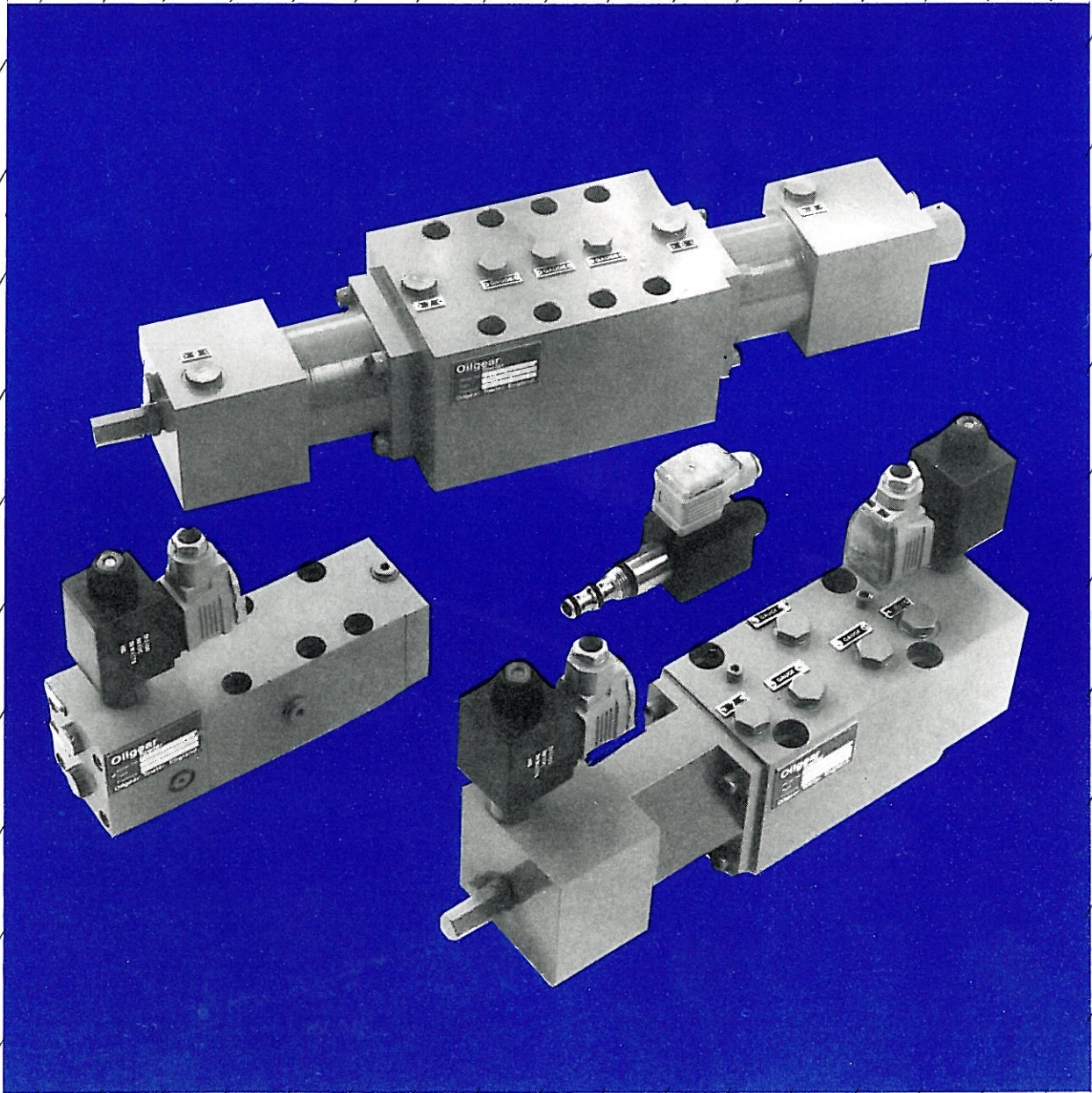


Oilgear Towler

VD★
DIRECTIONAL CONTROL VALVES.



Bulletin 80302

PERFORMANCE ASSURANCE IS STANDARD WITH EVERY OILGEAR TOWLER COMPONENT AND SYSTEM.

Every Oilgear Towler directional control valve manufactured is shipped with a corporate commitment to support the component until it performs as specified.

This total dedication to performance is based upon experience gained since 1921 in matching fluid power equipment to a tremendous variety of machines and applications.

Performance Assurance is made possible because of experience gained over the years in supplying machinery builders and users with unique solutions to thousands of unusual fluid power problems.

Historically, Oilgear Towler has concentrated its energies on hydraulic equipment and systems. Every facility is staffed with factory trained and field experienced application engineers.

Performance Assurance doesn't stop with the design of the system or the sale of the component. Oilgear Towler engineers will be there, when they are needed, supplying the technical support, field service, parts and repairs, to make sure each component or system operates correctly.



You the customer and user of the equipment, have a vital role to play in ensuring that components and systems are installed, operated and maintained in accordance with our recommendations. By doing this you will help us to achieve Performance Assurance, to our mutual benefit.

A major cause of damage to any system or component is FLUID CONTAMINATION. We take great care in specifying filtration in systems we design and for individual components. You are requested to consult our bulletin "General Guidelines for Filtration and Contamination" and contact us if you have any questions.

Data and information in this document may be changed at any time without notification, to incorporate new developments.

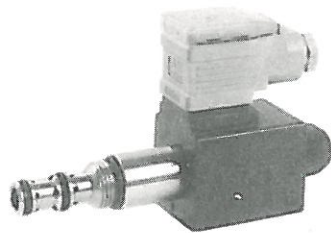
You are strongly recommended to check with Oilgear Towler that you have up-to-date information when designing with, specifying or purchasing equipment.

The final selection of components for use in systems and compliance with all operational, performance and safety requirements is the responsibility of the user.



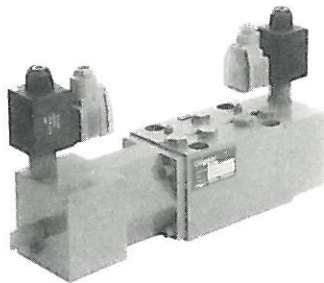
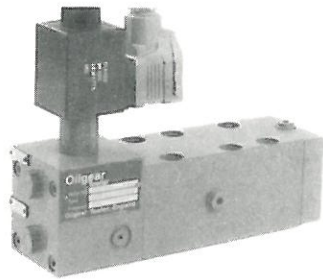
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DIRECTIONAL CONTROL VALVES.



Internationally known as a world class hydraulics company, Oilgear Towler specialises in the design, engineering technology and equipment needed to solve difficult hydraulic problems by supplying the right components to meet specific needs.

This wide range of directional control valves is part of Oilgear Towler extensive range of hydraulic components. Collectively they present a range of valves from which to choose. Individually, each has a distinct application advantage.



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TRADITIONAL RANGE

VD** (Solenoid & Pilot operated four port 02T)

Manifold Mounted

10 - 11

VD** (Solenoid & Pilot operated five port (with check) 04U)

Manifold Mounted

12 - 13

VDPO (Pilot operated 12T)

Manifold Mounted

14 - 15

DIMENSIONAL DATA

General Overall Dimensions with Mounting Patterns and Centres

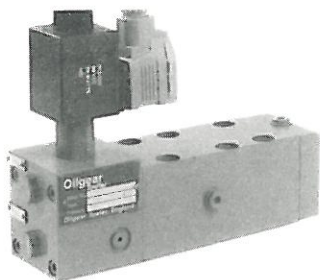
16 - 19

DIRECTIONAL CONTROL VALVES.

PRINCIPLE OF OPERATION & DESIGN FEATURES.

The range of directional control valves used by Oilgear Towler is extensive, but can be sensibly grouped into a small number of categories which are easily defined.

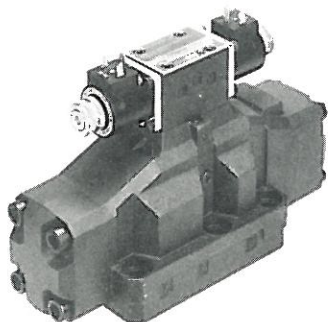
Group 1.



