

Oilgear Towler

SLIP-IN CARTRIDGE INSERT VALVES & OPERATORS



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INTRODUCTION & FEATURES IN BRIEF

General Features

1. 350 bar service.
2. Sizes from DIN 016 to DIN 100.
3. Slip-in cartridge insert valves can provide the following functions:
 - a) Check valve.
 - b) Flow control.
 - c) Pressure regulating.
 - d) Directional control.
 - e) Decompression control.
 - f) Special combinations.
4. A single cartridge can provide more than one function with proper operator circuiting.
5. Cartridges of the same size but different ratios are interchangeable.
6. Cartridges are small, compact and handle high flow rates.
7. Individual cartridges can be sized to satisfy circuit flow rates.
8. Different size cartridges (with spacers) can be designed into a common manifold eliminating necessity for angular drilling.
9. Cartridges can be installed in a manifold at right angles to each other or even reversed from standard position to simplify manifold machining.

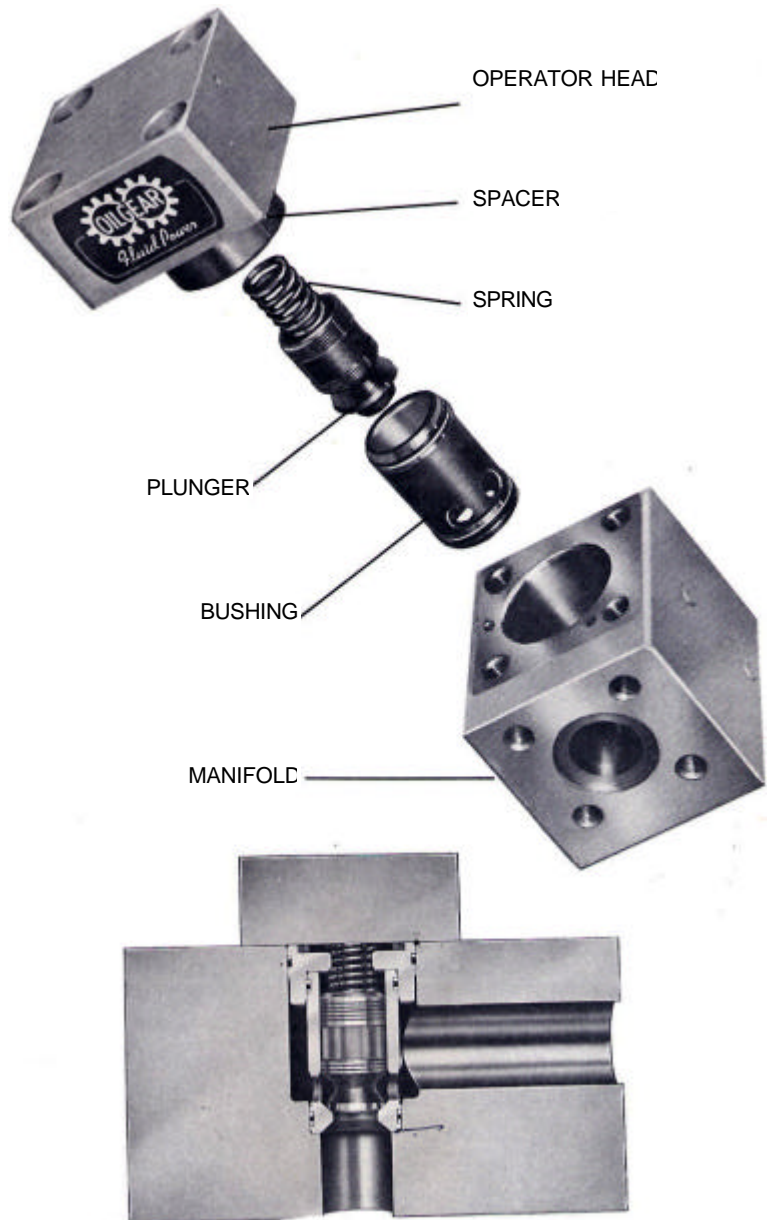


Figure 2. Cross Section of Typical Slip-in Cartridge Insert Valve

Insert Construction Features

1. Low pressure drop due to streamline flow through valve.
2. Fast response because of small control volume necessary.
3. Poppet type seat minimizes leakage.
4. Available with or without throttling nose.
5. Different plunger area ratios are available to provide various functions.
6. Side loads on bushing are eliminated through use of spacer.
7. Various length spacers available simplify manifold layout and machining.
8. Various springs are available to provide different cracking pressures.
9. Back-up rings are used with O-ring seals to insure long seal life.

Operator Features

1. Operators for insert valves of the same size are interchangeable.
2. Test stations and orifices are in operator heads.
3. Operator heads for various control valves are offered.

OPERATION OF SLIP-IN CARTRIDGE INSERT VALVES

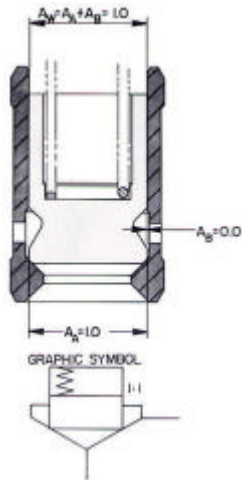


Figure 4. port A area (A_A) is unity (1.0), effective Port B area (A_B) is zero. Therefore, top plunger area A_W is $1 + 0 = 1$. Ratio of this valve plunger is expressed as 1:1.

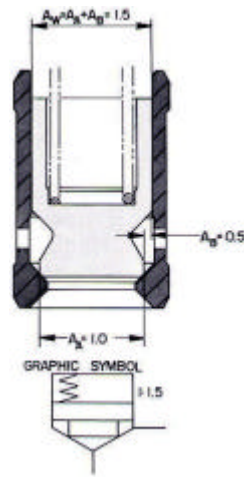


Figure 5. port A area (A_A) is unity (1.0), effective Port B area (A_B) is half of port A area (0.5). Therefore, top plunger area A_W is $1.0 + 0.5 = 1.5$. Ratio of this valve plunger is expressed as 1:1.5.

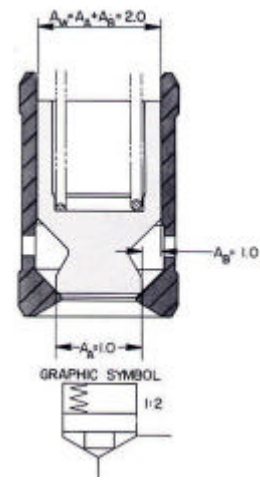


Figure 6. port A area (A_A) is unity (1.0), effective Port B area (A_B) is same as port A area (1.0). Therefore, top plunger area A_W is $1.0 + 1.0 = 2.0$. Ratio of this valve plunger is expressed as 1:2.

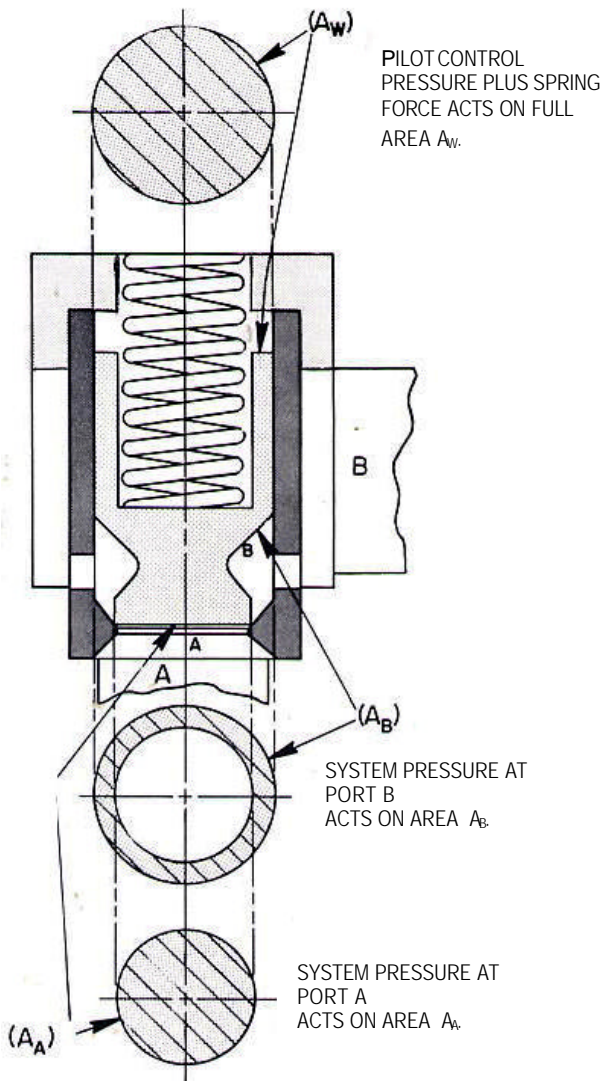


Figure 3. Valve Operating Areas.

Ratios — What are they?

Opening and closing of the valve is a function of force balances on three areas; A_A , A_B and A_W . Pressures in areas A_A and effective area A_B tend to open the plunger. Spring force and pressure acting on area A_W tend to close the plunger.

NOTE: Area A_A is always considered “unity” (1.0) and area A_W is the sum of areas A_A and A_B .

Valves with a 1:1 ratio are primarily used to regulate pressure. Valves with a 1:1.5 ratio are primarily used as pilot operated check valves, directional control valves and (when used with stroke limiter option) flow control valves. Valves with a 1:2 ratio are sometimes used as directional valves when it is necessary that flow characteristics be the same in either direction.

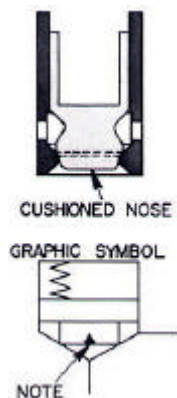


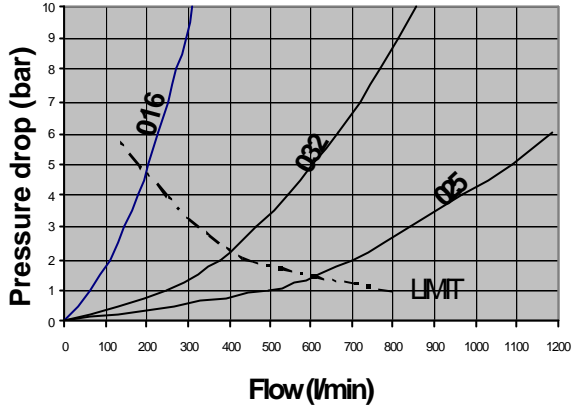
Figure 7. Cushion Nose Plunger

Cushion Nose Plungers

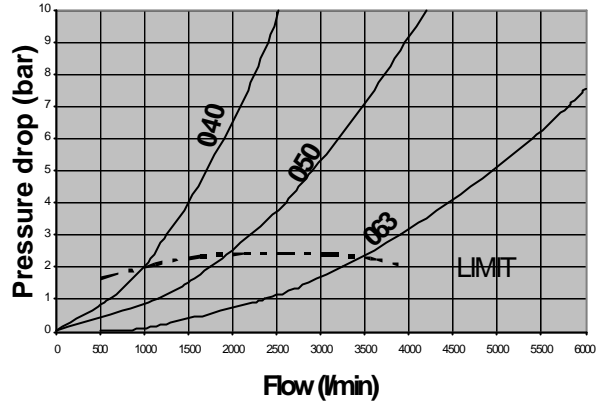
Valve plungers are also available with a tapered “cushion nose”. This nose provides gradual opening and closing of flow passage to pressure for decompression control and smooth operation of hydraulic system. When used with stroke limiting option, it provides a very fine flow adjustment.

