TR ENGINEERING
INCORPORATED

OUR QUALITY MISSION STATEMENT

Provide a quality product that satisfies our customers' needs and expectations the first time, every time!

Our goal is to meet or exceed our customers' needs, whether it is through timely delivery, providing the best value for the money, efficient and courteous service, or superior quality, reliability and durability of our products.

As such, we have committed ourselves to the following:

- Understanding and responding to our customers' needs and expectations.
- Providing "Proven Design" products.
- Operating the systems of production well planned to generate continuing quality and productivity improvements.
- Maintaining a highly trained and motivated workforce with full accountability and responsibility.
- Having long-term relations with our suppliers.
- Design, materials and manufacturing 100% Made-in-USA.
- Continue maintaining and improving on all of the above.

When Performance Counts

TR ENGINEERING is a fluid power company engaged in the design, manufacturing and marketing of technically advanced hydraulic components and systems.

At the Scotts Valley, California design and manufacturing facility we engineer and manufacture a broad line of hydraulic hand pumps and directional control valves, as well as custom-designed fluid power systems for the construction, manufacturing, aerospace, marine and petro-chemical industries. System capabilities include the design, fabrication and servicing of large hydraulic power supplies and cylinders, including computer-controlled automatic testing equipment.

However, high quality products and easy product access are not always enough. A through knowledge of clients' unique application demands is a must. With years of practical and technical experience behind them, *TR ENGINEERING* personnel can provide clients in many fields with highly effective solutions.

TR ENGINEERING knows the real potentials of technology and its applications. As our clients needs, and subsequently our products, become more complex, we are confident that our commitment to engineering excellence will assure *TR ENGINEERING* continued growth, as well as the success of our clients.

Table of Contents

This catalog provides you with the *TR ENGINEERING* general product line. Many additional Hand Pumps and Control Valves are designed and manufactured to specifications provided by the buyer. For such specialties, please contact *TR ENGINEERING* at the address below.

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Hydraulic Hand Pumps

The TR Engineering Hydraulic Hand Pumps are available as self-contained or modular units with working pressure of up to 20,000 PSI. All pumps are of lightweight design and easily portable.

TR Hand Pumps incorporate:

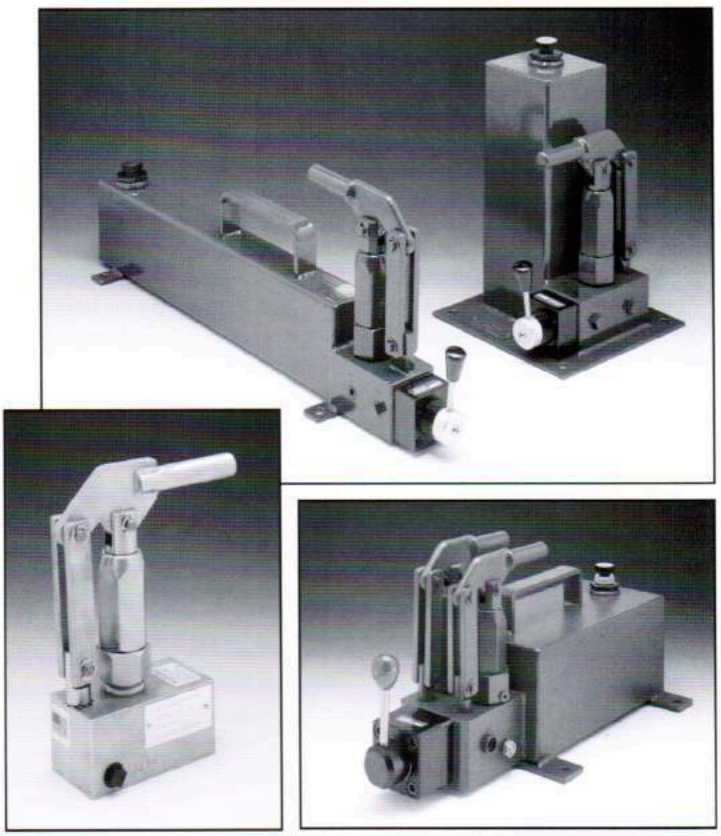
- heat-treated, ground and chrome plated pistons
- gripped tubular steel handles
- release screws fine-threaded for vernier control
- seals compatible with petroleum based fluids.

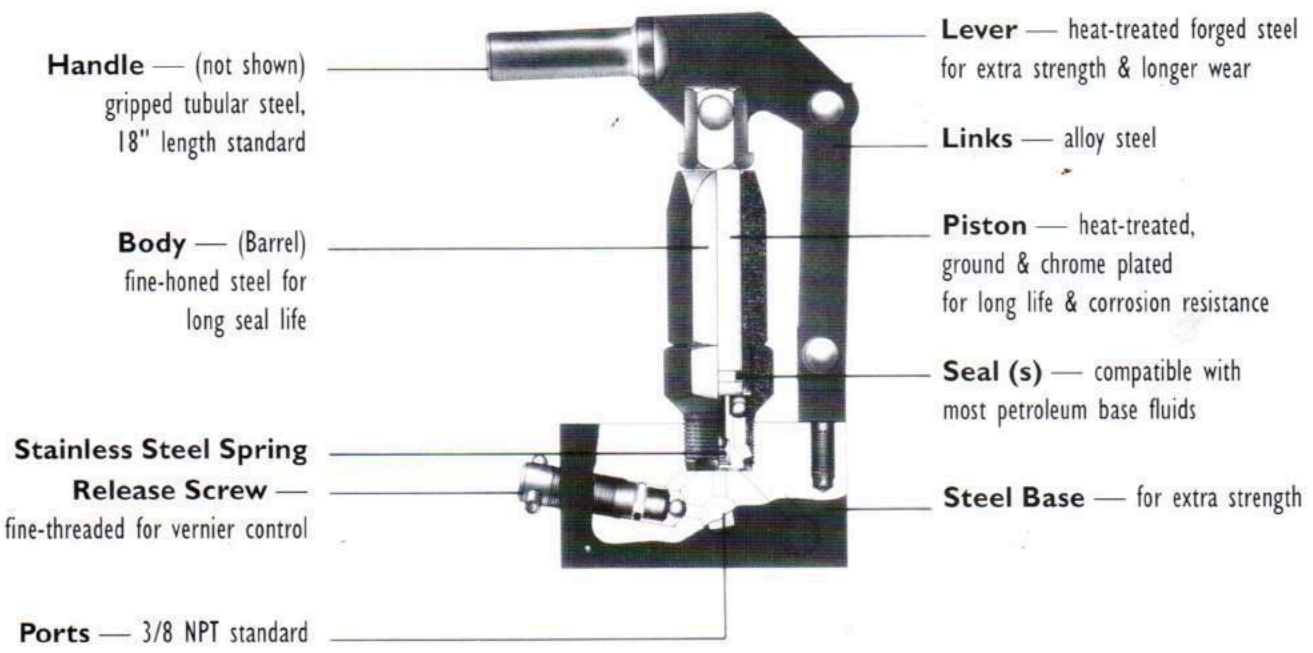
On request, TR can provide: design in stainless steel, special seals, pumps designed and manufactured to customer's specifications. Integral pressure relief valve option is also available.

