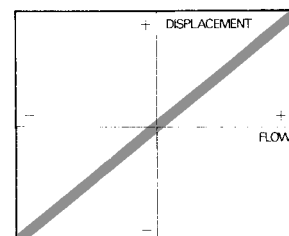
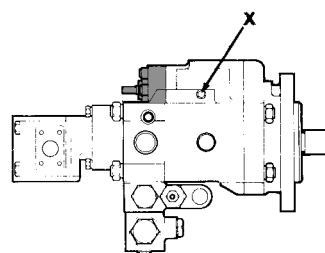
MSNS (Code 3)

Control is similar to the MS with the addition of a positive spring centering device which gives an accurate zero flow position especially useful for transmissions.

The force required to operate this control is 67N (15 lbf) at zero capacity rising to 98N (22 lbf) at maximum capacity.

MAMS (Code 4)

Control is similar to the MS with the addition of a handwheel with position indicator.

**Damped Servo Response**

If required an orifice can be fitted in the servo feed drilling under plug X threaded 1/8 inch BSP.

An orifice is fitted as standard with the MSNS control.

Pressure Compensated**CPSV (Code 6)**

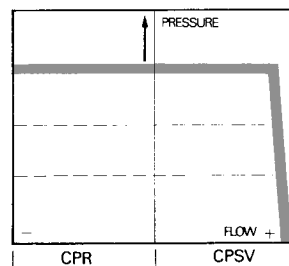
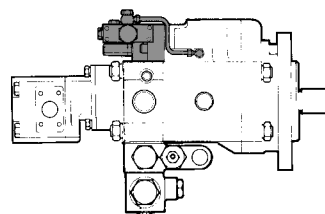
Variable pump with stroke control to provide a constant pressure at the pump outlet. Maximum and minimum stroke stops are provided. Vent allows complete off-load to zero swash.

CPR (Code 6A)

Overcentre option for rendering winches. Minimises power wastage, reduces oil heating and improves system response.

CPSVP and CRRP (Codes 6D and 6E)

Controlled by external pilot pressure for remote control. The ratio between the pump delivery pressure and the pilot pressure is 20:1.



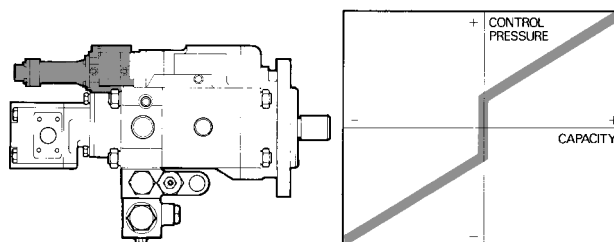
The system high pressure relief valve must be set above the compensator and will normally remain closed.

Overcentre Remote Control

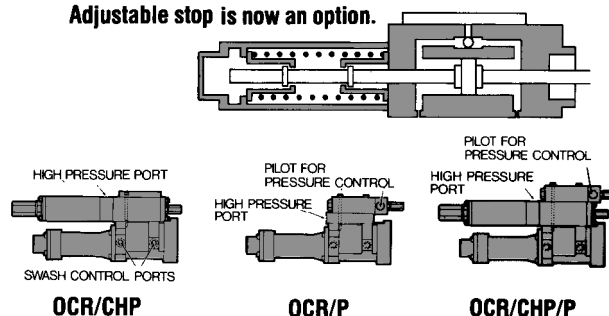
OCR (Code 5)

Provides proportional control of swash angle by hydraulic pilot pressure signals derived from the system boost pressure operating a double acting control cylinder. Below the start pressure the swashplate is spring centred to zero flow. Control orifices of 0.030 inches (0.75 mm) diameter are fitted as standard to the two control ports.

Unit	HD2-900	HD2-1400	HD2-2200 3000/4000/6600
Start pressure +/-	2.7 bar 39 psi	3.4 bar 49 psi	3.4 bar 49 psi
Max capacity pressure	9.6 bar 140 psi	12.0 bar 175 psi	14.8 bar 215 psi
Peak pilot pressure	35 bar 500 psi	35 bar 500 psi	35 bar 500 psi
Cylinder displacement 2 x	6.5 cc	15.8 cc	20.5 cc



Adjustable stop is now an option.



OCR/P (Code 5B)

As basic OCR plus pressure override control which reduces pump displacement towards zero to maintain constant delivery pressure. The pressure setting is screw adjustable but it can also be varied remotely by a hydraulic pilot pressure signal derived from the system boost pressure. The ratio between pump delivery pressure and the pilot pressure is 20:1. A preset maximum pressure stop can be incorporated.

OCR/CHP/P (Code 5A)

OCR with both constant horsepower and pressure override.

OCR/CHP (Code 5C)

As basic OCR plus constant horsepower override control which reduces pump displacement as pressure rises.

Controls are coded in horsepower per 1000 rpm.

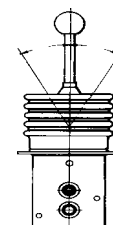
The maximum and minimum settings for each size of pump are as shown.

HD2	900	1400	2200	3000	4000	6600
Min Power kW	7.45	11.2	18.6	29.8	37.3	61.1
per 1000 rpm hp	10	15	25	40	50	82
Max. power kW	37.3	55.9	82	111.9	149.1	246.1
per 1000 rpm hp	50	75	110	150	200	330

OCRB/P (Code 5E) and OCRB/CHP/P (Code 5D)

OCR controls with the signal to CHP and P from the outer end of the OCR cylinder blanked off internally, this allows these controls to be used for crane and winch drives when paying out under load.

All OCR controls can be operated remotely by proprietary joystick controllers with a suitable pressure range.

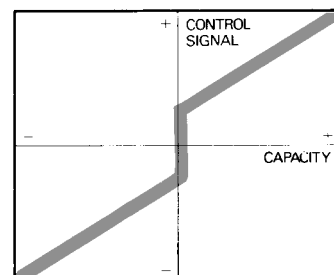
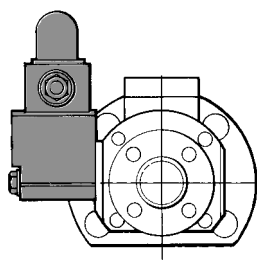


OCR/E (Code N5, M5, L5 and T5)

OCR with remote electrical control by low cost single stage proportional pressure regulating valves which are powered by boost pressure.

