



Williams Air Cylinders

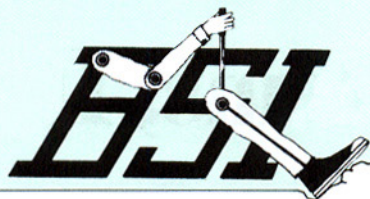
Available From

Brake Systems Inc.

MADE IN THE USA
REVISED 2012.04.03

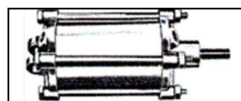
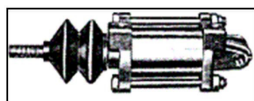
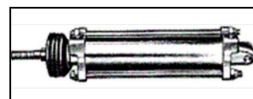
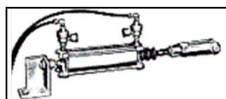
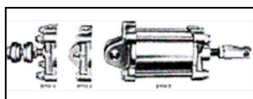


MANUFACTURED BY BRAKE SYSTEMS INC. 2221 NE HOYT, PORTLAND, OR 97232
PH: 503-236-2116 FAX: 503-239-5005 TOLL FREE: 800-452-5734
EMAIL: brakesystems@brakesystemsinc.com



Brake Systems, Inc.

MANUFACTURER OF WILLIAMS AIR CYLINDERS



HEAVY DUTY CYLINDER

1 1/4"

SINGLE ACTING

WM635

PGS. 39-40

DOUBLE ACTING

WM637

PGS. 41-42

2"

SINGLE ACTING

WM448

PGS. 13-15

DOUBLE ACTING

WM447

PGS. 19-21

DOUBLE ACTING

WM449

PGS. 16-18

3 1/4"

DOUBLE ACTING

WM463

PGS. 22-23

MEDIUM DUTY CYLINDER

2"

SINGLE ACTING

WM309

SUPERSEDED TO WM448

DOUBLE ACTING

WM336

SUPERSEDED TO WM449

FEATHERING CYLINDER

1 1/4"

WM633

PGS. 37-38

2"

WM475

PGS. 25-27

3 1/4"

WM495

PGS. 28-29

INDEXING CYLINDER 2"

3 POSITION

WM384

PGS. 1-4

4 POSITION

WM394

PGS. 5-8

THROTTLE SLAVE 1 3/4"

WM788

PGS. 43-45

SPECIALTY CYLINDERS

WM612

PGS. 30-31

WM615

PGS. 32-33

WM622

PGS. 34-36

SHIFT CONTROL

WM445

PGS. 9-12

WM466

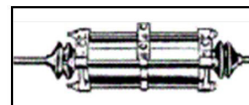
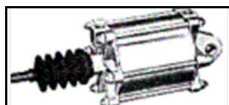
PGS. 9-12

WM487

PGS. 9-12

ESCUTCHEON PLATES

PG. 46



REV. 2011.05.03

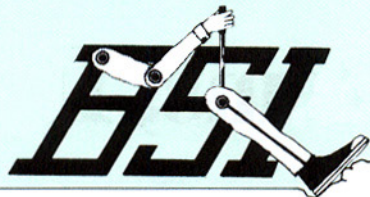
"Specializing in Manufacture and Distribution of



Air, Electronic Throttles and Exhaust Brakes"

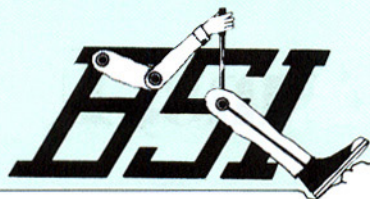
BRAKE SYSTEMS, INC.

2221 N.E. Hoyt Street • Portland, Oregon 97232 • 503/236-2116 • FAX 503/239-5005 • E-Mail: brakesystems@brakesystemsinc.com



Brake Systems, Inc.





3 POSITION INDEXING CYLINDER

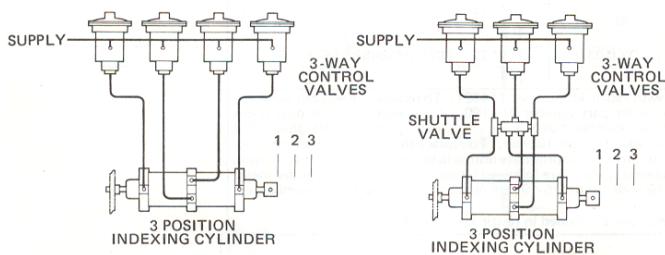
PRODUCT DESCRIPTION

DESCRIPTION The WM384 series indexing cylinder is a heavy duty pneumatic control device is frequently used in positioning applications. The unit consists of a pair of double-acting cylinders which share a common center barrier plate. In most applications, one piston rod is mounted in a fixed position while the other rod moves to a maximum of three positions. The WM384 cylinders are available with field-adjustable, factory preset, or fixed stroke configurations.

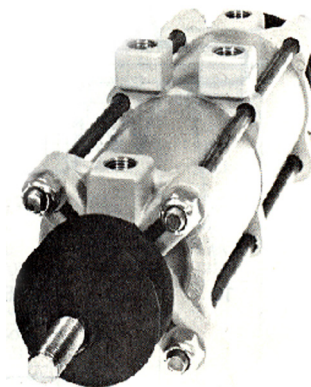
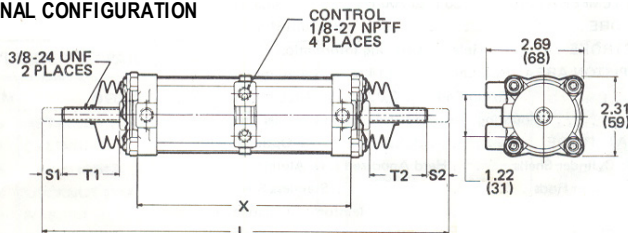
OPERATION The WM384 cylinder requires an air connection to each of its four ports. As illustrated below, the cylinder is normally controlled by four three-way valves or by three such valves with a dual shuttle valve. Pressure is simultaneously applied to two cylinder ports and exhausted from the other two ports. In response to the pressure signal, the pistons move to one of the stroke positions. The WM384 produces an actuating force equal to the effective surface area of the piston multiplied by the pressure applied to the piston.

APPLICATION The most common usage of the WM384 is in shifting systems of heavy duty automatic transmissions. The WM384 cylinders are also used for shifting auxiliary power take off units and operating clutch mechanisms on equipment such as drum winches. The WM384 cylinders may be purchased alone or in cylinder kits.

TYPICAL INSTALLATION

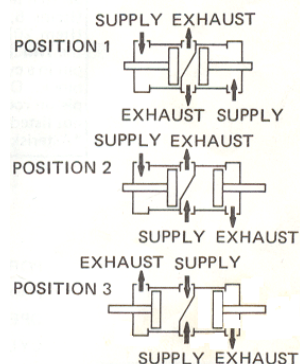


EXTERNAL CONFIGURATION



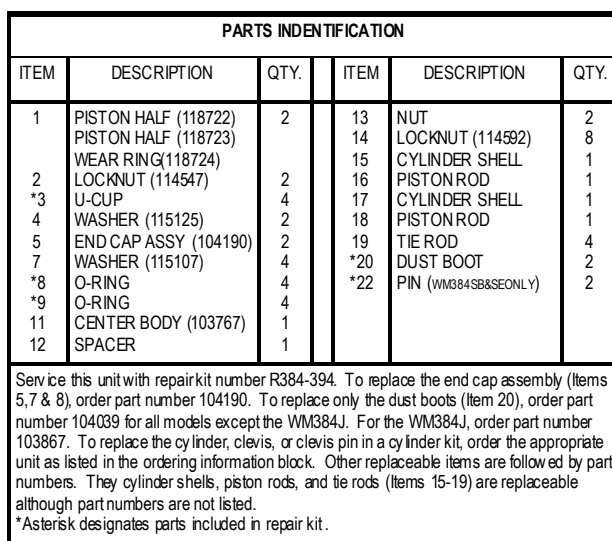
3 POSITION INDEXING CYLINDER

FUNCTIONAL DIAGRAM



I. S. O. SYMBOL

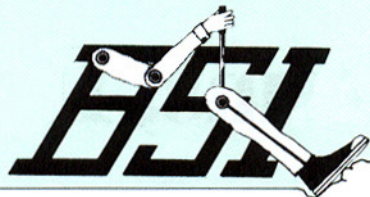




PORT SIZE.....	1/8-27NPTF
MAXIMUM OPERATING PRESSURE.....	150 PSI (1034, Kpa)
OPERATING TEMPERATURE*.....	-20° F to 200° F (-28,9° C to 93,3° C)
CYLINDER BORE.....	2.00 in. (51 mm)
CYLINDER STROKE.....	Refer to Ordering Information Block
EFFECTIVE PISTON AREA:	
Piston End.....	3.03 sq. in. (1955 mm ²)
Rod End.....	3.14 sq. in. (2026 mm ²)
MOUNTING.....	Mounting Provisions Included in Cylinder kits
MOUNTING ATTITUDE.....	Optional
MATERIALS:	
Cylinder Shell.....	Hard Anodized I.D. Aluminum
Piston Rods.....	Stainless Steel
Pistons.....	Fabric-Reinforced Phenolic
Clavies.....	Steel
O-Ring & U-Cup.....	Buna N
NET WEIGHT.....	3 lb. - 3 lb. 10 oz. (1.4-1.6 kg)

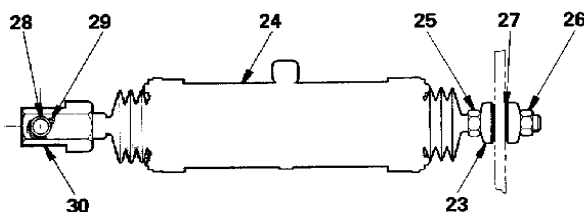
*For continuous operation bey and this range, contact factory.





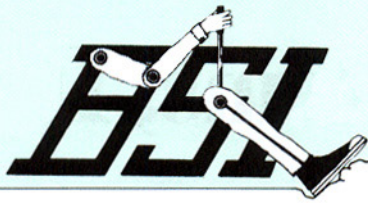
Brake Systems, Inc.

TO ORDER, SPECIFY								
WM384								
			Model Number		Suffix			
SELECT SUFFIX NUMBER BELOW								
CYLINDERS								
SUFFIX	CATALOG NUMBER	BODY LENGTH X	MAX. LENGTH L	CYLINDER STROKE			THREAD LENGTH T1	THREAD LENGTH T2
				TYPE	S1	S2		
H	112624	7.19 (183)	12.31 (313)	Preset	.75 (19)	.75 (19)	1.56 (40)	.88 (22)
HB	112625				.63 (16)	.63 (16)		
J	112628	7.94 (202)	14.94 (379)	Adjustable	.88 to 1.13 (22 to 29)	.88 to 1.13 (22 to 29)	2.25 (57)	1.56 (40)
N	112639	6.44 (164)	11.44 (291)	Preset	.38 (10)	.38 (10)	1.56 (40)	1.88 (22)
R	112643	6.94 (176)	12.94 (329)	Adjustable	.38 to .63 (10 to 16)	.38 to .63 (10 to 16)	2.25 (57)	1.56 (40)
RA	112644			Preset	.50 (13)	.50 (13)		
S	112652	6.44 (164)	12.13 (308)	Adjustable	.13 to .38 (3 to 10)	.13 to .38 (3 to 10)	2.44 (62)	
SB	112655			Fixed	.29 (7)	.29 (7)		
SE	100965				.38 (10)	.38 (10)		
T	112659	7.19 (183)	12.75 (324)	Adjustable	.50 to .75 (13 to 19)	.50 to .75 (13 to 19)	2.25 (57)	
TB	112663			Preset	.60 (15)	.60 (15)		
W	112675		13.44 (341)	Adjustable	.50 to .75 (13 to 19)	.50 to .75 (13 to 19)	1.56 (40)	
WA	112676			Preset	.60 (15)	.60 (15)		



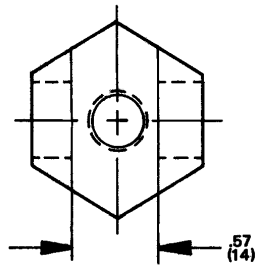
CYLINDER KIT PARTS IDENTIFICATION		
ITEM	DESCRIPTION	QTY.
23	RETAINER (103145)	2
24	CYLINDER	1
25	NUT (114542)	1
26	LOCKNUT (114644)	2
27	WASHER (115122)	2
28	CLEVIS PIN	1
29	COTTER PIN	1
30	CLEVIS	1

CYLINDER KITS					
SUFFIX	PART NUMBER	CYLINDER (ITEM 24)	CLEVIS (ITEM 30)	CLEVIS PIN (ITEM 28)	ITEMS 23,26 & 27 INCLUDED IN KIT
RAK2	112646	WM384RA (PIN 112644)	115395	115163	YES
RBK2	117183	WM384R (PIN 112643)	100897	115152	YES
JBK	112632	WM384J (PIN 112628)	115395	115163	YES
TBK	112664	WM384TB (PIN 112663)	115383	115159	YES
WAK	112677	WM384WA (PIN 112676)	115383	115159	NO

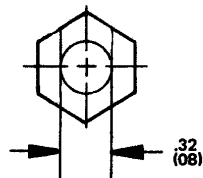
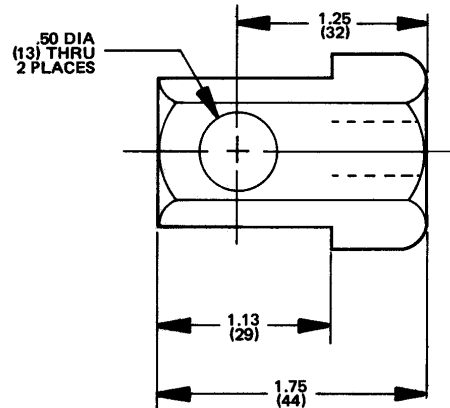


Brake Systems, Inc.