NOTES: Standard TR Engineering Hand Pumps do not have a relief valve.

Standard handpump handles are removable and not shown in all illustrations.

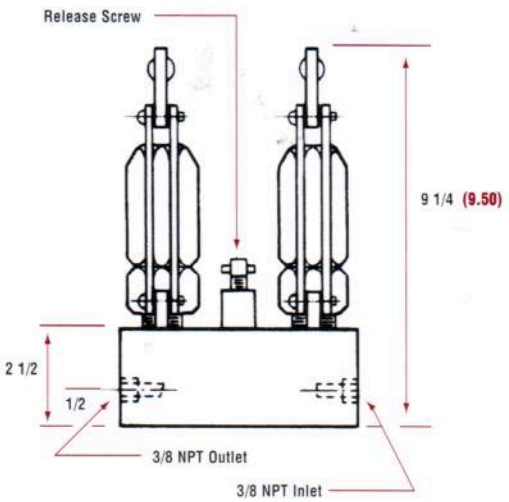
A knurled knob release screw option is available on these handpumps.

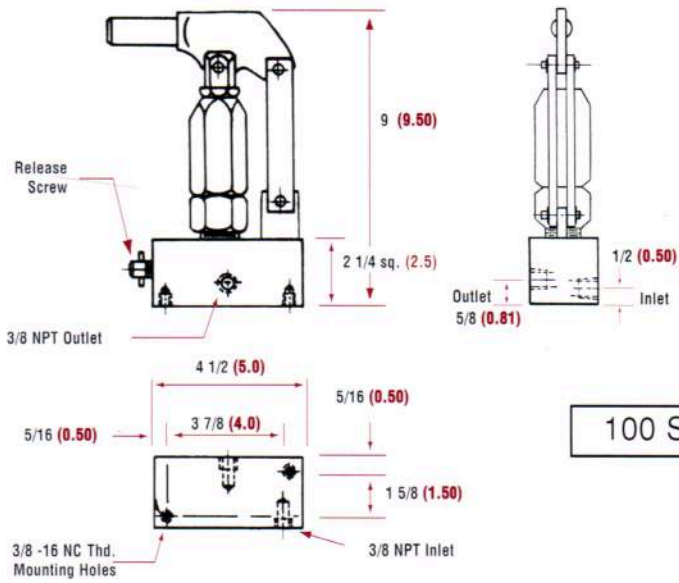




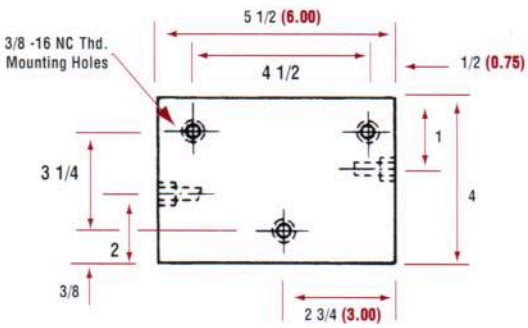
Modular Hand Pumps

Single and Double Piston with Release Screw for Single Acting Cylinders





100 Series



200 Series

NOTES: (XX) indicates –12 dimensions for 1.50 Diameter piston models which differ from the dimensions shown for all other models.

Standard 200 Series Pumps have a single outlet with a common release screw and are available with individual outlets and same size pistons.

SAE ports –4 and –6 are available on all models.

Standard ports are 3/8 NPT.

Piston combinations other than those shown are available.

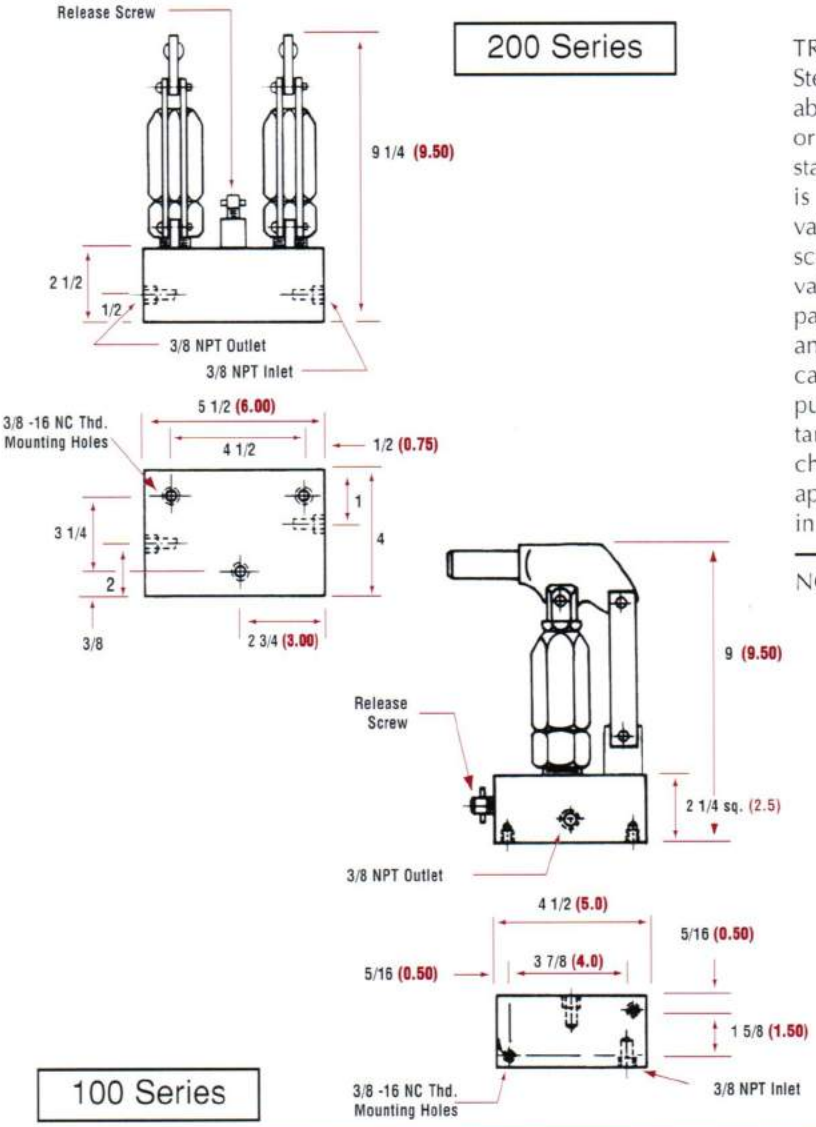
Pressure limiting valves can be provided on these pumps.