This control mounts directly onto the side of the OCR and can be used with /CHP/P and CHP/P options.

A joystick or universal driver card is available as an optional extra.



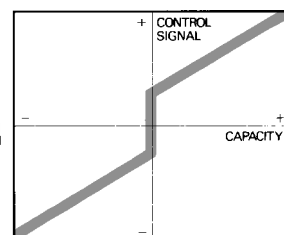
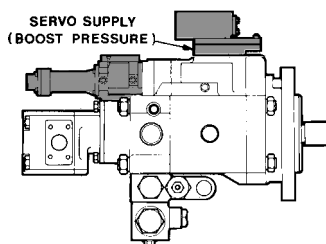
Typical performance with an oil viscosity 21 cS (103 SUS)	HD2-900	HD2-1400	HD2-2200 3000/4000/6600
Response standard orifice 0 - max (secs)	1.4	1.6	2.2
Response standard orifice max - 0 (secs)	0.6	1.3	1.8
Minimum control input pressure	10.6 bar 155 psi	13 190	16 230

OCR/EH (Codes 5F, 5G, 5H and 5J)

Combines the advantages of the OCR control with remote electrical operation by a high response proportional or servo valve.

The output from the servo valve drives the OCR piston which operates at low pressure. The servo valve can therefore be powered by boost pressure eliminating the need for a separate servo supply pump, filter and relief valve which are needed with the EH control.

The spring return to neutral of the OCR also allows low cost controllers to be used. These controllers incorporate a mechanical stroke position feedback signal which virtually eliminates hysteresis between the command signal and flow rate. For further details contact the Company.



Typical performance :-

Command signal ± 2.7 volts DC 50 mA. Oil viscosity 21 cS (103 SUS). Supply 20 bar (300 psi).	HD2-900	HD2-1400	HD2-2200 to 6600
Response standard orifice 0 - max (secs)	1.4	1.6	2.2
Response standard orifice max - 0 (secs)	0.6	1.3	1.8
Response orifice 1.27mm (0.050") 0 - max (secs)	0.3	0.4	0.8
Response orifice 1.27mm (0.050") max - 0 (secs)	0.3	0.4	0.5
Minimum control input pressure	12.6 bar 185 psi	15 220	17.8 260

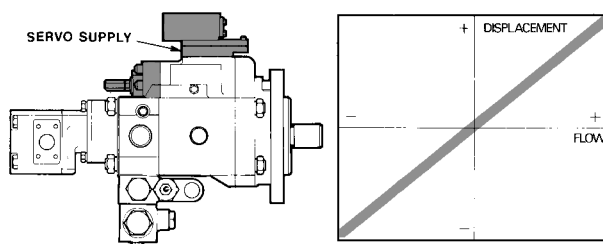
N.B. Standard orifices are required for /CHP and /P options.

Variable Capacity with Electro-Hydraulic Control EH (Code 8)

A variable capacity unit with facilities to move the swashplate using an electrical signal. A mounting base is provided for various servo and high response proportional valves.

In its basic form control is achieved through a simple potentiometer connected by wires to the pump. Electrical power can be from a suitable DC supply. Full closed loop control can be achieved through electronic modules and a suitable feedback transducer.

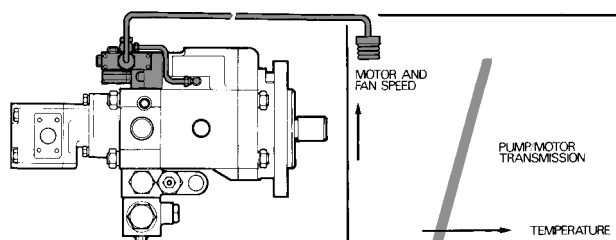
An independent oil supply between 28 bar (400 psi) and 140 bar (2000 psi) is required to power the servo valve. The flow depends upon the response time required. This oil supply should be filtered to 10 micron or better and is usually supplied by a small auxiliary pump mounted directly onto the HD2 pump or its boost pump. For further details of the options available contact the Company



Temperature Control for Fan Drives TC (Code 6C)

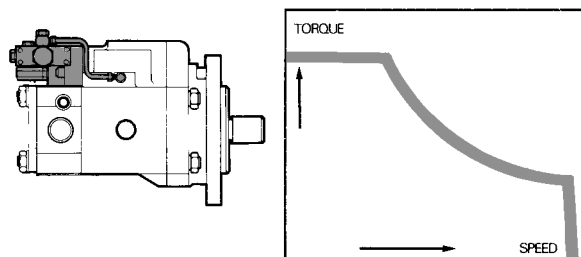
Pressure control sensing cooling water temperature. Hot water increases signal pressure to provide more flow to raise motor and fan speed. Cooling reduces signal pressure to reduce flow and decrease fan speed in proportion irrespective of pump speed.

The Parker temperature sensor gives a low pressure hydraulic pilot signal to the pressure control which is also suitable for multiple sensors with highest error signal priority.



Constant Power Motor CPM (Code 6B)

Constant pressure control gives constant power output by varying motor capacity between maximum and down to 25% of maximum.

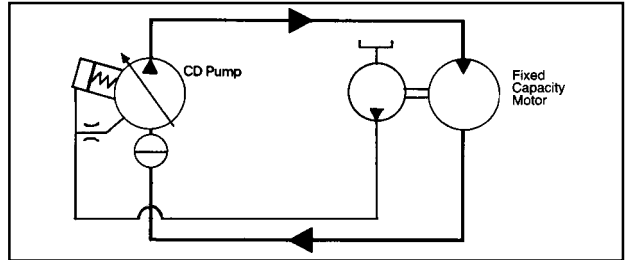
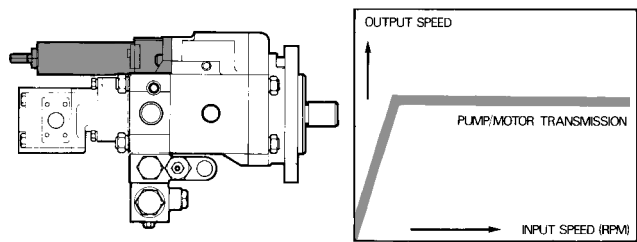


Constant Speed Control CD (Code 12)

Constant output speed from the motor regardless of prime mover speed variations. Typical applications: alternator and compressor drives.