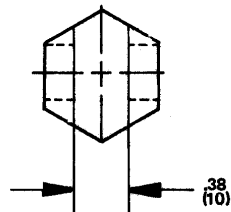
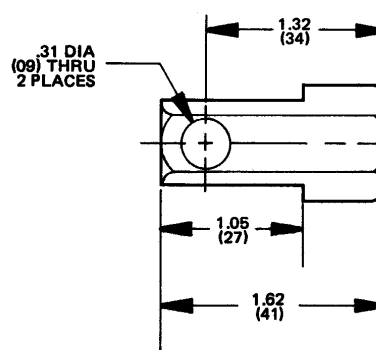
CLEVIS OPTIONS



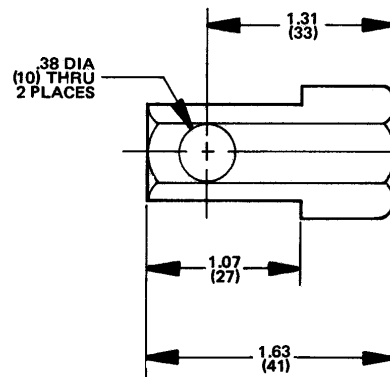
CLEVIS
P/N 115395

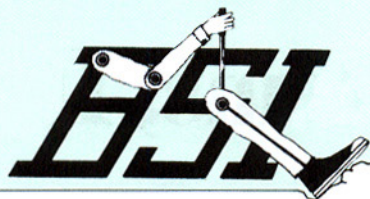


CLEVIS
P/N 100897



CLEVIS
P/N 115383





4 POSITION INDEXING CYLINDER WM394

PRODUCT DESCRIPTION

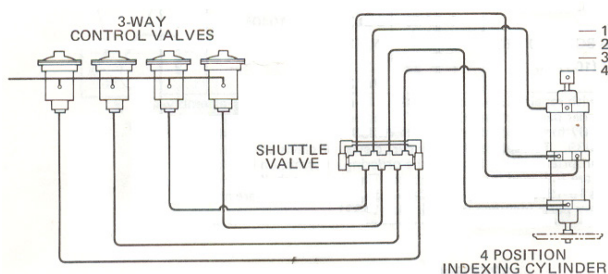
DESCRIPTION The WM394 heavy duty indexing cylinder serves as a pneumatic control device in positioning applications. Each unit is composed of two shorter double-acting cylinders that share a common center casting. The WM394 cylinders are available with field-adjustable, factory-preset or fixed stroke configurations. One piston rod is usually mounted in a fixed position while the other rod strokes to a maximum of four positions. If the stroke at one end is equal to twice that of the other end, the four stroke positions will be evenly spaced.

OPERATION As illustrated in the installation schematic below, a multiple shuttle valve and four three-way valves are normally used to pressurize the WM394 cylinder.

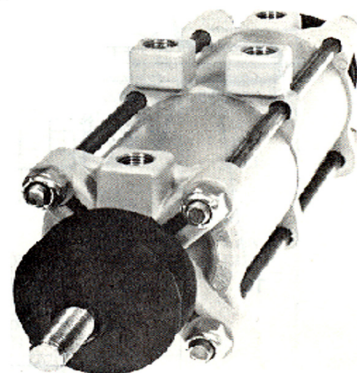
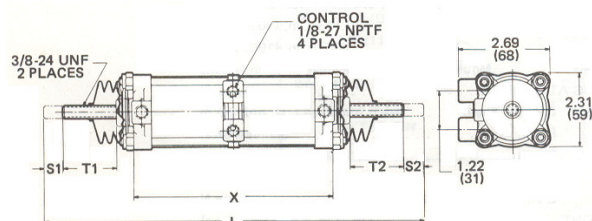
Pressure must be applied to one side of each piston to change the cylinder's stroke position. When two cylinder ports are pressurized, pressure is simultaneously exhausted from the two other ports, and the piston rods move to a new stroke position. The WM394 cylinder produces an actuating force that is equal to the piston's effective surface area multiplied by the pressure applied to the piston surface.

APPLICATION The WM394 cylinder is commonly used in shifting systems of heavy duty automatic transmissions. These cylinders are also used to shift auxiliary power takeoff units. Some WM394 models are available with mounting hardware in cylinder kits.

TYPICAL INSTALLATION

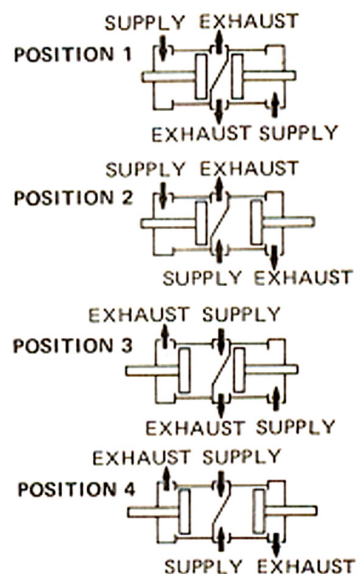


EXTERNAL CONFIGURATION



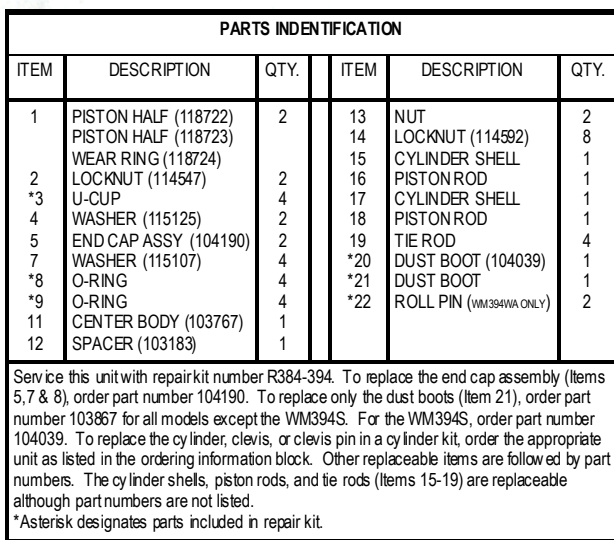
4 POSITION INDEXING CYLINDER

FUNCTIONAL DIAGRAM



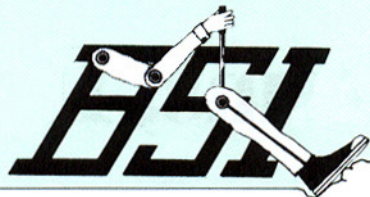
I. S. O. SYMBOL





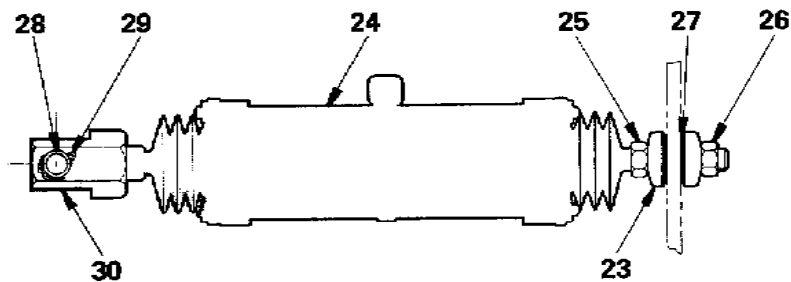
PORT SIZE.....	1/8-27 NPTF
MAXIMUM OPERATING PRESSURE.....	150 PSI (1034, Kpa)
OPERATING TEMPERATURE*.....	-20° F to 200° F (-28,9° C to 93, "3° C)
CYLINDER BORE.....	2.00 in. (51 mm)
CYLINDER STROKE.....	Refer to Ordering Information Block
EFFECTIVE PISTON AREA:	
Piston End.....	3.03 sq. in. (1955 mm ²)
Rod End.....	3.14 sq. in. (2026 mm ²)
MOUNTING.....	Mounting Provisions Included in Cylinder kits
MOUNTING ATTACHMENT.....	Optional
MATERIALS:	
Cylinder Shell.....	Hard Anodized I.D. Aluminum
Piston Rods.....	Stainless Steel
Pistons.....	Fabric-Reinforced Phenolic
Cleaves.....	Steel
O-Ring & U-Cup.....	Buna N
NET WEIGHT.....	3 lb.- 3 lb. 6 oz. (1,41,5kg)

*For continuous operation beyond this range, contact factory.



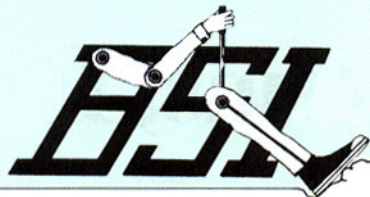
Brake Systems, Inc.

TO ORDER, SPECIFY								
WM394_____								
Model Number Suffix								
SELECT SUFFIX NUMBER BELOW								
CYLINDERS								
SUFFIX	CATALOG NUMBER	BODY LENGTH X	MAX. LENGTH L	CYLINDER STROKE			THREAD LENGTH T1	THREAD LENGTH T2
				TYPE	S1	S2		
WM394 R	112740	7.70 (196)	14.44 (367)	Adjustable	.50-.75 (13-19)	1.00-1.25 (25-32)	2.25 (57)	1.56 (40)
WM394 S	112742	6.70 (170)	12.65 (321)	Adjustable	.13-.38 (3-10)	.38-.63 (10-16)	2.44 (62)	
WM394 SA	112743			Preset	.29 (7)	.58 (15)		
WM394 T	112749	7.45 (189)	13.94 (354)	Adjustable	.38-.63 (10-16)	.88-1.13 (22-29)	2.25 (57)	
WM394 TA	112750			Preset	.50 (13)	1.00 (25)		
WM394 W	112759	7.07 (180)	13.84 (352)	Adjustable	.50 (13)	.50 (13)		
WM394 WA	112760			Fixed	.38 (10)	.75 (19)		

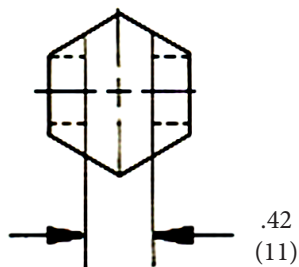


CYLINDER KIT PARTS IDENTIFICATION		
ITEM	DESCRIPTION	QTY.
23	RETAINER (103145)	2
24	CYLINDER	1
25	NUT (114542)	1
26	LOCKNUT (114644)	2
27	WASHER (115122)	2
28	CLEVIS PIN	1
29	COTTER PIN	1
30	CLEVIS	1

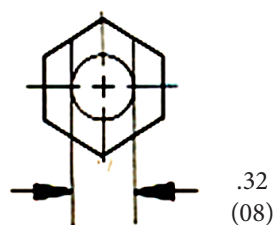
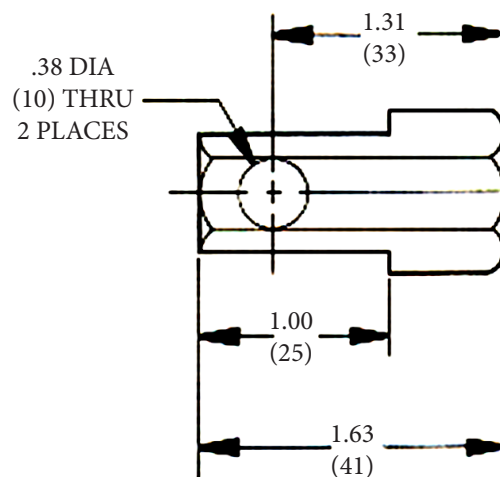




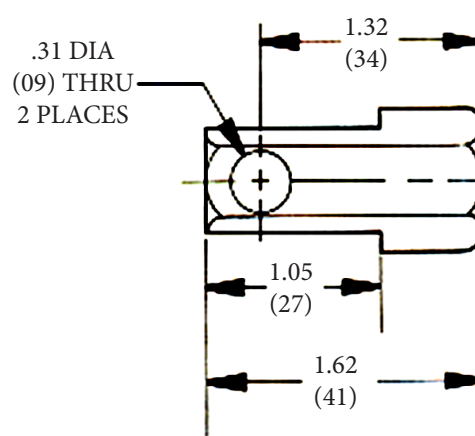
Brake Systems, Inc.

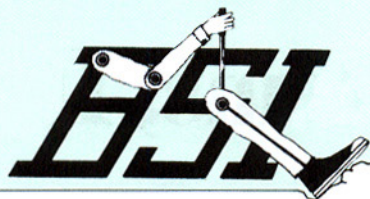


CLEVIS
P/N 115396



CLEVIS
P/N 100897





Brake Systems, Inc.

WM445, WM466, WM487

Brake Systems, Inc. Shift Control Devices include an operator control valve as shown above which routes air pressure to the appropriate actuator (cylinder or diaphragm type). One of the main uses of the product is for remote shifting of automatic transmissions (2-B-04) such as Allison, Clark, Twin Disc, etc. As this device is basically a sequence programming selector, it has many other uses such as single stick control of:

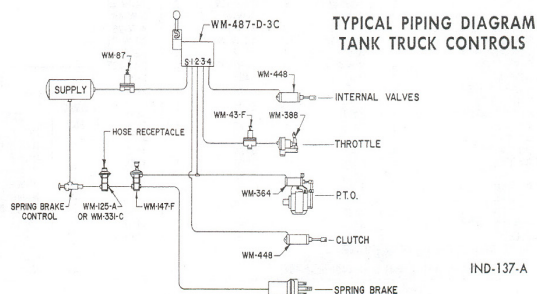
1. Cement Mixer.
2. PTO clutch control for winch.
3. Tank truck pumper.
4. General industrial.

All valves are custom assemblies of similar parts while the difference in part numbers define such items as:

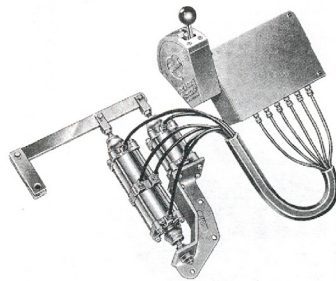
1. Number of valve units:
WM487 Series—4 valves
WM445 Series—6 valve
WM466 Series—8 valves
2. Left hand or right hand assembly.
3. Valve timing.
4. Handle type.
5. Shift gate pattern.
6. Number of handle positions.

Heavy duty design includes these features:

1. Lightweight housings of cast aluminum.
2. Shift gate labyrinth of long wearing malleable iron.
3. Stainless steel cam shaft.
4. Die cast cams.
5. Low effort spool type valves.
6. Air flow approximate 15 CFM (1/8" NPT ports).
7. Rubber dust boot over each operating stem.
8. Repair may be effected without complete disassembly by removal of outlet fitting from bottom of each individual valve as necessary.