Model No.	Pressure Rating PSI	Piston Diameter In.	Handle Force Req'd. for Rated Pressure Lbs.	Volume/ Stroke Cu. In.	Net Weight Lbs.
100 SERIES					
100-3	0-20000	.375	210	.16	12
100-4	0-10000	.50	191	.28	12
100-5	0-5000	.62	153	.38	12
100-6	0-3000	.75	128	.66	12
100-8	0-1500	1.00	114	1.08	12
100-12	0-500	1.50	86	2.20	18
NOTE: A knurled knob release screw option is available on these handpumps.					
200 SERIES					
200-4-6	0-10000 0-3000	.50 .75	191 128	.28 .66	21
200-4-8	0-10000 0-1500	.50 1.00	191 114	.28 1.08	21
200-4-12	0-10000 0-500	.50 1.50	191 86	.28 2.20	25
200-6-6**	0-3000 0-3000	.75 .75	128 128	.66 .66	21
200-8-8**	0-1500 0-1500	1.00 1.00	114 114	1.08 1.08	21
200-12-12**	0-500 0-500	1.50 1.50	86 86	2.20 2.20	25

*Note: Handle force required is linear, i.e. force required for 2,000 PSI is half that required for 4,000 PSI.
**Standard with individual outlets and release screws.

Stainless Steel Hand Pumps

200 Series



TR Engineering Stainless Steel Hand Pumps are available in either 100% stainless or "wetted parts only" in stainless. Stainless steel alloy is used for pump block, valve block, piston, release screw and necessary check valve parts. In the "wetted parts only" version, the balance of the components are cadmium plated. These pumps offer excellent resistance to corrosion in marine, chemical and processing applications, or when used in corrosive atmospheres.

NOTES: (XX) indicates –12 dimensions for 1.50 Diameter piston models which differ from the dimensions shown for all other models.

Standard 200 Series Pumps have a single outlet with a common release screw and are available with individual outlets and same size pistons.

Self-contained units with reservoirs are available.

Dimensions for self-contained handpumps 100-X-120 and 100-X-150 are on page 5. The –12 is not available in the 100-120 style.

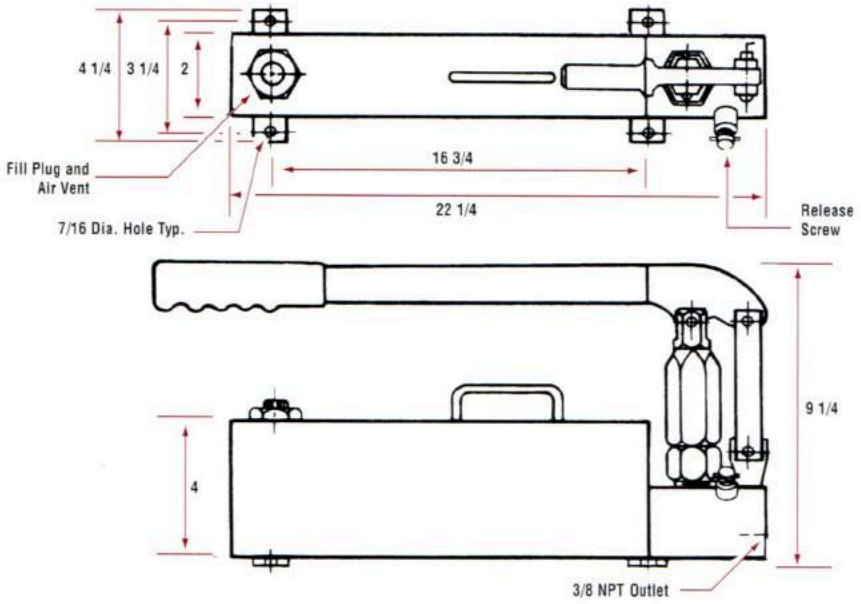
100 Series

Complete Stainless Model No.	Wetted Parts Only Model No.	Pressure Rating PSI	Piston Diameter In.	*Handle Force Req'd. for Rated Pressure Lbs.	Volume/ Stroke Cu. In.	Inlet and Outlet Size In.	Net Weight Lbs.
100-3-SS1*	100-3-SS2	0-20000	.375	210	.16	3/8 NPT	12
100-4-SS1	100-4-SS2	0-10000	.50	191	.28	3/8 NPT	12
100-6-SS1	100-6-SS2	0-3000	.75	128	.66	3/8 NPT	12
100-8-SS1	100-8-SS2	0-1500	1.00	114	1.08	3/8 NPT	12
100-12-SS1	100-12-SS2	0-500	1.50	86	2.20	3/8 NPT	18
200-4-6-SS1	200-4-6-SS2	0-10000 0-3000	.50 .75	191 128	.28 .66	3/8 NPT	21
200-4-8-SS1	200-4-8-SS2	0-10000 0-1500	.50 1.00	191 114	.28 1.08	3/8 NPT	21
200-4-12-SS1	200-4-12-SS2	0-10000 0-500	.50 1.50	191 86	.28 2.20	3/8 NPT	25

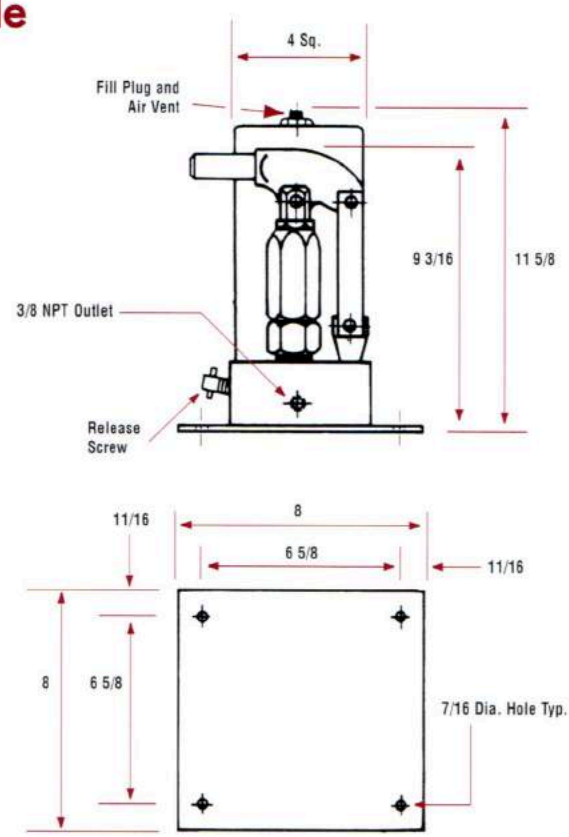
* Note: Available on special order.