Principle of CD Control

The flow from the motor mounted metering pump is used to measure speed by means of an orifice which may be fixed or variable. At a control pressure drop of 2.7 bar (40 psi) the pump capacity is increased or decreased to maintain a constant motor speed typically within steady state accuracy of $\pm 0.5\%$. This control cannot be used overcentre.



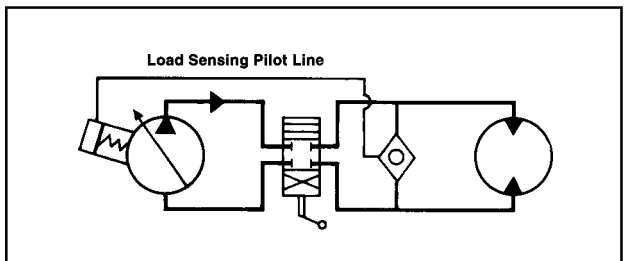
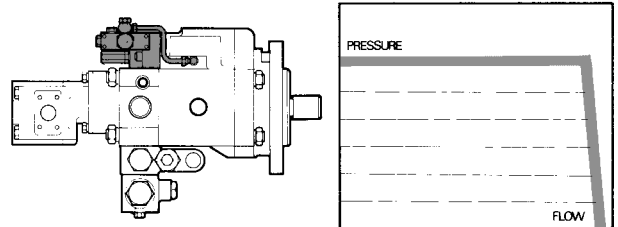
Load Sensing Control LS (Code 14)

A pressure compensated pump with the delivery pressure determined by an adjustable bias spring setting "no load" pressure plus the load pressure sensed from an external pilot line. The bias spring setting, typically 14 bar (200 psi), and the maximum pump delivery pressure, 14 bar (200 psi) to 345 bar (5000 psi), are independently adjustable.

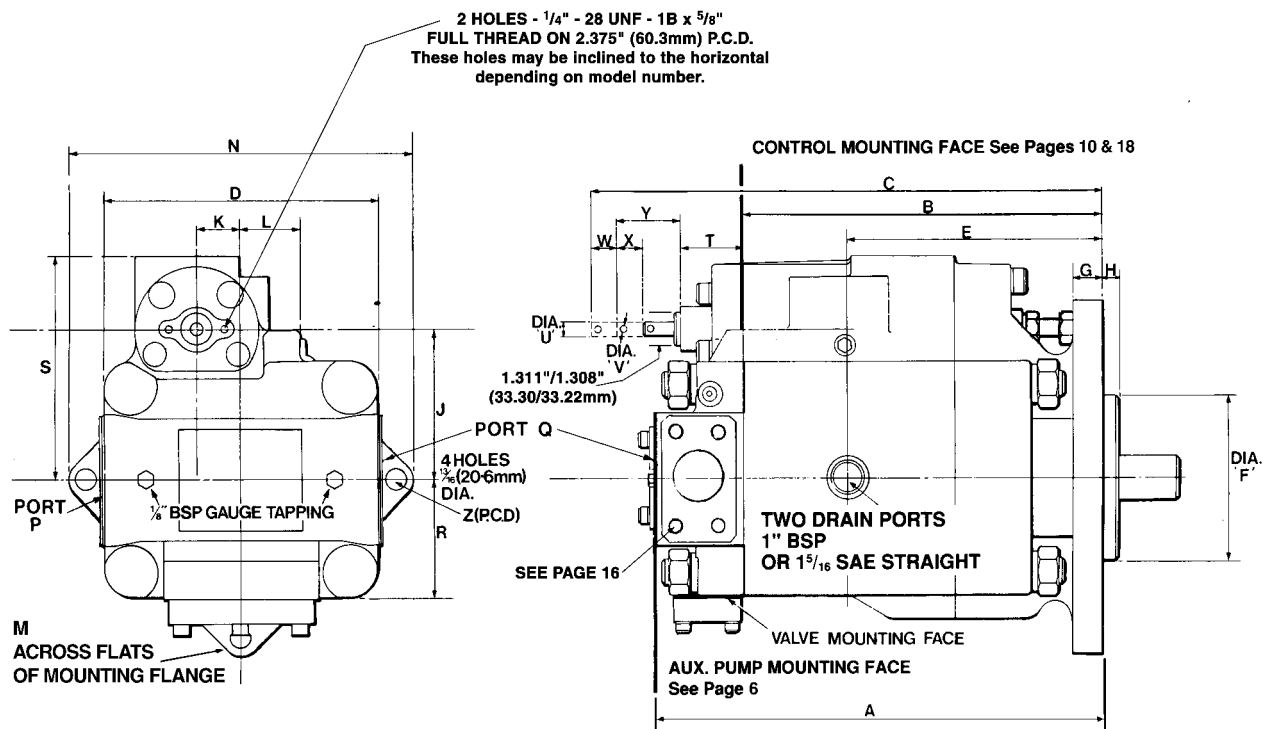
Principle of Load Sensing Control

Flow control is achieved by placing a flow control orifice in the pump output. The pressure drop across this orifice is the pressure that governs the pumps output flow. When the pressure drop across the orifice increases the pump will attempt to compensate by decreasing the output flow. Conversely the pump will attempt to increase flow when the pressure across the orifice decreases. The pump will always try to maintain a constant pressure drop across the flow control orifice. The flow will therefore remain the same regardless of the magnitude of the pressure in the system.

The flow will also remain relatively constant regardless of the drive speed of the pump within displacement and power limitations of the system.