This series of valves has been designed for pressures up to 700 bar for surface mounting using a suitable mounting pattern which is not to an internationally recognised standard. The valves are of steel construction and are fitted with spools with a much smaller clearance and longer lap than those used in groups 2 & 3. These valves incorporate many advantageous features which are not available in other ranges, and which can allow a hydraulic system to be created using a minimum of other controls.

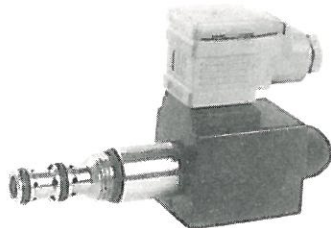
This Bulletin describes valves in this range.

Group 2.



Those valves which are surface mounting using a mounting pattern to I.S.O 4401, and usually of high grade iron construction. Maximum working pressure of valves of this group is in the order of 350 bar, with flow ratings up to 2,000 litres/minute. The valves can be operated by mechanical devices, solenoids, or hydraulic fluids and combinations of them. Proportionally controlled valves are also available in this group.

Group 3.



Those cartridge valves designed to fit into manifolds generally incorporating a screw thread on the sleeve to retain the valve in the manifold. Working pressures up to 500 bar and flow ratings up to 1,000 litres/minute are possible. Operators are as group two. One valve from this group, used as a pilot valve on two stage valves is described in this bulletin.

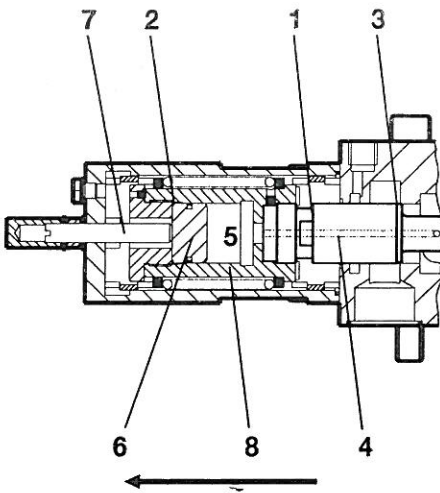
DIRECTIONAL CONTROL VALVES.

PRINCIPLE OF OPERATION & DESIGN FEATURES.

Pilot Operation.

This range of valves is specially designed to use a low pressure pilot supply to actuate the valves, and so as this is usually independent of the main system, more constant long term performance is achieved. Solenoid valves are therefore not working at their upper limit and consequently do not suffer malfunction or stalling from the effects of flow and pressure, and internal leakage within the pilot system is low.

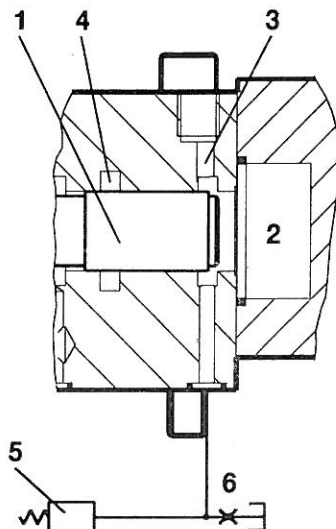
Decompression - sizes 4 & 12.



Direction of spool movement for Decompression.

Decompression can be controlled automatically through the main spool (1) of two stage directional control valves which are fitted with a suitable device (2) within the valve assembly. The device controls the movement of the spool (1) so that the spool will move quickly to the decompression position (3), pause until decompression is complete, and then continue quickly to its fully operated position. Adjustment is provided to control the rate of decompression. The device operates at the optimum rate with high or low pressures in the system, such that the decompression time is related to pressure. The pressure to be decompressed is fed through a hole (4) in the centre of the spool (1) to the cylinder (5) mounted to the spool. This pressure pushes the small piston (6) outwards to its stop (7). The cylinder (8) moves with the spool (1) until the piston (6) contacts the adjusting screw (7), at which point the spool (1) will stop as the force applied to the other end of the spool (1) by pilot pressure will be less than that of the high pressure on the piston (6). The position at which the spool stops is adjusted by the screw (7) to give an opening (3) over the main spool (1) to give the required rate of decompression. The spool (1) is machined so that during the pause for decompression all other flow paths through the valve are as given in the centred spool position.

Sequence - sizes 4 & 12.

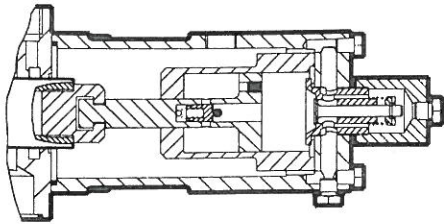


Extra ports are machined in the valve block near each end, in a position such that when the main directional valve spool (1) almost reaches its final operated position a flow path is created to allow pilot fluid (2) to pass to the sequence port (3). The spool (1) is machined such that flow paths are correctly created through the main galleries (4) of the valve before connecting the sequence port (3) to pilot fluid (2). The sequence port (3) can then be suitably hydraulically connected to other valves (5) in the system which are then operated by the pilot flow from this directional control valve, thus ensuring an automatic system timing without using additional controls and solenoids. If required the sequence port can be connected to electrical devices such as pressure switches which can then signal that the directional control valve spool has almost reached final position. In both cases a small reset orifice (6) connected to tank is required between the sequence port (3) of the directional valve and the device it operates, to allow it to return to its normal position, as in neutral position the directional sequence port will be closed.

DIRECTIONAL CONTROL VALVES.

PRINCIPLE OF OPERATION & DESIGN FEATURES.

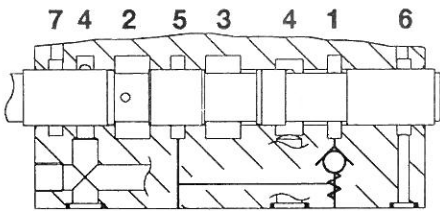
Anti-surge damping, size 12 only.



Direction of spool movement for Anti Surge Damping.

The size 12 valve is capable of passing relatively high flows at high pressure, and can, if operating speed is uncontrolled, create large shocks in the system. The normal and simple method used on most large directional control valves slows the spool movement over the full stroke of the valve, or involves some kind of electrically proportional control. An anti-surge device can be fitted to the size 12 valve which will automatically allow quick spool movement over the stroke, except at the port opening position of the spool where speed is controlled to reduce the shock. Full speed is available before and after this position so reducing the delay to a minimum. The device is not externally adjustable.

Unloading - sizes 4.



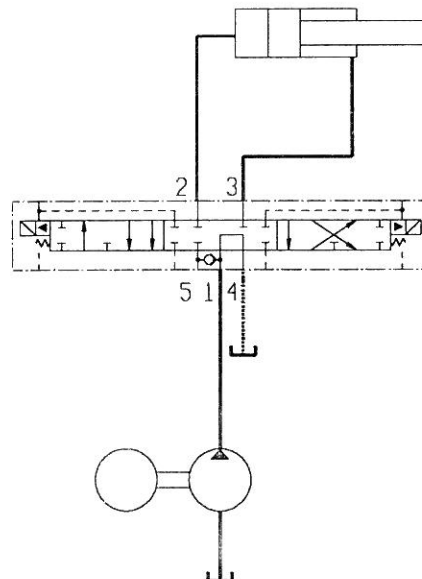
Unloading or constant pressure porting size 4 only.

Valves are available with "series unloading" ports and integral check valve. The spool is manufactured so that correct phasing of the flow direction is assured, with the pump unloading port closing after the main flow path is established, and the built-in check preventing reverse flow from the system passing through to tank or other parts of the system.

This valve can also be fitted with the decompression device from page 5, to control decompression of port 2.

This feature is regularly used in three different ways shown below :-

Pump Unloading.