CARTRIDGE SPECIFICATIONS

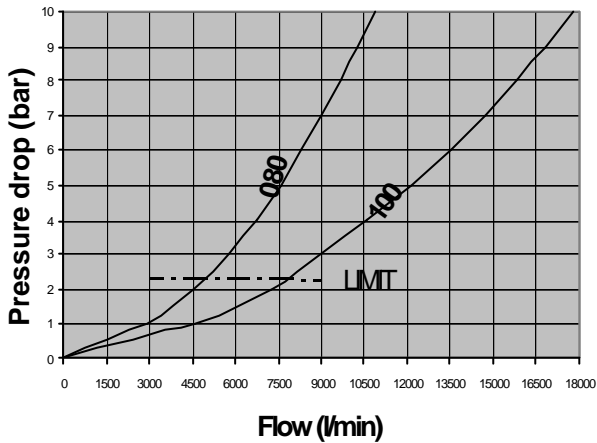
Type PE - A (not progressive)
016 / 025 / 032



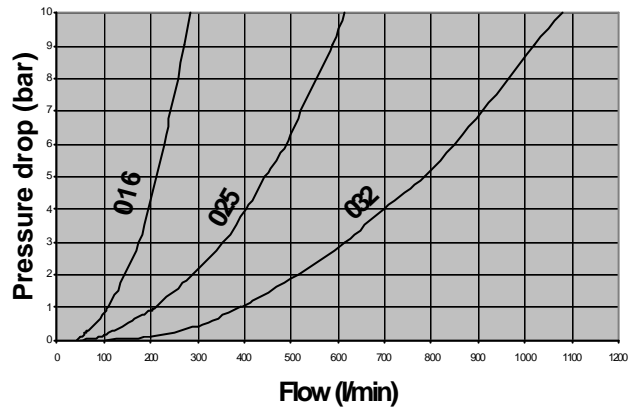
Type PE - A (not progressive)
040 / 050 / 063



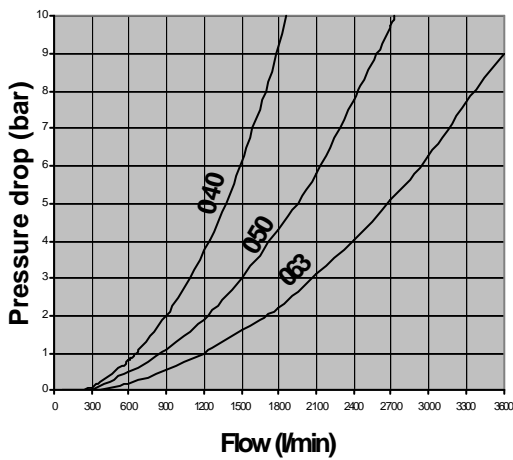
Type PE - A (not progressive)
080 / 100



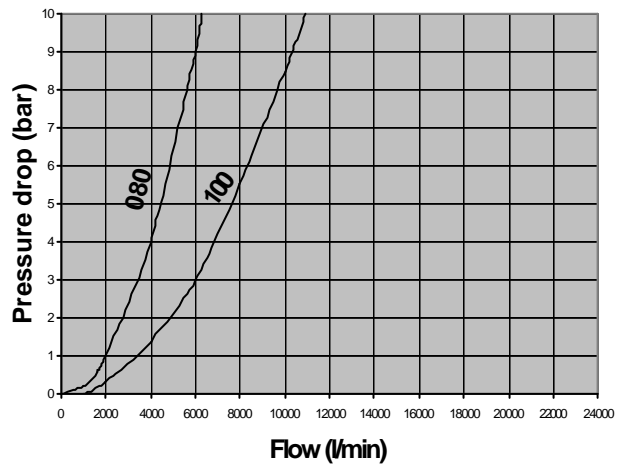
Type SE - A 1.5 / 2.0 (not progressive)
016 / 025 / 032



Type SE - A 1.5 / 2.0 (not progressive)
040 / 050 / 063

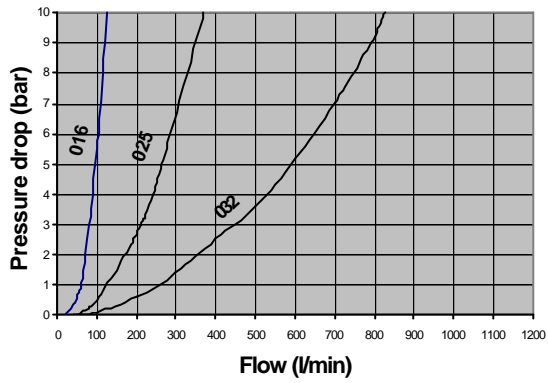


Type SE - A 1.5 / 2.0 (not progressive)
080 / 100

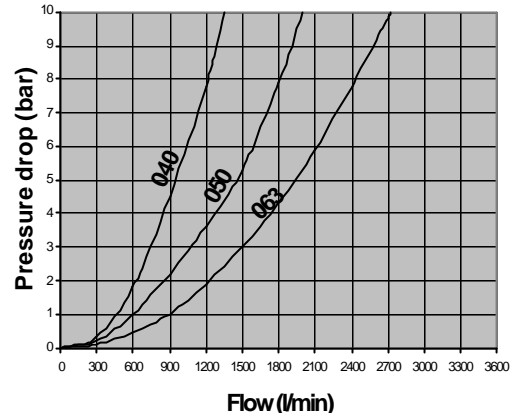


CARTRIDGE SPECIFICATIONS

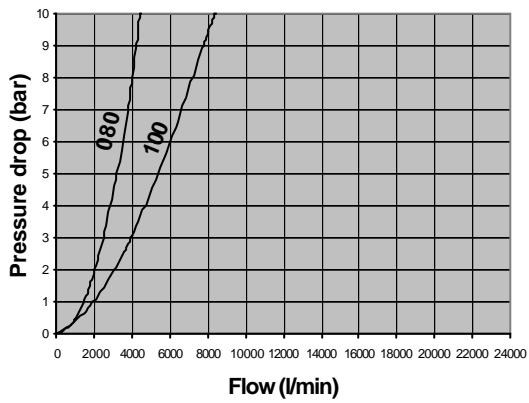
Type SE - B (progressive)
016 / 025 / 032



Type SE - B (progressive)
040 / 050 / 063



Type SE - B (progressive)
080 / 100



HOW TO ORDER SLIP- IN CARTRIDGE INSERT ASSEMBLIES

Explanation

Example:

S E 040 - X A 1.5 / 3 P

Application

S = Standard 350 bar service
 Z = Special, write out description
 L = Pressure reducer function
 P = Relief valve function

Design

E = Standard cartridge insert valve per DIN 24342 standards

Choke (Only for S application)

Omit = Without choke (std.)
 W = With choke

Size

016, 025, 032, 040, 050, 063, 080, 100

Series

X (last version will be delivered)

Omit = Standard
 E = Piston with seals

O-ring material

P = Perbunan (std.)
 V = Viton (std. in PE cartridges)

Spring number

See table

Plunger Area Ratios (See page 3)

1.0= 1:1
 1.5= 1:1.5
 2.0= 1:2
 0.94=0.94:1 (Only SE type)
 Omit = type L

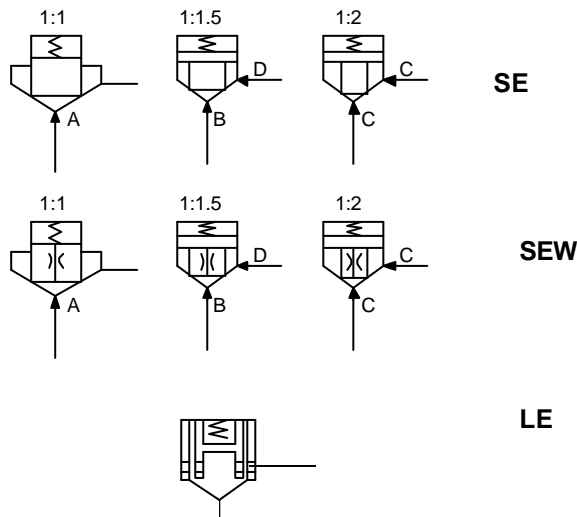
Note: Cartridges PE only 1:0

Plunger type (See page 3)

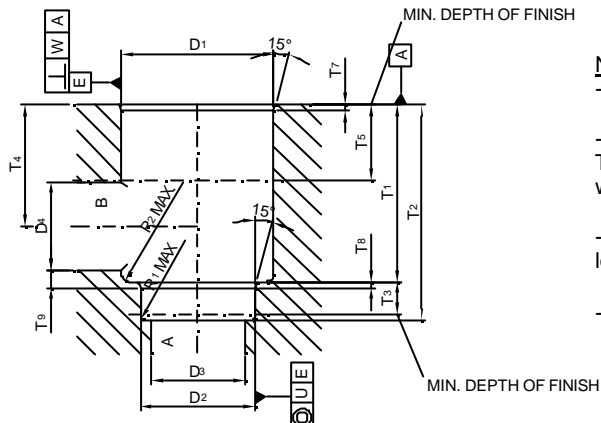
A = Not progressive
 B = Progressive
 Omit = type L

Cracking pressure for all sizes

Direction at Flow	Spring Number					
	No Spring 0	1	2	Standard 3	LE 4	PE 5
	bar	bar	bar	bar	bar	bar
A	0	0.31	0.62	1.24		4
B	0	0.48	0.96	1.93		
C	0	0.62	1.24	2.48		
D	0	0.96	1.93	3.86		



DIMENSION FOR INSERTING CARTRIDGE VALVE



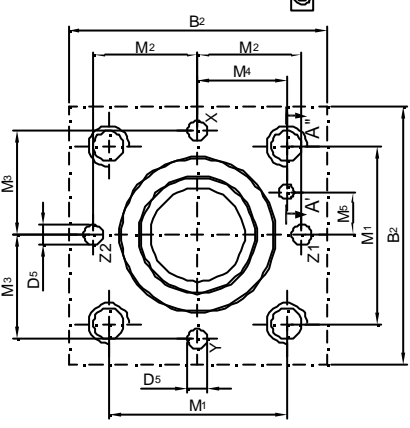
NOTES:

-Pilot valve may exceed B1 & B2 dimensions.

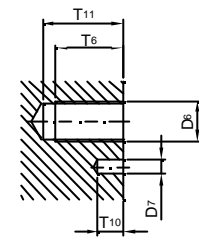
-The location of working port B (D₄) may be anywhere within the location of T1-T5 as long as the minimum shoulder length T9 is maintained. The center line of working port B may be arranged at other angles than 90° with respect to D1

-The depth and angles of the pilot connections are arranged by the function and location of the valves in the manifold. (D₇)

-Recommended thread engagement for ferrous materials (T₆ y T₁₁).



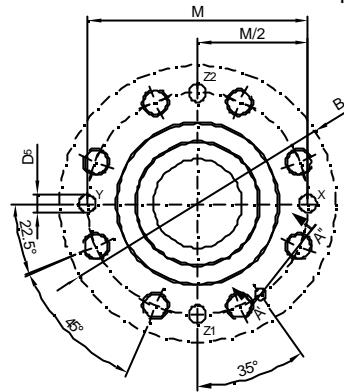
SECTION A'-A''



INSTALLATION DIMENSIONS
PER DIN 24 342-C & N.F.P.A.
SIZES 16 THRU 100

INSTALLATION DIMENSIONS
PER DIN 24 342-C & N.F.P.A.

SIZES 80 THRU 200



- PORT A:** WORKING PORT
- PORT B:** WORKING PORT
- PORT B1:** OPTIONAL WORKING PORT
- PORT X:** PILOT SUPPLY
- PORT Y:** PILOT DRAIN
- PORT Z1:** ADDITIONAL PILOT CONNECTION PREFERRED PILOT SUPPLY
- PORT Z2:** ADDITIONAL PILOT CONNECTION PREFERRED PILOT DRAIN

Figure 9. Installation Dimensions (cavity bore, port and thread size) for size 016 through size 100. (510980-1).