Basic Manual Servo Unit



Flow Direction

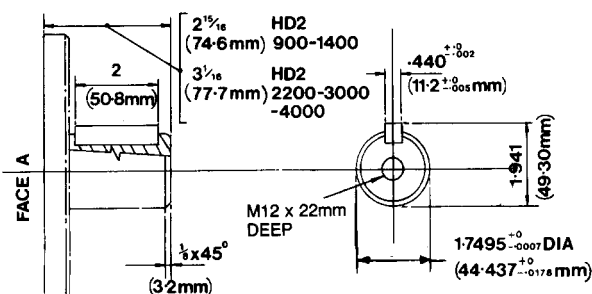
ROTATION LOOKING ONTO DRIVE SHAFT FROM PRIME MOVER	SWASH CONTROL	
	Out	In
Clockwise	P in Q out	P out Q in
Anticlockwise	P out Q in	P in Q out

On CD pumps fixed and CPM motors control is "out"
 On CPSV and TC pumps control is "in"
 Other types work both sides of centre.

All dimensions given are for rough scheming only.

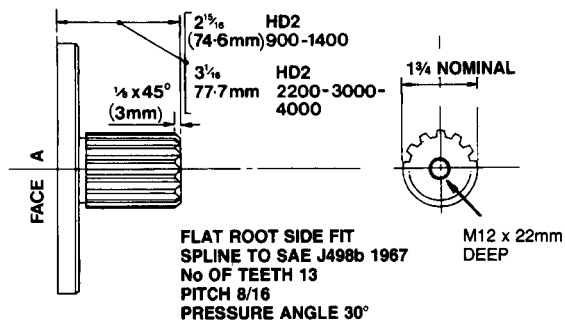
An official installation drawing should be obtained before commencing any detail design.