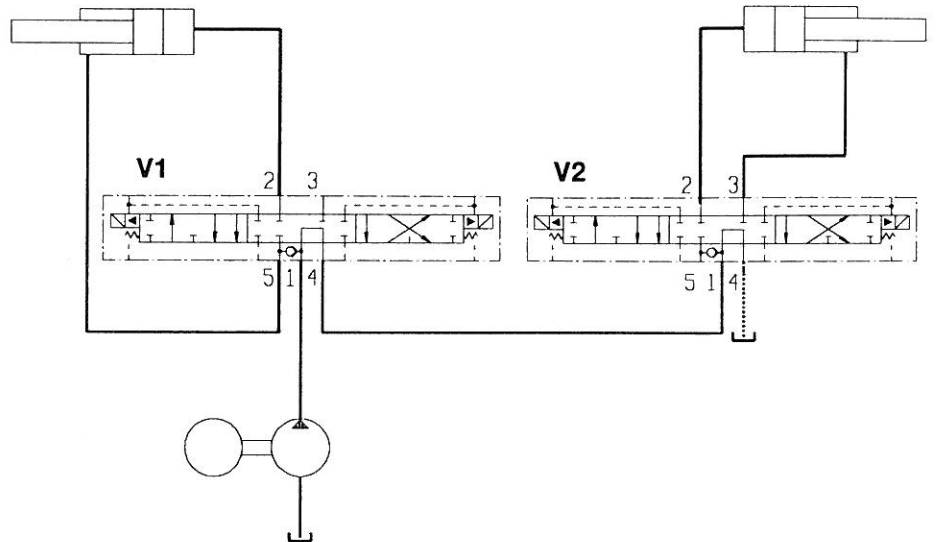
DIRECTIONAL CONTROL VALVES.

PRINCIPLE OF OPERATION & DESIGN FEATURES.

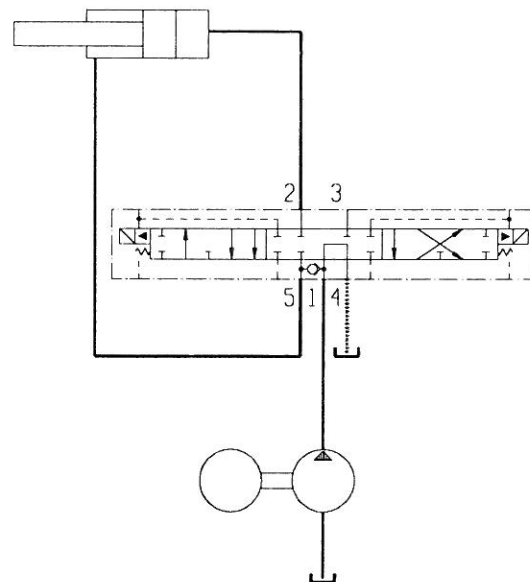
Series unloading.

This valve V1 must be externally drained.

Pilot code "U".



Constant pressure / Regenerative.



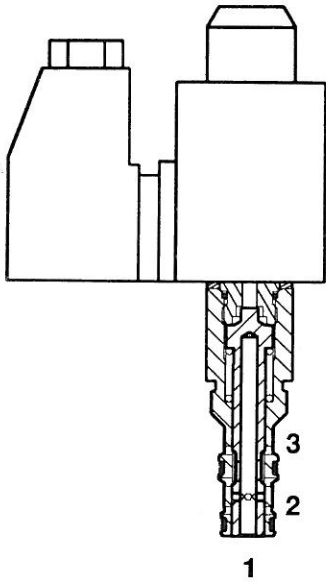
Note :- These circuit diagrams are only representative, and various safety features which are required are not shown in order to, more clearly demonstrate how the directional control valve is used.

DIRECTIONAL CONTROL VALVES.

PILOT VALVE DIRECTIONAL CONTROL

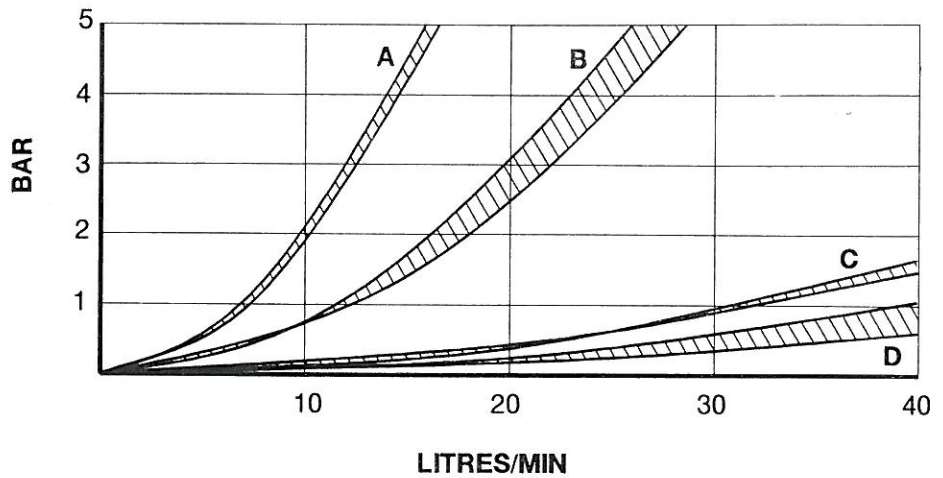
SOLENOID OPERATED SCREW IN CARTRIDGE

PERFORMANCE DATA.



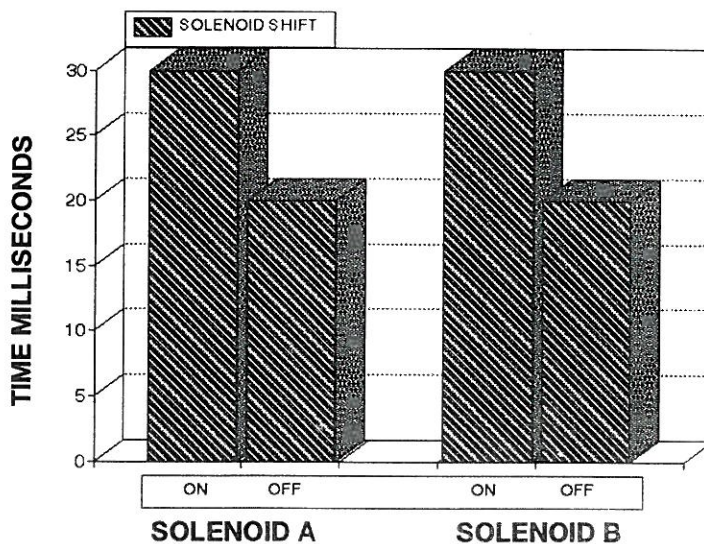
VDSHS02H3 - **A1ND**NBBA1
PILOT VALVE

All testing generally in accordance with BS4062 part 1. "Fluid" - mineral oil, 32 centistokes at 40°C.



- Curve A = (3J spool), flow 3 - 2 (valve and block).
(3K spool), flow 2 - 1, 3 - 2 (valve and block).
- Curve B = (3J spool), flow 2 - 1 (valve and block).
- Curve C = flow 3 - 2 (block only).
- Curve D = flow 2 - 1 (block only).

Maximum Pressures (bar)	
Port 1	70
Port 2	70
Port 3	70



Note:- Switching times for "off" will increase substantially if diodes are used to prevent back emf voltage surges, or rectifiers are fitted in cap. Allow 100m/s for solenoid shift at switch off.

DIRECTIONAL CONTROL VALVES.

PILOT VALVE DIRECTIONAL CONTROL SOLENOID OPERATED SCREW IN CARTRIDGE HOW TO ORDER.

