



FILTER & COOLING STATION









## MANNESMANN REXROTH

# Variable displacement pump A4VSO

Series 1 and 2, Open Circuit Axial Piston – Swashplate Design

Brueninghaus Hydromatik

FLUID POWER

Sizes 40...750 No

Nominal pressure 5100 psi (350 bar) Peak pressure RA 92 050/05.95 metric Replaces 03.93

Size 40...355, SAE-Version see data sheet RA 92 050/05.95 (SAE) For the description and operation of the various controls, see relevant RA-sheets (see page 2)



5800 psi (400 bar)

Axial piston variable displacement pump A4VSO is of swashplate design and is designed for open circuit operation.

Flow is proportional to input speed and displacement, and is infinitely variable by adjustment of the swashplate angle.

- Swashplate design
- Infinitely variable displacement
- Good self priming suction characteristics
- Continuous operating pressure of 5100 psi (350 bar)
- Low noise level
- Excellent service life
- Drive shaft able to accept axial and radial loading
- Low power to weight ratio
- Compact modular design
- Short control times
- Through drive and pump combinations possible
- Swivel angle indicator standard
- Installation positional optional
- Operation on HF fluids permitted at derated parameters



Before finalising your design, please request a certified drawing. Dimensions in inches and millimeters ()

Variable displacement pump A4VSO, Series 1 and 2

#### Unit Dimensions, Size 250

(Example: const. pressure control; exact dimensions of control devices see separate data sheets)







REVISION SIG



PILOT OIL SUPPLY STATION

# **Accumulators**



Fig. 1. Cross-sectional views of typical of bladder and piston-type accumulators.



Fig. 2. Six stages of operation accumulators: stage (a), accumulator is empty — no gas charge; stage (b), accumulator has been precharged with dry nitrogen; stage (c), system pressure exceeds precharge pressure, and hydraulic fluid flows into accumulator; stage (d), system pressure peaks, maximum fluid has entered accumulator, and system relief opens; stage (e), system pressure drops, precharge pressure forces fluid from accumulator and into system; and stage (f), system pressure reaches minimum needed to do work.

1500 r Test To Check Pilot System Accumulator Precharge Prefili Pilot (psi) 12.5 37.5 62.5 87.5 Time (Sec)

Pilot Pressure vs. Time



# **Bent Axis Piston Pumps**











| MANNESMANN   | 4/3- and 5/3-way Proportional Directional Control Valves<br>Model 4 WRZ (Pilot-Operated)<br>Model 4 WRH (Hydraulically Pilot Operation)<br>Sizes 10, 25, 32, 52 Series 5X; Size 16 Series 6X |                       |                         | RA<br>29 113/2.96 |
|--|--|-----------------------|-------------------------|-------------------|
| <b>NEXNO</b>   | Sizes 10 to 52   | 5100 PSI<br>(350 bar) | 740 GPM<br>(2800 L/min) |                   |
| Characteristics:<br>– Pilot operated 2-stage prop<br>– Valve for controlling both flo<br>– Proportional solenoid opera<br>– Mounts on standard ISO 44<br>NFPA 3.5.1M R1 and ANSI<br>D 10 interfaces<br>For subplates, see data she<br>– Emergency operator (option<br>– Spring centering<br>– Control unit:<br>Electrical amplifier (subject | ortional directional valve<br>ow direction and volume<br>ation<br>401- <b>5, 7, 8</b> or <b>10</b> ,<br>B 93.7 <b>D 05, D 07, D 08</b> of<br>eets RA 45 054 RA 450<br>hal)                   | or<br>60              |                         |                   |

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Model 4 WRZ 16...6X/6A..NZ4... with associated electronic control (ordered separately)

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# Symbols (detailed)



## Functional description, section

### Pilot control valve Model 3 DREP 6...

Direct operated proportional pressure reducing valves, model 3 DREP 6, are used to control the pressure and direction of fluid flow in the pilot stage of 4WRZ and 5WRZ valves. The required pressure is set with a 0 - 9 V (or a 0 - 10 V differential) input signal to the associated electronic amplifier card (VT 3000 or VT 3006).

The valve basically consists of the housing (3), pilot control spool (2), two sensing pistons (5 & 4) and two proportional solenoids (6 & 1).