Input Shaft Details



B.S. 46 PART 1. 1958

Keyed Shaft

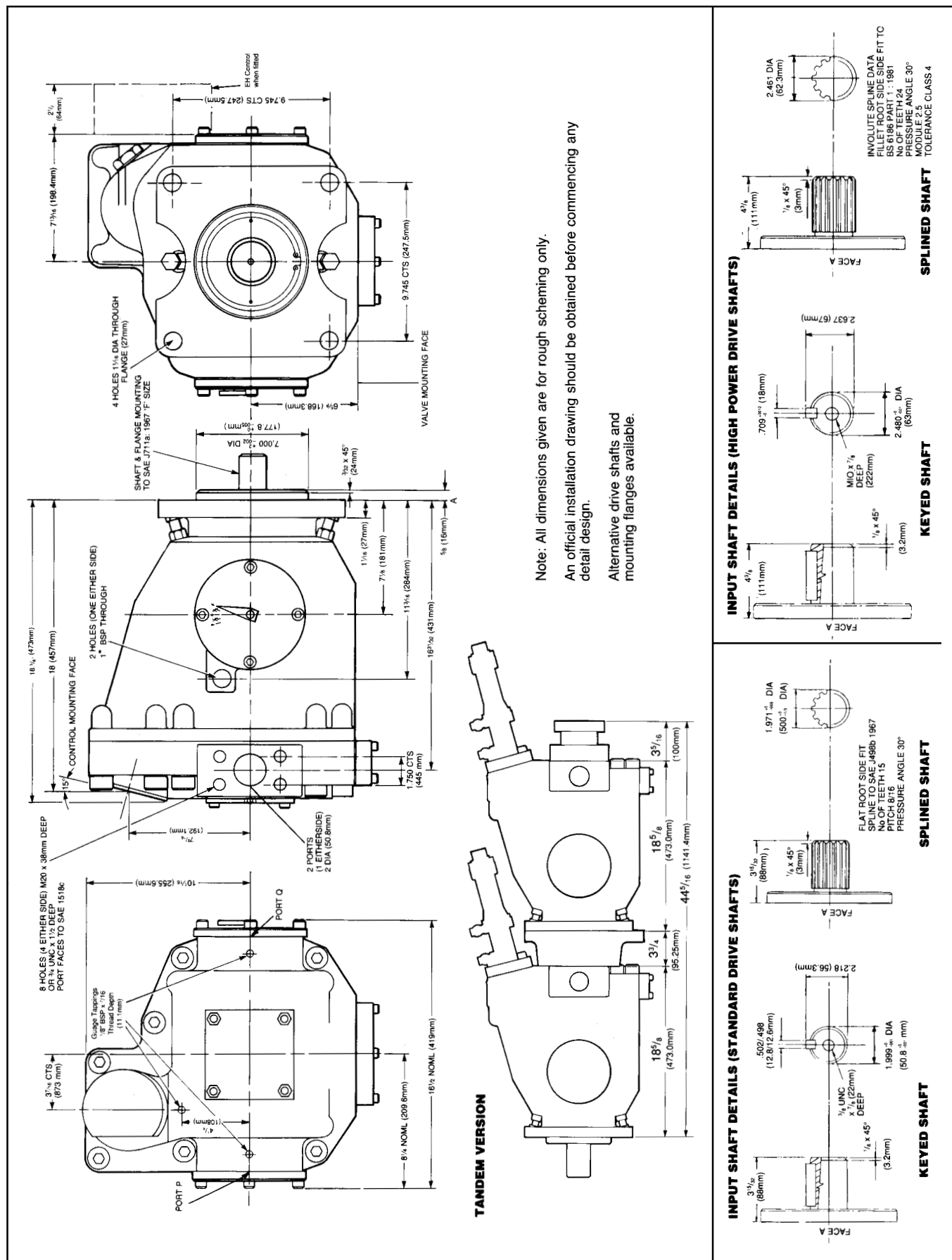


Splined Shaft

Symbol	HD2-900		HD2-1400		HD2-2200/3000/4000	
	mm	Inches	mm	Inches	mm	Inches
A	327	12.875	376.2	14.813	460.4	18.125
B	247.7	9.75	294.5	11.594	371.5	14.625
C	350.8	13.813	444.5	17.5	520.7	20.5
D	239.7	9.437	222.3	8.75	276.2	10.875
E	168.3	6.625	218.3	8.594	262.7	10.344
Dia. F	152.4 +0/-0.05	6.000 +0/-0.002	152.4 +0/-0.05	6.000 +0/-0.002	165.1 +0/-0.05	6.500 +0/-0.002
G	25.4	1	27.0	1.063	31.7	1.25
H	12.7	0.25	12.7	.5	15.9	.625
J	98.4	3.875	114.3	4.5	150.8	5.938
K	31.8	1.25	38.1	1.5	46.0	1.813
L	47.6	1.875	57.2	2.25	58.7	2.313
M	200	7.875	203.2	8	261.9	10.313
N	266.7	10.5	269.9	10.625	355.6	14
R	79.4	3.125	104.8	4.125	119.1	4.688
S	155.6	6.125	174.6	6.875	223.8	8.813
T	41.3	1.625	71.4	2.813	65.1	2.563
Dia. U	8.64 +/-0.13	.340 +/-0.005	12.69 +0/-0.02	.4997 +0/-0.0008	12.69 +0/-0.02	.4997 +0/-0.0008
Dia. V	2.4 +0.08 -0	.094 +0.003/-0	4.9 +0.08/-0	.192 +0.003/-0	4.9 +0.08/-0	.192 +0.003/-0
W	20.6	0.813	23.8	.938	31.8	1.25
X	20.6	0.813	23.8	.938	31.8	1.25
Y	41.3	1.625	59.5	2.434	53.2	2.094
Z (P.C.D.)	228.6	9.000	228.6	9.000	317.5	12.500
Mounting flange and drive	SAE D	Option SAE C 2 bolt	SAE D		SAE E	
Pressure Ports	2 x 1.25" BSP or 2 x 1.25" SAE62 0.5" UNC or M14		2" SAE62 0.75" UNC or M20		2" SAE62 0.75" UNC or M20	

The use of SAE standard mountings and drive shafts enables the HD2 range to be readily fitted to proprietary pump drive splitter gearboxes or to motor reduction gearboxes when high torque low speed drives are required.

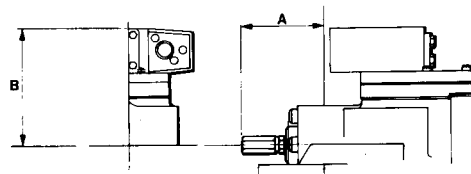
For the supply of the relevant port flanges use Code 70.



Control Dimensions

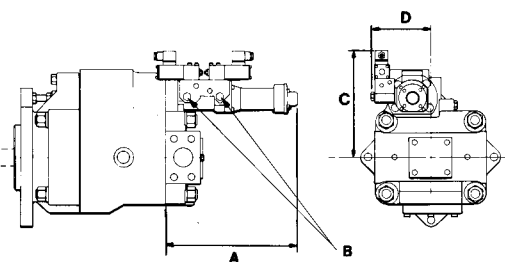
EH

Unit	In	A mm	In	B mm
HD900	3 ¹⁵ / ₁₆	100	5 ⁵ / ₁₆	136
HD1400	5 ⁵ / ₁₆	129	5 ⁵ / ₁₆	141
HD2200:				
3000:4000:	5 ⁵ / ₁₆	141	7 ¹ / ₁₆	179
6600				



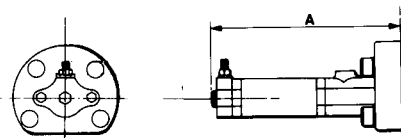
OCR/E/P
OCR/E/CHP
OCR/E/CHP/P

Unit	In	A mm	In	B mm	In	C mm	In	D mm
HD900	13 ⁵ / ₁₆	346	1/4 BSP	-			3 ³ / ₁₆	97
HD1400	13 ⁵ / ₁₆	344	1/4 BSP	-	4 ³ / ₄	120		
HD2200:								
3000:4000:	13 ¹¹ / ₁₆	348	1/4 BSP	-			MAX	
6600								



CD

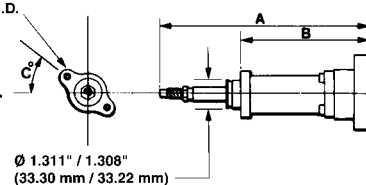
Unit	In	A mm
HD900	8 ³ / ₁₆	208
HD1400	8 ³ / ₁₆	277
HD2200:		
3000:4000:	8 ¹⁵ / ₁₆	227
6600		



MSNS

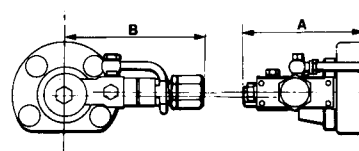
Unit	In	A mm	In	B mm	C°
HD900	9 ¹¹ / ₁₆	246	6	152	38°
HD1400	11 ¹ / ₁₆	282	7 ³ / ₁₆	182	50°
HD2200:					
3000:4000:	10 ⁵ / ₁₆	270	6 ¹⁵ / ₁₆	176	Zero
6600					

2 Holes - 1/4" - 28 UNF - 1B x 5/8" (16 mm)
 Full Thread on 2.375" (60.3 mm) P.C.D.



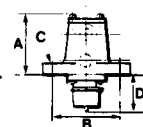
CPSV,
CPSVP,
CPM,
TC,LS

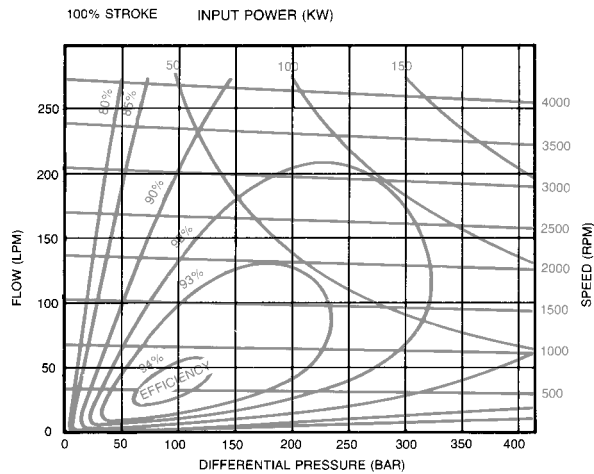
Unit	In	A mm	In	B mm
HD900	4 ²⁵ / ₃₂	122	5 ¹ / ₂	140
HD1400	5 ¹¹ / ₁₆	144	5 ⁷ / ₁₆	149
HD2200:				
3000:4000:	6 ³ / ₁₆	154	6 ⁹ / ₁₆	167
6600				