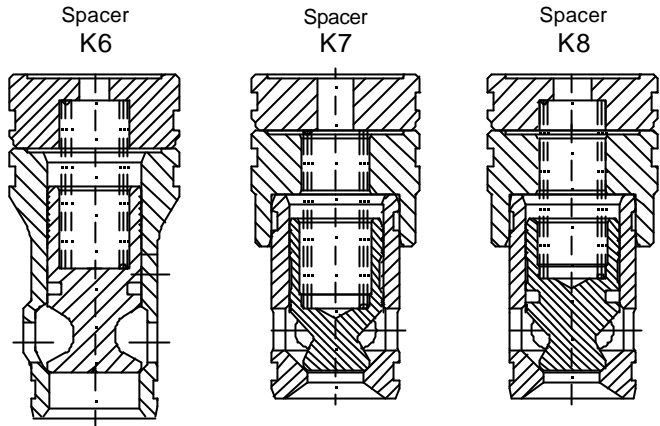
VALVE SIZE	B	B ₁	B ₂	D ₁ H7	D ₂ H7	D ₃		D ₄		D ₅ MAX	D ₆	D ₇ H13	M ±0.1	M ₁ ±0.1	M ₂ ±0.1	M ₃ ±0.1	M ₄ ±0.2	M ₅ ±0.2
						MIN	MAX	MIN	MAX									
016		63.5	63.5	32	25	16	19	16	25	4	M8	4		46	25	25	23	10.5
025		85.8	85.8	45	34	25	27	25	32	6	M12	6		58	33	33	29	16
032		101.6	101.6	60	45	32	37	32	40	8	M16	6		70	41	41	35	17
040		124	124	75	55	40	44	40	50	10	M20	6		85	50	50	42.5	23
050		139.7	139.7	90	68	50	55	50	63	10	M20	8		100	58	58	50	30
063		177.8	177.8	120	90	63	73	63	80	12	M30	8		125	75	75	62.5	38
080	250			145	110	80	88	80	100	16	M24	10	200					
100	300			180	135	100	109	100	125	20	M30	10	245					

VALVE SIZE	T ₁	T ₂	T ₃	T ₄		T ₅	T ₆	T ₇	T ₈	T ₉	T ₁₀	T ₁₁	U	W	R ₁	R ₂
				When D ₄ min	When D ₄ max											
016	43 ^{+0.23}	56 ^{+0.1}	11	34	29.5	20	15	2	2	0.5	10	18	0.03	0.05	0.8	2
025	58 ^{+0.1}	72 ^{+0.1}	12	44	40.5	30	20	2.5	2.5	1	10	24	0.03	0.05	0.8	3
032	70 ^{+0.23}	85 ^{+0.1}	13	52	48	30	27	2.5	2.5	1.5	10	32	0.03	0.1	0.8	3
040	87 ^{+0.23}	105 ^{+0.1}	15	64	59	30	32	3	3	2.5	10	36	0.05	0.1	1	5
050	100 ^{+0.1}	122 ^{+0.1}	17	72	65.5	35	32	4	3	2.5	10	36	0.05	0.1	1	5
063	130 ^{+0.23}	155 ^{+0.1}	20	95	86.5	40	47	4	4	3	10	52	0.05	0.2	1	5
080	175 ^{+0.1}	205 ^{+0.1}	25	130	120	40	40	5	5	4.5	10	45	0.05	0.2	2	8
100	210 ^{+0.1}	245 ^{+0.1}	29	155	142	50	48	5	5	4.5	10	53	0.05	0.2	2	8

ACCESSORIES - Spacers -

Spacers types:

- Spacers for PE cartridges (K6)
- Spacers for SE standard cartridges (K7)
- Spacers for SE sealed cartridges (K8)



Spacers codes and seal kits:

K6 type. (PE cartridges)

Size	LENGTH							Seal kit code	
	015	030	045	060	075	100	125	Perbunan	Viton (Std)
016	3003159810	3003159820	3003159830					7702000552	7703000552
025	3003159910	3003159920	3003159930					7702000553	7703000553
032		3003160020	3003160030					7702000554	7703000554
040	3003160110	3003160120	3003160130	3003160140				7702000555	7703000555
050		3003156920	3003156930	3003156940	3003156950			7702000556	7703000556
063		3003160220	3003160230	3003160240	3003160250			7702000557	7703000557
080		3003160320	3003160330	3003160340	3003160350	3003160360	3003160370	7702000558	7703000558
100		3003160420	3003160430	3003160440	3003160450	3003160460	3003160470	7702000559	7703000559

K7 type. (SE cartridges)

Size	LENGTH							Seal kit code	
	015	030	045	060	075	100	125	Perbunan (Std)	Viton
016	3003236510	3003236520	3003236530					7702000552	7703000552
025	3003236610	3003236620	3003236630					7702000553	7703000553
032	3003236710	3003236720	3003236730	3003236740				7702000554	7703000554
040	3003236810	3003236820	3003236830	3003236840				7702000555	7703000555
050	3003236910	3003236920	3003236930	3003236940				7702000556	7703000556
063		3003237020	3003237030	3003237040	3003237050			7702000557	7703000557
080		3003237120	3003237130	3003237140	3003237150	3003237160	3003237170	7702000558	7703000558
100		3003237220	3003237230	3003237240	3003237250	3003237260	3003237270	7702000559	7703000559

K8 type. (SE sealed cartridges)

Size	LENGTH							Seal kit code	
	015	030	045	060	075	100	125	Perbunan (Std)	Viton
016	3003231710	3003231720	3003231730					7702000552	7703000552
025	3003231810	3003231820	3003231830					7702000553	7703000553
032	3003231910	3003231920	3003231930	3003231940				7702000554	7703000554
040	3003232010	3003232020	3003232030	3003232040				7702000555	7703000555
050	3003232110	3003232120	3003232130	3003232140				7702000556	7703000556
063		3003232220	3003232230	3003232240	3003232250			7702000557	7703000557
080		3003232320	3003232330	3003232340	3003232350	3003232360	3003232370	7702000558	7703000558
100		3003232420	3003232430	3003232440	3003232450	3003232460	3003232470	7702000559	7703000559

ACCESSORIES - Seal kit -

SE/PE cartridges seal kit.

Size	Seal kit code	
	Perbunan (Std)	Perbunan (Std)
016	7702000228	7703000228
025	7702000229	7703000229
032	7702000230	7703000230
040	7702000231	7703000231
050	7702000232	7703000232
063	7702000233	7703000233
080	7702000234	7703000234
100	7702000235	7703000235

SE sealed cartridges seal kit.

Size	Seal kit code	
	Perbunan (Std)	Perbunan (Std)
016	7702000562	7703000562
025	7702000563	7703000563
032	7702000564	7703000564
040	7702000565	7703000565
050	7702000566	7703000566
063	7702000567	7703000567
080	7702000568	7703000568
100	7702000569	7703000569

PE sealed cartridges seal kit.

Size	Seal kit code	
	Perbunan (Std)	Perbunan (Std)
016	7702000570	7703000570
025	7702000571	7703000571
032	7702000572	7703000572
040	7702000573	7703000573
050	7702000574	7703000574
063	7702000575	7703000575
080	7702000576	7703000576
100	7702000577	7703000577

ACCESSORIES - Springs -

SE cartridges spring

Size	Spring type		
		Ref.	Code
016	1	247729	2862477290
	2	247730	2862477300
	3	247731	2862477310
025	1	247732	2862477320
	2	247733	2862477330
	3	247734	2862477340
032	1	247735	2862477350
	2	247736	2862477360
	3	247737	2862477370
040	1	247738	2862477380
	2	247739	2862477390
	3	247740	2862477400

SE cartridges spring

Size	Spring type		
		Ref.	Code
050	1	247741	2862477410
	2	247742	2862477420
	3	247743	2862477430
063	1	247744	2862477440
	2	247745	2862477450
	3	247746	2862477460
080	1	247747	2862477470
	2	247748	2862477480
	3	247749	2862477490
100	1	247750	2862477500
	2	247751	2862477510
	3	247752	2862477520

PE cartridges spring

Size	Spring type	
	Ref.	Code
016	4.56.31592	2850315920
025	4.56.31593	2850315930
032	4.56.31594	2850315940
040	4.56.31595	2850315940
050	4.56.30806	2850308060
063	4.56.31596	2850315960
080	4.56.30907	2850309070
100		

STANDARD OPERATORS

A		Plain operator
B		Operator with stroke limiter
C		Operator for use with pilot valve
D		Operator with stroke limiter for use with pilot valve
E		Operator with dual checks for use with pilot valve
F		Operator with dual checks and stroke limiter for use with pilot valve
G		Operator with pressure limiter (Sizes 016 thru 063)
H		Operator with pressure limiter for use with pilot valve (Sizes 016 thru 063)
K		Operator for Sandwich pressure limiter for use with pilot valve (Sizes 016 thru 063)
L		Operator with subtle check valve for use with pilot valve (Sizes 016 thru 063)
M		Operator with pressure limiter for use with sealed pilot valve

ACCESSORIES – Seal kit -

Operator codes (Perbunan Seal)

		016	025	032	040	050	063	080	100
S-A		5011011010	5012011010	5013011010	5014011010	5015011010	5016011010	5018011010	5019011010
S-B		5011021010	5012021010	5013021010	5014021010	5015021010	5016021010	5018021010	5019021010
S-C	01/02	5011031110	5012031110	5013031110	5014031110	5015031110	5016031110	5018031110	5019031110
	03/04	5011031310	5012031310	5013031310	5014031310	5015031310	5016031310	5018031310	5019031310
S-D	01/02	5011041110	5012041110	5013041110	5014041110	5015041110	5016041110	5018041110	5019041110
	03/04	5011041310	5012041310	5013041310	5014041310	5015041310	5016041310	5018041310	5019041310
S-E	01/02	5011051110	5012051110	5013051110	5014051110	5015051110	5016051110	5018051110	5019051110
	03/04	5011051310	5012051310	5013051013	5014051310	5015051310	5016051310	5018051310	5019051310
S-F	01/02	5011061110	5012061110	5013061110	5014061110	5015061110	5016061110	5018061110	5019061110
	03/04	5011061310	5012061310	5013061310	5014061310	5015061310	5016061310	5018061310	5019061310
S-G	01/02	5011071110	5012071110	5013071110	5014071110	5015071110	5016071110	-	-
	03/04	5011071310	5012071310	5013071310	5014071310	5015071310	5016071310	-	-
S-H	01/02	5011081110	5012081110	5013081110	5014081110	5015081110	5016081110	-	-
	03/04	5011081310	5012081310	5013081310	5014081310	5015081310	5016081310	-	-
S-K		5011091010	5012091010	5013091010	5014091010	5015091010	5016091010	-	-
S-L		5011101010	5012101010	5013101010	5014101010	5015101010	-	-	-
S-M	07	-	-	5013111111	-	-	-	-	-
	20	-	-	5013111112	-	-	-	-	-
	35	-	-	5013111113	-	-	-	-	-
	50	-	-	5013111114	-	-	-	-	-
P-G	07	5021071011	5022071011	5023071011	5024071011	5025071011	5026071011	5028071011	5029071011
	20	5021071012	5022071012	5023071012	5024071012	5025071012	5026071012	5028071012	5029071012
	35	5021071013	5022071013	5023071013	5024071013	5025071013	5026071013	5028071013	5029071013
	50	5021071014	5022071014	5023071014	5024071014	5025071014	5026071014	5028071014	5029071014
P-H	07	5021081011	5022081011	5023081011	5024081011	5025081011	5026081011	5028081011	5029081011
	20	5021081012	5022081012	5023081012	5024081012	5025081012	5026081012	5028081012	5029081012
	35	5021081013	5022081013	5023081013	5024081013	5025081013	5026081013	5028081013	5029081013
	50	5021081014	5022081014	5023081014	5024081014	5025081014	5026081014	5028081014	5029081014

Seal Kit Operator codes

		016	025	032	040	050	063	080	100
S-A	P	7702000274	7702000283	7702000291	7702000300	7702000310	7702000320	-	7702000332
	V	7703000274	7703000283	7703000291	7703000300	7703000310	7703000320	-	7703000332
S-B	P	7702000275	7702000284	7702000292	7702000301	7702000311	7702000321	-	-
	V	7703000275	7703000284	7703000292	7703000301	7703000311	7703000321	-	-
S-C	P	7702000276	7702000285	7702000293	7702000302	7702000312	7702000322	7702000328	7702000333
	V	7703000276	7703000285	7703000293	7703000302	7703000312	7703000322	7703000328	7703000333
S-D	P	7702000277	7702000286	7702000294	7702000303	7702000313	7702000323	-	-
	V	7703000277	7703000286	7703000294	7703000303	7703000313	7703000323	-	-
S-E	P	7702000278	7702000287	7702000295	7702000304	7702000314	7702000324	7702000329	7702000334
	V	7703000278	7703000287	7703000295	7703000304	7703000314	7703000324	7703000329	7703000334
S-F	P	7702000279	7702000288	7702000296	7702000305	7702000315	7702000325	-	-
	V	7703000279	7703000288	7703000296	7703000305	7703000315	7703000325	-	-
S-G	P	-	-	-	-	-	-	-	-
	V	-	-	-	-	-	-	-	-
S-H	P	7702000530	7702000514	7702000550	7702000544	-	-	-	-
	V	7703000530	-	7703000550	7703000544	-	-	-	-
S-K	P	-	-	-	-	-	-	-	-
	V	-	-	-	-	-	-	-	-
S-L	P	-	-	7702000526	7702000531	7702000527	-	-	-
	V	-	-	7703000526	7703000531	-	-	-	-
S-M	P	-	-	-	-	-	-	-	-
	V	-	-	-	-	-	-	-	-
P-G	P	-	-	-	-	-	-	-	-
	V	-	-	-	-	-	-	-	-
P-H	P	-	-	-	-	-	-	-	-
	V	-	-	-	-	-	-	-	-

HOW TO ORDER OPERATORS

Explanation

Example: S 050 - C X / 01 P /

Operator Head

S = Standard
P = Relief valve function

Size

16, 25, 32, 40, 50, 63, 80, 100

Operator

A, B, C, D, E, F, G, H, K, L, M
(See page ?)

