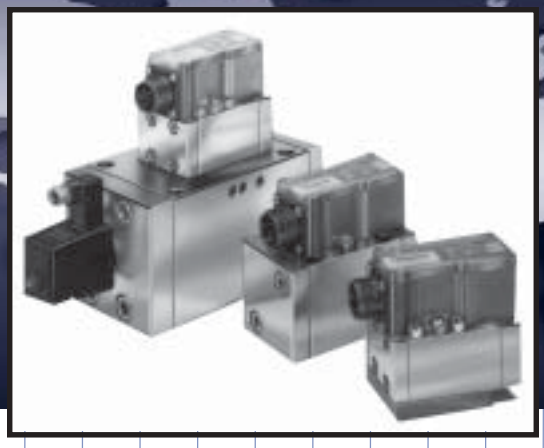
Oilgear

VSC4

4-WAY

SERVO VALVES



BULLETIN 36115

VSC4
4-WAY SERVO VALVES

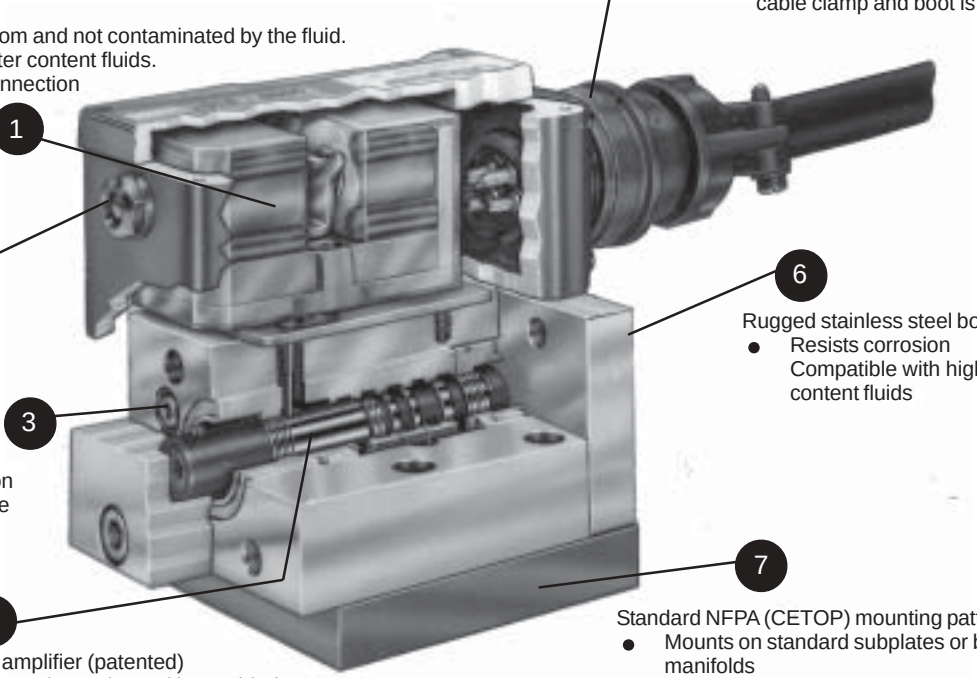
A servo valve that is simple, rugged in design and dependable in performance to give superior system control and long trouble free operation.

Double air gap low DC current dry torque motor (130 ma standard – others available)

- Extremely stiff and well dampended to achieve the best dynamic properties.
- Large encapsulated coils provide a very stable and rugged magnetic system.
- Torque motor is isolated from and not contaminated by the fluid.
- Can be used with high water content fluids.
- There is no mechanical connection between the magnet system and the power spool.

Rugged electrical connections

- A simple easy to plug-in electrical connection using four pin MS receptacle and mating connector plug with cable clamp and boot is standard.



97089

External null adjustment

- Easy accessibility for fine tuning valve.

Rugged stainless steel body

- Resists corrosion Compatible with high water content fluids

Integral 55 micron filter screen

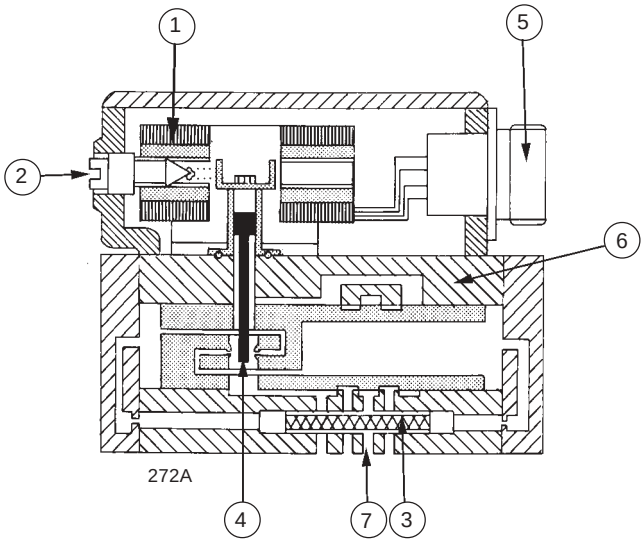
- Protects orifices and nozzles from contamination and resulting performance degeneration.
- Easily accessible