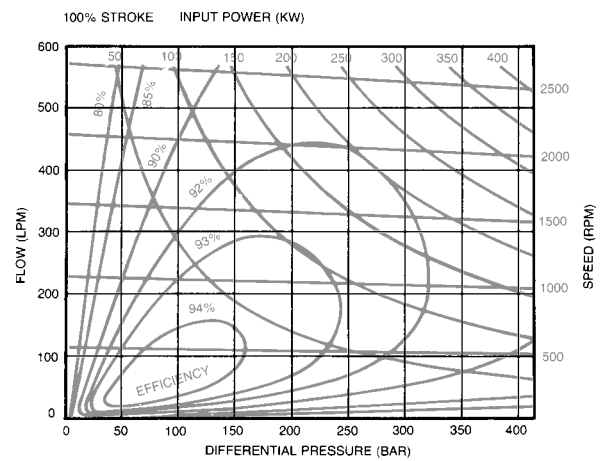
TC Sensor

Unit	In	A mm	In	B mm	In	C mm	In	D mm	FLANGE
HD900						(2 off)			
HD1400	2 ¹⁵ / ₃₂	62.7	2 ¹¹ / ₁₆	68.26	1 ³ / ₃₂	10.3	1 ¹⁷ / ₃₂	31	SAE
HD2200:									J535a
3000:4000:									
6600									