Series

X (Last version will be delivered)

Pressure

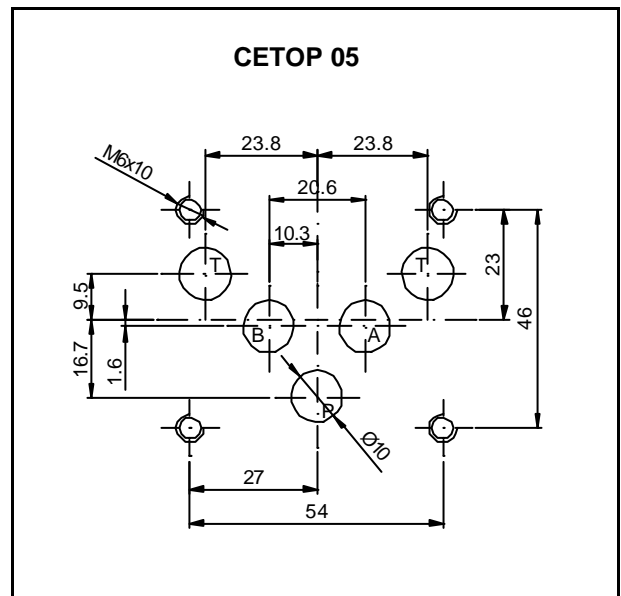
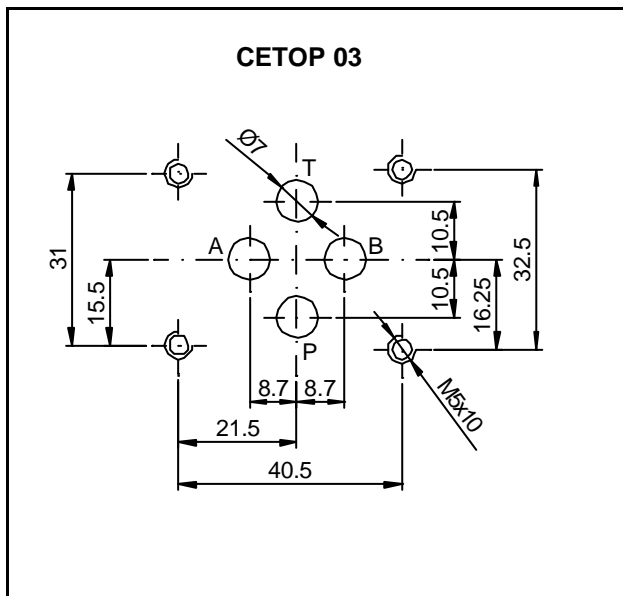
Omit = Without pressure limiter
07 = 5 - 100 bar
20 = 5 - 200 bar
35 = 5 - 350 bar
50 = 5 - 630 bar

Seals

P = Buna - N (std.)
V = Viton

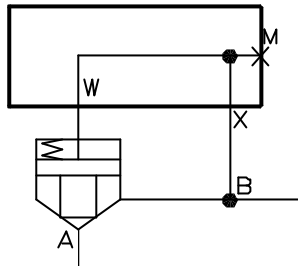
Pilot Valve Mounting

00 = No pilot valve
01 = Mounting surface (CETOP 03) available for sizes 016 thru 050. Arranged for N.O. pilot valve function
02 = Mounting surface (CETOP 05) available for sizes 063 thru 100. Arranged for N.O. pilot valve function
03 = Mounting surface (CETOP 03) available for sizes 016 thru 050. Arranged for N.C. pilot valve function
04 = Mounting surface (CETOP 05) available for sizes 063 thru 100. Arranged for N.C. pilot valve function



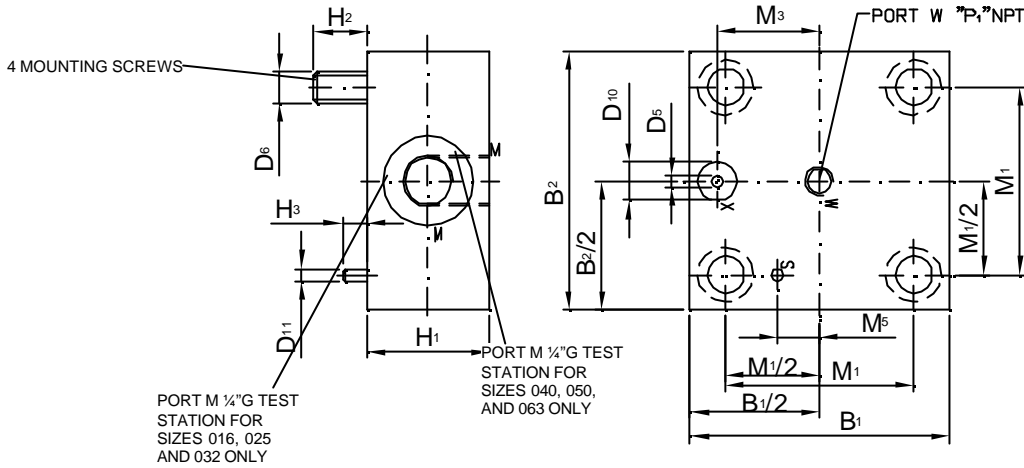
PLAIN OPERATOR-TYPE "A"

External pilot:
Can be used to connect area Aw to one of the working ports (A or B).

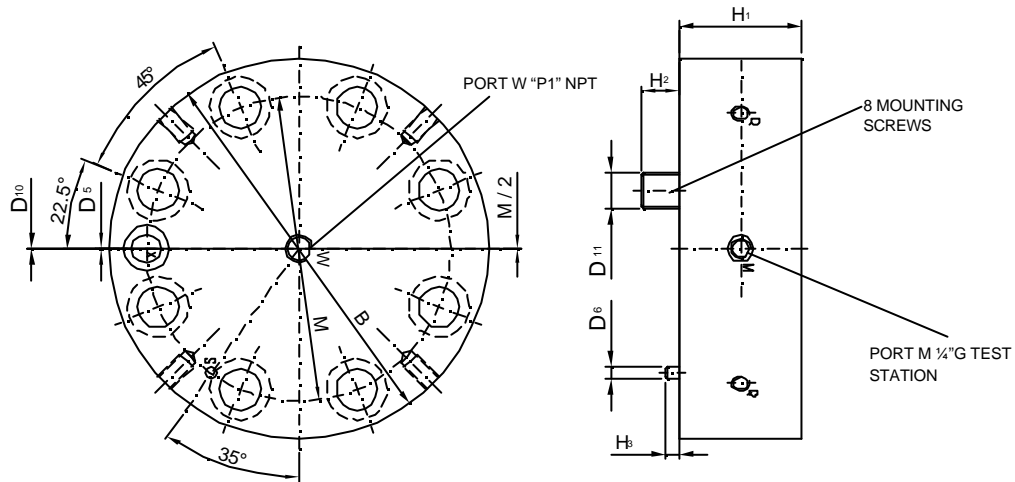


NOTE:
INSTALLING ORIFICE IN
PORT "W" WILL CONTROL
CARTRIDGE PLUNGER
SHIFTING RATE.

GRAPHIC SYMBOL
OPERATOR HEAD
SHOWN



Installation Dimensions for Type "A" Plain Operator Cartridge Insert

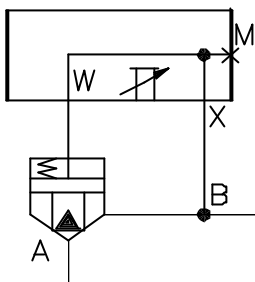


Installation Dimensions for Type "A" Plain Operator for use with size 80 & 100 Cartridge Insert Valves.

VALVE SIZE	B ₁	B ₂	D ₅	D ₆	D ₁₀	D ₁₁	H ₁	H ₂	H ₃	M ₁	M ₃	M ₅	M	P ₁
016	MM	63.5	63.5	3,17	M8	9.5	3.17	30.0	13	6	46.0	25.0	10.5	1/16
025	MM	86	86	6.35	M12	13.3	4,75	30.0	17	5	58.0	33.0	16.0	1/16
032	MM	102	102	6.35	M16	16	4,75	35	20	5	70.0	41.0	17.0	1/16
040	MM	124.0	124.0	9.52	M20	19.1	4,75	50.0	30	5	85	50	23	1/16
050	MM	140	140	9.5	M20	19.1	6	50.0	25	5	100.0	58.0	30.0	1/8
063	MM	178	178	12.0	M30	21	6,35	60	37	5	125.0	75.0	38.0	1/8
080	MM	250,0	14,7	M24	30	7,9	80,0	25,5	8,6					200,0 3/8"
100	MM	300,0	17,9	M30	30	7,9	98,6	43,5	8,6					245,0 1/2"

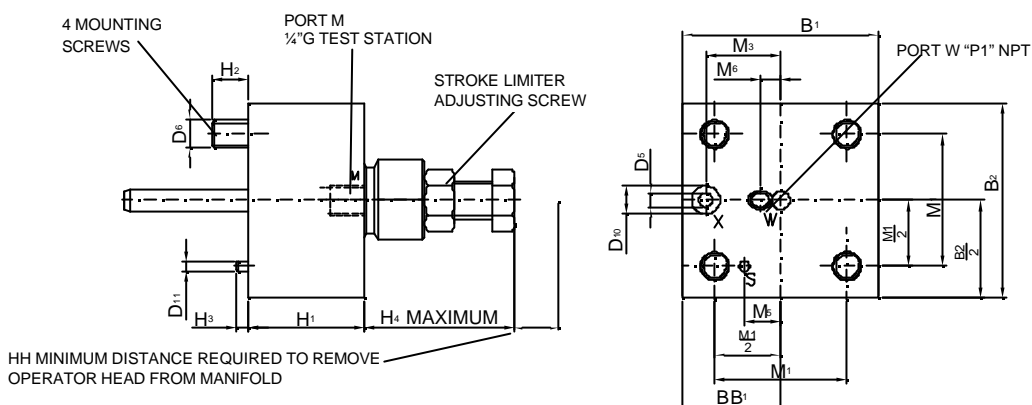
OPERATOR W/STROKE LIMITER-TYPE "B"

And adjustment screw limits the travel of a floating pin which in turn limits the amount the plunger can open. Thus, it results in (adjustable) throttling of flow through the insert valve. For fine adjustment, it is suggested a cartridge plunger with a cushion nose be used. It is suggested the adjustment screw be cut off at a length corresponding to minimum derived flow to prevent accidentally locking the valve in the closed position.