Self-Contained Hand Pumps

Single Piston with Release Screw for Single Acting Cylinders



100-120 Series



100-150 Series

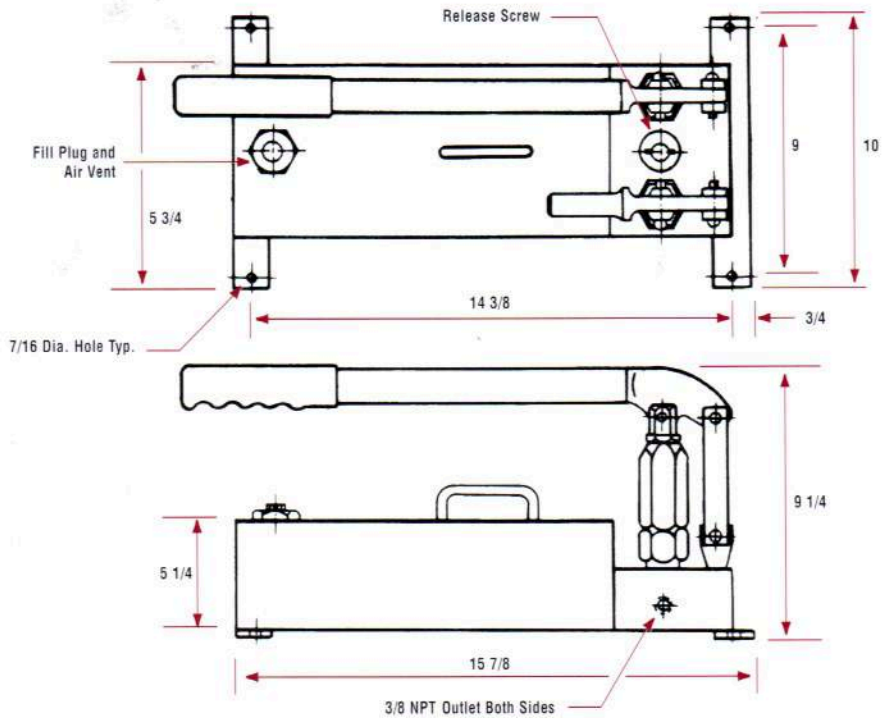
NOTE: Pressure limiting valves can be provided on these pumps.

Model No.	Pressure Rating PSI	Reservoir Capacity Cu. In.	Piston Diameter In.	Handle Force Req'd. for Rated Pressure Lbs.	Volume/ Stroke Cu. In.	Outlet Size In.	Net Weight Lbs.
100-120 SERIES							
100-3-120	0-20000	120	.375	210	.16	3/8 NPT	17
100-4-120	0-10000	120	.50	191	.28	3/8 NPT	17
100-5-120	0-5000	120	.62	153	.38	3/8 NPT	12
100-6-120	0-3000	120	.75	128	.66	3/8 NPT	17
100-8-120	0-1500	120	1.00	114	1.08	3/8 NPT	17
100-12-120	0-500	120	1.50	86	2.20	3/8 NPT	21
100-150 SERIES							
100-3-150	0-20000	150	.375	210	.16	3/8 NPT	21
100-4-150	0-10000	150	.50	191	.28	3/8 NPT	21
100-5-150	0-5000	150	.62	153	.38	3/8 NPT	21
100-6-150	0-3000	150	.75	128	.66	3/8 NPT	21
100-8-150	0-1500	150	1.00	114	1.08	3/8 NPT	21
100-12-150	0-500	150	1.50	86	2.20	3/8 NPT	23

NOTE: Handle force required is linear, i.e. force required for 2,000 PSI is half that required for 4,000 PSI.

Self-Contained Hand Pumps

Double Piston with Release Screw for Single Acting Cylinders



200-300 Series

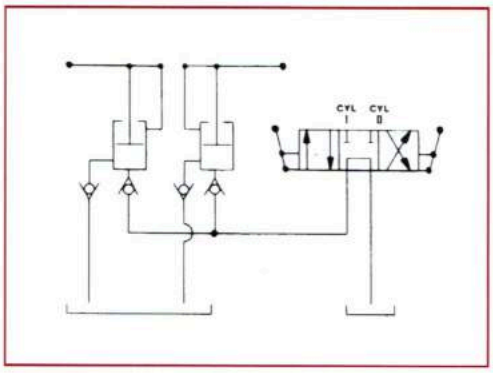
NOTE: 450 and 900 cu. in. reservoirs available in this design.

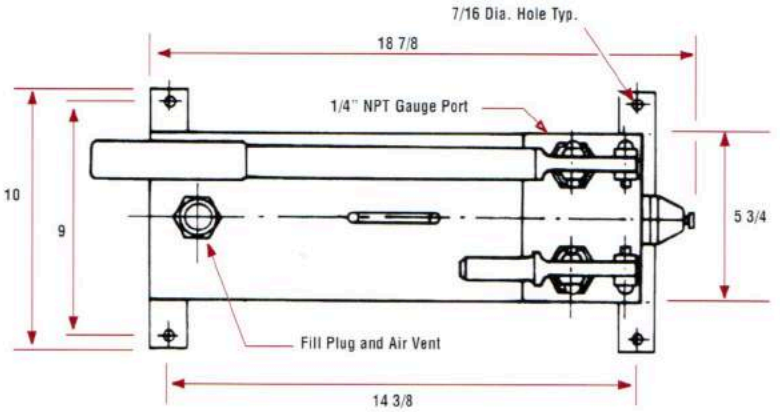
Model No.	Pressure Rating PSI	Reservoir Capacity Cu. In.	Piston Diameter In.	Handle Force Req'd. for Rated Pressure Lbs.	Volume/ Stroke Cu. In.	Outlet Size In.	Net Weight Lbs.
200-300 SERIES							
200-4-6-300	0-10000 0-3000	300	.50 .75	191 128	.28 .66	3/8 NPT	36
200-4-8-300	0-10000 0-1500	300	.50 1.00	191 114	.28 1.08	3/8 NPT	36
200-4-12-300	0-10000 0-500	300	.50 1.50	191 86	.28 2.20	3/8 NPT	36
200-6-8-300	0-3000 0-1500	300	.75 1.00	128 114	.66 1.08	3/8 NPT	36
200-6-12-300	0-3000 0-500	300	.75 1.50	128 86	.66 2.20	3/8 NPT	39
200-8-12-300	0-1500 0-500	300	1.00 1.50	114 86	1.08 2.20	3/8 NPT	40