Block Number	1	2	3	4	5	6		7	8	9	10	11	12	13	14	15	16
Explanation																	
Valve Example	V	D	SH	S	02	H3	—	3J	A1	N	D	*	*	N	B	*	A1

1 UNIT

V Valve

2 BASIC FORM

D Directional

3 VALVE TYPE

SH Solenoid Push

4 SPOOL

S Metal Lap

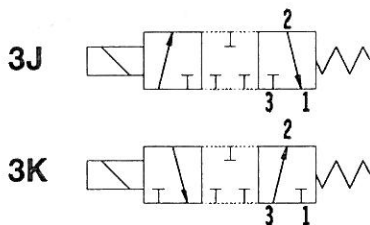
5 NOMINAL SIZE

02 6mm

6 MOUNTING PATTERN

H3 Hydrostack cavity 3 Port

7 SPOOL FUNCTION



8 WORKING POSITION

A 2 Position

SPRING ACTION

1 Spring return to "0"

9 SPECIAL END "a"

N None

10 SOLENOID TYPE

D DC wet pin, 210 bar tube

11 & 12 VOLTAGE AND CAP

Voltage and cap	**
110V AC with lamp and rectifier	AA
250V AC with lamp and rectifier	CA
24V DC with lamp	JL
98V DC with lamp	PL

Other voltages by request.

13 ORIFICE POSITION

N No choke fitted

14 DIMENSIONS

B Metric with BSP fittings

15 SEALS

B Buna N

V Viton

E E.P.D.M

Z Special

16 DESIGN SERIES

A1 Assigned by factory

Spool **3K** is used in a standard pilot valve for 02T.

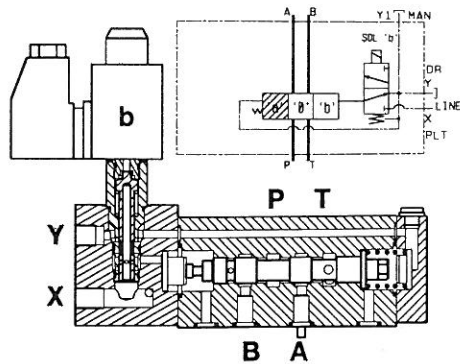
Spool **3J** is used in a standard pilot valve for 04U.

NOTE:- This valve when used as a pilot valve for valves described in this bulletin should be only used at the maximum pilot pressure shown for each 2 stage valve. The valve is capable of working at pressures up to 350 bar. Consult Oilgear Towler for data at these higher pressures.

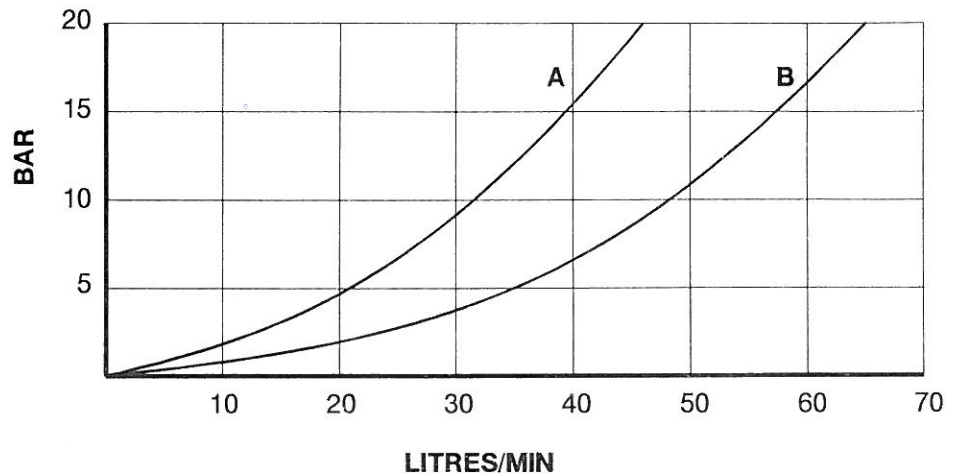
DIRECTIONAL CONTROL VALVES. 02T

PILOT OPERATED FOUR PORT
 MAXIMUM WORKING PRESSURE 700 BAR
 PERFORMANCE DATA.

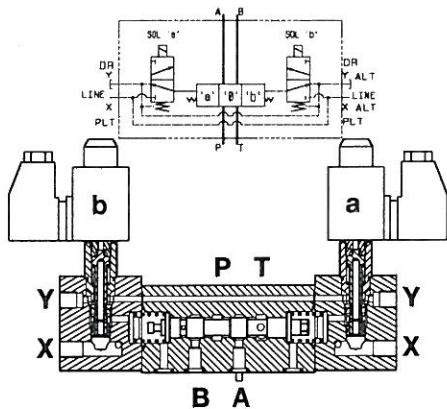
(H2)



All testing generally in accordance with BS4062 part 1. "Fluid" - mineral oil, 32 centistokes at 40°C.



VDPSS02T - 01B1NNFNBBB1 /
 VDSHS02H3-3KA1ND**NBBA1
SINGLE SOLENOID PILOT VALVE



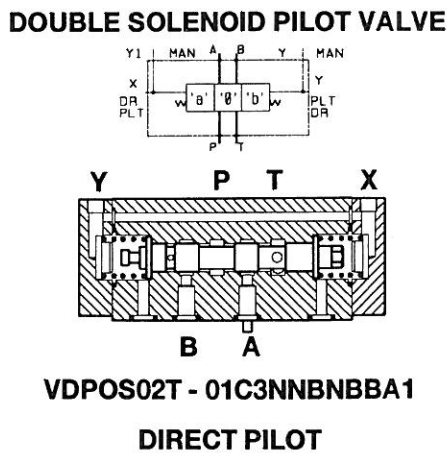
Curve A = flow P - T.
 flow B - T.

Curve B = flow P - A.
 flow P - B.
 flow A - T.

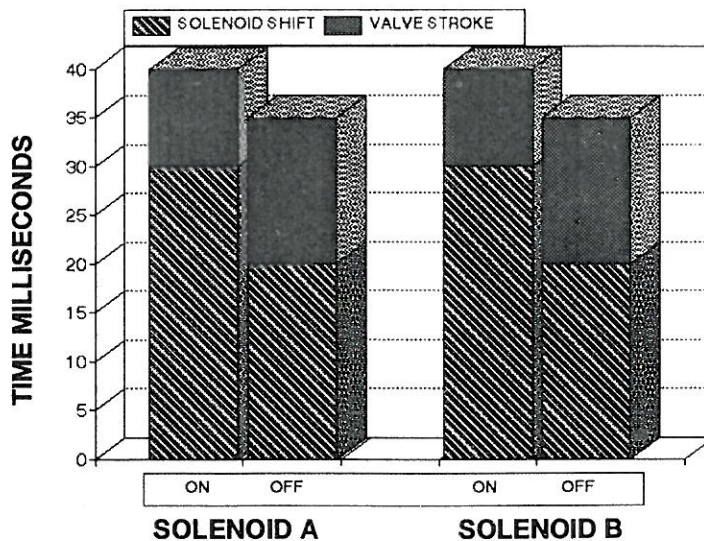
VDPSS02T - 01C1NNDNBBA1 /
 VDSHS02H3-3KA1ND**NBBA1
DOUBLE SOLENOID PILOT VALVE

Pilot pressure (bar)	
Minimum	17
Recommended	35
Maximum	50

Volume of Pilot fluid required for both directions from mid position	
02T	1 cm ³



VDPOS02T - 01C3NNBNBBB1
DIRECT PILOT



Maximum Pressures (bar)	
Port P, A, B	700
Pilot X, Y	50
Drain T	350

Note:- Switching times for "off" will increase substantially if diodes are used to prevent back emf voltage surges, or rectifiers are fitted in cap. Allow 100m/s for solenoid shift at switch off.

DIRECTIONAL CONTROL VALVES. 02T

PILOT OPERATED FOUR PORT
 MAXIMUM WORKING PRESSURE 700 BAR
 HOW TO ORDER.

(H2)

Block Number	1	2	3	4	5	6		7	8	9	10	11	12	13	14	15
Explanation																
Valve Example	V	D	**	S	02	T	—	**	**	N	N	*	N	B	*	A1

1 UNIT

V Valve

2 BASIC FORM

D Directional

3 VALVE TYPE

PS Solenoid Pilot

PO Direct Pilot

4 SPOOL

S Metal Lap

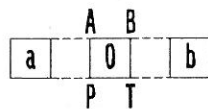
5 NOMINAL SIZE

02 6mm

6 MOUNTING PATTERN

T House Standard

7 SPOOL FUNCTION



* SPOOL 11, 53, 59 LIMITED TO 350 BAR.