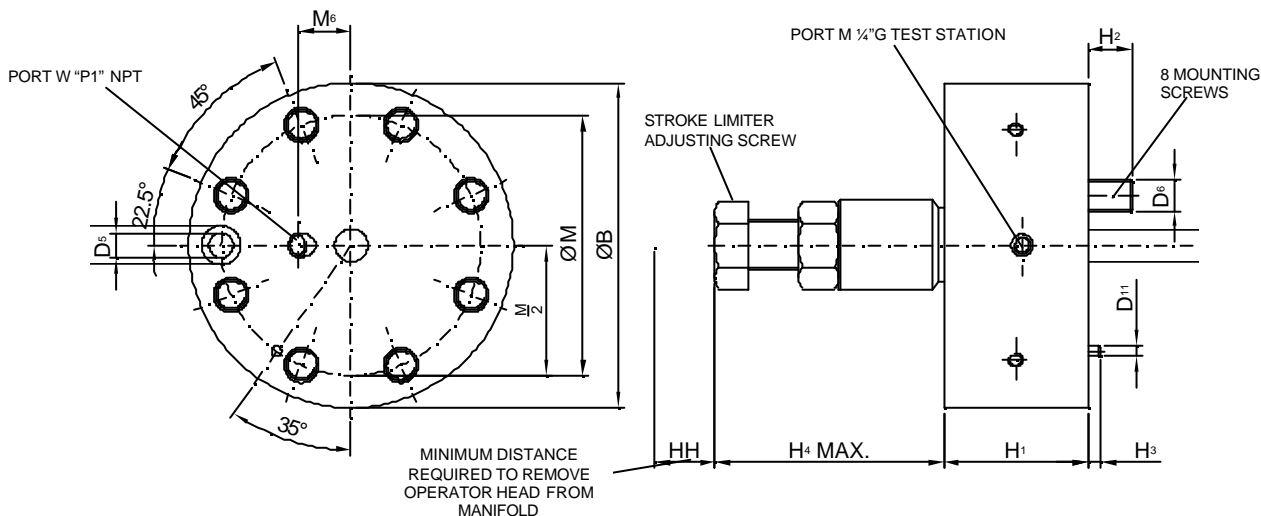


NOTE:
INSTALLING ORIFICE IN
PORT "W" WILL
CONTROL CARTRIDGE
PLUNGER SHIFTING

GRAPHIC SYMBOL
OPERATOR HEAD SHOWN
WITH INSERT VALVE.



Installation Dimensions for Type "B" Operator w/Stroke Limiter for use with size 016 through 063 Cartridge Insert Valve

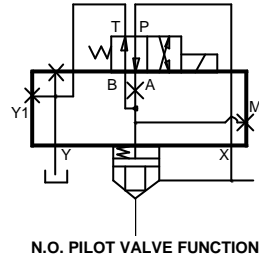


Installation Dimensions for Type "B" Operator w/Stroke Limiter for use with size 080 & 100 Cartridge Insert Valve.

VALVE SIZE	B	B ₁	B ₂	D ₅	D ₆	D ₁₀	D ₁₁	H ₁	H ₂	H ₃	H ₄	M	M ₁	M ₃	M ₅	M ₆	P ₁	HH	BB ₁
016	MM	69.9	63.5	3.96	M8	9.6	3.0	50.8	17.2	7.1	57.2	46	25	10.5	5	1/16"	36.6	38.1	
025	MM	86	86	6.35	M12	13.3	4.8	51	16	8.6	74.7	58	33	16	9	1/16"	47.2	43	
032	MM	102	102	6.35	M16	16.0	4.8	50	25	8.6	74.7	70	41	17	12	1/16"	57.2	51	
040	MM	124	124	9.52	M20	19.1	4.8	54	26	8.6	114.3	85	50	23	15	1/16"	69	62	
050	MM	140	140	9.5	M20	19.1	6.4	54	31	8.6	114.3	100	58	30	20	1/8"	78.2	70	
063	MM	178	178	12.0	M30	21	6.4	75	38	8.6	114.3	125	75	38	29	1/8"	100	89	
080	MM	250		14.7	M24	30	7.9	111,25	34,25	8,6	176,3	200			41,15	3/8"	139,7		
100	MM	300		17,85	M30	30	7,9	136,5	47,5	8,6	226,1	245			50,8	1/2"	189,5		

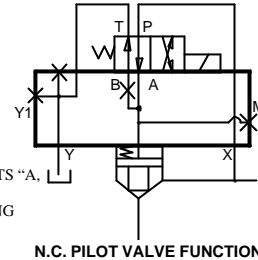
OPERATOR FOR PILOT VALVE-TYPE "C"

These operator heads will accommodate a plunger or ball check type three-way valve. The drawings show commonly used electrically operated valves. Thus, with this operator, the cartridge valve functions as a pilot operated check valve or appropriate area ratios.

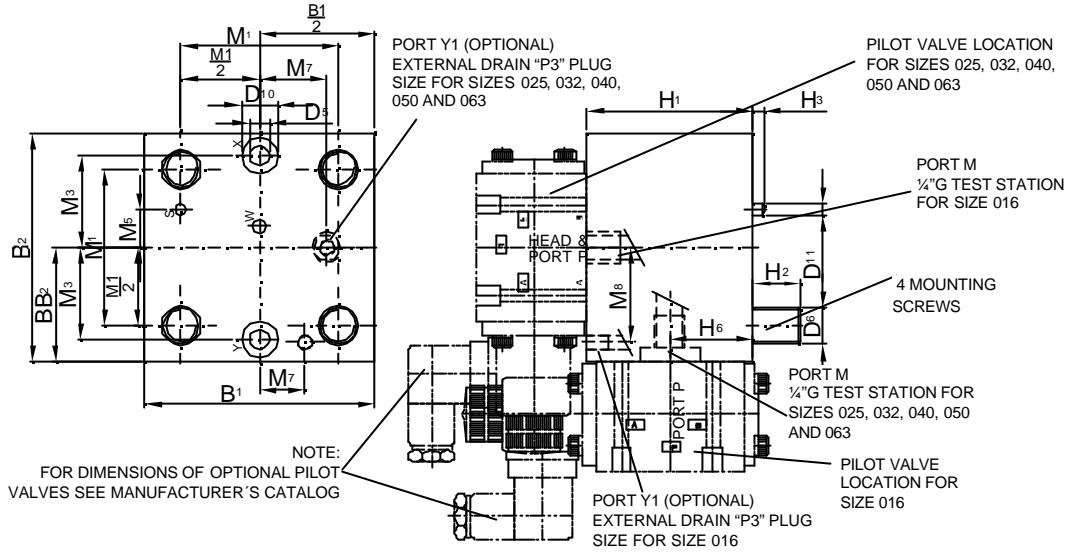


GRAPHIC SYMBOL FOR SIZES 016 THRU 100. OPERATOR HEAD SHOWN WITH INSERT VALVE AND OPTIONAL PILOT VALVE

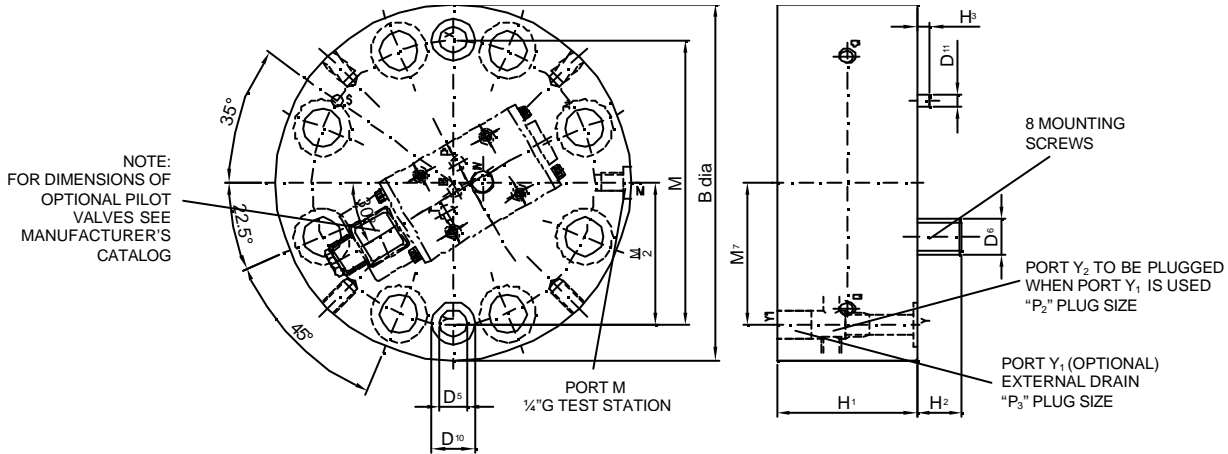
NOTE:
INSTALLING ORIFICES IN PORTS "A", "B", "P" AND "T" WILL CONTROL CARTRIDGE PLUNGER SHIFTING RATE



NOTE: PORT "X" MAY BE CONNECTED TO EITHER PORTS "A" OR "B" OR TO SOME REMOTE POINT IN THE SYSTEM



Installation Dimensions for Type "C" Operator for Pilot valve used with size 016 through 063. Cartridge Insert Valve



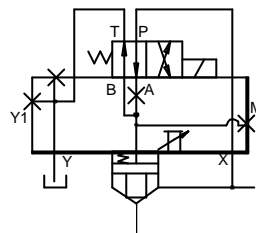
Installation Dimensions for Type "C" Operator for Pilot valve used with size 080 & 100 Cartridge Insert Valve

VALVE SIZE	B	B ₁	B ₂	D ₅	D ₆	D ₁₀	D ₁₁	H ₁	H ₂	H ₃	H ₆	M	M ₁	M ₃	M ₆	M ₇	M ₈	P ₃	BB ₂
016 MM		63,5	88,9	3,17	M8	9,6	3,2	101,5	14	7,1	60,25		46	25	10,5	19,65	27	1/8"G	53,8
025 MM		86	86	4,77	M12	13,3	4,8	54	18	8,6			58	33	16	31,75		1/8"G	43
032 MM		102	102	6,35	M16	16,0	4,8	54	21	8,6			70	41	17	35		1/4"G	51
040 MM		124	124	8	M20	19,1	4,8	73	29	8,6			85	50	23	42,5			62
050 MM		140	140	8	M20	19,1	6,4	73	30	8,6			100	58		51			70
063 MM		178	178	11	M30	21,0	6,4	111	41	8,6			125	75		62,5			89
080 MM	250			14,7	M24	30	7,92	98,5	32			200				100		1/8"G	
100 MM	300			14,7	M30	30	7,92	86	46			245				122,5		1/8"G	

OPERATOR W/STROKE LIMITER FOR PILOT VALVES-TYPE "D"

These heads include an adjustment screw which limits the amount the plunger can open as well as accommodate a plunger or ball check type three-way valve. Thus, the cartridge valve functions as a pilot operated check valve with a flow throttling adjustment.

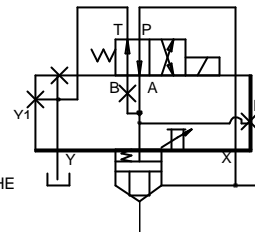
It is suggested the adjustment screw be cut off at a length corresponding to minimum desired flow to prevent accidentally locking the valve in the closed position.



N.O. PILOT VALVE FUNCTION

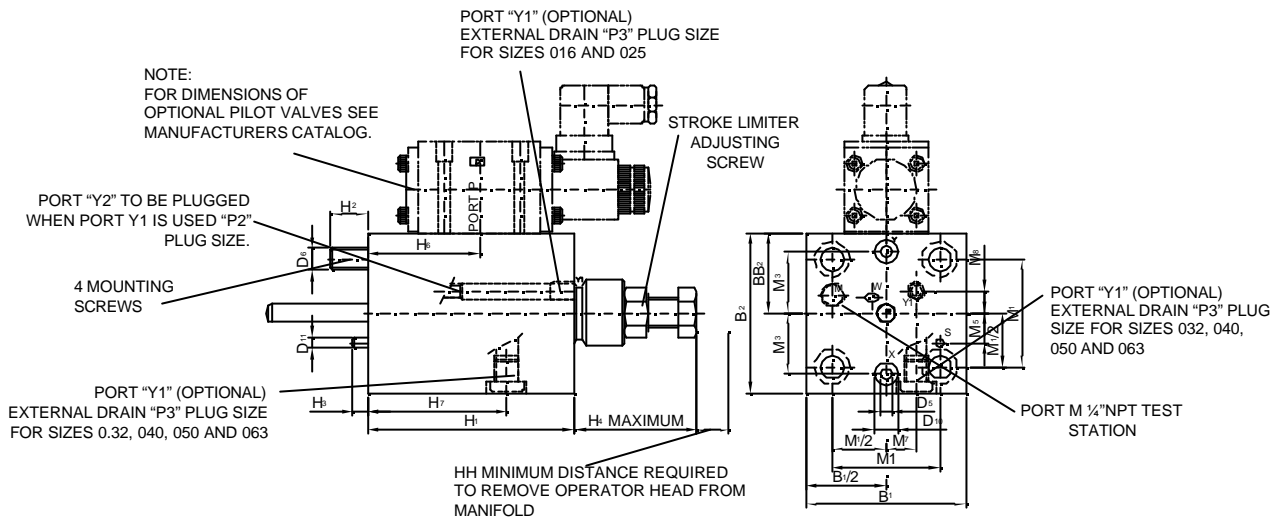
NOTE:
INSTALLING ORIFICES IN PORTS "A, B, P AND T" WILL CONTROL CARTRIDGE PLUNGER SHIFTING RATE