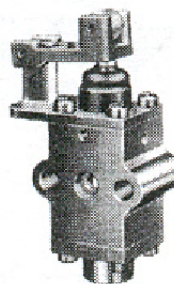


SHIFT CONTROL

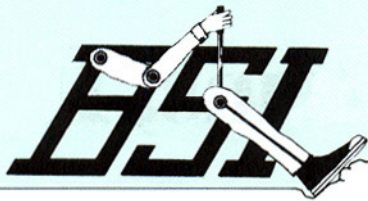


SEQUENCE PROGRAMMING

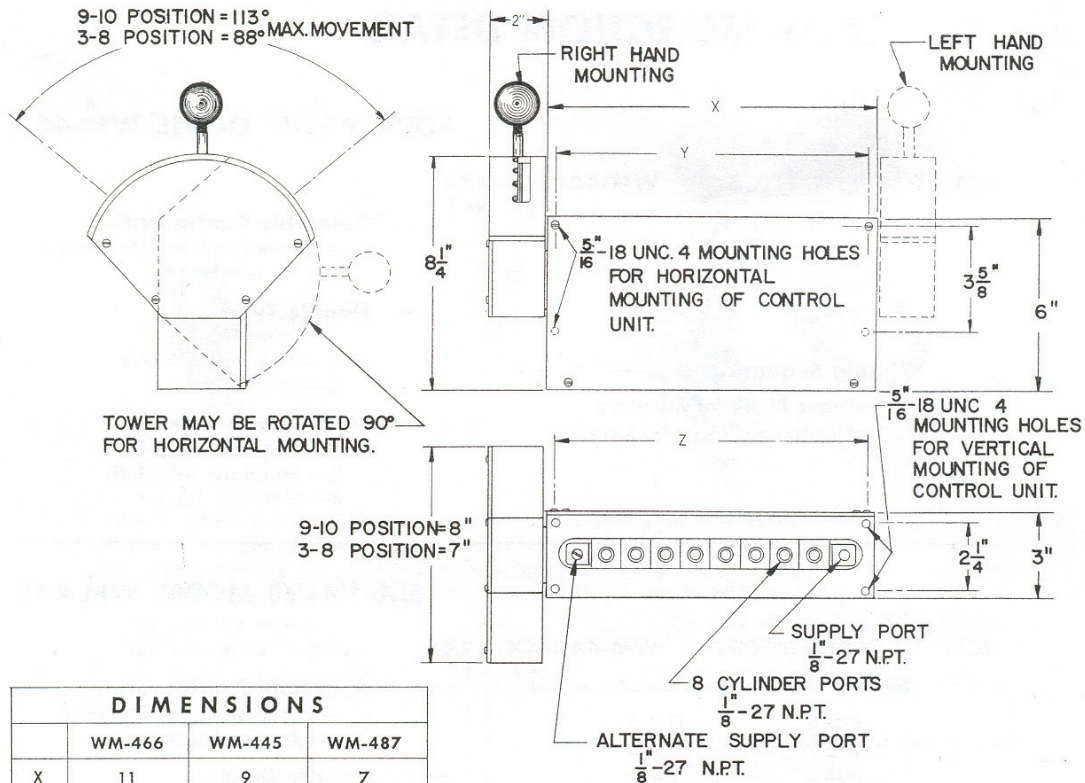
SYSTEM CONTROL



WM-458-A INDIVIDUAL VALVE ASSEMBLY

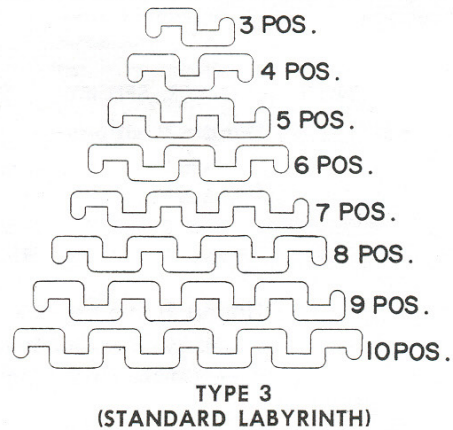
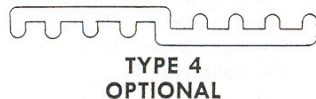
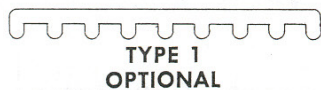


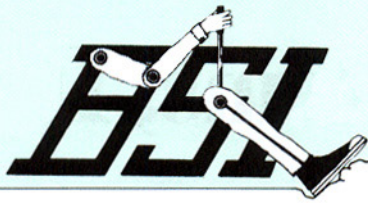
Brake Systems, Inc.



DIMENSIONS			
	WM-466	WM-445	WM-487
X	11	9	7
Y	10	8	6
Z	10 1/2	8 1/2	6 1/2

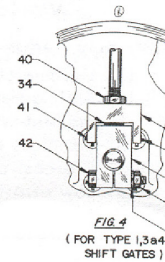
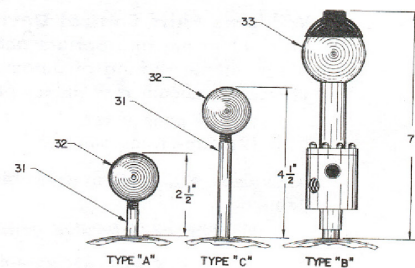
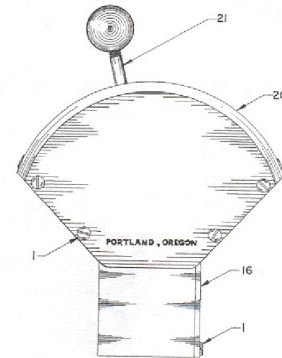
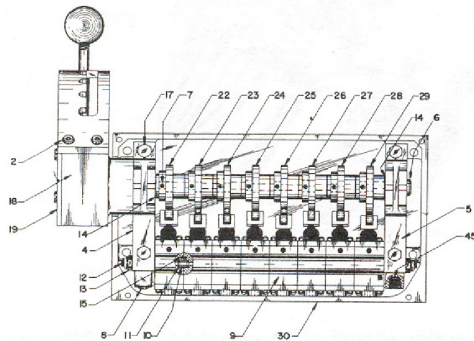
SHIFT GATE PATTERNS





Brake Systems, Inc.

WM-445-466-487



TYPICAL PARTS LIST

DWG. NO.	DESCRIPTION	WM-466-B-4A		WM-445-A-3A		WM-487-E-3A	
		QTY.	PART NO.	QTY.	PART NO.	QTY.	PART NO.
1	SCREW	8	3-W-156	8	3-W-156	8	3-W-156
2	CAP SCREW	4	3-W-226	4	3-W-226	4	3-W-226
3	CAP SCREW	4	3-W-251	4	3-W-251	4	3-W-251
4	SUPPLY BODY	1	3146	1	3146	1	3146
5	SUPPLY BODY	1	3457	1	3457	1	3457
6	CAM SHAFT	1	3473	1	3124	1	3472
7	SET SCREW	16	16-W-25	12	16-W-25	8	16-W-25
8	PIPE PLUG	1	7-W-43	1	7-W-43	1	7-W-43
9	CONTROL VALVE	8	WM-458-A	6	WM-458-A	4	WM-458-A
10	SEAL BUSHINGS	9	3193	7	3193	5	3193
11	O RING	18	52-W-3	14	52-W-3	10	52-W-3
12	TIE ROD	2	14-W-19	2	14-W-19	2	14-W-19
13	NUT	4	2-W-66	4	2-W-66	4	2-W-66
14	WASHER	2	4-W-29	2	4-W-29	2	4-W-29
15	ROLL PIN	9	10-W-24	7	10-W-24	5	10-W-24
16	CONTROL BOX COVER	1	3507	1	3117	1	3506
17	CAP SCREW	4	3-W-227	4	3-W-227	4	3-W-227
18	TOWER	1	3441	1	3438	1	3438
19	TOWER COVER	1	3442	1	3439	1	3439
20	SHIFT GATE	1	3599	1	3538	1	3534
21	HANDLE ASSY.	1	3493	1	3493	1	3495
22	#1 CAM	1	3408	1	3125	1	3126
23	#2 CAM	1	3408	1	3125	1	3126
24	#3 CAM	1	3408	1	3126	1	3125
25	#4 CAM	1	3408	1	3126	1	3125
26	#5 CAM	1	3406	1	3127	—	—
27	#6 CAM	1	3407	1	3127	—	—
28	#7 CAM	1	3408	—	—	—	—
29	#8 CAM	1	3409	—	—	—	—
30	CONTROL BOX	1	3469	1	3069	1	3457
45	SCREEN	1	53-W-1	1	53-W-1	1	53-W-1

INDIVIDUAL VALVE REPAIR KIT R-458

COMPLETE REPAIR KIT (R-466) or (R-445) or (R-487)

HANDLE ASSEMBLY

DWG. NO.	DESCRIPTION	TYPE 3A (# 3493)	TYPE 3B (# 3496)	TYPE 3C (# 3495)
31	HANDLE	3134	3497	3446
32	KNOB	62-W-7	—	62-W-7
33	PUSH BUTTON LEVER	—	WM-371-A	—
34	RUBBER SPRING	3142	3142	3142
35	HANDLE BASE	3132	3132	3132
37	LEVER BLOCK	3131	3131	3131
40	JAM NUT	2-W-76	2-W-76	2-W-76
41	ROLL PIN	10-W-4	10-W-4	10-W-4
42	CAP SCREW	3-W-26	3-W-26	3-W-26
43	LOCK WASHER	4-W-20	4-W-20	4-W-20
44	NUT	2-W-12	2-W-12	2-W-12

REV. 2010.06.16

Manufactured in the USA by Brake Systems Inc.

11

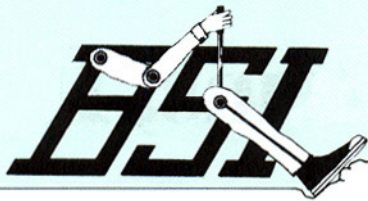
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Air, Electronic Throttles and Exhaust Brakes"

BRAKE SYSTEMS, INC.

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Brake Systems, Inc.

SELECTION DETAIL

FOUR VALVE MODEL WM-487

NOTE: TO ORDER, SPECIFY: **WM-487-XX-XXX**

Handle Positions

A=8 D=5
B=7 E=4
C=6 F=3

Timing Sequence

—Leave Blank for Standard
—Number Assigned for Specials

Assembly Configuration

—Leave Blank for Standard
—L for Left Hand

Handle Type

A—Short Handle
B—Push Button Valve
C—Long Handle

Shift Gate Pattern

1—Optional Type 1
3—Standard Labyrinth
4—Optional Type 4

SIX VALVE MODEL WM-445

NOTE: TO ORDER, SPECIFY: **WM-445-XX-XXX**

Handle Positions

A=8 D=5
B=7 E=4
C=6 F=3

Timing Sequence

—Leave Blank for Standard
—Number Assigned for Specials

Assembly Configuration

—Leave Blank for Standard
—L for Left Hand

Handle Type

A—Short Handle
B—Push Button Valve
C—Long Handle

Shift Gate Pattern

1—Optional Type 1
3—Standard Labyrinth
4—Optional Type 4

EIGHT VALVE MODEL WM-466

NOTE: TO ORDER, SPECIFY: **WM-466-XX-XXX**

Handle Positions

A=10 E=6
B=9 F=5
C=8 G=4
D=7 H=3

Timing Sequence

—Leave Blank for Standard
—Number Assigned for Specials

Assembly Configuration

—Leave Blank for Standard
—L for Left Hand

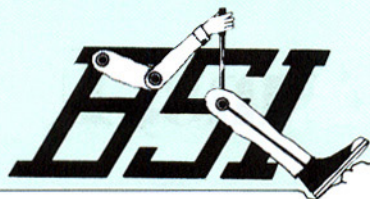
Handle Type

A—Short Handle
B—Push Button Valve
C—Long Handle

Shift Gate Pattern

1—Optional Type 1
3—Standard Labyrinth
4—Optional Type 4





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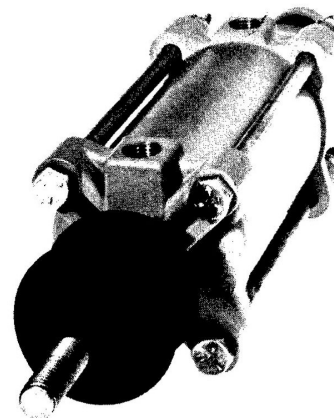
WM448 SERIES HEAVY DUTY 2" CYLINDER

PRODUCT DESCRIPTION

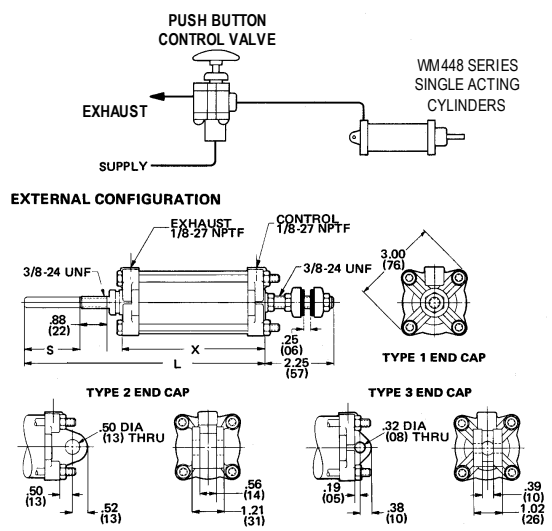
DESCRIPTION The WM448 single acting cylinder is a spring-returned pneumatic control device engineered for heavy duty vehicular or industrial service. Each WM448 model strokes to a fixed position (the stroke length options are listed in the ordering information block). On the stationary end of the cylinder, one of the following three end caps is used: (1) a die cast end cap with locknuts, rubber washers and a 3/8 -24 mounting stud; a cast iron end cap that features an integral trunnion and bushings for a 5/16 inch pin. On all cylinder models, the piston rod is threaded for installing a clevis or a rod end. A clevis and additional mounting provisions are included on cylinder kit configurations.

OPERATION The WM448 series cylinder requires only one air connection. A three-way control valve is normally used to deliver pressure to the cylinder's control port. When this port is pressurized, the piston strokes to its full stroke position. Because the cylinder is spring-loaded, the piston returns to its normal position when pressure is released. **IMPORTANT:** The return spring is designed to provide only the force required to retract the piston. If the actuated device requires any return force, an external spring should be added to the WM448 or double-acting cylinder should be used.