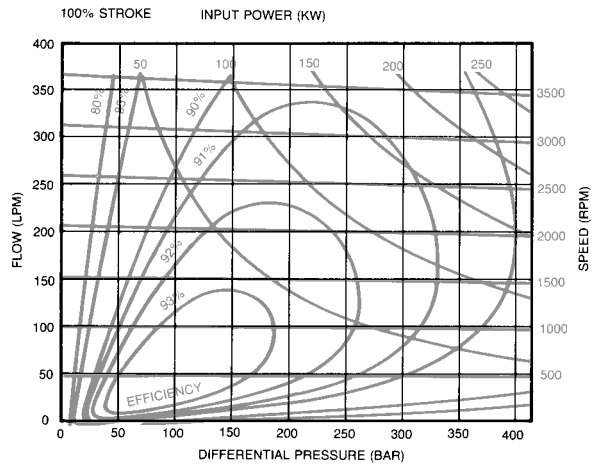




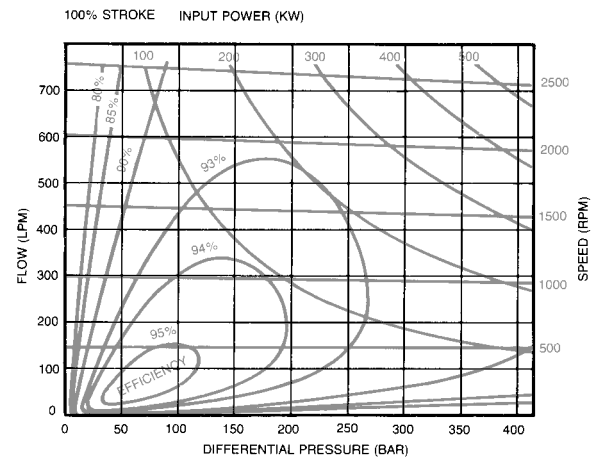
HD 2-900 Pump



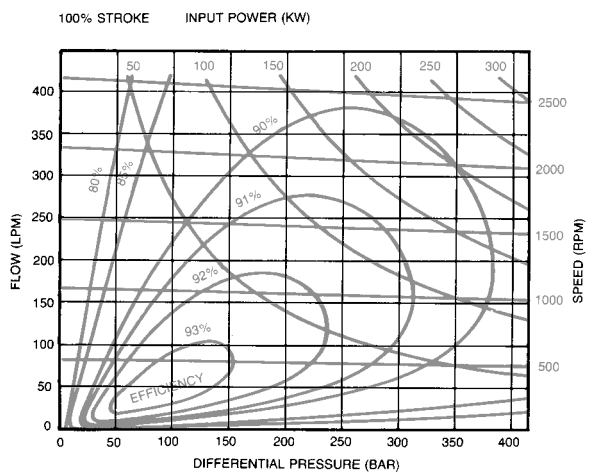
HD 2-3000 Pump



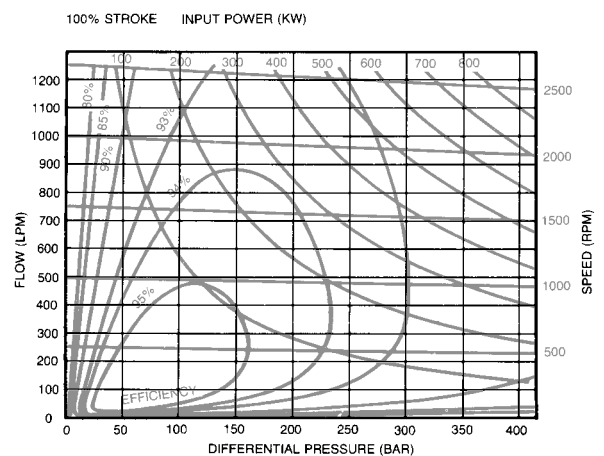
HD 2-1400 Pump



HD 2-4000 Pump

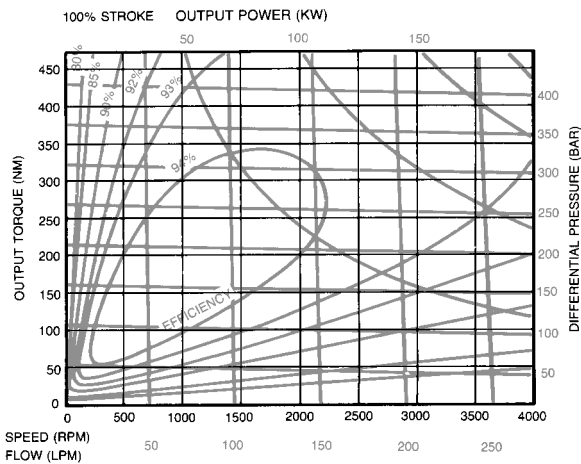


HD 2-2200 Pump

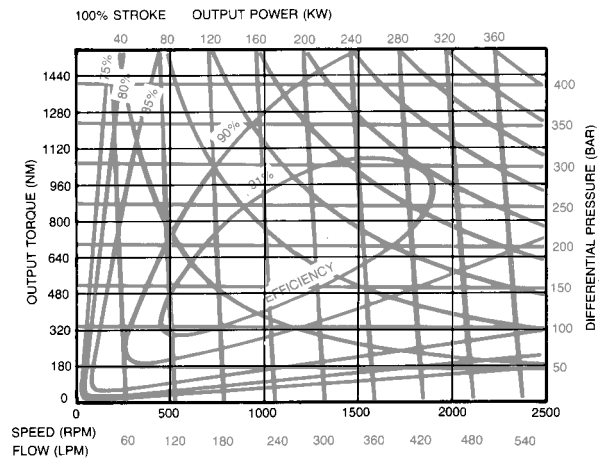


HD 2-6600 Pump

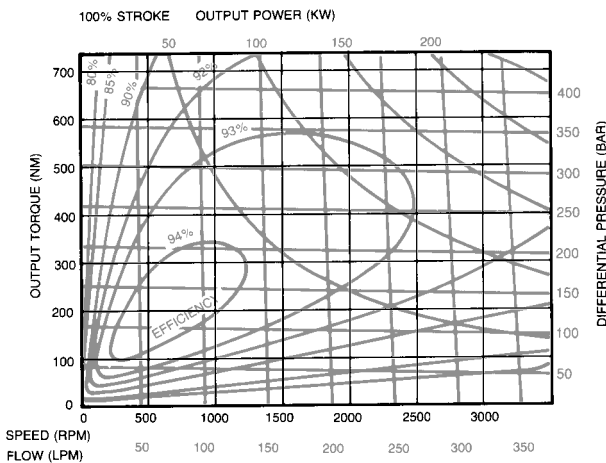
All curves show performance at full capacity.
 Inlet temperature 50°C.
 Oil viscosity 21 centistokes.(103SUS)



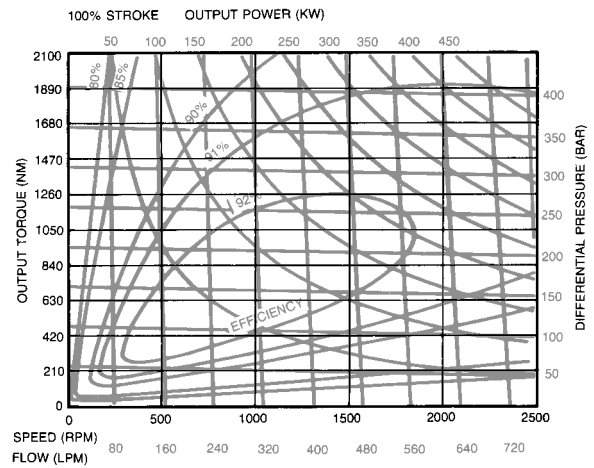
HD 2-900 Motor



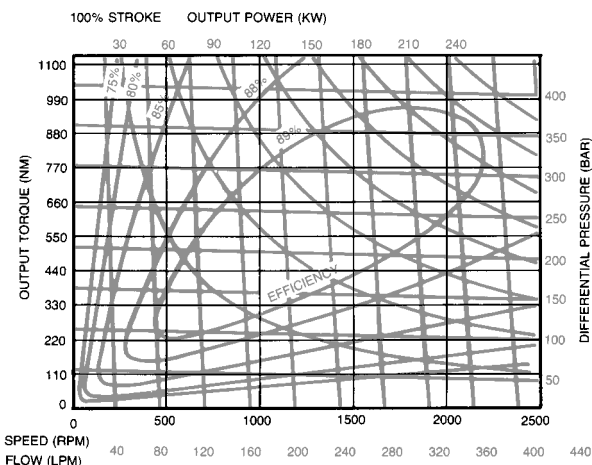
HD 2-3000 Motor



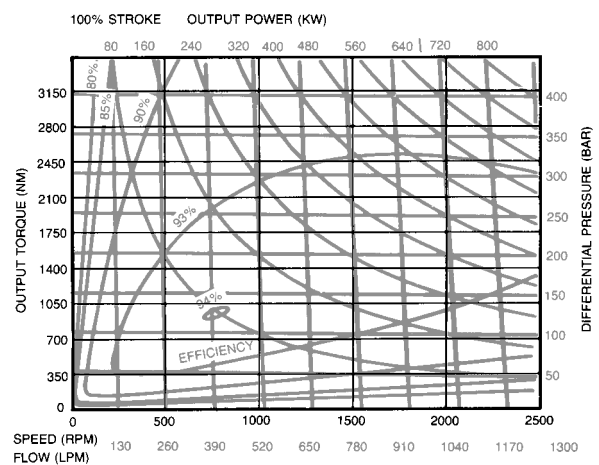
HD 2-1400 Motor



HD 2-4000 Motor



HD 2-2200 Motor



HD 2-6600 Motor

N.B.
 1 kW = 1.34 hp
 1 Nm = 0.74 lb ft
 1 l/min = 0.22 imp galls/min = 0.264 US galls/min
 1 bar = 14.5 lb/sq. in.

All curves show performance at full capacity.
 Inlet temperature 50°C.
 Oil viscosity 21 centistokes.(103SUS)

N.B. Motor Static Torques are 80% of Running Torques shown.