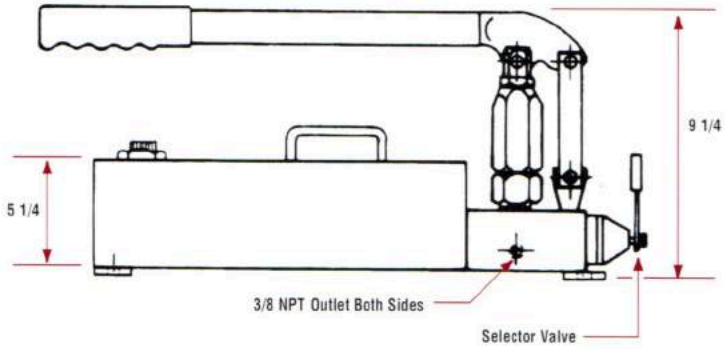
NOTE: Handle force required is linear, i.e. force required for 2,000 PSI is half that required for 4,000 PSI.

Self-Contained Hand Pumps

Double Piston with 4-Way Valve for Double Acting Cylinders







NOTES: Dimensions for 1.50 in. diameter piston models will vary slightly from those shown here.

225, 450, and 900 cu. in. reservoirs available in this design.

200-300-S Series

Model No.	Pressure Rating PSI	Reservoir Capacity Cu. In.	Piston Diameter In.	Handle Force Req'd. for Rated Pressure Lbs.	Volume/ Stroke Cu. In.	Outlet Size In.	Net Weight Lbs.
200-300-S SERIES							
200-4-8-300-S	0-10000	300	.50	191	.28	3/8 NPT	37
	0-1500		1.00	114	1.08		
200-4-12-300-S	0-10000	300	.50	191	.28	3/8 NPT	40
	0-500		1.50	86	2.20		
200-6-8-300-S	0-3000	300	.75	128	.66	3/8 NPT	37
	0-1500		1.00	114	1.08		
200-6-12-300-S	0-3000	300	.75	128	.66	3/8 NPT	40
	0-500		1.50	86	2.20		

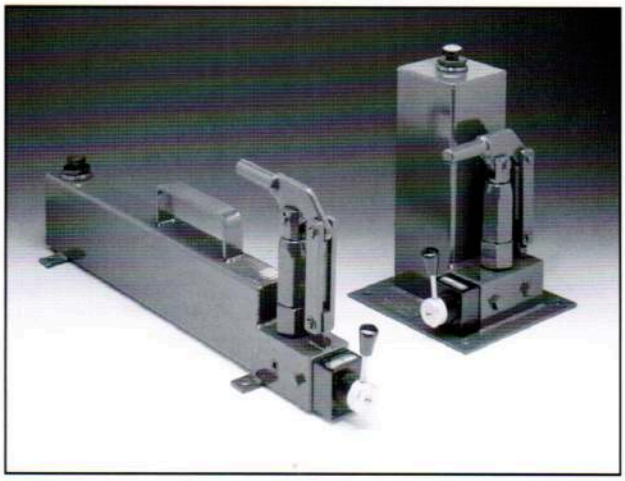
NOTE: Handle force required is linear, i.e. force required for 2,000 PSI is half that required for 4,000 PSI.

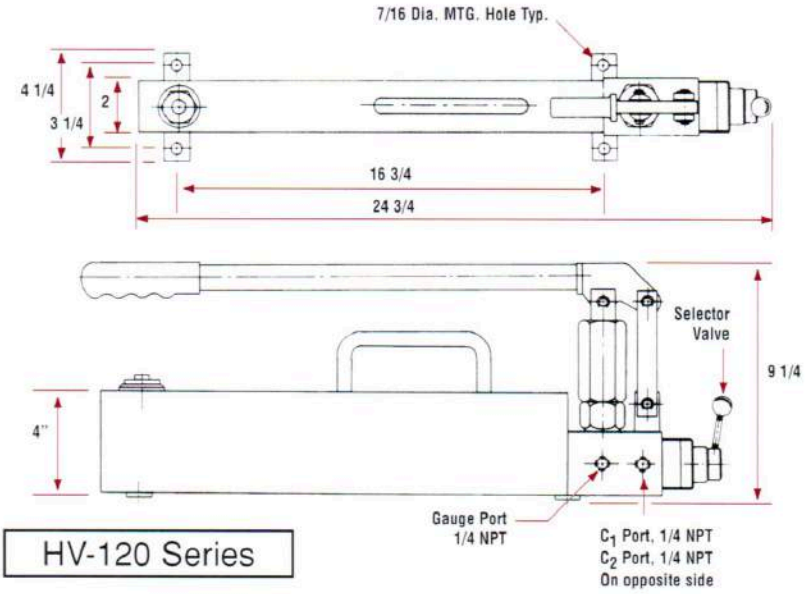
Self-Contained Hand Pumps

HV Series – Single Piston with 4-way Valve for Double Acting Cylinders

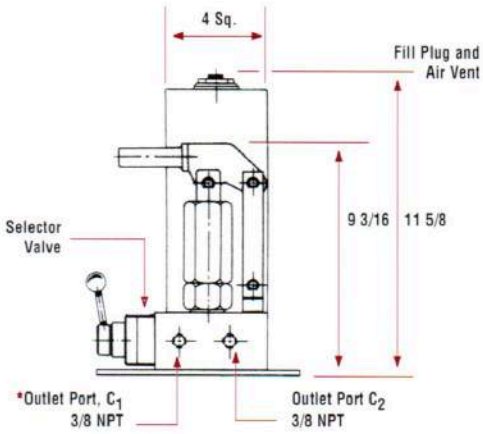
TR Engineering's HV Series Handpumps are ideally suited for hand-pump applications employing double-acting cylinders. They offer a high quality, low-cost alternative to separate components. The hand-pumps are available in two basic styles: the horizontal 120 style and the vertical 150 style. The 120 style includes a 1/4" NPT gauge port which may be used to monitor pump pressure.

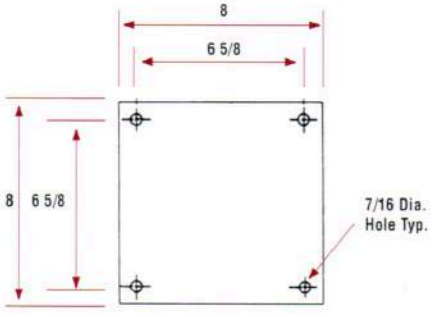
The HV Series Handpumps use the TR Engineering MDCM valves and are available with three flow pattern options, as well as a seal and handle option. Consult the factory for incorporating a pressure relief valve in the HV Series pumps.