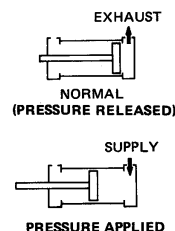
APPLICATION The WM448 series cylinders should be used only in applications where work is performed as the piston is extended. Typical applications include holding, clamping or positioning operations. In such applications, the cylinder repositions itself after each actuation.



SINGLE ACTING CYLINDER

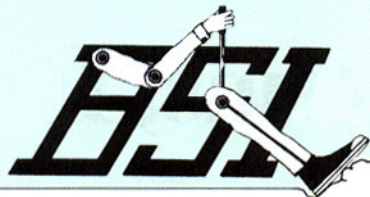


FUNCTIONAL DIAGRAM



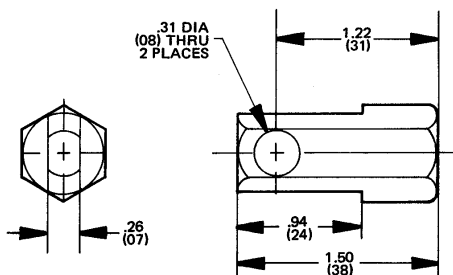
S. O. SYMBOL





Brake Systems, Inc.

TO ORDER, SPECIFY WM448 Model Number Suffix					
SELECT SUFFIX NUMBER BELOW					
CYLINDERS					
SUFFIX	CATALOG NUMBER	END CAP	BODY LENGTH X	MAX. LENGTH L	STROKE S
WM448 A1	112972	Type 1	3.98 (101)	6.73 (171)	1.00 (25)
WM448 A2A	112974	Type 2	3.91 (99)	6.36 (162)	.62 (16)
WM448 A3	112975	Type 3	3.98 (101)	6.74 (171)	1.00 (25)
WM448 B1	112979	Type 1	4.98 (126)	8.42 (214)	2.00 (51)
WM448 B1B	117914			8.17 (208)	1.75 (44)
WM448 B3	112982	Type 3		8.43 (214)	2.00 (51)
WM448 C1	112993	Type 1	7.35 (187)	12.11 (308)	3.00 (76)
WM448 C2	112994	Type 2	7.29 (185)	12.04 (306)	
WM448 C3	112995	Type 3	7.36 (187)	12.11 (308)	

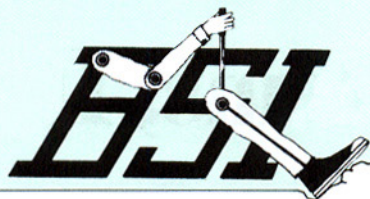


CLEVIS (P/N 115382)

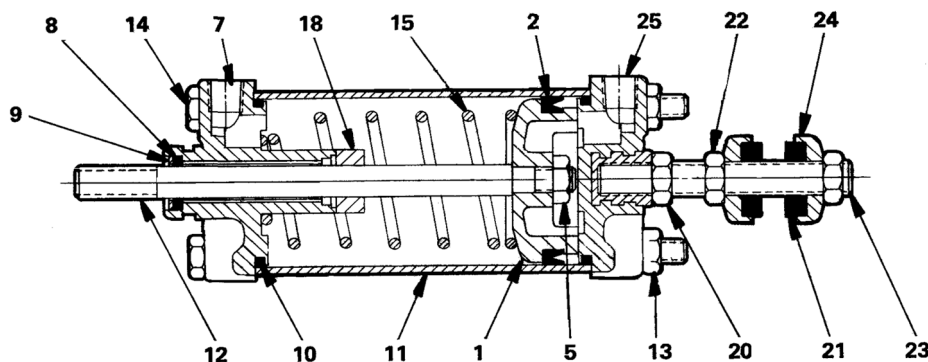
CYLINDER KIT PARTS IDENTIFICATION		
ITEM	DESCRIPTION	QTY.
NA	WM448B3 CYLINDER (112982)	1
NA	SPRING	1
NA	NUT (114540)	1
NA	NUT (114542)	1
NA	LOCKNUT (114547)	1
NA	CLEVIS PIN (115152)	1
NA	CLEVIS PIN (115153)	1
NA	COTTER PIN	2
NA	EYE END (115375)	1
NA	CLEVIS (115382)	1
NA	WASHER (WM448B3K3 ONLY)	2

TO ORDER, SPECIFY WM448 Model Number Suffix PART NUMBER			
SUFFIX	PART NUMBER	CYLINDER	MOUNTING HARDWARE
WM448 B3K2	112990	WM448B3	Included
WM448 B3K3	112991	(112982)	(Refer to Parts List)





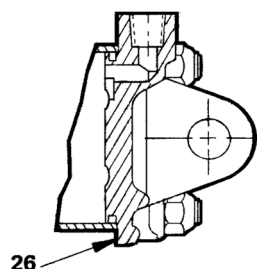
Brake Systems, Inc.



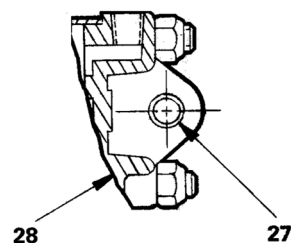
CYLINDER PARTS IDENTIFICATION

QUANTITY

ITEM	DESCRIPTION	TYPE 1	TYPE 2	TYPE 3
1	PISTON (118391)	1	1	1
*2	U-CUP (116335)	1	1	1
5	LOCKNUT (114547)	1	1	1
7	END CAP (104190)	1	1	1
*8	O-RING (116304)	1	1	1
9	WASHER (115107)	1	1	1
*10	O-RING (116377)	2	2	2
11	CYLINDER SHELL	1	1	1
12	PISTON ROD	1	1	1
13	LOCKNUT (114592)	4	4	4
14	TIE ROD	4	4	4
15	SPRING (101496)	1	1	1
18	SPACER	1	1	1
20	NUT (114542)	1		
*21	WASHER (115122)	2		
22	LOCKNUT (114644)	2		
23	MOUNTING STUD (115448)	1		
24	RETAINER (103145)	2		
25	TYPE 1 END CAP (103605)	1		
26	TYPE 2 END CAP (102993)		1	
27	BUSHING (116476)		2	
28	TYPE 3 END CAP (103016)			1



TYPE 2 END CAP



TYPE 3 END CAP

SPECIFICATIONS

PORT SIZE.....1/8-27 NPTF
 MAXIMUM OPERATING PRESSURE.....150 PSI (1034, Kpa)
 OPERATING TEMPERATURE*.....-20 F to 200 F (-28.9 C to 93, 3 C)
 CYLINDER BORE.....2.00 in. (51 mm)
 CYLINDER STROKE.....Refer to Ordering Information Block
 EFFECTIVE PISTON AREA.....3.14 sq. in. (2026 mm)
 MOUNTING.....Using type 1, Type 2, or type 3 End Cap
 MOUNTING ATTITUDE.....Optional
 MATERIALS: Cylinder Shell.....Hard Anodized I.D. Aluminum
 Piston Rod.....Stainless Steel
 Piston.....Die Cast Zinc Alloy
 End Cap: Types 1 & 3.....Die Cast Zinc Alloy
 Type 2.....Cast Iron
 Packing.....Leather
 O-Rings & Rubber Washers.....Buna N
 NET WEIGHT.....2 lb. - 2 lb. 6 oz. (0.9-1, 1kg)
 *For continuous operation beyond this range, contact factory.

Service this unit with repair kit number R448. Other replaceable items are followed by part numbers. The cylinder shell, piston rod and tie rods (Items 11, 12, & 14) are also replaceable although part numbers are not listed.

*Asterisk designates parts included in repair kit R448.

REV. 2003.10

15

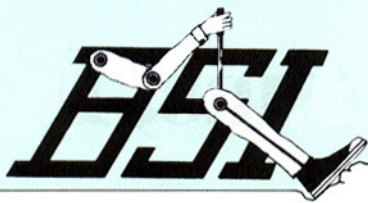
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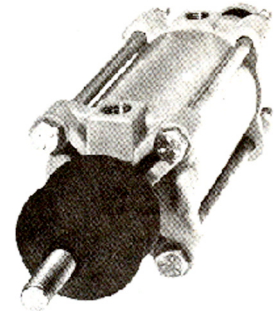
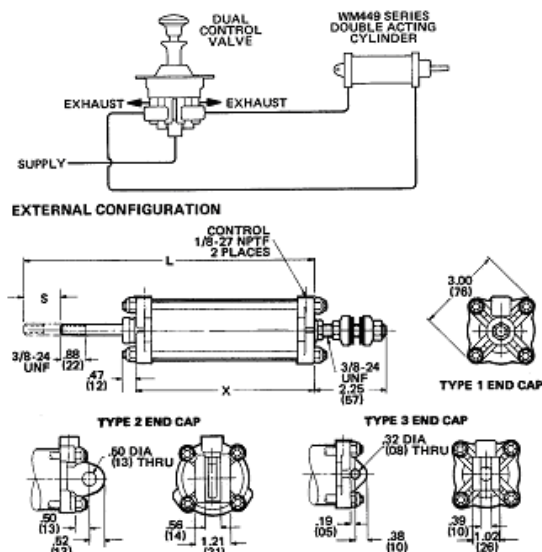
WM449 SERIES HEAVY DUTY 2" CYLINDER

PRODUCT DESCRIPTION

DESCRIPTION Designed for industrial or vehicular applications, the WM449 is a heavy duty double acting cylinder. This two-position cylinder is available with various fixed stroke configurations. The stationary end of each cylinder model is equipped with one of the following three end caps: (1) a die cast end cap with locknuts, rubber washers, and a 3/8-24 UNF mounting stud; (2) a cast iron end cap that features an integral trunnion for a 1/2 inch pin; or (3) a die cast end cap that has an integral trunnion and bushings for a 5/16 inch pin. On all WM449 series cylinders, the piston rod is threaded for mounting a clevis or a rod end.

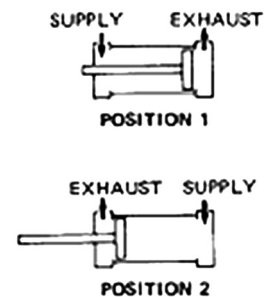
OPERATION The WM449 cylinder has two cylinder ports which require air connections. The ports receive pressure from either a pair of cam-actuated three-way valves (as shown in the installation schematic) or a four-way directional control valve. When one cylinder port is pressurized, the piston rod strokes to its full stroke position and pressure is exhausted from the other cylinder port.

APPLICATION The WM449 double acting cylinder is engineered for applications where linear operating force is required in both stroke directions. (For applications where operating force is required in only one direction, the WM448 series cylinders may be substituted.) The WM449 cylinders are frequently used a pneumatic control devices for power take-off units, transmission shift systems, or latching/unlatching functions. These cylinders are NOT designed for modulating or "feathering" applications.



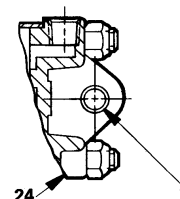
DOUBLE ACTING CYLINDER

FUNCTIONAL DIAGRAM



I. S. O. SYMBOL



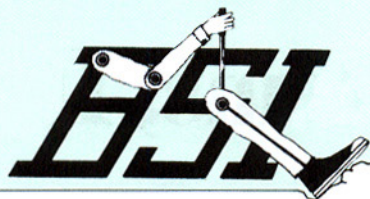


PORT SIZE.....	1/8-27 NPTF
MAXIMUM OPERATING PRESSURE.....	150 PSI (1034, Kpa)
OPERATING TEMPERATURE.....	-20 F to 200 F (-28.9 C to 93, 3 C)
CYLINDER BORE.....	2.00 in. (51 mm)
CYLINDER STROKE.....	Refer to Ordering Information Block
EFFECTIVE PISTON AREA:	
Piston End.....	3.03 sq. in. (1955 mm ²)
Rod End.....	3.14 sq. in. (2026 mm ²)
MOUNTING.....	Using type 1, Type 2, or type 3 End Cap
MOUNTING ATTACHMENT.....	Optional
MATERIALS:	
Cylinder Shell.....	Hard Anodized I.D. Aluminum
Piston Rod.....	Stainless Steel
Piston.....	Fabric-Reinforced Phenolic
End Cap: Types 1 & 3.....	Die Cast Zinc Alloy
Type 2.....	Cast Iron
O-Rings, U-Cups & Rubber Washers.....	Buna N
NET WEIGHT.....	2 lb.- 3 lb. (0.9-lb., 1kg)

*For continuous operation beyond this range, contact factory.

Service this unit with repairkit number R449. Other replaceable items are followed by part numbers. The cylinder shell, piston rod and tie rods (Items 12-14) are also replaceable although part numbers are not listed.

*Asterisk designates parts included in repair kit R449.



Brake Systems, Inc.