Standard NFPA (CETOP) mounting patterns

- Mounts on standard subplates or bar manifolds
- Can replace low performance proportional valves

Power spool with integral force amplifier (patented)

- Feedback of the second stage (power) spool is provided by the unique patented design which throttles the nozzles mounted within the spool. This design eliminates the need for a cantilever feedback spring and long control passages in the second stage spool control areas. The short symmetrical pilot lines improve frequency response while the elimination of the feedback spring results in high reliability.
- The control edges of the power spool and cylinder are hardened, ground and lapped.



272A

Oilgear's extensive application experience

- Oilgear is a hydraulic equipment manufacturer totally dedicated to microelectronic control systems.
- Electronics is integrated in Oilgear's hydraulic engineering as a integral part of the engineering department. CAD/CAM insures optimal system design incorporating the latest developments.
- Oilgear has been an electrohydraulic manufacturer since 1954 and will be there if you need help in the future.

98004

9

Oilgear servo valves can be driven by Oilgear's standard amplifier for superior performance, but they can also be driven by amplifiers manufactured by others.

- Rail-mounted amplifier for servo or porportional solenoid controlled valves.
- Built-in flow, pressure, pressure and horsepower limiting, and load sense program configurations.
- Closed-loop control for a single valve.
- Built-in password protected parameter and program setup

PERFORMANCE ASSURANCE IS STANDARD WITH EVERY OILGEAR COMPONENT.

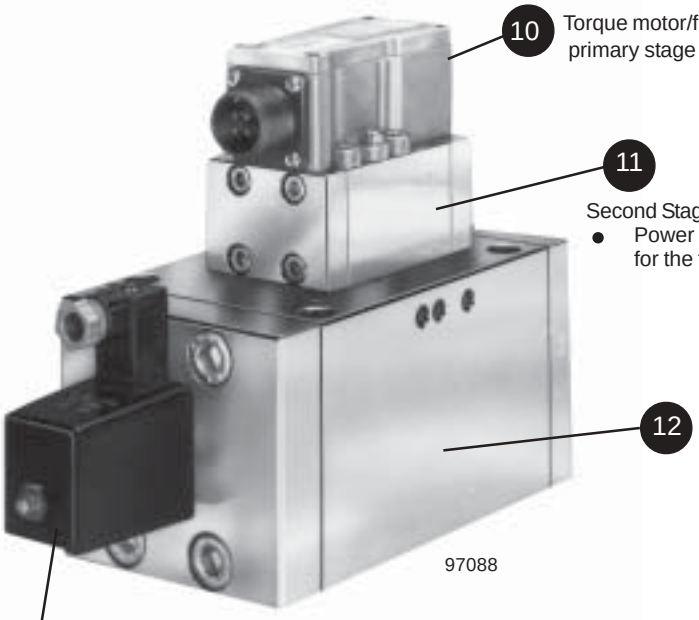
Every Oilgear servo valve is shipped with a corporate commitment to support the component until it performs as specified.

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.

Oilgear's 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 has concentrated its energies on hydraulics and electrohydraulic equipment and systems. Every Oilgear facility is staffed with factory trained and field experienced application engineers.

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



10 Torque motor/flapper primary stage

11 Second Stage

- Power spool is pilot for the three-stage valve

12 Third Stage (also, see page 5)

- Has a Linear Variable Differential Transformer (L.V.D.T.) for feedback.

97088

8 LVDT (3rd-stage valves only)

A linear variable differential transformer (L.V.D.T.) is used to monitor the position of the main spool on a three-stage valve.