8 WORKING POSITION

A 2 Position



B 2 Position



C 3 Position



SPRING ACTION

1 Spring return to "0"

9 SPECIAL END "a"

N None

10 SPECIAL END "b"

N None

11 PILOT CONNECTIONS

B External Pilot & Drain with external tapings

D Internal Pilot & Drain

F External Pilot & Internal Drain

12 EXTRAS

N None

13 DIMENSIONS

B Metric with BSP Port threads

14 SEALS

B Buna N

V Viton

E E.P.D.M

Z Special

15 DESIGN SERIES

A1 Assigned by factory

/ Pilot valve required see page 9

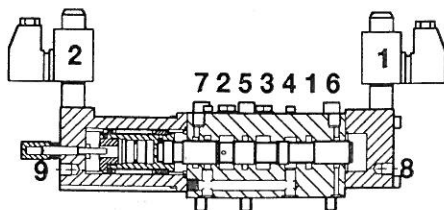
VDSHS02H3 - 3KA1ND**NBBA1

DIRECTIONAL CONTROL VALVES. 04U

SOLENOID PILOT & PILOT OPERATED
 FIVE PORT WITH CHECK VALVE
 MAXIMUM WORKING PRESSURE 500 BAR
 PERFORMANCE DATA.

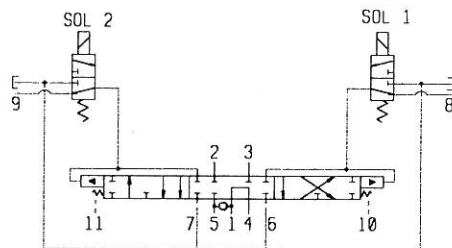
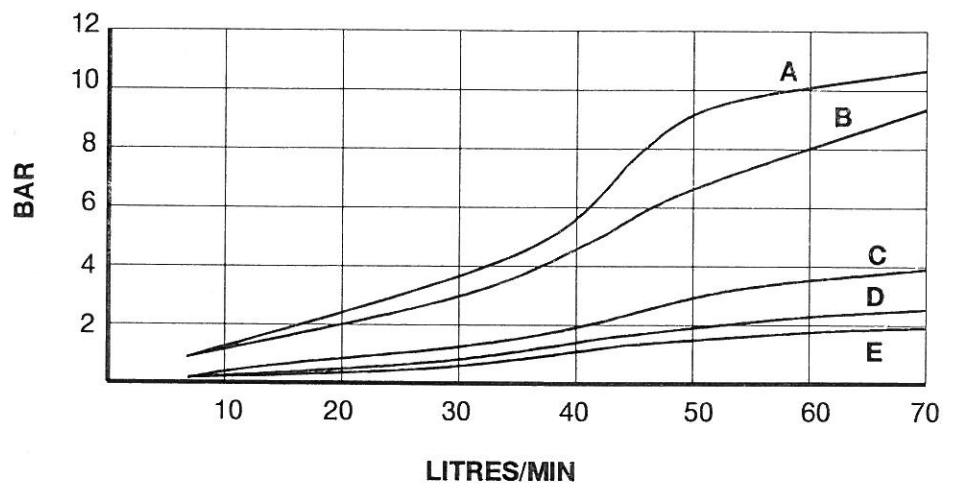
(No. 4)

All testing generally in accordance with BS4062 part 1. "Fluid" - mineral oil, 32 centistokes at 40°C.



VDPSS04U - 98C1DNTNBBA1 /
 VDSHS02H3-3KA1ND**NBBA1

SOLENOID VALVE WITH
 DECOMPRESSION SEQUENCE
 PORTS.



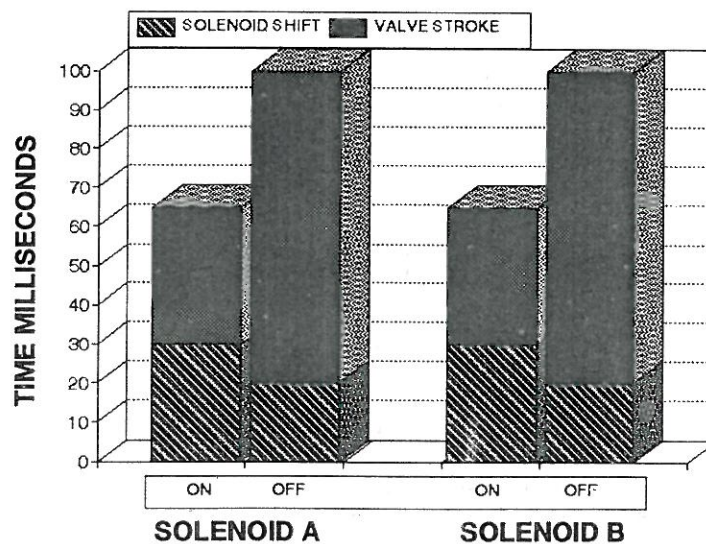
- Curve A = flow 1 - 2.
 flow 1 - 3.
- Curve B = flow 1 - 5.
- Curve C = flow 2 - 4.
- Curve D = flow 3 - 4.
- Curve E = flow 1 - 4.

Maximum Pressures (bar)	
Port 1, 2, 3, 4, 5	500
Pilot 6, 7, 8, 9	50
Drain 10, 11	50

Internal pilot drain is through port 4.
 In this case port 4 maximum pressure
 is 30 bar less than pilot pressure.

Volume of Pilot fluid required for both directions from mid position	
04U	7 cm ³

Pilot pressure (bar)	
Minimum	17
Recommended	35
Maximum	50



Note:- Switching times for "off" will increase substantially if diodes are used to prevent back emf surges, or rectifiers are fitted in cap. Allow 100m/s for solenoid shift at switch off.

These times do not include decompression delay.

DIRECTIONAL CONTROL VALVES. 04U
SOLENOID PILOT & PILOT OPERATED
FIVE PORT WITH CHECK VALVE
MAXIMUM WORKING PRESSURE 500 BAR
HOW TO ORDER.

(No. 4)

Block Number	1	2	3	4	5	6		7	8	9	10	11	12	13	14	15
Explanation																
Valve Example	V	D	**	S	04	U	—	**	C1	D	N	*	N	*	*	A1

1 UNIT

V Valve

2 BASIC FORM

D Directional

3 VALVE TYPE

PS Solenoid Pilot

PO Direct Pilot

4 SPOOL

S Metal Lap

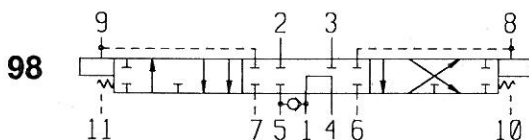
5 NOMINAL SIZE

04 12mm

6 MOUNTING PATTERN

U House Standard, 5 Port and check valve in Port 1.