TO ORDER, SPECIFY

WM449 _____

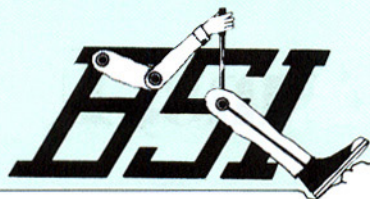
Model Number

Suffix

SELECT SUFFIX NUMBER BELOW

SUFFIX	CATALOG #	END CAP	BODY LENGTH X	MAXIMUM LENGTH L	STROKE S
WM449 A1	113002	TYPE 1	4.26 (108)	6.92 (176)	1.00 (25)
WM449 A2	113008	TYPE 2	4.19 (106)	6.86 (174)	1.00 (25)
WM449 A3	113009	TYPE 3	4.26 (108)	6.93 (176)	1.00 (25)
WM449 B1	113014	TYPE 1	5.26 (134)	8.92 (227)	2.00 (51)
WM449 B2	113017	TYPE 2	5.19 (132)	8.86 (225)	2.00 (51)
WM449 B3	113018	TYPE 3	5.26 (134)	8.93 (227)	2.00 (51)
WM449 B3A	113019	TYPE 3	5.26 (134)	8.11 (206)	1.19 (30)
WM449 B3C	110308	TYPE 3	5.26 (134)	8.68 (220)	1.75 (44)
WM449 C1	113021	TYPE 1	6.26 (159)	10.92 (277)	3.00 (76)
WM449 C2	113024	TYPE 2	6.19 (157)	10.86 (276)	3.00 (76)
WM449 C2A	113025	TYPE 2	6.19 (157)	10.23 (260)	2.38 (60)
WM449 C3	113026	TYPE 3	6.26 (159)	10.93 (278)	3.00 (76)
WM449 C3A	113027	TYPE 3	6.26 (159)	10.43 (265)	2.50 (64)
WM449 D1	113028	TYPE 1	7.26 (184)	12.92 (328)	4.00 (102)
WM449 D2	113029	TYPE 2	7.19 (183)	12.86 (327)	4.00 (102)
WM449 D3	113030	TYPE 3	7.26 (184)	12.93 (328)	4.00 (102)
WM449 E1	113032	TYPE 1	8.26 (210)	14.92 (379)	5.00 (127)
WM449 E2	113033	TYPE 2	8.19 (208)	14.86 (377)	5.00 (127)
WM449 E3	113034	TYPE 3	8.26 (210)	14.93 (379)	5.00 (127)
WM449 F2	113036	TYPE 2	9.19 (233)	16.86 (428)	6.00 (152)
WM449 F3	113037	TYPE 3	9.26 (235)	16.43 (430)	6.00 (152)
WM449 H		TYPE 2		9.0	





WM447 SERIES HEAVY DUTY 2" CYLINDER

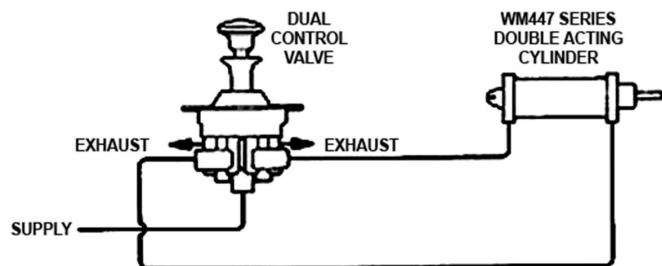
1/2" SS SHAFT, MODULAR IRON END CAP

PRODUCT DESCRIPTION

DESCRIPTION Designed for industrial or vehicular applications, the WM447 is a heavy duty double acting cylinder. This two-position cylinder is available with various fixed stroke configurations. The stationary end of each cylinder model is equipped with one of the following three end caps: (1) a die cast end cap with locknuts, rubber washers, and a UNF mounting stud; (2) a cast iron end cap that features an integral trunnion for a 1/2 inch pin; or (3) a die cast end cap that has an integral trunnion and bushings for a 5/16 inch pin. On all WM447 series cylinders, the piston rod is threaded 1/2-20 UNF for mounting a clevis or a rod end.

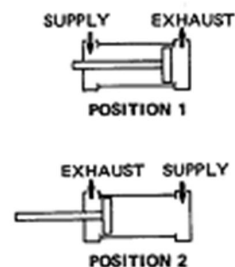
OPERATION The WM477 cylinder has two cylinder ports which require air connections. The ports receive pressure from either a pair of cam-actuated three-way valves (as shown in the installation schematic) or a four-way directional control valve. When one cylinder port is pressurized, the piston rod strokes to its full stroke position and pressure is exhausted from the other cylinder port.

APPLICATION The WM447 double acting cylinder is engineered for applications where linear operating force is required in both stroke directions. (For applications where operating force is required in only one direction, the WM446 series cylinders may be substituted.) The WM447 cylinders are frequently used pneumatic control devices for power take-off units, transmission shift systems, or latching/unlatching functions.



DOUBLE ACTING CYLINDER

FUNCTIONAL DIAGRAM



I. S. O. SYMBOL



REV. 2011.05.03



Technical drawing of a hydraulic cylinder, showing cross-sections and end views for two configurations: SINGLE ACTING (WM446) and DOUBLE ACTING (WM447).

SINGLE ACTING (WM446): The cross-section shows a single-rod cylinder with a piston rod diameter of $\frac{1}{2}$ -20 UNC. The piston is connected to the rod via a pin (11). The cylinder head (1) is shown with a flange (28) and a mounting bracket (27). The end view shows a 3.00 inch diameter.

DOUBLE ACTING (WM447): The cross-section shows a double-rod cylinder with a piston rod diameter of $\frac{1}{2}$ -20 UNC. The piston is connected to the rod via a pin (11). The cylinder head (1) is shown with a flange (28) and a mounting bracket (27). The end view shows a 3.00 inch diameter.

End Views: The end views show the cylinder head (1) and the mounting bracket (27). The end view for the single acting configuration shows a 3.00 inch diameter. The end view for the double acting configuration shows a 3.00 inch diameter.

Dimensions: The drawing includes various dimensions for the cylinder components, including diameters (e.g., .50 DIA, .50), lengths (e.g., .19, .38, .52, .56), and thread specifications (e.g., $\frac{1}{2}$ -20 UNC).

Legend:

REV.	DESCRIPTION	DATE
1	REVISED BY	12/00/01
2	REVISED BY	12/00/01

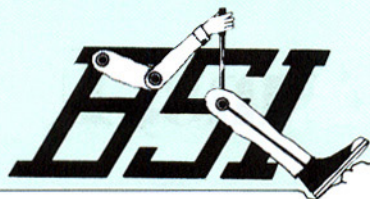
BRAKE SYSTEMS INC.

CYLINDER VARIATIONS 2 IN.HD

WM446 & WM447

SUFFIX	END CAP	BODY LENGTH X	MAXIMUM LENGTH L	STROKE S
WM447 A1	TYPE 1	4.26 (108)	6.92 (176)	1.00 (25)
WM447 A2	TYPE 2	4.19 (106)	6.86 (174)	1.00 (25)
WM447 A3	TYPE 3	4.26 (108)	6.93 (176)	1.00 (25)
WM447 B1	TYPE 1	5.26 (134)	8.92 (227)	2.00 (51)
WM447 B2	TYPE 2	5.19 (132)	8.86 (2325)	2.00 (51)
WM447 B3	TYPE 3	5.26 (134)	8.93 (227)	2.00 (51)
WM447 B3A	TYPE 3	5.26 (134)	8.11 (206)	1.19 (30)
WM447 B3C	TYPE 3	5.26 (134)	8.68 (220)	1.75 (44)
WM447 C1	TYPE 1	6.26 (159)	10.92 (277)	3.00 (76)
WM447 C2	TYPE 2	6.19 (157)	10.86 (276)	3.00 (76)
WM447 C2A	TYPE 2	6.19 (157)	10.23 (260)	2.38 (60)
WM447 C3	TYPE 3	6.26 (159)	10.93 (278)	3.00 (76)
WM447 C3A	TYPE 3	6.26 (159)	10.43 (265)	2.50 (64)
WM447 D1	TYPE 1	7.26 (184)	12.92 (328)	4.00 (102)
WM447 D2	TYPE 2	7.19 (183)	12.86 (327)	4.00 (102)
WM447 D3	TYPE 3	7.26 (184)	12.93 (328)	4.00 (102)
WM447 E1	TYPE 1	8.26 (210)	14.92 (379)	5.00 (127)
WM447 E2	TYPE 2	8.19 (208)	14.86 (377)	5.00 (127)
WM447 E3	TYPE 3	8.26 (210)	14.93 (379)	5.00 (127)
WM447 F2	TYPE 2	9.19 (233)	16.86 (428)	6.00 (152)
WM447 F3	TYPE 3	9.26 (235)	16.43 (430)	6.00 (152)

REV. DATE 2011.05.03

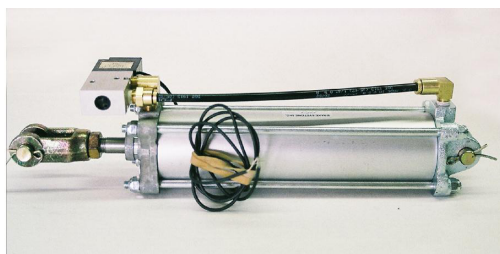


Blue Ox Tail Gate Lock Air Cylinders

- Heavy Duty Assembly
- Cylinder Shell, Hard Anodized Aluminum
- Cylinder Rod, Stainless Steel, Heavy Duty
- End Cap, 2" Modular Cast Iron, Heavy Duty Mounting Boss
3¼" Die Cast, Heavy Duty Mounting Boss with Replaceable Bushings
- Piston, Proprietary Design with Buna-N Seals
- Trunion Pin: ½"
- Clevis Assy: ½" Pin
- Easily Rebuildable, All Components Available
- 40+ Years of Industrial/Automotive Service

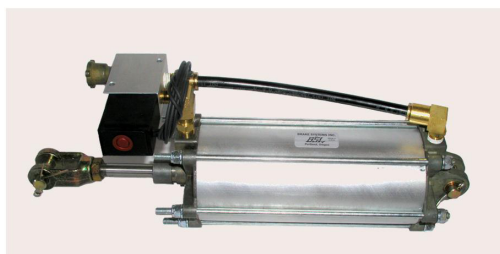
Cylinder Assy	Retracted Length	Stroke	Cylinder Assembly with Installation Kit
WM-447D2	9.875	4	WM-447D2101
WM-447F2	11.875	6	WM-447F2101
WM-447H2	13.875	8	WM-447H2101

Bore Size: 2" Double Acting
 Rod Diameter: ½" x 20 U.N.F.
 Port Size: ¼" NPT x 2
 Trunion Pin Dia. ½"
 Recommended Operating Pressure: 100 PSI
 Maximum Operating Pressure: 150 PSI



Cylinder Assy	Retracted Length	Stroke	Cylinder Assembly with Installation Kit
WM-463D	10.00	4	WM-463D101
WM-463F	12.00	6	WM-463F101
WM-463H	14.00	8	WM-463H101

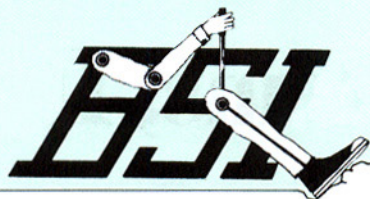
Bore Size: 3¼" Double Acting
 Rod Diameter: ½" x 20 U.N.F.
 Port Size: ¼" NPT x 2
 Trunion Pin Dia. ½"
 Recommended Operating Pressure: 100 PSI
 Maximum Operating Pressure: 150 PSI



WM447K1			
Installation Kit, Elec/Air			
Item No.	Qty.	Part No.	Description
1	1		Solenoid—4w
2	1		Breather
3	1		Fitting, Straight
4	1		Fitting, Elbow
5	1		Street Elbow
6	1		Nipple, Hex
7	1		Tubing, Nylon

WM463K1			
Installation Kit, Elec/Air			
Item No.	Qty.	Part No.	Description
1	1		Solenoid—4w
2	1		Breather
3	1		Fitting, Straight
4	1		Fitting, Elbow
5	1		Street Elbow
6	1		Nipple, Hex
7	1		Tubing, Nylon

REV. 2010.09.28



WM463 DOUBLE ACTING CYLINDER

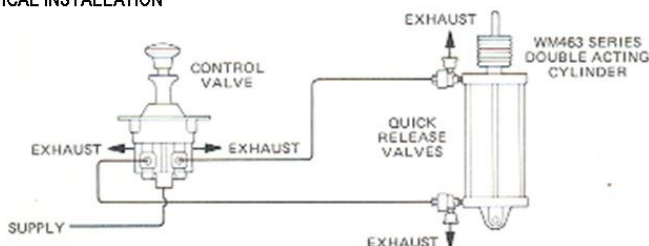
PRODUCT DESCRIPTION

DESCRIPTION The WM463 is a large double acting cylinder engineered for applications where linear operating force is required in both stroke directions. The stroke is fixed on each cylinder but the stroke length varies from model to model in the WM463 series (Refer to the ordering information block for available stroke length options.). All cylinder models have an integral trunnion for mounting and a threaded piston rod for a clevis. The longer the stroke models do not include dust boots.

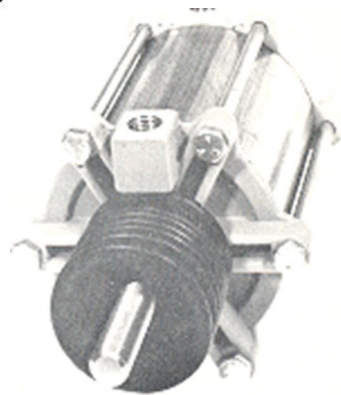
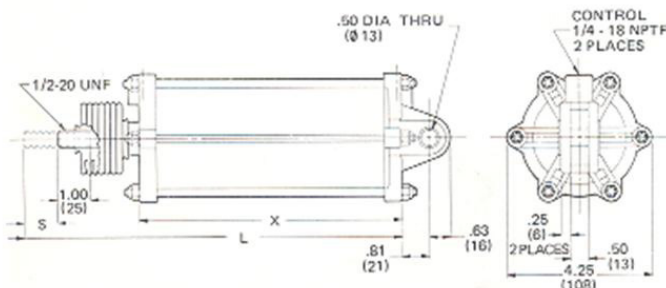
OPERATION Each WM463 cylinder has two ports which require air connections. To effect piston movement, pressure must be applied to one side of the piston. When one cylinder port is pressurized, pressure is exhausted from the other port and the piston strokes by a fixed amount.

APPLICATION The WM463 cylinder is commonly used to control mechanical devices on heavy duty industrial equipment. Since the WM463 cylinder produces more force than a 2.00 inch (51 mm) diameter cylinder, the WM463 is also used for direct-acting linkage applications such as the operation of two-position valves on dump trucks or the control of sequencing functions. The cylinder is normally pressurized by a single four-way control valve. Quick release valves are often used between the control valve assembly and the cylinder to improve the cylinder's response to the control signal.

TYPICAL INSTALLATION

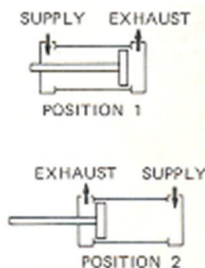


EXTERNAL CONFIGURATION



DOUBLE ACTING CYLINDER

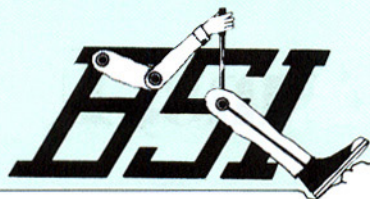
FUNCTIONAL DIAGRAM



I.S.O. SYMBOL



3-J-12

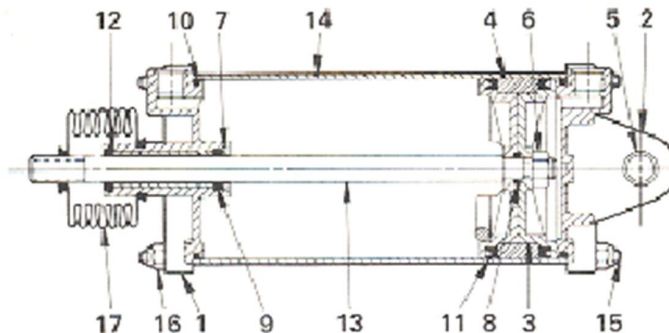


Brake Systems, Inc.