Oilgear PERFORMANCE ASSURANCE

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CONTENTS

PRINCIPLE OF OPERATION
Two-Stage Servo Valves

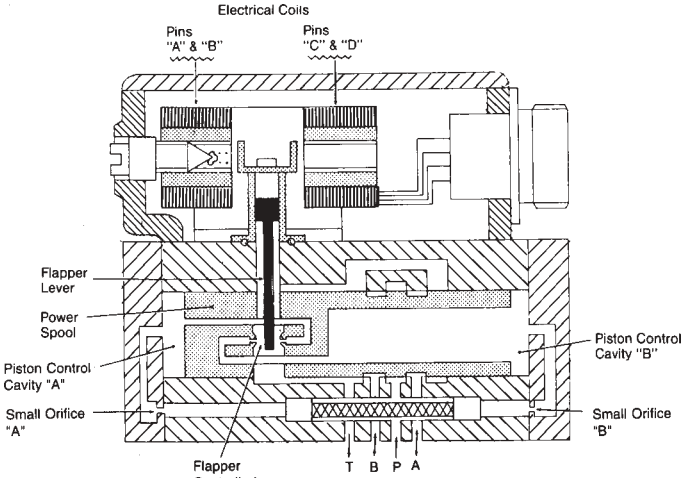


Figure "A"

Art 272

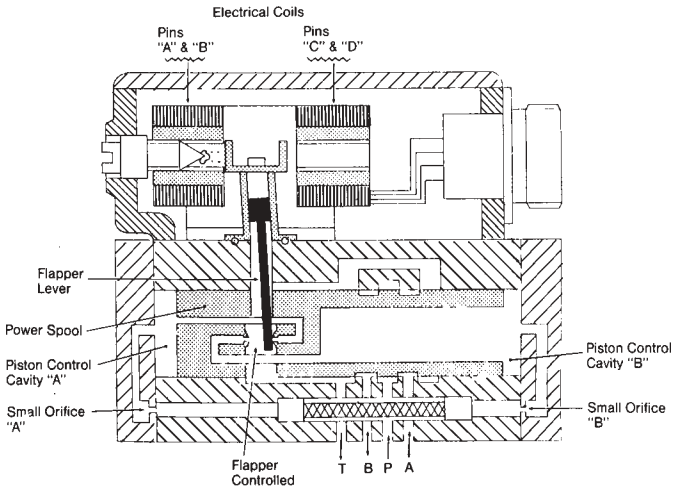


Figure "B"

Art 273

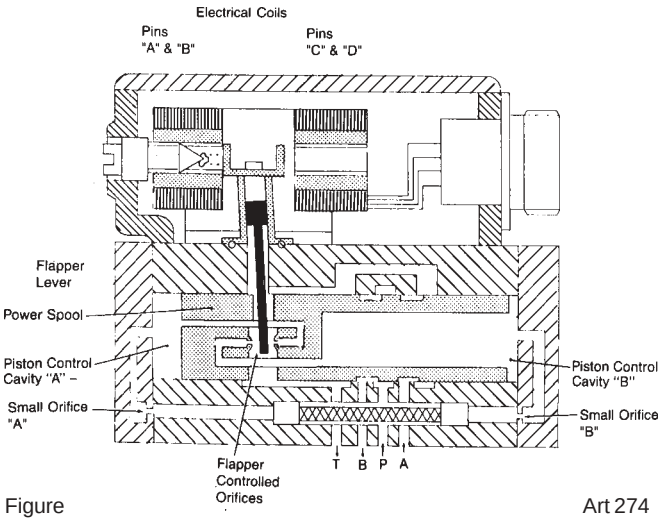


Figure "C"

Art 274

Two-Stage Servo Valves

The primary stage of a two stage servo valve, shown in Figure “A”, is a current driven device. Current in the coils produce a magnetic field which deflects the flapper lever an amount proportional to the current level and in the direction consistent with the direction of current flow.

The movement of the flapper lever upsets the pressure balance positioning the power spool. The power spool then repositions in the direction of the flapper lever so the pressure balance is again maintained.

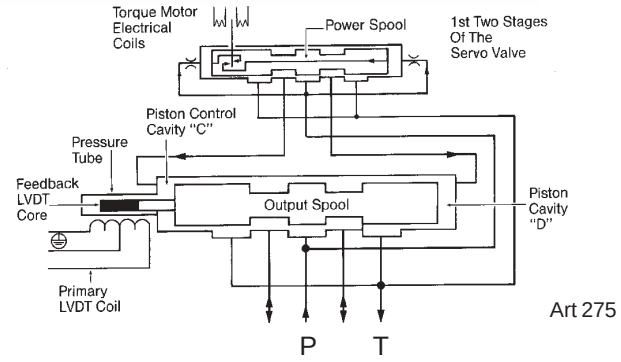
Although the power of the flapper lever is very small, the hydraulic force amplification generated on the piston control cavities “A” and “B” is enough to accurately position the power spool.