NOTE: PORT "X" MAY BE CONNECTED TO EITHER PORTS "A" OR "B" OR TO SOME REMOTE POINT IN THE SYSTEM

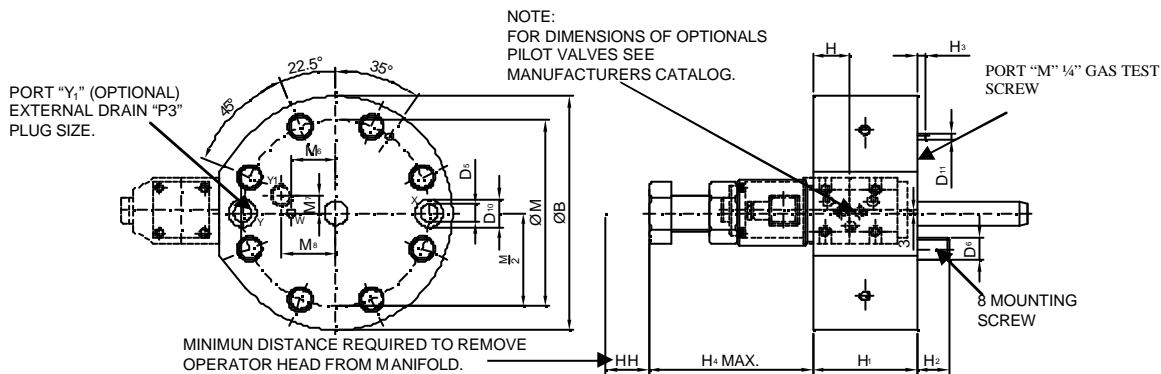


N.C. PILOT VALVE FUNCTION

GRAPHIC SYMBOL FOR SIZES 016TRHU 100. OPERATOR HEAD SHOWN WITH INSERT VALVE AND OPTIONAL PILOT VALVE



Installation Dimensions for Type "D" Operator w/Stroke Limiter for Pilot Valves, used with Size 016 through 063 Cartridge Insert Valve

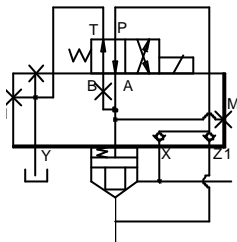


Installation Dimensions for Type "D" Operator w/Stroke Limiter for Pilot Valves, used with Size 080 Cartridge Insert Valve

VALVE SIZE	B	B ₁	B ₂	D ₅	D ₆	D ₁₀	D ₁₁	H	H ₁	H ₂	H ₃	H ₄	H ₆	M	M ₁	M ₃	M ₅	M ₇	M ₈	P ₂	P ₃	HH	BB ₂	
016 MM		63,5	89	3,17	M8	9,6	3,2		101,5	14	7,1		60,25		46	25	10,5	9,7	27	1/16"	1/8"G	36,6	53,8	
025 MM		86	86	4,77	M12	13,3	4,8		114,3	18	8,6		60,25		58	33	16	25,5	12		1/8"G	47,2	43	
032 MM		102	102	6,35	M16	16	4,8		111,3	19	8,6		60,25		70	41	17	15,75			1/4"G	57,2	51	
040 MM		124	124	8	M20	19,1	4,8		111,3	26	8,6		60,25		85	50	23	20,5			1/4"G	69,0	62	
050 MM		140	140	8	M20	19,1	6,4		111,3	30	8,6		60,25		100	58	30	25,5			1/4"G	78,2	70	
063 MM		178	178	11	M30	21	6,4		159	42	8,6		84,25		125	75	38	30,25			1/2"	3/8"G	100	89
080 MM	250			14,7	M24	30,2	7,9	39,9	142	40	8,6	176,3		200					19,1	58,7			139,7	
100 MM	300			14,7	M30	30,2	7,9	H ₁ - 84,15	136,7	48	8,6	226,1		245					19,1	76,2			189,5	

OPERATOR W/DUAL CHECK FOR PILOT VALVES-TYPE "E"

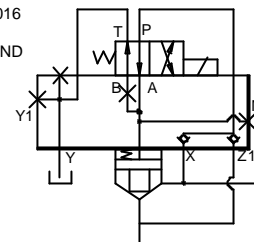
This operator head will accommodate a plunger or ball check type three-way pilot valve which can connect through two integral check valves to ports X and Z. With this operator, the cartridge insert valve functions as a two-way valve.



N.O. PILOT VALVE FUNCTION

GRAPHIC SYMBOL FOR SIZES 016 TRHU 100. OPERATOR HEAD SHOWN WITH INSERT VALVE AND OPTIONAL PILOT VALVE

NOTE: INSTALLING ORIFICES IN PORTS "A, B, P AND T" WILL CONTROL CARTRIDGE PLUNGER SHIFTING RATE

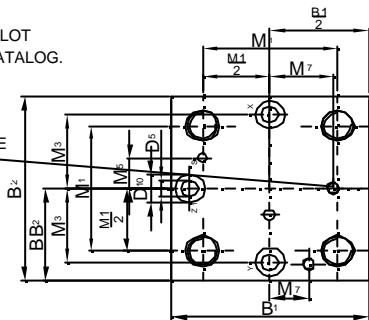


N.C. PILOT VALVE FUNCTION

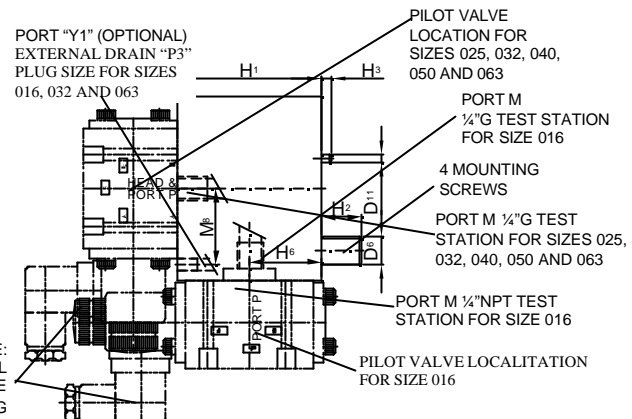
NOTE: PORT "X" AND "Z1" MAY BE CONNECTED TO EITHER PORTS "A" OR "B" OR TO SOME REMOTE POINT IN THE SYSTEM

NOTE: FOR DIMENSIONS OF OPTIONAL PILOT VALVES SEE MANUFACTURERS CATALOG.

PORT "Y1" (OPTIONAL) EXTERNAL DRAIN "P3" PLUG SIZE FOR SIZES 025 040 AND 050

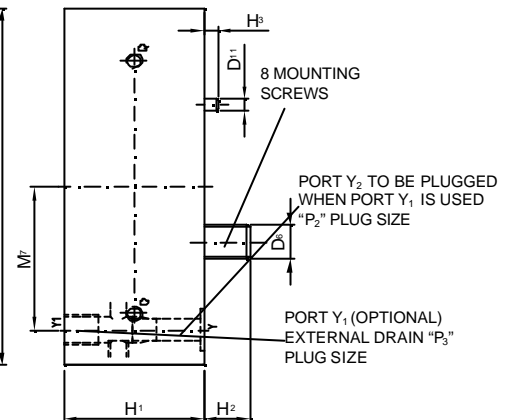
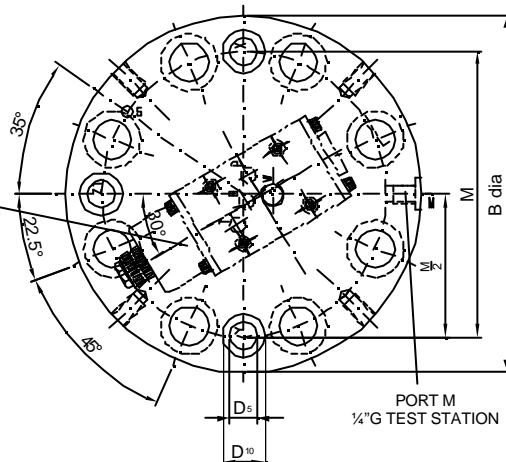


NOTE: FOR DIMENSIONS OF OPTIONAL PILOT VALVES SEE MANUFACTURER'S CATALOG



Installation Dimensions for Type "E" Dual Check Operator for Pilot Valve used with size 016 through 063. Cartridge Insert Valves

NOTE: FOR DIMENSIONS OF OPTIONAL PILOT VALVES SEE MANUFACTURER'S CATALOG



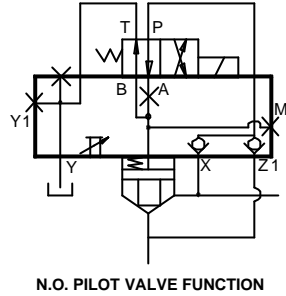
Installation Dimensions for Type "E" Dual Check Operator for Pilot valve used with size 080 & 100 Cartridge Insert Valve

VALVE SIZE	B	B ₁	B ₂	D ₅	D ₆	D ₁₀	D ₁₁	H ₁	H ₂	H ₃	H ₆	M	M ₁	M ₂	M ₃	M ₆	M ₇	M ₈	P ₃	BB ₂
016	MM	63,5	101,6	3,2	M8	9,5	3,2	101,6	15	7,1	60,5		46	25	25	10,5	9,7	26,9	1/8"G	53,8
025	MM	85,8	85,8	4,8	M12	12,7	4,8	53,8	20	8,6			58	33	33	16	31,8		1/8"G	42,9
032	MM	101,6	101,6	6,35	M16	16	4,8	54	21	8,6			70	41	41	17	35,1		1/4"G	50,8
040	MM	124	124	8	M20	19,1	4,8	73	29	8,6			85	50	50	23	44,5			62
050	MM	139,7	139,7	8	M20	19,1	6,4	73	30	8,6			100	58	58	30	50,8			69,9
063	MM	177,8	177,8	11	M30	21	6,4	111	45	8,6			125	75	75	38	63,5			88,9
080	MM	250		14,7	M24	30,2	7,9	98,6	40	8,6		200					100			
100	MM	300		14,7	M30	30,2	7,9	98,6	45	8,6		245					122,5			

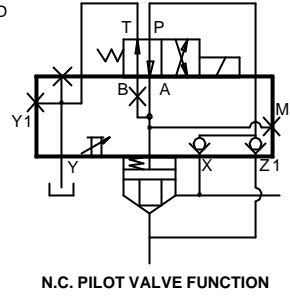
OPERATOR W/DUAL CHECK & STROKE LIMITER FOR PILOT VALVES-TYPE "F"

These heads include an adjustment screw (which limits the amount the plunger can open), and will accommodate a plunger or ball check type three-way pilot valve which can connect through the two integral check valves to ports X and Z. With this operator, the cartridge insert valve functions as an area ratio two way valve with throttling adjustment.

It is suggested the adjustment screw be cut off at length corresponding to minimum desired flow to prevent accidentally locking the valve in the closed position.