PARTS IDENTIFICATION			
ITEM	DESCRIPTION	QUANTITY A,B,C & D,E,F,H	
1	END CAP (103277)	1	1
2	END CAP (103278)	1	1
3	PISTON (103279)	2	2
4	BUSHING (103280)	1	1
5	BUSHING (103304)	2	2
6	LOCKNUT (114568)	1	1
7	WASHER (115127)	1	1
*8	O-RING	1	1
*9	QUAD SEAL	1	1
*10	O-RING	2	2
*11	U-CUP	2	2
*12	WIPER SEAL	1	1
13	SHAFT	1	1
14	CYLINDER SHELL	1	1
15	TIE ROD	6	6
16	LOCKNUT (114592)	12	12
*17	DUST BOOT (103837)	1	

Service this unit with repair kit number R463-601. Replaceable items are followed by part numbers. The cylinder shell, shaft and tie rod (Items 13-15) are also replaceable although part numbers are not listed.

*Asterisk designates items included in repair kit.



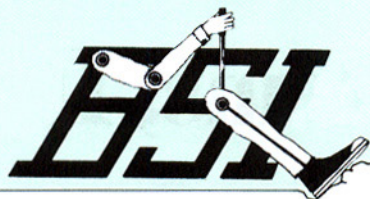
SPECIFICATIONS

PORT SIZE.....	1/4-18 NPTF
MAXIMUM OPERATING PRESSURE.....	150 PSI (1034, 2kPa)
OPERATING TEMPERATURE*.....	20°F to 200°F (-28,9°C to 93,3°C)
CYLINDER BORE.....	3.25IN. (83 mm)
CYLINDER STROKE.....	Refer to Ordering Information Block
EFFECTIVE PISTON AREA: Rod End.....	8.10 sq.in. (5226mm ²)
Piston End.....	8.29 sq.in. (5349mm ²)
MOUNTING.....	Integral Trunnion & Bushings for 0.50in (13mm) Dia Pin
MOUNTING ATTITUDE.....	Optional
MATERIALS: Cylinder Shell.....	Brass
Piston.....	Die Cast Zinc Alloy w/Phenolic Bushing
O-rings, U-cups & Quad Seal.....	Buna N
Wiper Seal.....	Polyurethane Rubber
Dust Boot.....	Cloroprene Rubber
O-Rings,U-Cups & Rubber Washers.....	Buna N
NET WEIGHT: WM463A.....	4 lb. 8 oz (2,0kg)
WM463B.....	4 lb. 14 oz (2,2kg)
WM463C.....	5 lb. 3 oz (2,4kg)
WM463D.....	5 lb. 9 oz (2,5kg)
WM463E.....	5 lb. 14 oz (2,7kg)
WM463F.....	6 lb. 4 oz (2,6kg)
WM463H.....	5 lb. 10 oz (2,5kg)

*For continuous operation beyond this range, contact factory.

TO ORDER, SPECIFY					
WM463					
Model Number		Suffix			
SELECT SUFFIX NUMBER BELOW					
SUFFIX	CATALOG NUMBER	BODY LENGTH X	MAX. LENGTH L	STROKE S	DUST BOOT
WM463 A	113155	3.75 (95)	7.19 (183)	1.00 (25)	Included
WM463 B	113156	4.75 (121)	9.19 (233)	2.00 (51)	
WM463 C	113157	5.75 (146)	11.19 (284)	3.00 (76)	
WM463 D	113158	6.75 (171)	13.19 (335)	4.00 (102)	
WM463 E	113159	7.75 (197)	15.19 (386)	5.00 (127)	Not Included
WM463 F	113160	8.75 (222)	17.19 (437)	6.00 (127)	
WM463 H	113161	10.75 (273)	21.19 (538)	8.00 (203)	



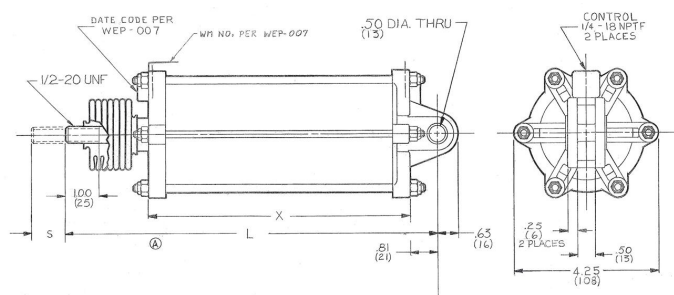


WM464 SINGLE ACTING CYLINDER (SPRING RETURN)

DESCRIPTION: The WM464 is a single acting version of the WM463. It is a large single acting (spring return) air cylinder, typically used in automotive/industrial applications. It is available in one, two, and three inch strokes with spring return. The WM463 can be used with an air return and an infinite stroke to duplicate the spring return feature of the WM464. All cylinder models feature a die cast trunion end cap, set up for a 1/2" pin mounting. The piston rod is of 1/2" material, threaded 1/2-20 UNF. Several clevises are available (see page 020299) and are heat treated for longevity and strength.

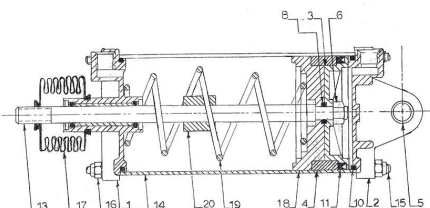
OPERATION: The WM464 cylinder has two ports (1/4-20 NPTF), one for air supply and one for breathing. A breather (WM111A), is available, or the WM124K remote breather kit.

APPLICATION: The WM464C approximates the physical size of the now obsolete Wagner A21301. 15 to 20PSI will cause the cylinder to full stroke, with additional air pressure required for work.



WM464 EXTERNAL CONFIGURATION

Part Number	Stroke - S	L	X	Pressure for Full Extension
WM464A	1	6 1/8	6	15 PSI
WM464B	2	7 1/8	7	20 PSI
WM464C	3	8 1/8	8	25 PSI



WM464 C102
3" Stroke

WM464 E102
4 1/2" Stroke

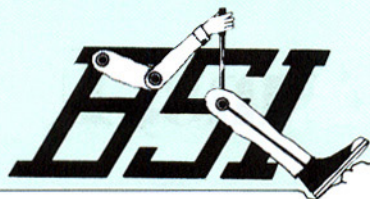
Similar to Wagner A21301



WM464 C103
2 1/2" Stroke

Similar mounting to
Wagner A2778

REV. 2012.04.03



WM475 3-POSITION FEATHERING CYLINDER

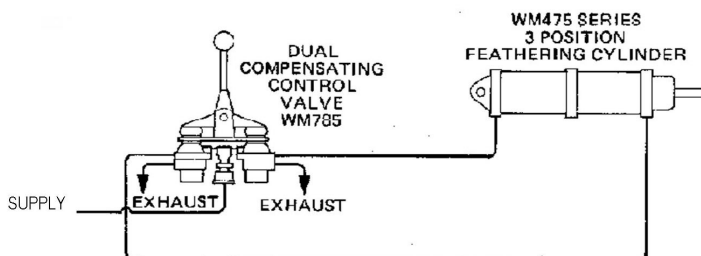
PRODUCT DESCRIPTION

DESCRIPTION The WM475 is a feathering cylinder used in systems that require infinite positioning in two directions from a given center position. The cylinder stroke in either the extension or retraction direction is limited to a fixed maximum. This stroke maximum varies according to the WM475 series model. Models also differ in the type of end cap used on the stationary end of the cylinder. The following end caps are available: (1) a die cast end cap with locknuts, washers, and a 3/8-24 UNF mounting stud; or (2) a cast iron end cap that incorporates a trunnion for a 1/2 inch pin. All WM475 models have a threaded piston rod for installing a clevis or a rod end.

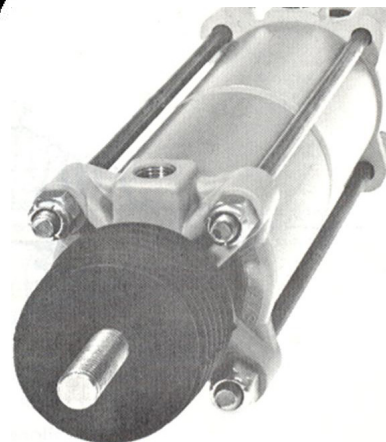
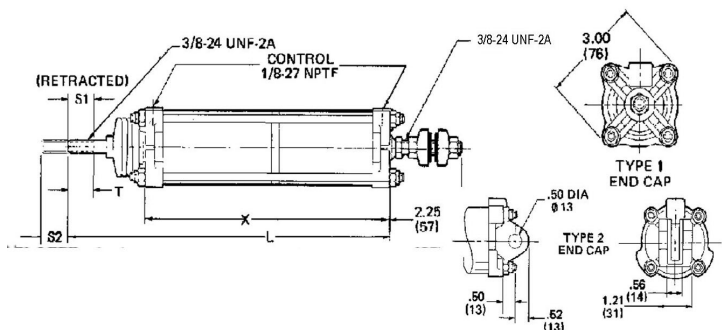
OPERATION To obtain variable positioning of the WM475, a compensating dual control valve is normally used to modulate pressure delivery to the ports. When pressure is applied to one cylinder port, it is simultaneously exhausted from the other. From the center position, the piston can be positioned at any point between the full extension and retraction positions, depending on which port is pressurized, and to what degree. When pressure is released from both ports, a spring centers the piston in the normal position.

APPLICATION WM475 cylinders are frequently used in air over hydraulic systems. Some common applications are remote control of hydraulic spool valves, hydrostatic transmission control (See WM796 catalog page.), and boom positioning in crane-hoist applications.

TYPICAL APPLICATION

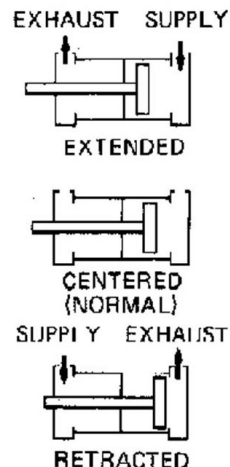


EXTERNAL CONFIGURATION



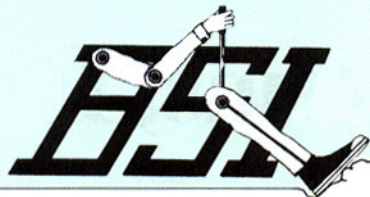
3-POSITION FEATHERING CYLINDER

FUNCTIONAL DIAGRAM

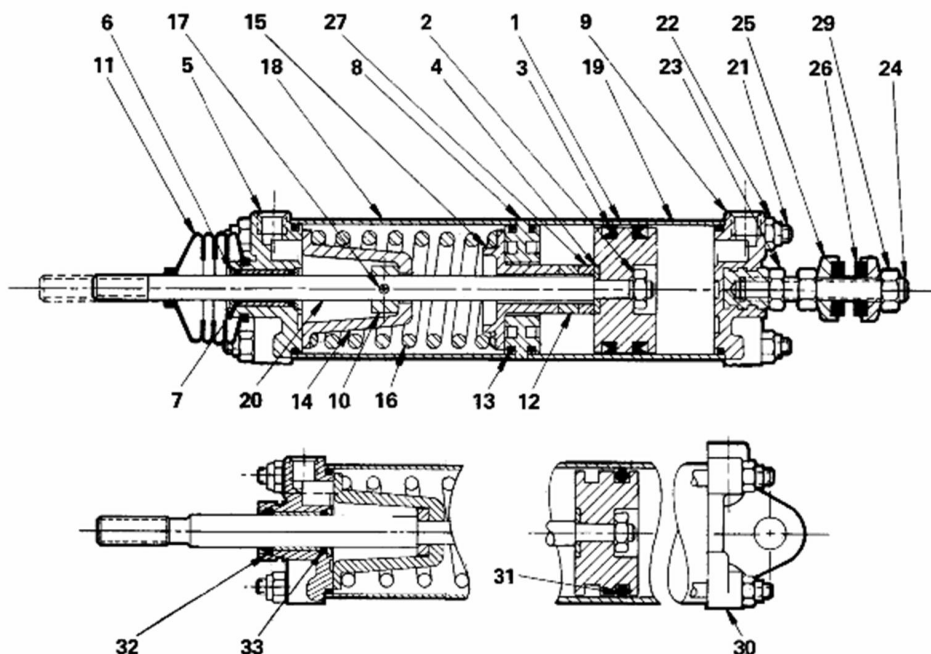


I.S.O. SYMBOL





Brake Systems, Inc.