Ordering Code

Example: HD2/4000/5/20/31/35/51/P30 C 678 BE P0 15-7/ 80

HD2

Size
 900
 1400
 2200
 3000
 4000
 6600

Shaft
 20 Key Standard PTO
 20H Key HighPower PTO
 21 Spline Standard PTO
 21H Spline High Power PTO

High Pressure Relief Valve
 35

Auxiliary Pump Type Number
 70
 Inlet and outlet port flanges for main pump

Port Connections

Control
 1 SA
 2 MS
 3 MSNS
 4 MAMS
 5 OCR
 N5 5+ /E
 1A FIXED WEDGE
 5A OCR/CHP/P
 M5 5A+ /E
 5B OCR/P
 L5 5B+ /E
 5C OCR/CHP
 T5 5C+ /E
 5D OCRB/CHP/P
 5E OCRB/P
 5F OCR/EH
 5G OCR/EH/CHP/P
 5H OCR/EH/P
 5J OCR/EH/CHP
 6 CPSV
 6A CPR
 6B CPM
 6C TC
 6D CPSVP
 6E CPRP
 8 EH
 12 CD
 14 LS

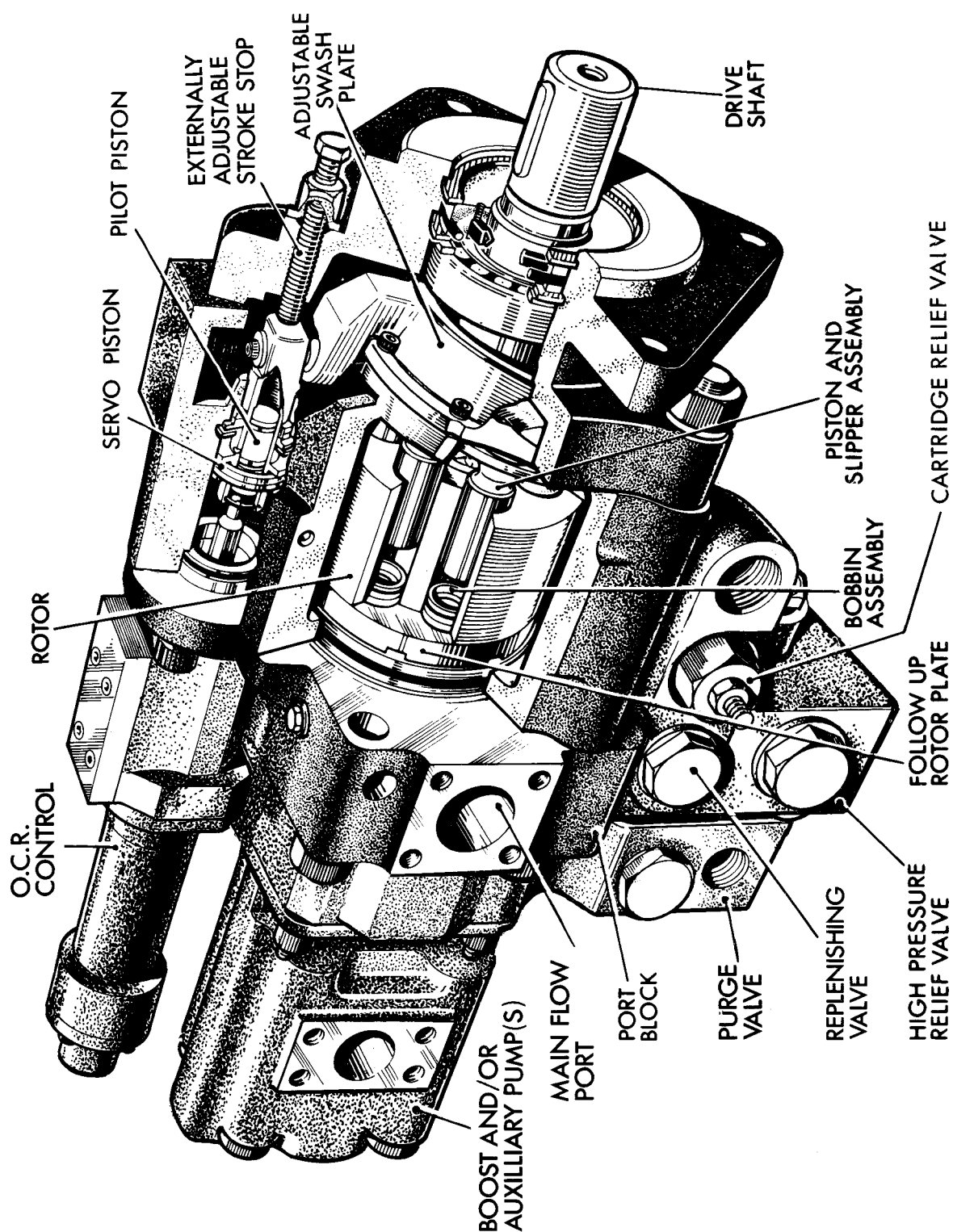
Replenishing Valve
 31
 31A LP. PORT Q
 HP. PORT P
 31B LP. PORT P
 HP. PORT Q

Auxiliary Pump Mounting
 41 3PA European Std.
 42 3.5PA European Std.
 43 4PA European Std.
 50 SAE "B" 2 and 4 Bolt
 51 SAE "C" 2 and 4 Bolt
 52 SAE "D" 2 and 4 Bolt
 53 SAE "B" 4 Bolt with purge HD2-900 only
 54 SAE "C" 4 Bolt with purge HD2 1400 to 6600 only
 55 PM60
 56 SAE E / To suit HD2 - 2200/4000
 57 SAE F / To suit HD2 - 6600

Ancillary items
 75 Temperature sensor for use with TC pump (35°C to 60°C)
 76 Temperature sensor for use with TC pump (60°C to 100°C)

Port Connections
 82
 PREFERRED STANDARD BSP PORTS + UNC THREADS
 ALTERNATIVE OPTIONS.
 81
 BSP + METRIC THREADS
 80
 METRIC STRAIGHT O RING BOSS ISO 6149 + METRIC THREADS
 83
 S.A.E. STRAIGHT O RING BOSS + UNC THREADS

Advise any special features if required







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