HV-120 Series





HV-150 Series

Model No.	Reservoir Capacity (cu. in.)	Pressure Rating PSI	Displacement (In^3/stroke)	Handle Effort* (lbs.)	Weight (dry lb.)
HV-120 SERIES					
HV100-4-120	120	5000	.25	95	16
HV100-5-120	120	3000	.35	92	16
HV100-6-120	120	2000	.60	85	16
HV100-8-120	120	1000	1.00	75	17
HV-150 SERIES					
HV100-4-150	150	5000	.25	95	21
HV100-5-150	150	3000	.35	92	21
HV100-6-150	150	2000	.60	85	21
HV100-8-150	150	1000	1.00	75	22

NOTE: *at rated pressure

Option - Add to base model #

-2 = 24" Handle -OC = Open Center -V = Viton Seals -CC = Closed Center -E = EPR Seals

NOTE: Unless seal and/or flow pattern options are selected, Buna N seals and a tandem center valve will be supplied.

NOTE: * 1/4" NPT or -4SAE are available.

Directional Control Valves

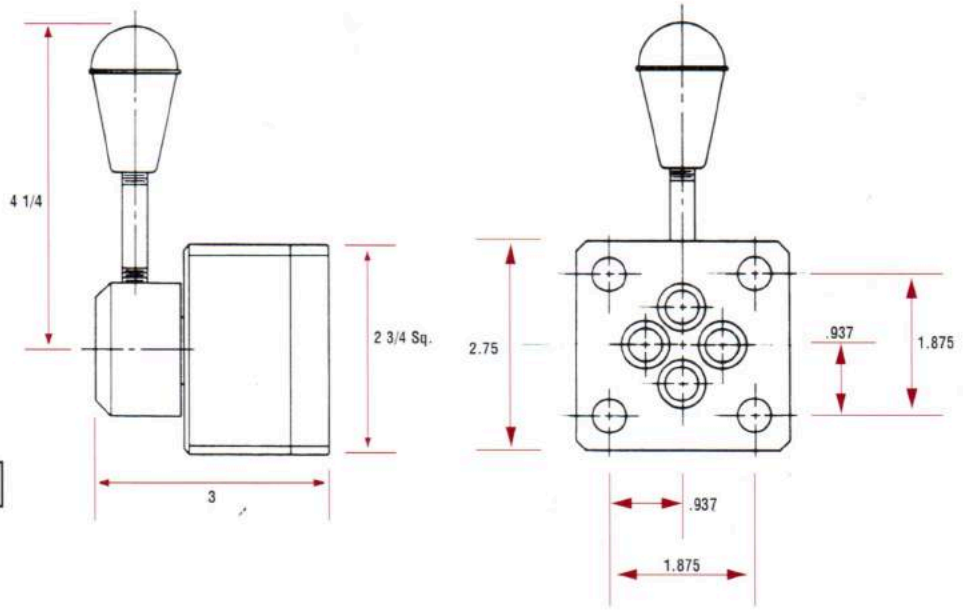
DC Series

The TR DC Series valves are three position, detented four-way valves and are constructed of heat-treated aluminum and alloy steels. The valves incorporate special seal designs to eliminate pressure loss when shifting from one position to another, as well as extremely low inter port leakage. Normal operating temperature range is -65°F to +160°F. The DC Series valves have a CV factor of .95.

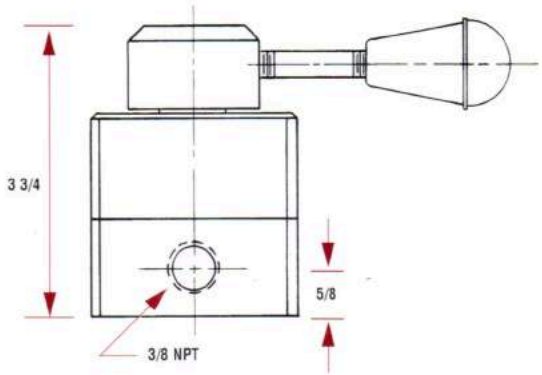
Back pressure should not exceed 250 PSI for satisfactory operation. The DC Series valves weigh about two (2) lbs. For the manifold version, valves are supplied with 3/8" - 16 high strength mounting bolts.

The DC Series valves are widely used for ground support applications and for hydraulic systems where extremely low leakage and high reliability are mandatory.

These valves are also available in stainless steel construction.



Manifold Mount Model



Side Port Model

Series	Pressure Rating PSI	Port Location	Rotor Configuration	Port Size	Seals
DC	L - 3,500	0 - Manifold	0 - Closed Center	1 - 3/8 NPT	N - Nitrile (STD)
	H - 10,000	1 - Side	1 - Tandem Center	2 - 6SAE	V - Viton
		2 - Bottom	2 - Open Center	3 - 6 Manifold	E - EPR
			3 - Manipulator	4 - 1/4 NPT	
				5 - 4 SAE	

NOTE: To Order: Develop valve model number from above table.
NOTE: For medium interflow poppets, add an "M" to the above model designation.
NOTE: -2 and -3 rotors are not available on 10,000 PSI valves.

Directional Control Valves

MDC Series

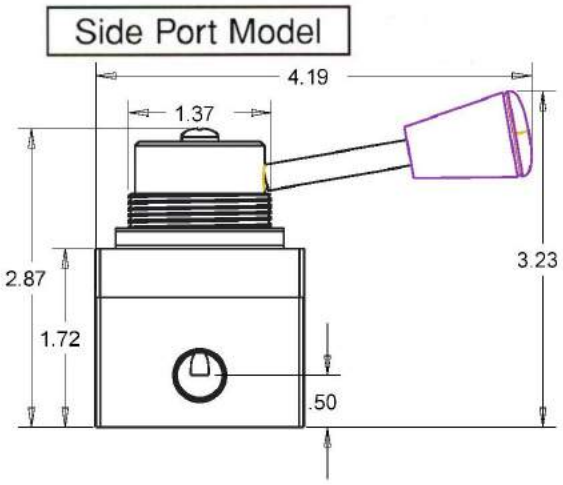
MDC Series valves are constructed of heat treated alloy steel and aluminum components. They are compact, lightweight (12 oz.) and shift easily even under maximum pressure. The valves have extremely low leakage, less than one (1) drop per two (2) minutes at rated pressure.