PARTS LIST

DWG. NO.	DESCRIPTION	QTY.	WM-475-B	WM-475-C	WM-475-D	WM-475-E	WM-475-F
1	PISTON HALF	1	118722	118722	118722	118722	118722
	PISTON HALF		118723	118723	118723	118723	118723
	WEAR RING		118724	118724	118724	118724	118724
2	JAM NUT	1	114547	114547	114547	114547	114547
*3	U-CUP	2	116335	116335	116335	116335	116335
4	WASHER 5/16"	1	115125	115125	115125	115125	115125
5	FRONT END CAP	1	104189	104189	104189	104189	103579
*6	SEAL RETAINER	2	115107	115107	115107	115107	115107
*7	O-RING	2	116304	116304	116304	116304	116304
8	CENTER BODY	1	103580	103580	103580	103580	103580
9	REAR END CAP	1	103605	103605	103605	103605	103605
10	STOP RING	1	103626	103626	103626	103626	103626
*11	BOOT	1	103867	103943	103943	103867	103943
12	SPACER	1	—	102021	102021	—	—
*13	O-RING	4	116377	116377	116377	116377	116377
14	SPRING RETAINER	1	103582	103745	103745	103582	103745
15	SPRING RETAINER	1	103583	103583	103583	103583	103583
16	SPRING	1	103584	103744	103779	101496	103779
17	ROLL PIN	1	115338	115338	115338	115338	115338
18	SHELL	1	104361	104362	104363	104361	104363
19	SHELL	1	101499	103747	102112	101499	102112
20	PISTON ROD	1	103585	103748	103781	103585	104182
21	TIE ROD	4	115441	115452	115452	115452	115452
*22	LOCK NUT	8	114592	114592	114592	114592	114592
23	JAM NUT	3	114542	114542	114542	114542	114542
24	STUD	1	115448	115448	115448	115448	115448
25	WASHER-RETAINER	2	103145	103145	103145	103145	103145
*26	WASHER-RUBBER	2	115122	115122	115122	115122	115122
27	SPACER	1	—	101498	—	—	—
S1	STROKE-EXTENDED		7/8"	2"	1 5/8"	7/8"	7/8"
S2	STROKE-RETRACTED		7/8"	2"	7/8"	7/8"	1 5/8"
B	BODY LENGTH		8 1/16"	12 9/16"	10 17/32"	8 1/16"	10 17/32"
L	OVERALL LENGTH		12 5/8"	18 9/16"	15 1/8"	12 5/8"	15 1/8"
T	THREAD LENGTH		7/8"	1 1/4"	7/8"	7/8"	7/8"

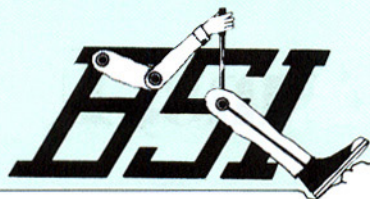
*PARTS INCLUDED IN R-475 REPAIR KIT





PORT SIZE.....	1/8-27 NPTF
MAXIMUM OPERATING PRESSURE.....	150 PSI (1034, 2kPa)
OPERATING TEMPERATURE*.....	20°F to 200 °F (-28,9°C to 93,3°C)
CYLINDER BORE.....	2.00IN.(51mm)
CYLINDER STROKE.....	Refer to Ordering Information Block
EFFECTIVE PISTON ON AREA: Rod End.....	3.14 sq.in.(2026mm²)
Piston End.....	3.03 sq.in.(1955mm²)
MOUNTING.....	Using Type 1 or Type 2 End Cap
MOUNTING ATTITUDE.....	Optional
MATERIALS: Cylinder Shells.....	Hard Anodized I.D. Aluminum
Piston Rod.....	Stainless Steel
Piston.....	Fabric-Reinforced Phenolic
End Caps: Type 1.....	Die Cast Zinc Alloy
Type 2.....	Cast Iron
Center Body.....	Die Cast Zinc Alloy
Dust Boot.....	Chloroprene Rubber
O-Rings,U-Cups & Rubber Washers.....	Buna N
NET WEIGHT: WM475B1.....	4 lb. 4 oz. (1,9kg)
WM475C1 & C2K.....	6 lb. 4 oz. (2,8kg)
WM475H.....	6 lb. 2 oz. (2,7kg)

SUFFIX	CATALOG NUMBER	END CAP	BODY LENGTH X	OVERALL LENGTH L	STROKE		PRESSURE TO BEGIN STROKE	PRESSURE FOR FULL STROKE	THREAD LENGTH T
					S1 (RETRACTED)	S2 (EXTENDED)			
WM475 B1	113245	Type 1	8.04 (204)	10.60 (269)	.88 (22)	.88 (22)	5/15 PSI (34/103 kPa)	55/65 PSI 379/448 kPa)	.91 (23)
WM475 C1	113250	Type 1	12.60 (320)	16.53 (420)	2.00 (51)	2.00 (51)	5/15 PSI (34/103 kPa)	80/90 PSI (552/621 kPa)	1.28 (33)
WM475 C2K	113253	Type 2	12.54 (318)	16.47 (418)	2.00 (51)	2.00 (51)	8/18 PSI 55/124 kPa)	80/90 PSI (552/621 kPa)	1.28 (33)
WM475 H	118472	Type 1	9.06 (230)	14.25 (362)	1.00 (25)	1.00 (25)	5/15 PSI (34/103 kPa)	55/65 PSI 379/448 kPa)	1.15 (29)



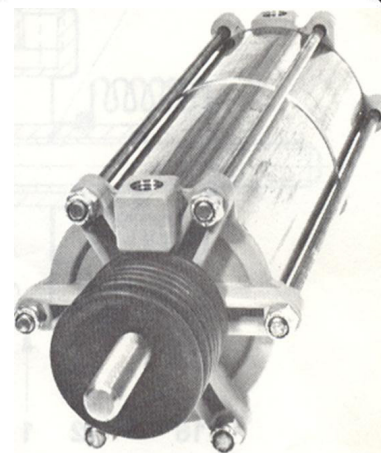
WM495 3-POSITION FEATHERING CYLINDER

PRODUCT DESCRIPTION

DESCRIPTION Designed for heavy force applications, the WM495B is a double acting feathering cylinder that has a 3.25 in. (83mm) bore. From the normal center position, the cylinder piston can stroke to any point between the maximum extension and retraction positions. The cylinder varies its stroke position according to the regulated pressure signal that it receives. To anchor the stationary end of the WM495B, the customer must supply a 1/2 inch pin for the built-in trunnion and bushings. The customer may also install a clevis or a rod end on the threaded end of the piston rod.

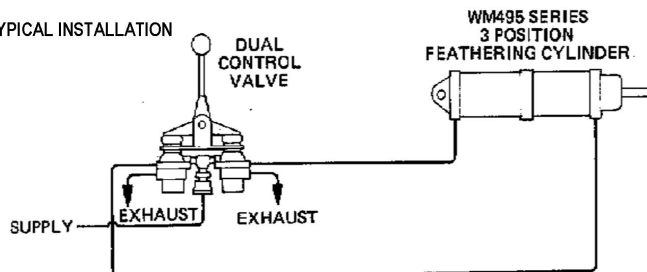
OPERATION To achieve infinite positioning of the cylinder, a compensating dual control valve is used to regulate pressure to the two cylinder ports. When pressure is applied to one port, it is simultaneously exhausted from the other. From the center position, the cylinder can stroke to any point between the full extension and retraction positions. The desired stroke is obtained by controlling the pressure signal to each port. When pressure is released from both ports, the cylinder is spring-returned to the center position.

APPLICATION In air-over-hydraulic systems, the WM495B is often used for remote control operation of hydraulic spool valves. This cylinder is engineered specifically for heavy force systems such as large diameter hydraulic spool valves. A high-flow compensating dual control valve is normally used to modulate pressure to the cylinder. In some applications, two cylinders may be used in conjunction with a high-flow, compensating quad valve.

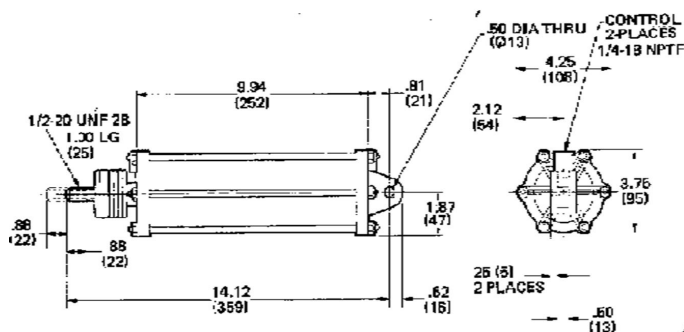


3-POSITION FEATHERING CYLINDER

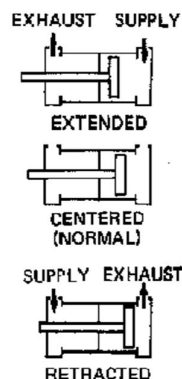
TYPICAL INSTALLATION



EXTERNAL CONFIGURATION

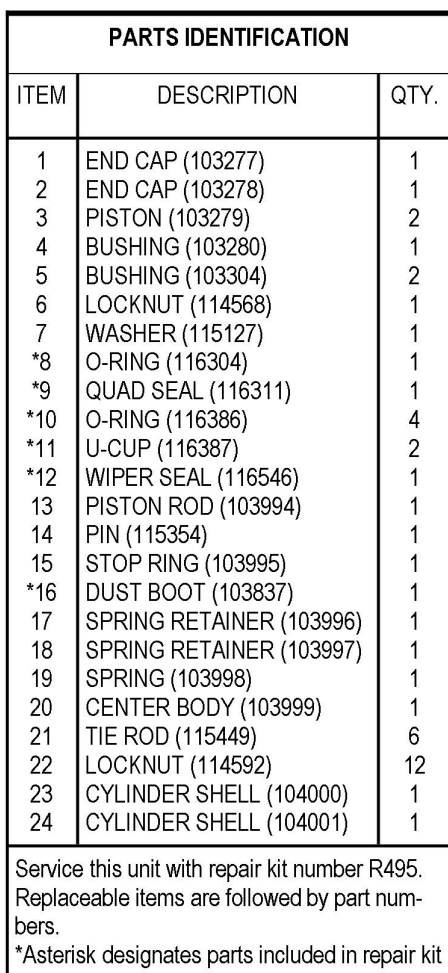


FUNCTIONAL DIAGRAM



I.S.O. SYMBOL

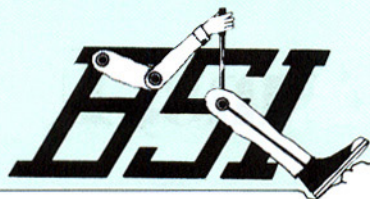




PORT SIZE.....	1/4 - 18 NPT
MAXIMUM OPERATING PRESSURE.....	150 PSI (1034, 2kPa)
OPERATING TEMPERATURE*.....	-20°F to 200°F (-28.9°C to 93,3°C)
CYLINDER BORE.....	3.25 in. (83mm)
CYLINDER STROKE.....	0.88 Extended or Retracted
EFFECTIVE PISTON AREA: Rod End.....	8.10 sq. in. (5226 mm ²)
Piston End.....	8.29 sq. in. (5349 mm ²)
PRESS TO BEGIN STROKE (No Ext. Force).....	0 to 10 PSI (0 to 68,9 kPa)
FULL STROKE PRESS (No Ext. Force).....	50 to 70 PSI (344,7 to 482,6 kPa)
MOUNTING.....	Integral Trunnion & Bushing for 0.50 (13mm) Dia. Pin
MOUNTING ATTITUDE.....	Optional
MATERIALS: Cylinder Shell.....	Brass
Piston.....	Die Cast Zinc Alloy w/ Phenolic Bushing
O-Rings, U-Cups & Quad Seal.....	Buna N
Wiper Seal.....	Polyurethane Rubber
Dust Boot.....	Chloroprene Rubber
NET WEIGHT.....	11 lb. 4 oz. (5,1 kg)

*For continuous operation beyond this range, contact factory.

WM495B
113370



Brake Systems, Inc.

WM612 SERIES

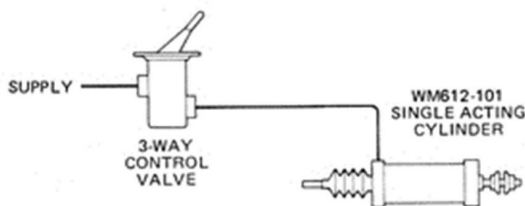
PRODUCT DESCRIPTION

DESCRIPTION The WM612-101 is a single acting, spring return pneumatic cylinder which is engineered for applications which require work to be performed by piston retraction. The WM 612-101's piston rod is threaded to accommodate a clevis or rod end, and the end cap on its stationary end is fitted with a 3/8-24 UNF-2A mounting stud.

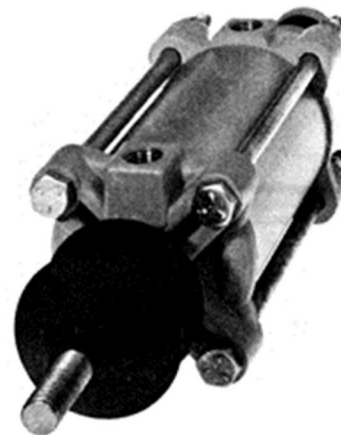
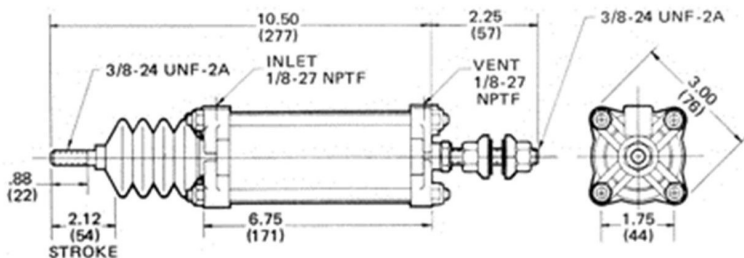
OPERATION The WM612-101 is usually used in conjunction with a three-way control valve. As the cylinder's supply port is pressurized, the piston retracts. When the pressure is released, the piston spring-returns to the extended position. **IMPORTANT:** The WM612-101's return spring is designed to provide only the force required to return the piston to the extended position. If any additional return force is required by the system; either ass an external spring to the WM612-101 or use a double acting cylinder.

APPLICATIONS The WM612-101 is used in industrial and vehicular applications which require a single-acting cylinder that applies operating force as its piston retracts. It is commonly used in clutch systems and positioning applications.