When the proportional solenoid (6) is supplied with a current, a corresponding force which pushes the control spool (2) to the right following fluid to flow from ports "P" to "B". At the same time pressure building in port B is fed back through two radial drilled holes in the control spool to the sensing piston (4). Since the piston is free to move in the end of the control spool (2), the pressure pushes the control spool (2) away from piston (4). The control spool (2) and piston (5) are forced against the solenoid (6). When the control spool is centered, the solenoid force is balanced by the hydraulic force due to the B port pressure. If the force of solenoid (6) is reduced, the pressure in the end cap (port "B") pushes the

spool even further to the left. Fluid can then drain from "B" to "T" until pressure is reduced to where it once again corresponds to the force of the solenoid.

Likewise, if an input signal is given to proportional solenoid (1) the process reverses with port "P" opening to the opposite end cap (port "A").

When there is no current flow to the proportional solenoid, port "P" is blocked and ports "A" and "B" are open to tank, therefore the main valve spool is centered.

### **Proportional solenoids**

Proportional force controlled solenoids are DC wet-pin type solenoids that are driven by an electronic amplifier card. An input voltage signal to the amplifier provides current to the solenoids which in turn is converted into a proportional force to the pilot spool.

Note on bleeding valves: (Bleed screws at 7 and 8) see page 3.



## Functional description, section

#### Proportional directional control valves Model 4 WRZ..., 5 WRZ.

Proportional directional control valves Model 4 WRZ, 5 WRZ are pilot operated spool valves. They control the start, stop, direction and amount of fluid flow for smooth acceleration and deceleration of an actuator.

These valves basically consist of the pilot control valve (9), with proportional solenoids (6 & 1), main valve body (12), with metering control spool (14), and push-pull spring assembly (15).

When both solenoids are de-energized, the main spool (14) is held in the center position by a pre-tensioned push-pull spring assembly (15). The spring set is installed on the spool with a rod and is held between two spring plates which allow free movement of the rod in either direction. The spool is normally "spring centered" until pilot pressure in one of the end caps is sufficient to overcome spring force and move the spool into a metering position. An input signal to the proportional solenoid "B" shifts the pilot valve which allows a pilot flow and also controls the pressure in chamber (13), this in turn moves the main spool (14) to the left, compressing the spring against the outer end cap. This provides a progressive metered flow from "P" to "A" and "B" to "T". Variable forces are achieved by the amount of signal supplied. Since the control grooves are triangular in shape to provide metering, each time a spool position is selected, a particular orifice is created which provides a flow control function for adjustable actuator speeds. Optional manual overrides are available for emergency operation of the valve (without an electronic signal).

5-way manifold mounted valves, size 52, are equipped with an extra port "R". Dependent on the valve position, fluid flows from "P" to "A" and "B" to "T" or "P" to "B" and "A" to "R".

**Important:** To achieve optimum operation of the valve, the air must be bled from the proportional solenoids on the initial start-up. This may be done two ways: 1) pressurize the valve, remove the two bleed screws (7 & 8) until no more air bubbles screws (7 & 8) insert standard oil can nozzle and pump fluid in one side until it flows, without air bubbles, out the other side, then reinstall screws. In both cases the tank line must be prevented from emptying if there is no inherent back pressure in the tank port of the circuit. This may be achieved by installing a check valve in the tank line. The valve's cracking pressure should be in the range of 22 ... 45 PSI (1.5 ... 3 bar)



The valves are the same as the WRZ version only without the pilot valve. The valve is replaced by an interconnecting cover plate (17), connecting pilot ports "A" to "T" ("Y") and "B" to "T" ("X"). The valve can then be remote-controlled by a joy stick (Model TH 7, see RA 64 558), pilot valve (Model 3 DREP 6, see RA 29 183) etc.

A pilot pressure of 22 ... 365 PSI (1.5 to 25 bar) [sizes 10, 16, 25, 32] or 22 ... 235 PSI (1.5 to 16 bar) [size 52], at port "X" will shift the main spool (14) to allow flow from "P" to "B" and "A" to "T" ("R"). Movement of the spool, and valve opening is proportional to the pressure applied. Likewise, pilot pressure to the "Y" port opens "P" to "A" and "B" to "T".

Opening begins at approximately 60 PSI (4.1 bar) [sizes 10, 16, 25, 32] or 38 PSI (2.6 bar) [size 52].

In the illustration to the right it can be seen that the Models 5 WRH are functionally identical, and similar in geometry.

![](_page_21_Figure_14.jpeg)

Fig. 3 External pilot operated proportional directional valve Model WRH... in 5-way construction