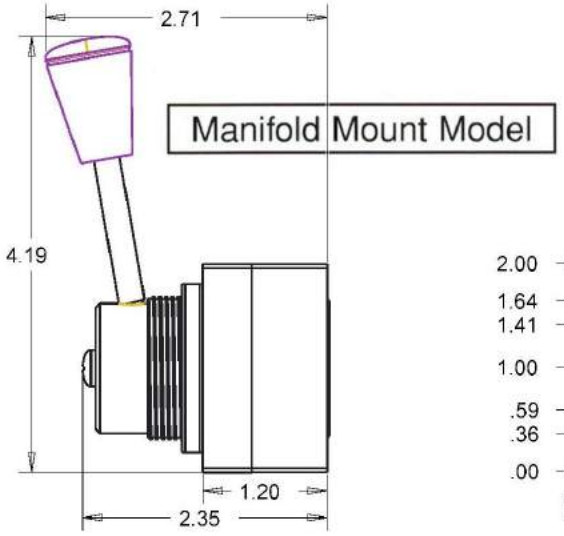
Two working pressure ratings, are available, 3000 PSI and 6000 PSI. The CV factor is .26 for the 1/8" NPT and -4 SAE, and .29 for the 1/4" NPT and -6 SAE. Temperature range is -65°F to +160°F. The manifold mounting conforms to 200 DO3 mounting pattern. For panel mounting, the hole should be 1 13/32" diameter and with a maximum thickness of 5/16".

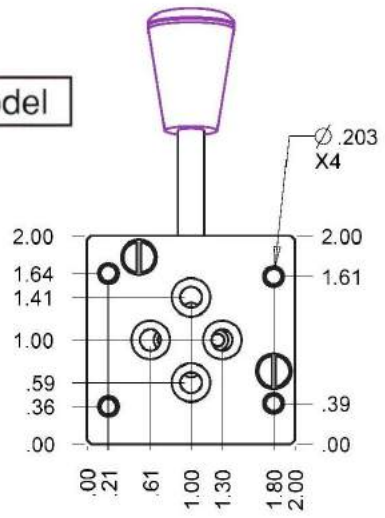
The -7 configuration manipulator provides a special 4 way flow pattern which is ideal for pilot applications. In the neutral position, P is blocked and A and B are connected to tank. There is a restriction in neutral between A, B and tank, and this valve cannot be used where return flow through A and B is high.

High strength mounting bolts are included with the manifold mount version valve.

The MDC Series valves are used on TR Handpumps due to their compact size and high reliability. The valves are also used in a broad range of OEM applications, including instrumentation systems for power plants, jet engine transport trailers and testing systems.







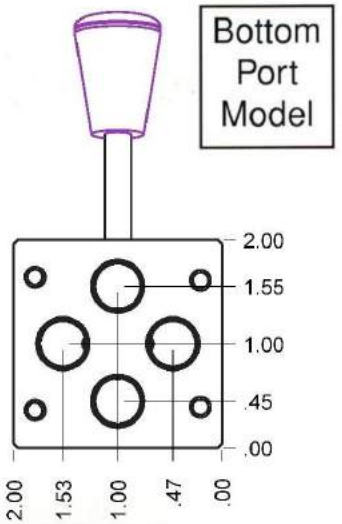
Series	Pressure Rating PSI	Port Location	Flow Configuration	Port Size	Seals	Panel Mounting
MDC	L - 3,000	0 - Manifold	2 - 2 Way	1 - 1/8" NPT	N - Nitrile (STD)	0 - No (STD)
	M - 6,000	1 - Side	3 - 3 Way	2 - 1/4" NPT	V - Viton	P - Yes
		2 - Bottom	4 - 4 Way Closed	3 - 4 SAE	E - EPR	
			5 - 4 Way Tandem	4 - 6 SAE		
			6 - 4 Way Open	5 - 6 Manifold		
			7 - Manipulator			

NOTE: To Order: Develop valve model number from above table.

NOTE: On bottom ports, only 1/8" NPT, 1/4" NPT and -4SAE are available.

NOTE: -D = 2 position detent.

MDC Series valves are available in stainless steel as well as combinations of stainless steel and aluminum construction.