If a positive current flows from pin “A” and “C” to pin “B” and “D”, the flapper lever will move to the right as shown in Figure “B”. This movement of the flapper effectively throttles the nozzle on the right while de-throttling the nozzle on the left. The result is a pressure increase in cavity “A” which is supplied with fluid from the pressure port thru the small orifice “A”. At the same time, the pressure in cavity “B” decreases as it is opened to tank "T (drain).

The pressure imbalance moves the power spool to the right until the flapper controlled nozzle gaps are equal and pressure in cavities “A” and “B” are once again equal as shown in figure "C". The repositioning of the power spool will result in pressure port “P” being connected to control port “B” and control port “A” connected to tank or drain port “T”.

By reversing the DC current direction from the above example, the flapper and main spool will move to the left and port “P” will be connected to control port “A” and control port "B" connected to tank “T” (drain).

Three-Stage Servo Valves



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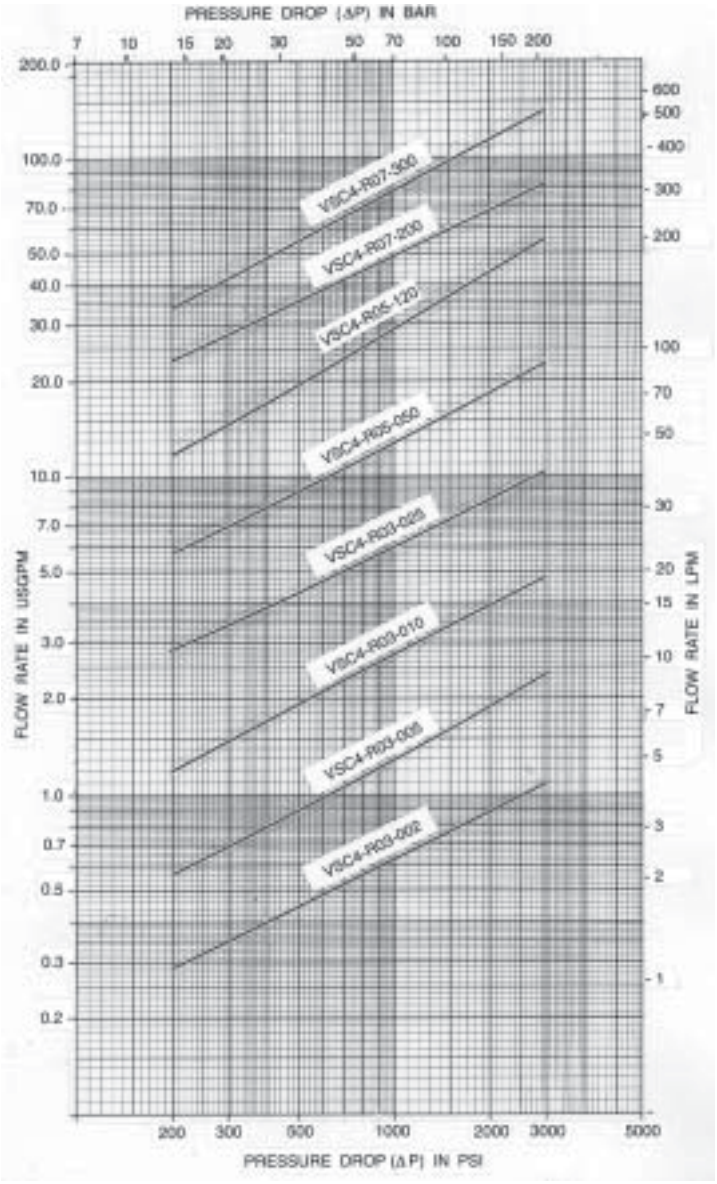
In the three-stage servo valve, the pilot valve is a standard VSC4-R03 two stage servo valve. This pilot valve directs fluid flow to position the third stage power spool. A Linear Variable Differential Transformer (LVDT) attached to the third stage generates an electrical feedback signal proportional to spool movement. The electronic package controlling the valve must supply the excitation for the LVDT as well as the signal conditioning circuitry for summing the feedback signal with the command. The standard Oilgear Amplifier Module provides all these functions.

When an error exists between the command signal and the conditioned LVDT feedback signal, the amplifier produces an output current to the two-stage pilot valve. This pilot valve in turn ports fluids to and from piston cavity areas “C” and “D” to shift the third stage spool. As the third stage spool moves, the LVDT feedback signal will change accordingly to cancel the command signal.

When the sum of the command voltage and the feedback volt is zero, the current output of the amplifier will also be zero. The result is the centering of the pilot valve. The pressure in piston control cavity “C” and “D” will be equal and the third stage spool will be at a new offset stable position.