7 SPOOL FUNCTION



8 WORKING POSITION

C 3 Position

SPRING ACTION

1 Spring return to "0"

9 SPECIAL END "a"

D Decompression

N None

10 SPECIAL END "b"

N None

11 PILOT CONNECTIONS

T External Pilot and Drain with line alternative and phased sequence

U Internal Pilot and Drain and phased sequence

12 EXTRAS

N None

13 DIMENSIONS

B Metric with BSP Port threads

14 SEALS

B Buna N

V Viton

E E.P.D.M

Z Special

15 DESIGN SERIES

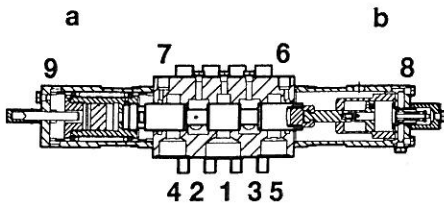
A1 Assigned by factory

/ Pilot valve required see page 9

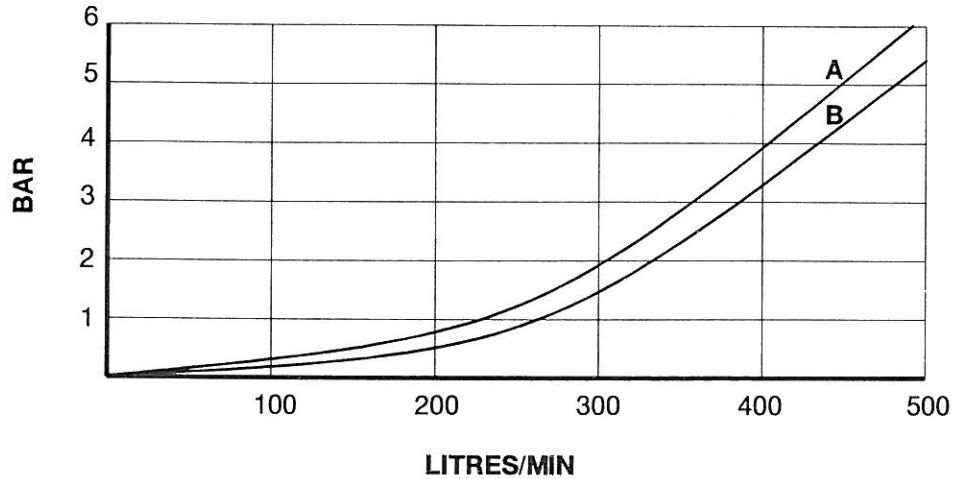
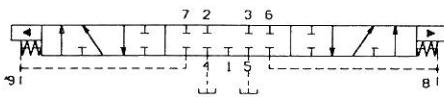
VDSHS02H3 - 3JA1ND**NBBA1

NOTE:- There are available, for spares or special order only, a similar valve range to these which are nominally 4 port valves, mounting pattern 04T. Consult Oilgear Towler for further details.

All testing generally in accordance with BS4062 part 1. "Fluid" - mineral oil, 32 centistokes at 40°C.



VDPOS12T - **C1JDTNBBA1
No12. PILOT VALVE



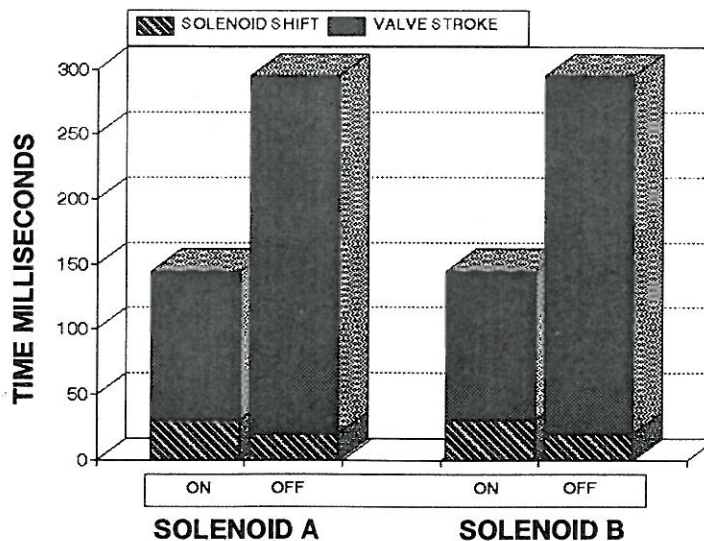
Curve A = flow 2 - 4.
 flow 3 - 5.
Curve B = flow 1 - 2.
 flow 1 - 3.

Typical timing diagram with VDSH separately mounted pilot valve.

Maximum Pressures (bar)	
Port 1, 2, 3	500
Ports 4, 5	100
Ports 6, 7, 8, 9	50

Volume of Pilot fluid required for both directions from mid position	
12T	24 cm ³

Pilot pressure (bar)	
Minimum	17
Recommended	35
Maximum	50



Note:- Switching times for "off" will increase substantially if diodes are used to prevent back emf voltage surges, or rectifiers are fitted in cap. Allow 100m/s for solenoid shift at switch off.

These times do not include decompression or damping delay.

DIRECTIONAL CONTROL VALVES. 12T

Block Number	1	2	3	4	5	6		7	8	9	10	11	12	13	14	15
Explanation																
Valve Example	V	D	PO	S	12	T	—	**	C1	*	*	T	N	*	*	A1

1 UNIT

V Valve

2 BASIC FORM

D Directional

3 VALVE TYPE

PO Direct Pilot

4 SPOOL

S Metal Lap

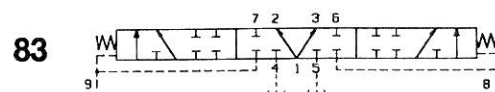
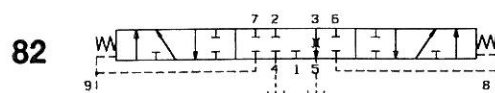
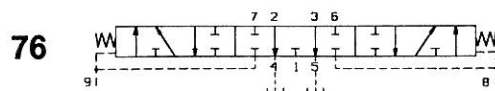
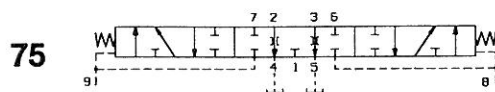
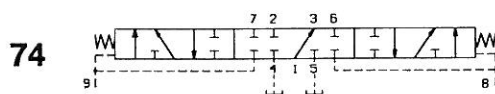
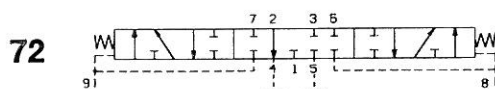
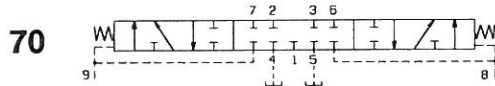
5 NOMINAL SIZE

12 38mm

6 MOUNTING PATTERN

T House Standard

7 SPOOL FUNCTION



8 WORKING POSITION

C 3 Position

SPRING ACTION

1 Spring return to "0"

9 SPECIAL END "a"

D Decompression

10 SPECIAL END "b"

J Damping and check

N None

11 PILOT CONNECTIONS

T External Pilot with line alternative and phased sequence

12 EXTRAS

N None

13 DIMENSIONS

B Metric with BSP Port threads

14 SEALS

B Buna N

V Viton

E E.P.D.M

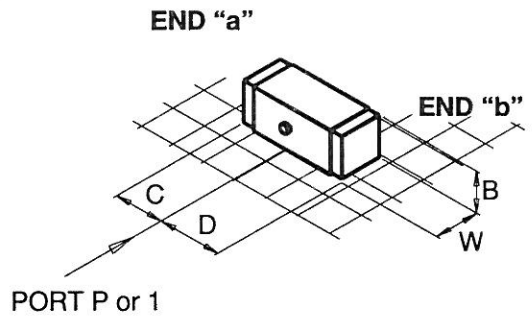
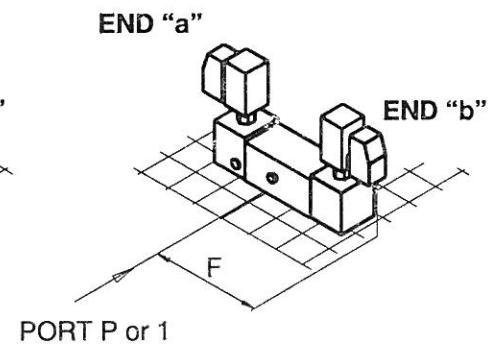
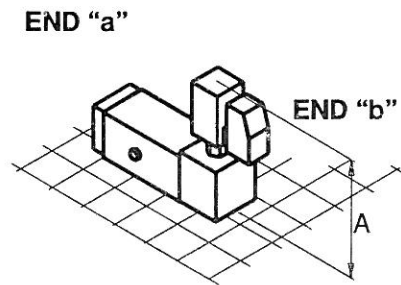
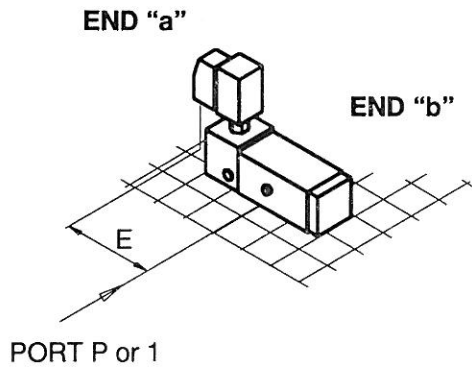
Z Special

15 DESIGN SERIES

A1 Assigned by factory

DIRECTIONAL CONTROL VALVES.