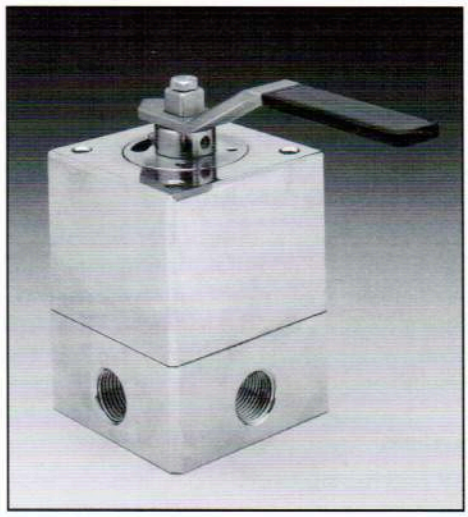


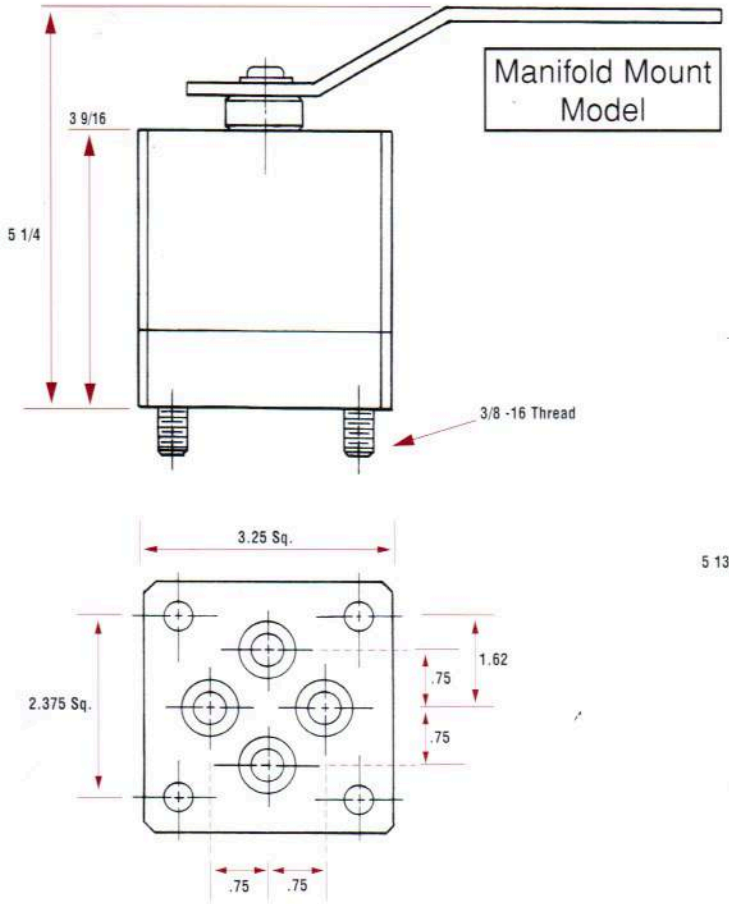
Directional Control Valves

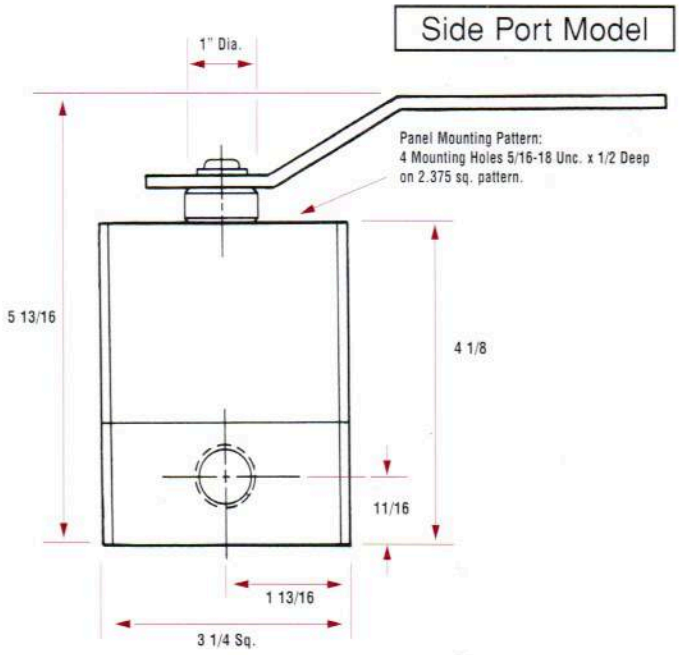
CVC Series

The CVC Series valves are rated for 3000 psi. Various flow paths are available. The CV factor is 2.8. The standard valves are constructed of aluminum and alloy steels and are suitable for hydraulic service. Valves for water service are available; constructed with various combinations of aluminum, stanless steel, and bronze. Consult the factory for details. These valves incorporate special seals for low leakage (less than 2 drops/min.). Temperature range is -65°F to 160°F.

High strength mounting bolts are included with the manifold mount version. The handle torque is 85 in. lb. at 2,000 psi for four way valves.





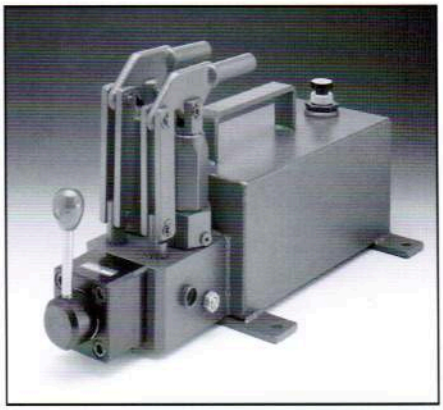


Series	Port Location	Flow Conference	Port Size	Seals	Service	Options
CVC	0 - Manifold	2 - 2 Way	1 - 3/8" NPT	N - Nitrile	H - Hydraulic Fluid	A - Panel Mount
	1 - Side	3 - 3 Way	2 - 1/2" NPT	V - Viton	W - Water	B - Spring Center
	2 - Bottom	4 - 4 Way Closed	3 - 6 SAE	E - EPR		C - 2-Pos Detent
		5 - 4 Way Tandem	4 - 8 SAE			(No center)
		6 - 4 Way Open	5 - Manifold			
		7 - 4 Way Manipulator				

Special Products

TR Engineering has developed a wide range of special products to meet the exacting demands of their customers. If the product you need to meet your requirements isn't shown in the catalog, please contact us so we may offer a variation of a standard or a custom engineered product.

A few of our special products include:

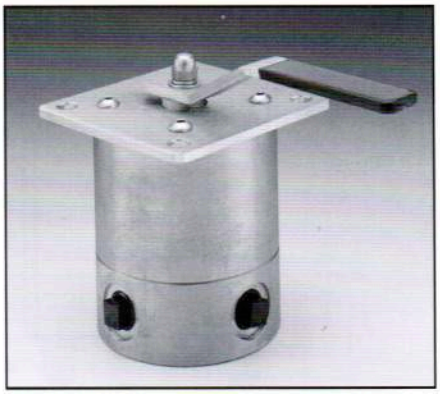


Hand Pumps & Cylinders

TR Engineering has designed and manufactured a broad range of hydraulic handpumps and cylinders for many ground support applications, including jet engine and missile trailers, aircraft tow bars and trailer leveling stabilizers and NASA Space Shuttle support equipment. TR has also supplied a variety of shipboard systems, and primary emergency backup systems for oil field tooling and safety equipment.

Systems

TR Engineering special capabilities also include large hydraulic power supplies and cylinders, as well as computer controlled automatic hydraulic testing equipment.



Pilot Operated Check Valve (PCV)

This valve has a ratio of 5 to 1 and can be operated up to 10,000 psi with a rated flow of 7 gpm. It can be supplied with special seals for use with non-petroleum based fluids.

Special Valves

The **4WDD valve** was specially designed to meet the exacting needs of the U.S. Military. The valve has no external or inter port leakage and is operational over an extremely wide temperature range. Its unique porting and internal flow paths enabled an extremely small envelope to be used.

The valve shown in the middle is an all strainless steel valve rated at 10,000 psi at seven (7) gpm for hydraulic service.

The 2XDC valve incorporates two 4-way closed center valves with a single input shaft in one body. Rated at 7 gpm, 3,000 psi, these valves allow multi-functions in one valve.

Relief Valves

TR Engineering has designed and supplies special relief valves for many applications. These valves operate up to 6,000 psi and 15 gpm.

SMDC

This Solenoid-operated valve features extremely low leakage. This valve is rated up to 5,000 psi and 3 gpm. Various flow paths and coil options are available. Consult factory for details.

Limited Warranty

TR Engineering Inc. Products are warranted against defects in material and workmanship for 90 days form the date of shipment except where otherwise stated in writing. TR Engineering shall provide full repair or replacement of defective parts during the warranty period, provided that the product has been operated properly, has been serviced and maintained only at an authorized TR Engineering Service Center and has not been damaged or altered. No representative of TR Engineering is authorized to make any other warranty. No warranty is given except the above limited commercial warranty.

Notes

TR ENGINEERING INCORPORATED

CELEBRATING 30 YEARS IN BUSINESS

CUSTOM DESIGNED hydraulic hand pumps and directional control valves

Proudly made in the USA

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