If the error signal between the command and feedback signal was opposite in polarity, the valve would shift in the opposite direction. The polarity and amplitude of a command voltage determines the direction and magnitude of spool offset and flow.

FLOW CHARACTERISTICS

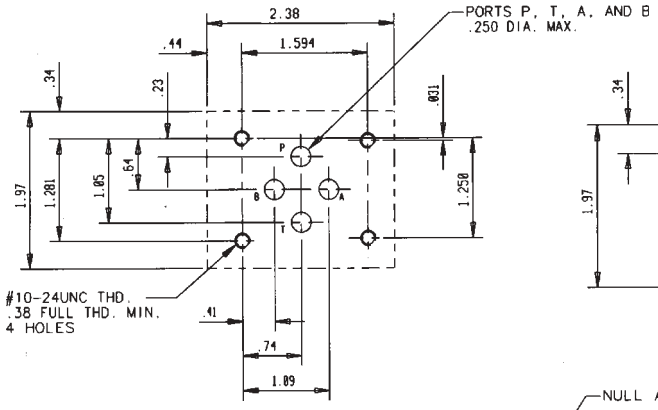


Art 276

PERFORMANCE CHARACTERISTICS

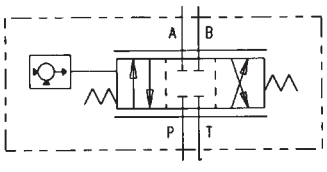
VSC4-R03 TWO-STAGE 4-WAY SERVO VALVES

VALVE DESCRIPTION		VSC4-R03			
Nominal Size	001	002	005	010	025
Rated Flow ± 10%					
at 1000 psi ΔP Drop - USgpm	0.26	0.66	1.32	2.65	6.62
at 70 bar ΔP drop - lpm	1,00	2,50	5,00	10,00	25,00
Frequency at 90º					
Phase Shift - Hz	150	150	130	130	100
Frequency at amplitude					
output/input = 3 Db Hz.	130	130	110	110	80
Switch time in mili seconds	2	2	3	3	4
Leakage at					
1000 psi, 50 cSt, cipm	36.61	48.81	54.91	61.01	91.52
70 bar, 50 cSt, l/min.	0,6	0,8	0,9	1,0	1,5
	All Flow Rates				
Maximum pressure, port P, A, B					
psi	4500				
bar	315				
Maximum pressure, port T					
psi	290				
bar	20				
Temperature range					
Fº	4 to 194				
Cº	-20 to + 90				
Fluid viscosity	20 to 360 cSt				
Response limit	0.2%				
Hysteresis	2%				
0 - point shift for pressure change of 20%	1%				
0 - point shift for viscosity change of 30 cSt	1.5%				

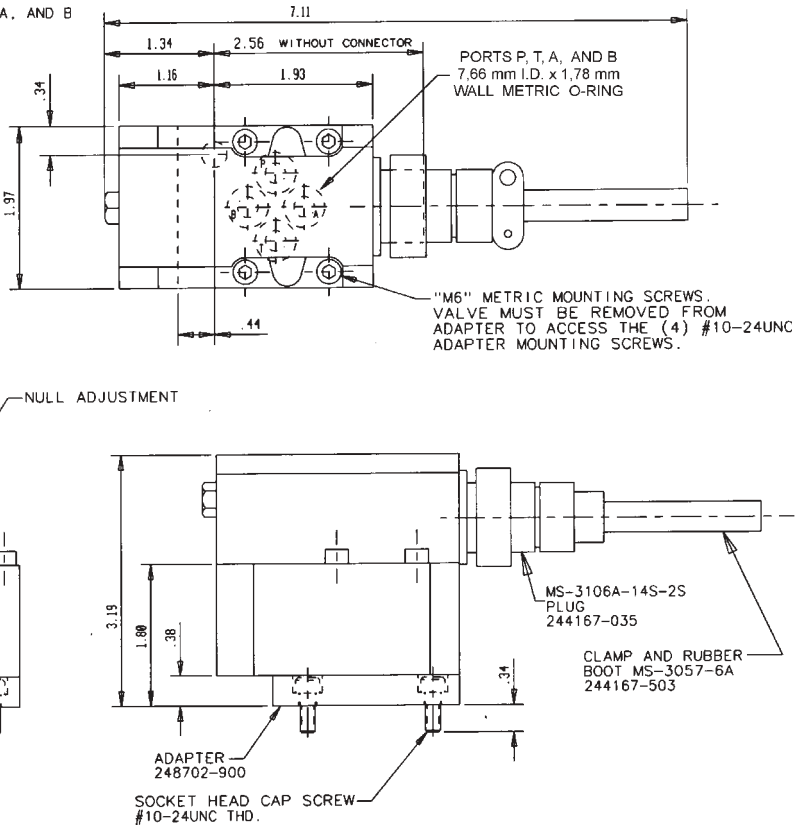


MOUNTING SURFACE DIMENSIONS

MOUNTING SURFACE IS A NFPA ISO-D03 VALVE MOUNTING PATTERN. SURFACE IS TO BE FLAT WITHIN .0003 INCHES PER INCH, AND HAVE A 63 MICRO INCHES (RMS) FINISH.