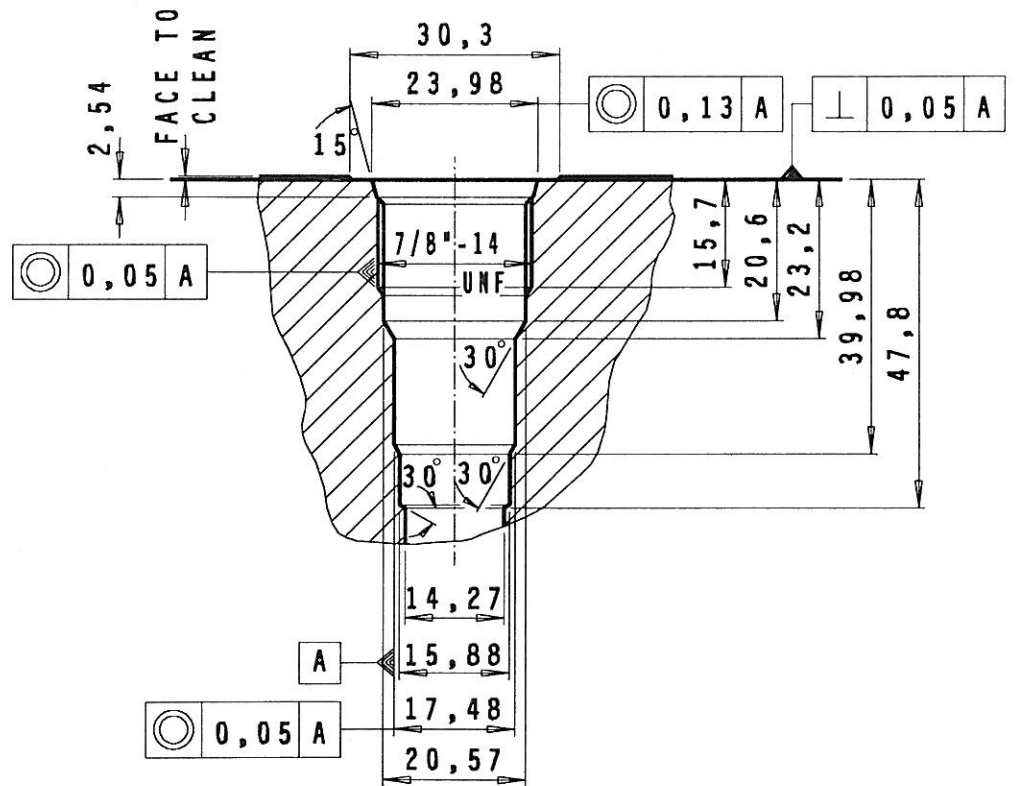
DIMENSIONAL DATA.



SIZE	A	B	C	D	E	F	W
02T	184,4	69	78,5	96	163,5	181	73
04U	201	111	322	104	322	156	95
12T	—	133	313	319	—	—	143

DIM TAB DIR/CON/VALVES 1

DIRECTIONAL CONTROL VALVES.
PILOT VALVE
SCREW IN CARTRIDGE CAVITY H3.

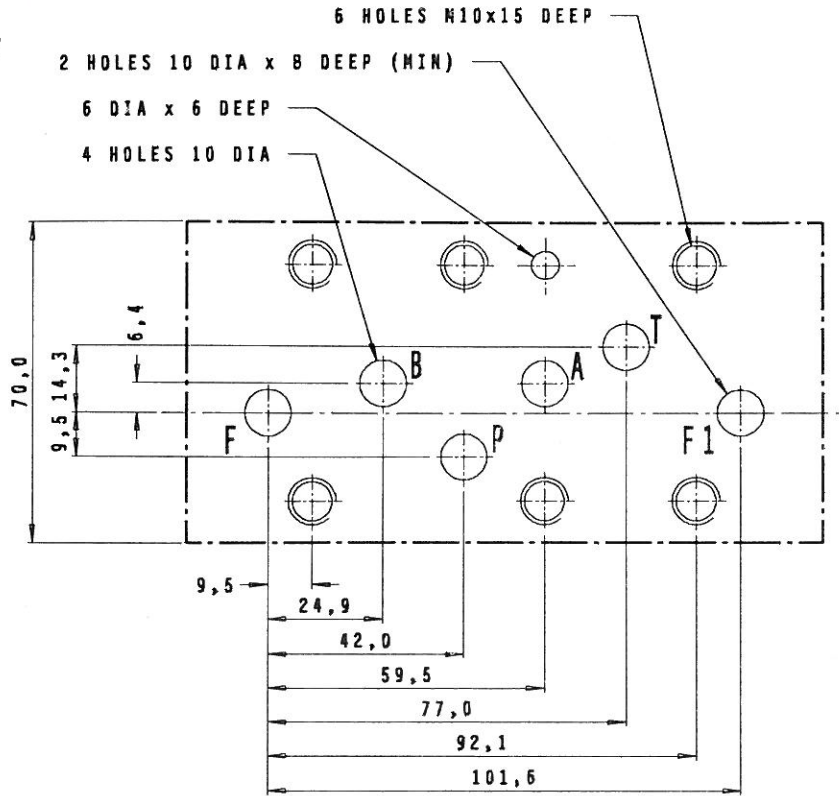


CAVITY DETAIL AA - HS600 - 3

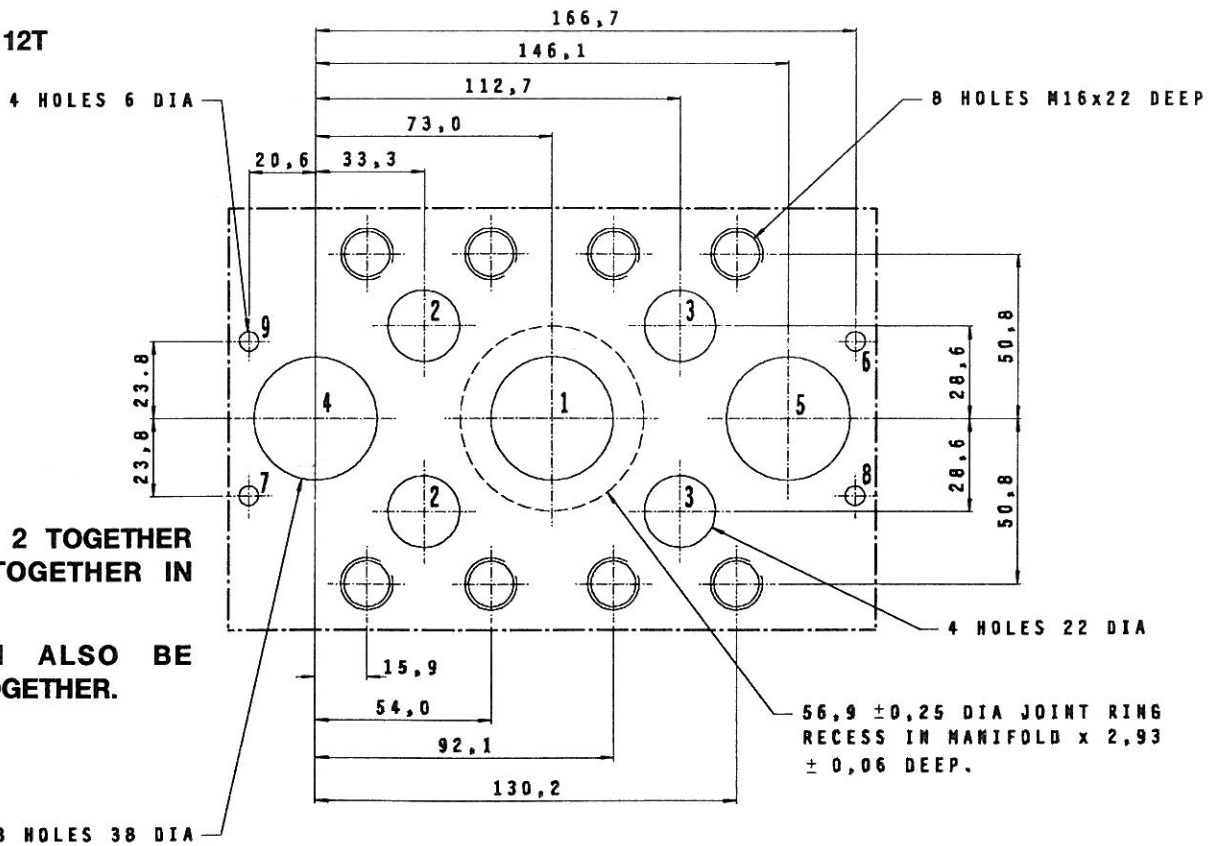
DIRECTIONAL CONTROL VALVES.