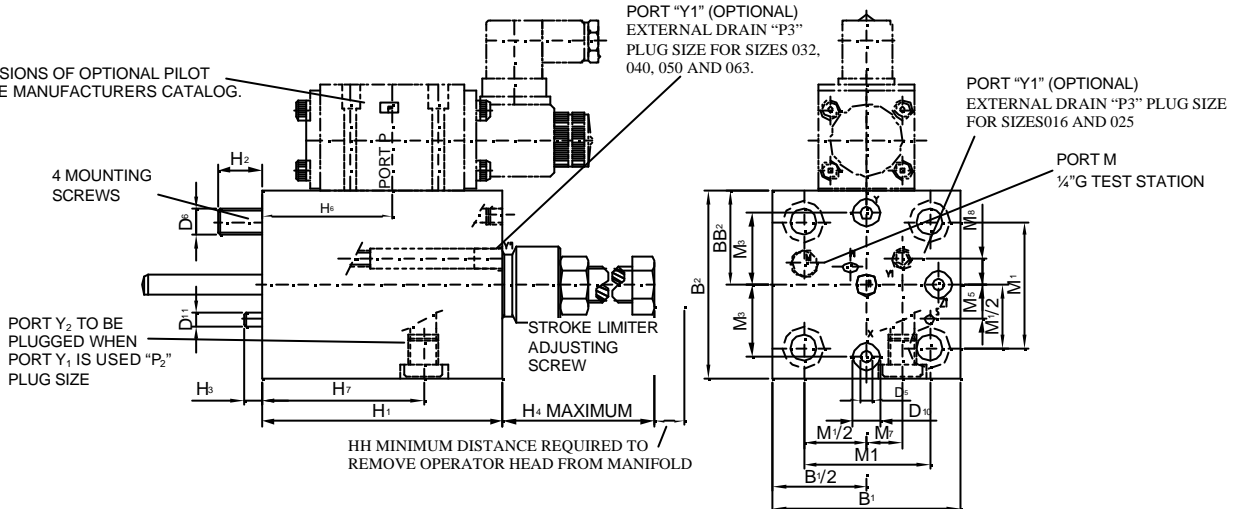
GRAPHIC SYMBOL FOR SIZES 016 TRHU 100. OPERATOR HEAD SHOWN WITH INSERT VALVE AND OPTIONAL PILOT VALVE



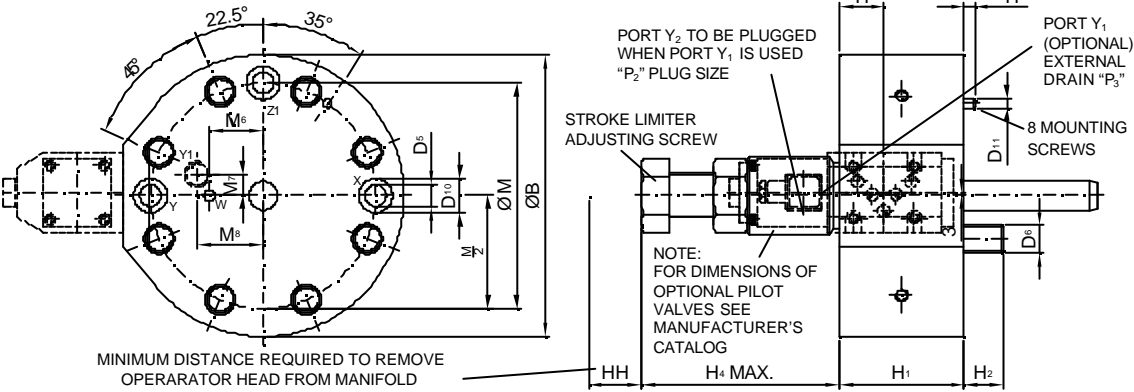
NOTE: INSTALLING ORIFICES IN PORTS "A, B, P AND T" WILL CONTROL CARTRIDGE PLUNGER SHIFTING RATE

NOTE: PORT "X" AND "Z1" MAY BE CONNECTED TO EITHER PORTS "A" OR "B" OR TO SOME REMOTE POINT IN THE SYSTEM

NOTE: FOR DIMENSIONS OF OPTIONAL PILOT VALVES SEE MANUFACTURERS CATALOG.



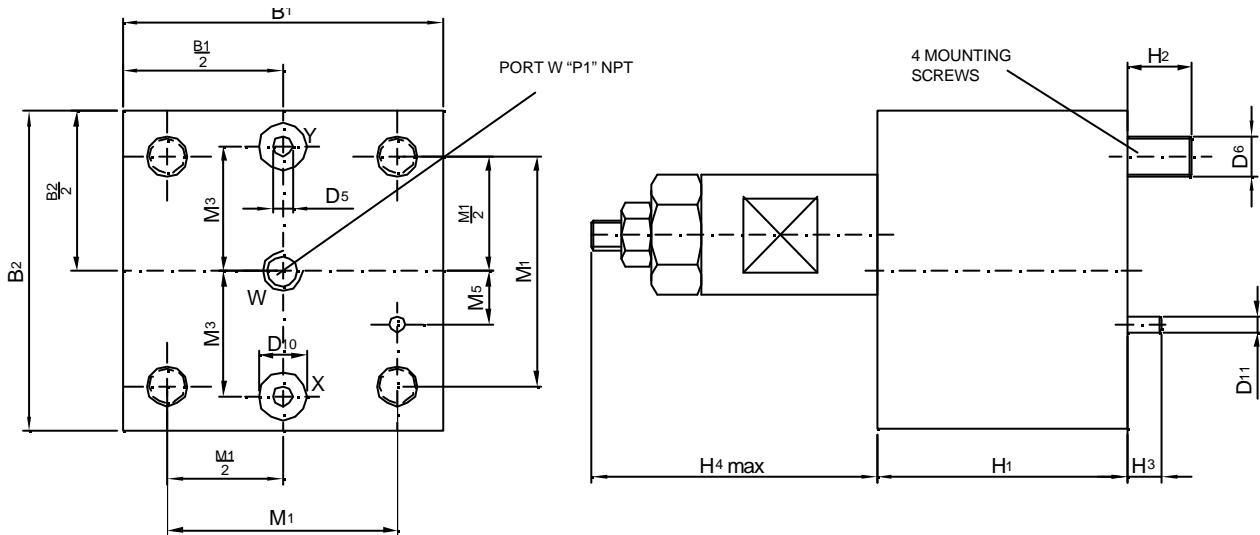
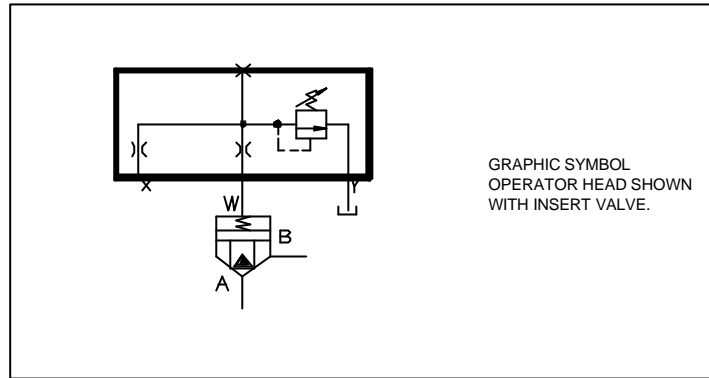
Installation Dimensions for Type "F" Dual Check Operator with Stroke Limiter for Pilot Valve used with 016 trough 063 Cartridge Insert Valve



Installation Dimensions for Type "F" Dual Check Operator with Stroke Limiter for Pilot Valve used with Size 080 & 100 Cartridge Insert Valves

VALVE SIZE	B	B ₁	B ₂	D ₅	D ₆	D ₁₀	D ₁₁	H	H ₁	H ₂	H ₃	H ₄	H ₆	H ₇	M	M ₁	M ₂	M ₃	M ₅	M ₇	M ₈	P ₃	HH	BB ₂	
016 MM		63,5	101,6	3,2	M8	9,5	3,2		101,6	15	7,1	57,2	60,5			46	25	25	10,5	9,7	26,9	1/8"G	36,6	53,8	
025 MM		85,8	85,8	4,8	M12	12,7	4,8		114,3	20	8,6	74,7	60,5			58	33	33	16	31,8	14,2	1/8"G	47,2	42,9	
032 MM		101,6	101,6	6,4	M16	16	4,8		111,3	21	8,6	74,7	60,5	31,8		70	41	41	17	35,1		1/4"G	57,2	50,8	
040 MM		124	124	7,9	M20	19,1	4,8		111,3	29	8,6	114,3	60,5	47,8		85	50	50	23	44,5			69	62,0	
050 MM		139,7	139,7	7,9	M20	19,1	6,4		111,3	30	8,6	114,3	60,5	47,8		100	58	58	30	50,8			78,2	69,9	
063 MM		177,8	177,8	11,1	M30	20,6	6,4		158,8	45	8,6	176,3	84,1	60,5		125	75	75	38	63,5			100	88,9	
080 MM	250			14,7	M24	30,2	7,9	39,9	136,7	40	8,6	176,3			200								19,1	58,7	139,7
100 MM	300			14,7	M30	30,2	7,9	H ₁ -84.15	136,7	45	8,6	226,1			245								19,1	76,2	189,5

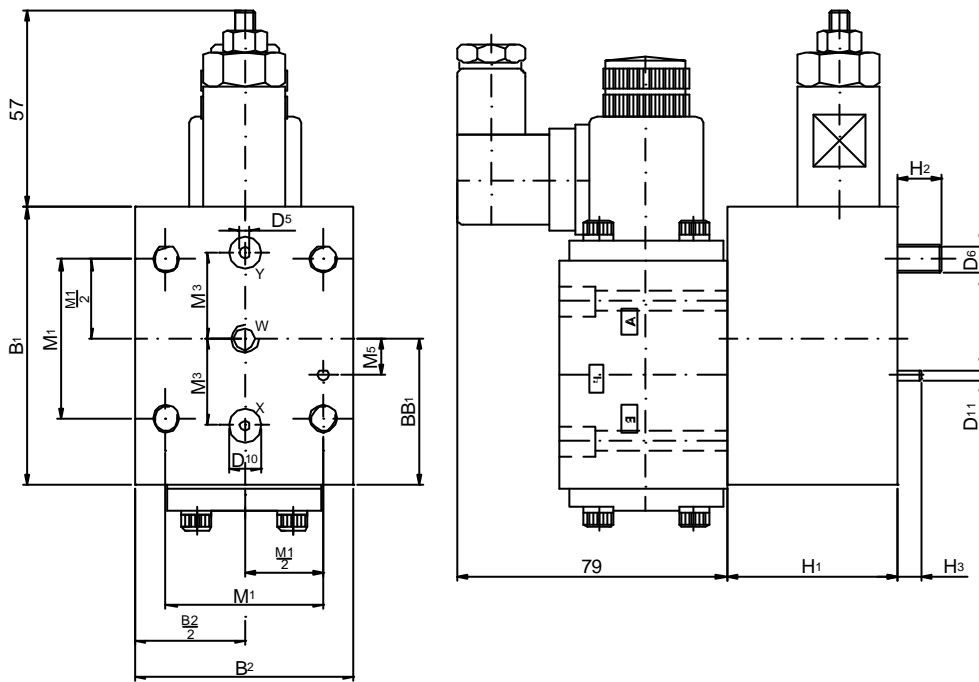
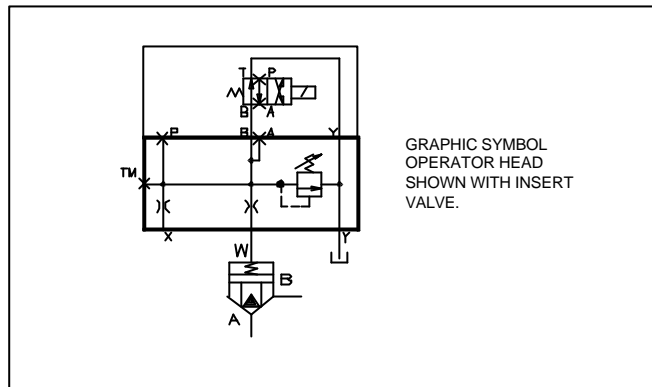
OPERATOR W/PRESSURE LIMITER-TYPE "S _ G"



Installation Dimensions for Type "G" Operator w/Pressure Limiter for use with size 016 through 063 Cartridge Insert Valve

VALVE SIZE	B ₁	B ₂	D ₅	D ₆	D ₁₀	D ₁₁	H ₁	H ₂	H ₃	H ₄	M ₁	M ₃	M ₅	P ₁
016 MM	64	64	4	M8	9.6	3	50	14	6	59	46	25	10.5	1/16"
025 MM	86	86	4	M12	13.3	5	50	18	5	59	58	33	16	1/16"
032 MM	102	102	6	M16	16	5	50	22	5	59	70	41	17	1/16"
040 MM	124	124	8	M20	19.1	5	85	27	5	73	85	50	23	1/8"
050 MM	140	140	8	M20	19.1	6	90	25	5	73	100	58	30	1/8"
063 MM	178	178	8	M30	21	6	90			73	125	75	38	1/8"