HYDRAULIC SCHEMATIC

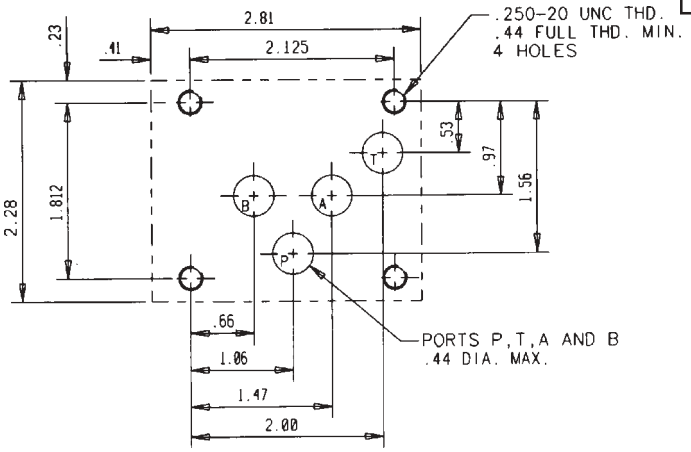


PERFORMANCE CHARACTERISTICS (cont'd)

VSC4-R05 TWO-STAGE 4-WAY SERVO VALVES

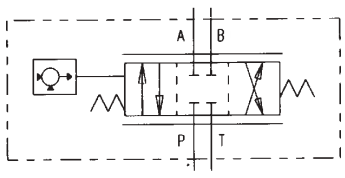
VALVE DESCRIPTION	VSC4-R05	
Nominal Size	050	120*
Rated Flow ± 10%		
at 1000 psi ΔP drop - US gpm	13.19	31.66
at 70 bar ΔP drop - lpm	50	120
Frequency at 90°		
Phase shift Hz.	50	60
Frequency at amplitude		
Output/input = -3 Db Hz.	40	50
Switch time in mili second	7	8
Leakage at		
1000 psi, 50 cSt, cipm	91.51	91.51
70 bar, 50 cSt, lpm	1,5	1,5
	All Flows	
Maximum pressure, Port P, A, B		
psi	4500	
bar	315	
Maximum pressure, port T		
psi	290	
bar	20	
Temperature Range		
F°	4 to 194	
C°	-20 to +90	
Fluid Viscosity	20 to 380 cSt	
Response Limit	0.2%	
Hysteisis	2%	
0-point shift for pressure change of 20%	1%	
0-point shift for viscosity change of 3cSt	1.5%	

*Size 120 includes an (additional) Linear Variable Differential Transformer (not shown).

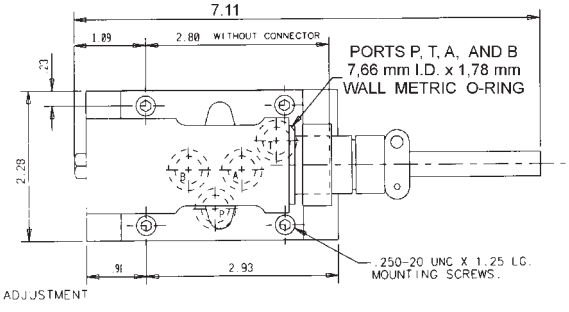


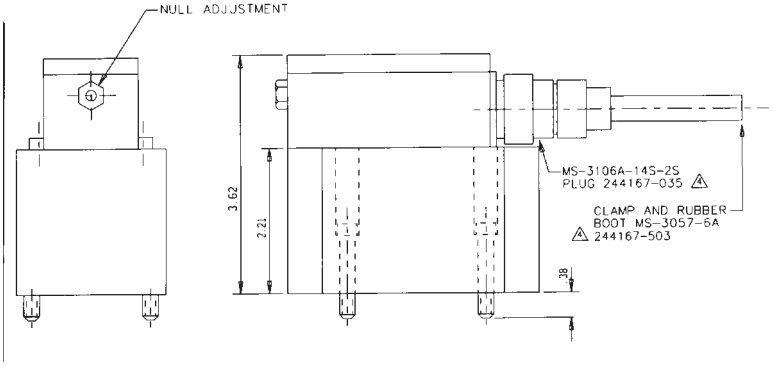
MOUNTING SURFACE DIMENSIONS

MOUNTING SURFACE IS A NFPA D02 (ISO-D05) VALVE MOUNTING PATTERN. SURFACE IS TO BE FLAT WITHIN .0003 INCHES PER INCH, AND HAVE A 63 MICRO INCHES (RMS) FINISH.