HOUSE STANDARD MANIFOLD MOUNTING 4 AND 5 PORT VALVES.

FOR MOUNTING 02T
700 BAR.



FOR MOUNTING 12T
500 BAR.

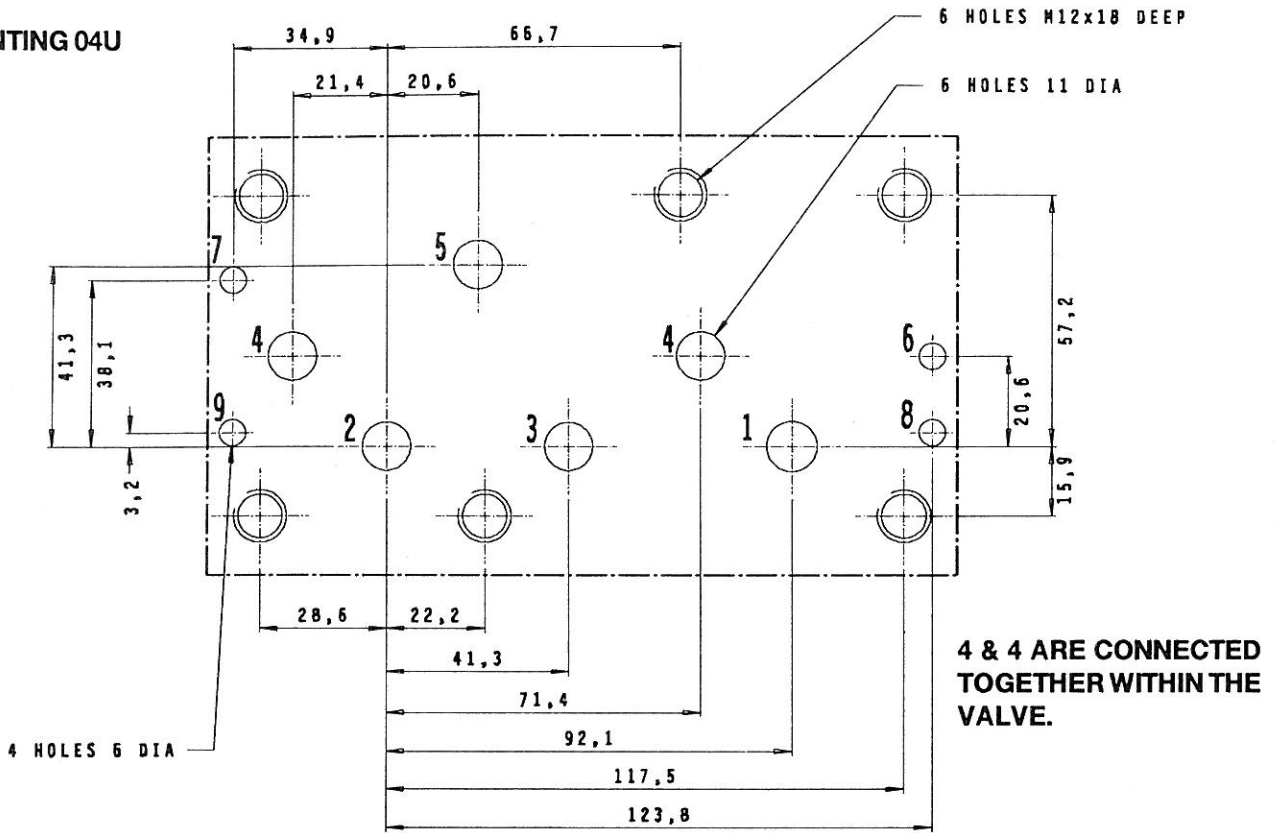


DIRECTIONAL CONTROL VALVES.

HOUSE STANDARD MANIFOLD MOUNTING

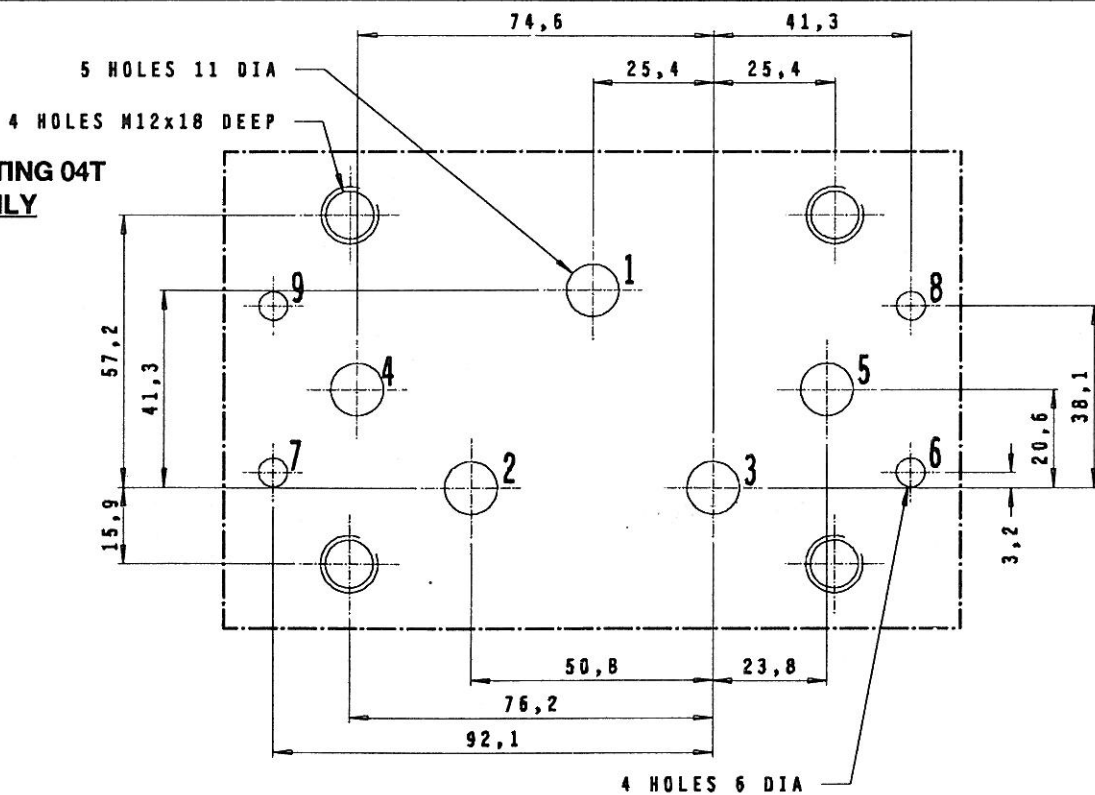
4 AND 5 PORT (WITH CHECK) VALVES.

FOR MOUNTING 04U
500 BAR.



FOR MOUNTING 04T
SPARES ONLY

500 BAR.



Oilgear Towler

VD★

DIRECTIONAL CONTROL VALVES.

The Oilgear Company

2300 South 51st Street
Milwaukee, WI USA 53219
Call toll free 1-800-558-6636
In WI call (414) 327-1700
Fax (414) 327-0532
Telex 2-69411