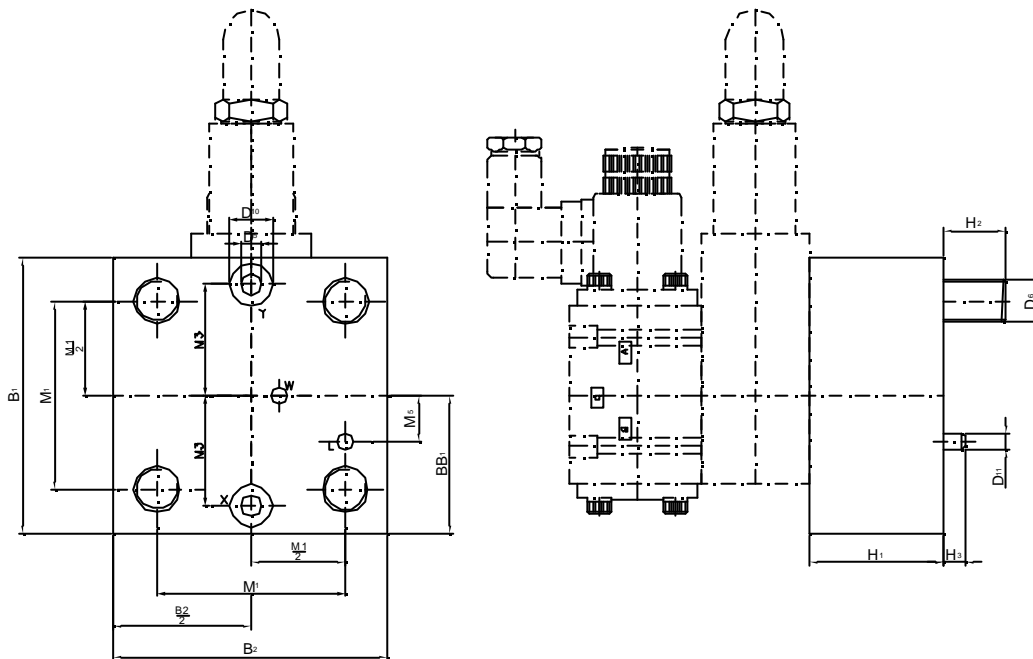
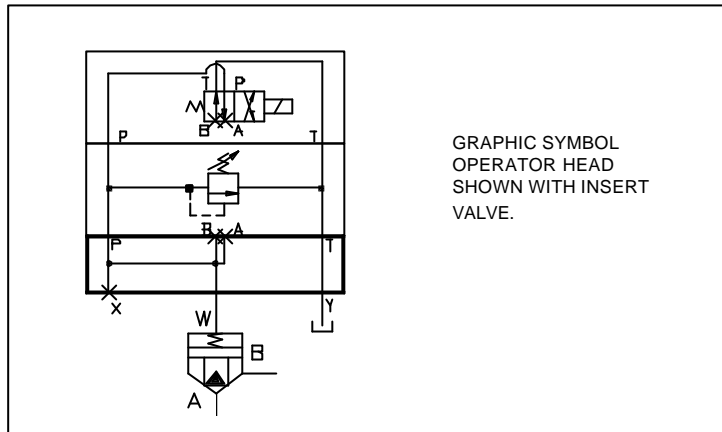
OPERATOR W/PRESSURE LIMITER FOR PILOT VALVE-TYPE "S _ H"



Installation Dimensions for Type "H" Operator w/Pressure Limiter for use w/pilot valve with size 016 through 063 Cartridge Insert Valve

VALVE SIZE	B ₁	B ₂	BB ₁	D ₅	D ₆	D ₁₀	D ₁₁	H ₁	H ₂	H ₃	M ₁	M ₃	M ₅	P ₁
016 MM	81	64	43	3	M8	9.6	3.17	50	14	7	46	25	10.5	1/16"
025 MM	86	86	43	5	M12	13.3	4.75	55	19		58	33	16	1/16"
032 MM	102	102	51	5	M16	16	4.75	55	23	5	70	41	17	1/16"
040 MM	124	124	62	8	M20	19.1	4.75	65	27	5	85	50	23	1/16"
050 MM	140	140	70	8	M20	19.1	6.5	65			100	58	30	1/16"
063 MM	178	178	89	10	M30	21	6.5	70			125	75	38	1/16"

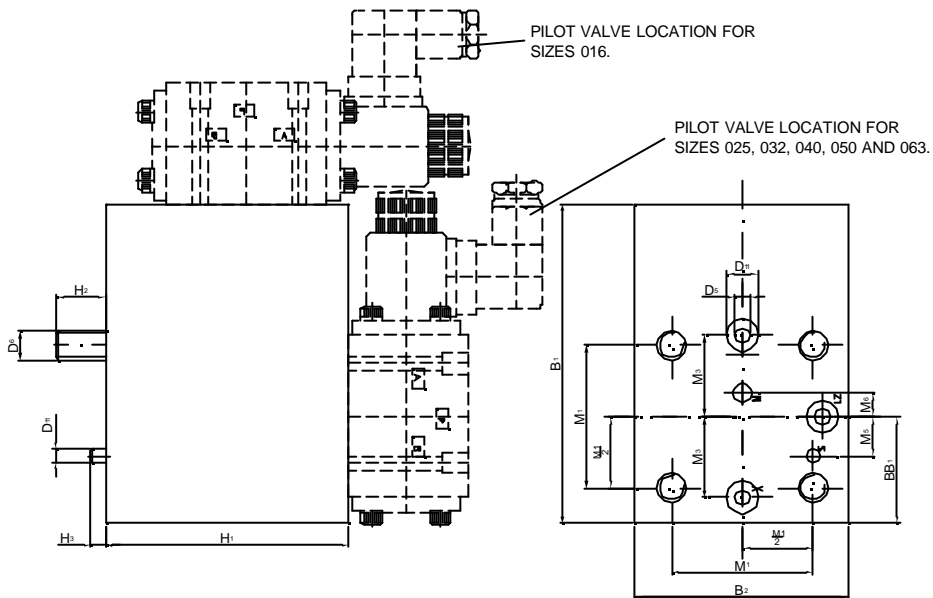
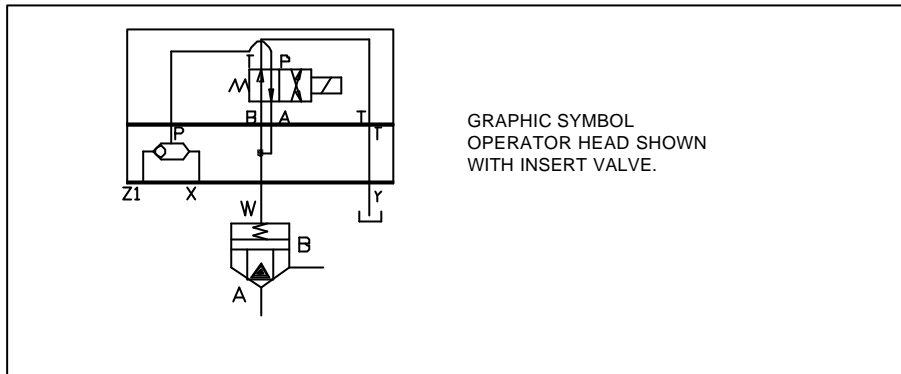
SANWICH PRESSURE LIMITER-TYPE "K"



Installation Dimensions for Type "K" Operator for sandwich pressure limiter with size 016 through 063 Cartridge Insert Valve

VALVE SIZE	B ₁	B ₂	BB ₁	D ₅	D ₆	D ₁₀	D ₁₁	H ₁	H ₂	H ₃	M ₁	M ₃	M ₅
016 MM	85	63,5	35,1	4	M8	9.6	3	55	12	4	46	25	10.5
025 MM	86	86	43	5	M12	13.3	4.75	50	17		58	33	16
032 MM	102	102	51	5	M16	16	4.75	50	24	5	70	41	17
040 MM	124	124	62	8	M20	19.1	4.75	50	29	5	85	50	23
050 MM	140	140	70	8	M20	19.1	6.5	50	29		100	58	30
063 MM	178	178	89	8	M30	21	6	60	44		125	75	38

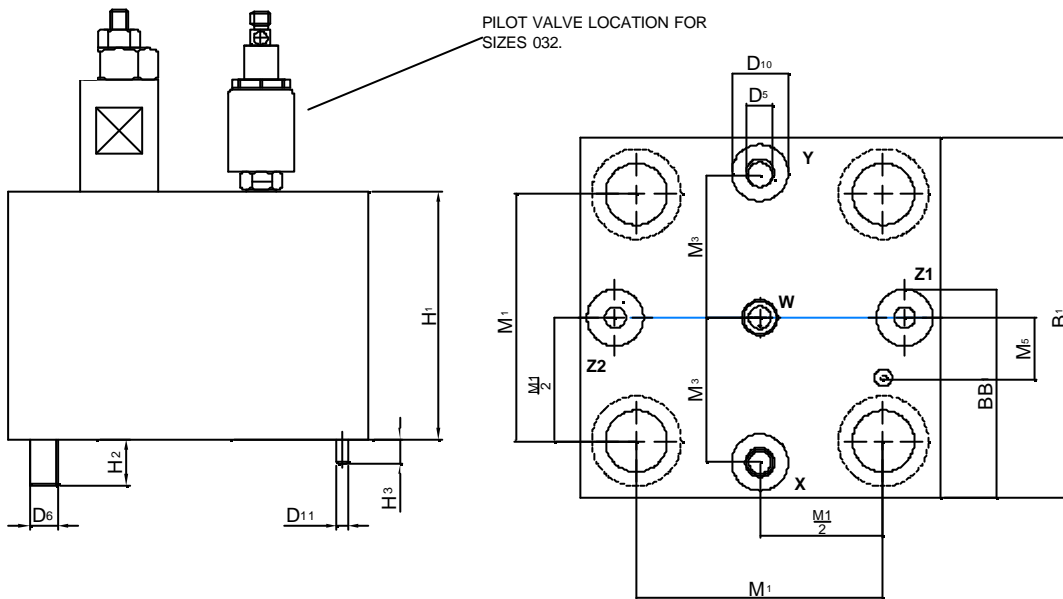
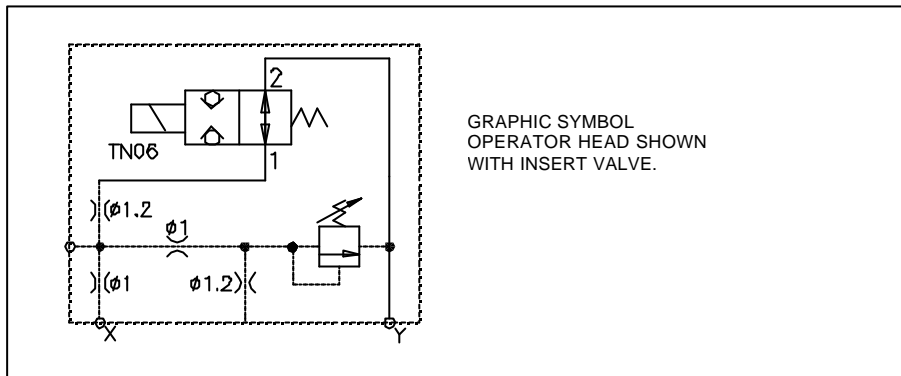
OPERATOR W/SHUTTLE CHECK VALVE -TYPE "L"



Installation Dimensions for Type "L" Operator with shuttle check valve with size 016 trough 050 Cartridge Insert Valve.

VALVE SIZE	B ₁	B ₂	BB ₁	D ₅	D ₆	D ₁₀	D ₁₁	H ₁	H ₂	H ₃	M ₁	M ₃	M ₅	M ₆
016 MM	89	63,5	35,2	3.17	M8	9.6	3	100	12	6	46	25	10.5	
025 MM	130	87	43,5	6.35	M12	13.3	5	85	20	5	58	33	16	8.7
032 MM	120	102	51	5	M16	16	6	85	23	5	70	41	50.8	10.8
040 MM	125	125	62.5	6.15	M20	19.1	5	85	29	4	85	50	23	17.5
050 MM	140	140	70	6	M20	19.1	6	85	27	4	100	58	30	20

OPERATOR W/PRESSURE LIMITER SEALED PILOT VALVE -TYPE "M"



Installation Dimensions for Type "M" Operator with shuttle check valve with size 032 Cartridge Insert Valve.

VALVE SIZE	B ₁	B ₂	BB ₁	D ₅	D ₆	D ₁₀	D ₁₁	H ₁	H ₂	H ₃	M ₁	M ₃	M ₅
032 MM	102	102	51	5	M16	16	5	70	23	5	70	41	17