HYDRAULIC SCHEMATIC

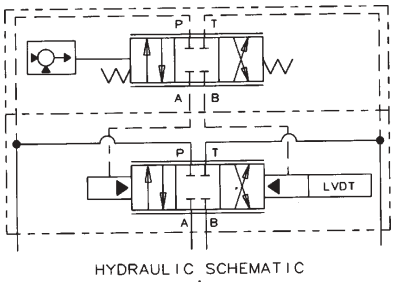




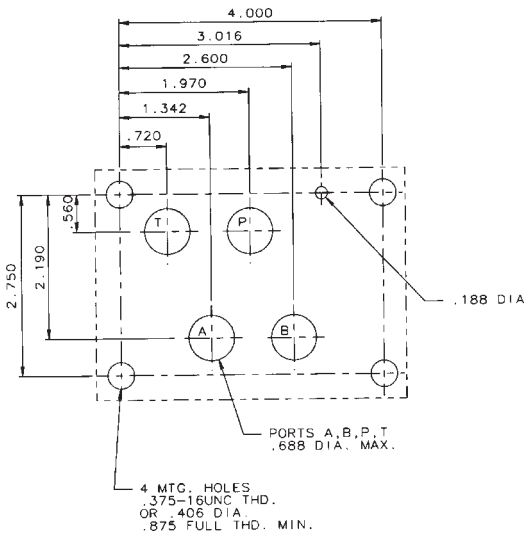
PERFORMANCE CHARACTERISTICS (cont'd)

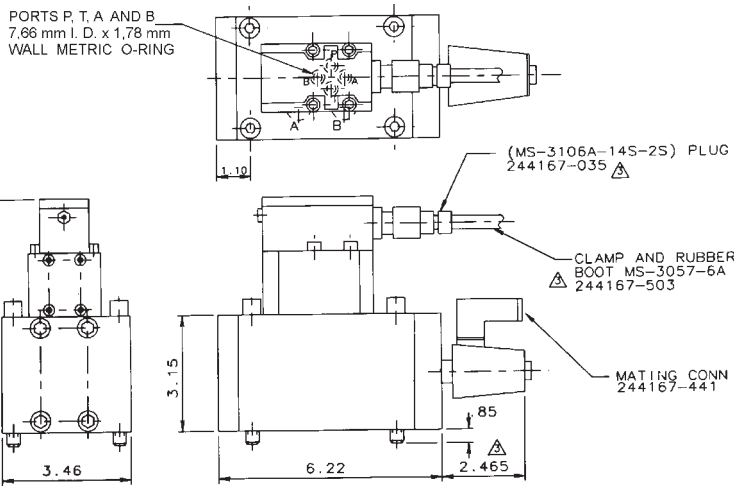
VSC4-R07 THREE-STAGE 4-WAY SERVO VALVES

VALVE DESCRIPTION	VSC4-R07	
Nominal Size	200	300
Rated Flow ± 10% at 1000 psi ΔP drop - US gpm at 70 bar ΔP drop - lpm 200	 52.77 300	 79.16
Frequency at 90° Phase shift Hz. Frequency at amplitude output/input = -3 Db Hz.	 40 30	 30 25
Switch time in mili seconds10	12	
Leakage at 1000 psi, 50 cSt, cipm 70 bar, 50 cSt, l/min.	 122.03 2	 122.03 2
	All Flows	
Maximum pressure, port P, A, B psi bar	 4500 315	
Maximum pressure, port T psi bar	 290 20	
Temperature Range F° C°	 4 to 194 -20 to +90	
Fluid Viscosity	20 to 380 cSt	
Response Limit Hysteresis 0-point for pressure change of 20% 0-point for viscosity change of 30 cSt	 0.2% 0.3% 1% 1.5%	



HYDRAULIC SCHEMATIC





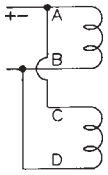
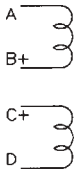
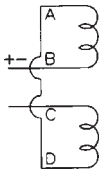
MOUNTING SURFACE DIMEMSIONS

MOUNTING SURFACE IS A NFPA D04 ISO-D07 (D07) VALVE MOUNTING PATTERN. SURFACE IS TO BE FLAT WITHIN .0003 INCHES PER INCH AND HAVE A 63 MICRO INCHES (RMS) FINISH.

ELECTRICAL

TORQUE MOTOR CHARACTERISTICS

The torque motor coils for each valve can be connected in one of three configurations: parallel, push-pull or series. The parallel configuration is standard for most systems.

Coil Connection	Oilgear Standard. Optional Standard Amplifier Avail. Parallel	User must furnish Electronics Push-Pull	User must furnish Electronics Series
Current mA	±1.3* (I)	I = 130	+0.66 (I)
Excitation DC Volts	±0.66* (V)	V = 12.00	±1.3 (V)
			

*When torque motor coils are connected in parallel, the current required is [±130 mA x 1.3 = ±169 mA].

In the parallel (standard) or series configuration, when the current flows from “B” to “A” the servo-valve will shift so that the pressure port “P” will be connected to port “A” and port “B” will be connected to tank (drain) port “T”. In the push-pull configurations, if current “B” to “A” is greater then current “C” to “D”, port “P” will be connected to port “A” and port “B” will be connected to port “T”.

The VSC4 Servo-valves can be supplied with a choice of 5 different rated torque motor coils.

SELECTION OF VALVE COILS

Coil Type	Oilgear Std. 130	40*	80*	100*	200*
Parallel					
Max. mA	170	52	104	130	350
Max. DC Volts	8	32	16	10	5
Push-Pull					
Max. mA	130	40	80	100	270
Max. DC Volts	12	48	24	16	7
Series					
Max. mA	86	27	53	66	175
Max. DC Volts	15	63	31	21	9
Resistance Per Coil at 160°C(70°C) ohms	90	1200	300	160	24

* Non standard coils ordered from Oilgear are not returnable.

HOW TO ORDER

BLOCK	1	-	2	-	3	-	4	-	5	-	6	-	7	-	8	-	9	-	10
EXAMPLE	VSC4	-	RO3	-	025	-	N	-	140	-	V	-	130	-	N	-	O	-	A1

1. - Series:
   VSC4 = 4-Way Servo Control Valve

2. - Size/Type Mounting :
   R03 = CETOP 03, Manifold Mounted
   R05 = CETOP 05, Manifold Mounted
   R07 = CETOP 07, Manifold Mounted

3. - Nominal Size
   CETOP 03 SIZE NOMINAL FLOW
   001 = .26 GPM (1,0 LPM) Standard 3 Stage Pilot
   002 = .66 GPM (2,5 LPM)
   005 = 1.3 GPM (5 LPM)
   010 = 2.6 GPM (10 LPM)
   025 = 6.6 GPM (25 LPM)

   CETOP 05 SIZE NOMINAL FLOW
   050 = 13.2 GPM (50 LPM)
   120 = 31.7 GPM (120 LPM)

   CETOP 07 SIZE NOMINAL FLOW
   200 = 52.9 GPM (200 LPM)
   300 = 79.4 GPM (300 LPM)

4. - Pilot Drain Arrangement
   N = Internal Drain/Internal Pilot (Std.) (for Size 03, 05 & 07)
   Y = Internal Pilot/External Drain (Size 07 only)
   X = External Pilot/External Drain (Size 07 only)

5. - Operating Pressure:
   040 = 580 PSI (40 BAR)
   070 = 1000 PSI (70 BAR)
   210 = 3000 PSI (210 BAR)

6. - Seal Material:
   V = Viton (Standard)
   B = Buna-N
   E = EDPM

7. - Torque Motor Coil:
   130 = 130 ma (Standard)
   040 = 40 ma *
   080 = 80 ma *
   100 = 100 ma *
   200 = 200 ma*

* non standard coils not returnable

8. - LVDT Feedback
   N = Without Feedback (Standard)
   L = With Feedback

9. - Amplifier
   O = Oilgear Format
   E = Eurocard Format
   N = None
   I = Integral Amplifier

10. - Design Series
   A1 = Assigned by Factory, Subject to Change

NOTES

Oilgear

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Phone: 414/327-1700 Fax: 414/327-0532
internet: http/www.oilgear.com

AUSTRALIA
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CANADA
The Oilgear Company

FRANCE
Oilgear Towler S.A.

GERMANY
Oilgear Towler GmbH

INDIA
Oilgear Towler Polyhydron Pvt. Ltd.

ITALY
Oilgear Towler S.r.l.

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Oilgear Towler Korea, Ltd.

MEXICO
Oilgear Mexicana S.A. de C.V.

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UNITED KINGDOM
Oilgear Towler Ltd.

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