TYPICAL INSTALLATION

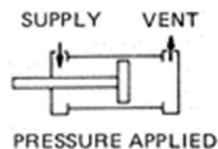


EXTERNAL CONFIGURATION

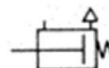


SINGLE-ACTING PULLING CYLINDER

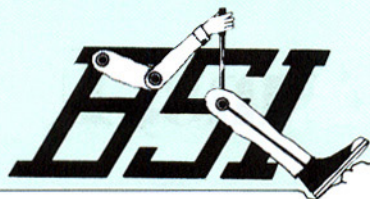
FUNCTIONAL DIAGRAM



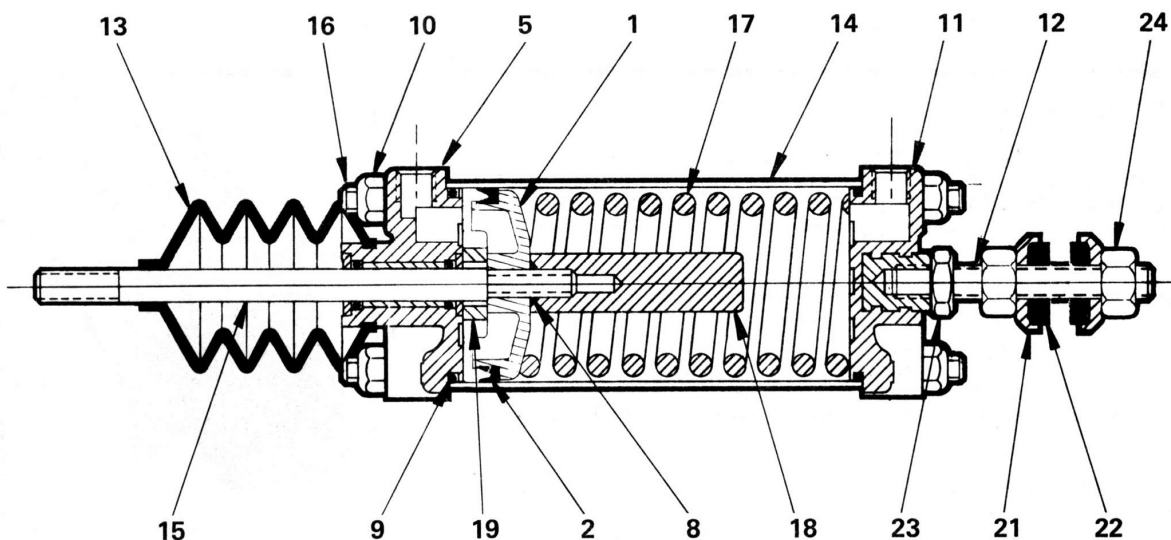
I.S.O. SYMBOL



Manufactured in the USA by Brake Systems Inc.



Brake Systems, Inc.



PARTS IDENTIFICATION

ITEM	DESCRIPTION	QTY.
1	PISTON (118391)	1
* 2	U-CUP	1
5	END CAP ASSY. (104189)	1
* 8	SEAL WASHER	1
* 9	O-RING	2
* 10	NUT	8
11	END CAP (103605)	1
12	PISTON ROD (115448)	1
* 13	DUST BOOT	1
14	CYL. SHELL (103245)	1
15	PISTON ROD (102884)	1
16	TIE ROD (115456)	4
* 17	SPRING	1
18	PISTON STOP (103926)	1
19	SPACER (102490)	1
21	WASHER (103145)	2
* 22	WASHER	2
23	NUT (114542)	1
24	NUT (114644)	2

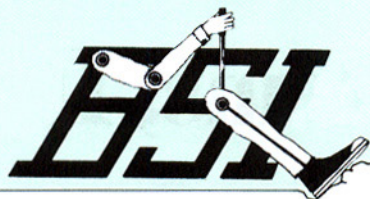
Service this unit with repair kit 117873.
 *Asterisk designates items included in repair kit.

SPECIFICATIONS

PORT SIZE 1/8-27 NPTF
 MAXIMUM OPERATING PRESSURE 150 PSI (1034,2 kPa)
 PRESS. TO BEGIN RETRACTION (No Ext. Force) . . . 15 PSI (103,4 kPa)
 FULL RETRACTION PRESS. (No Ext. Force) 35 PSI (241,3 kPa)
 OPERATING TEMPERATURE* . . -20°F to 200°F (-28,9°C to 93,3°C)
 CYLINDER BORE 2.00 in. (51 mm)
 PISTON AREA 3.03 in.² (19,6 cm²)
 MATERIALS: Cylinder Shell Anodized Aluminum
 Piston Rod Stainless Steel
 Piston Die Cast Zinc Alloy
 O-Rings Buna N
 NET WEIGHT 2 lbs. 10 oz. (1,2 kg)
 *For continuous operation beyond this range, contact factory.

TO ORDER, SPECIFY
WM612-101
 Model Number
 PART NUMBER 117872

Manufactured in the USA by Brake Systems Inc.



Brake Systems, Inc.

WM615-100

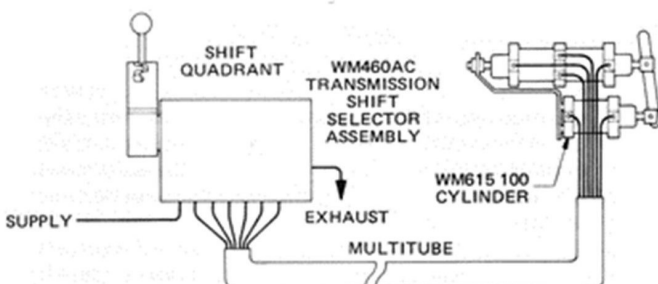
PRODUCT DESCRIPTION

DESCRIPTION The WM615-100 is a double acting pneumatic cylinder engineered for applications which require linear operating force in both stroke directions. It has a 2.00 inch (50,8 mm) diameter bore and a fixed stroke length of .1875 inch (4,76 mm). The WM615-100's piston rod is threaded to accommodate a clevis or rod end, and four bolts extend from its stationary end for mounting.

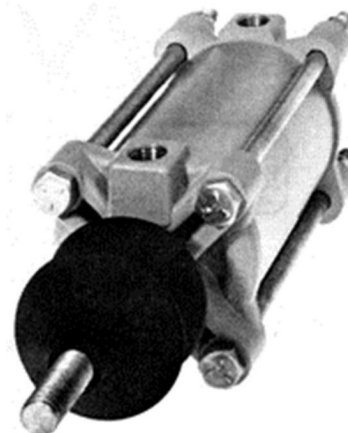
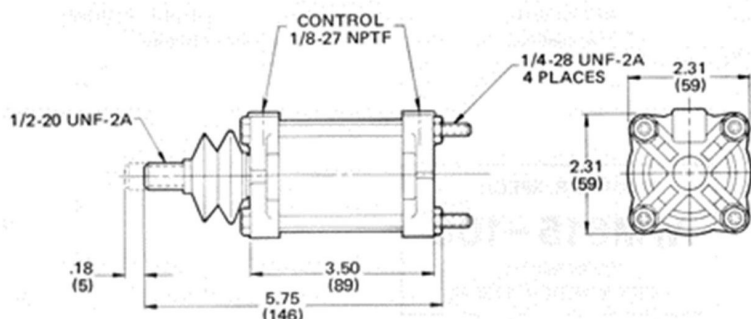
OPERATION The WM615-100 is usually used in conjunction with a four-way control valve which governs pressurization and release of the cylinder's two ports. As one port is pressurized, the piston strokes toward the other port, which exhausts through the control valve.

APPLICATION WM615-100 cylinders can be used in any application which requires a base mounted, double acting cylinder of their capacity and stroke length. They are commonly used in transmission shift cylinder assemblies and are sub-assembly components in WM460AC transmission shifters.

TYPICAL INSTALLATION

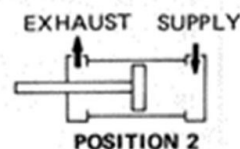
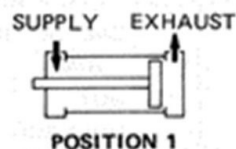


EXTERNAL CONFIGURATION



DOUBLE ACTING CYLINDER

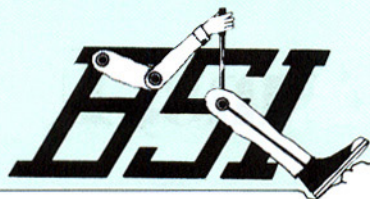
FUNCTIONAL DIAGRAM



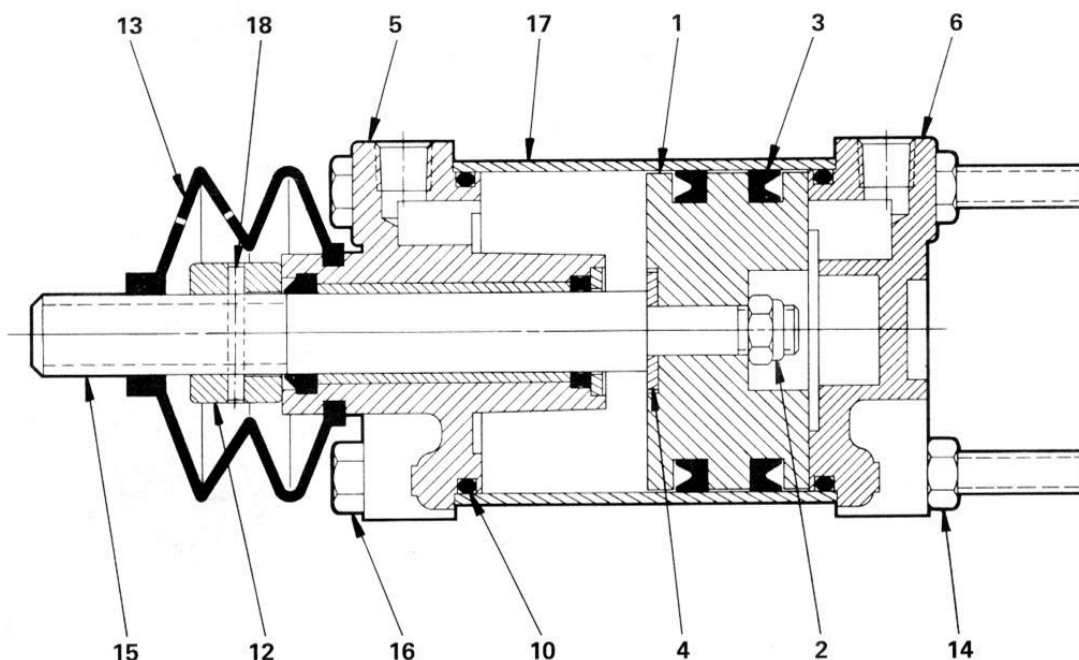
I.S.O. SYMBOL



Manufactured in the USA by Brake Systems Inc.



Brake Systems, Inc.



PARTS IDENTIFICATION

ITEM	DESCRIPTION	QTY.
1	PISTON (103017)	1
2	NUT	1
* 3	U-CUP	2
4	WASHER	1
5	END CAP ASSY. (105092)	5
6	END CAP (103144)	1
* 10	O-RING	2
12	NUT	1
* 13	DUST BOOT	1
14	NUT	4
15	PISTON ROD (104364)	1
16	SCREW	4
17	CYL. SHELL (102687)	1
18	PIN (100335)	1

Service this unit with repair kit number 114484.

*Asterisk designates items included in repair kit.

SPECIFICATIONS

PORT SIZE 1/8-27 NPTF
 MAXIMUM OPERATING PRESSURE 150 PSI (1034,2 kPa)
 OPERATING TEMPERATURE* . . . -20° F to 200° F (-28,9° C to 93,3° C)
 CYLINDER STROKE1875 inch (4,76 mm)
 CYLINDER BORE2.00 inches (50,8 mm)
 EFFECTIVE PISTON AREA:

Rod End 2.95 in.² (19,03 cm²)

Piston End 3.14 in.² (20,26 cm²)

MOUNTING. Base Mounted

MOUNTING ATTITUDE Optional

MATERIALS: Cylinder Shell Aluminum

Piston. Phenolic Compound

Piston Rod. Stainless Steel

Seals Buna N

Dust Boot Chloroprene Rubber

NET WEIGHT. 1 lb., 4 oz. (0,56 kg)

*For continuous operation beyond this range, contact factory.

TO ORDER, SPECIFY

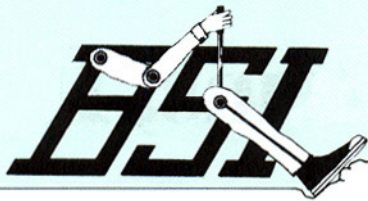
WM615-100

Model Number

PART NUMBER 113840

Manufactured in the USA by Brake Systems Inc.





Brake Systems, Inc.

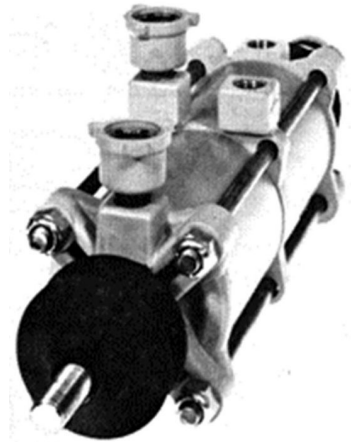
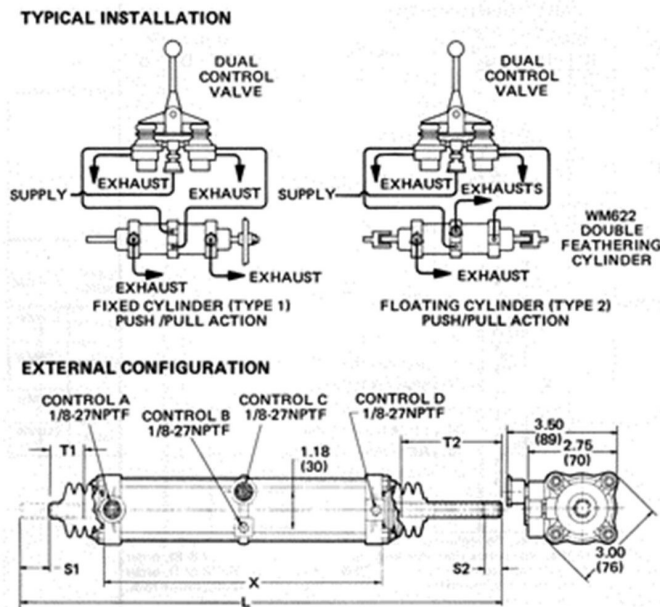
WM622 SERIES

PRODUCT DESCRIPTION

DESCRIPTION The WM622 double modulating cylinder consists of two single acting cylinders that are mounted back-to-back on a common center casting. The cylinder modulates the position of each piston rod in response to pressure from a compensating dual control calves. The direction and length of both strokes vary according to the WM622 series model.

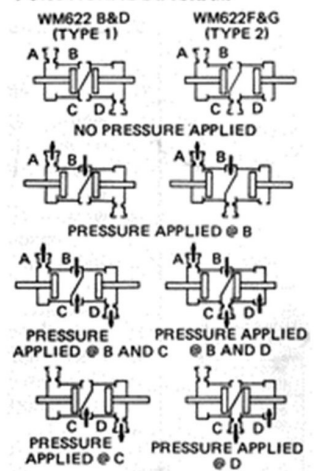
OPERATION Pressure lines are connected to two of the four WM622 cylinder ports. The remaining two ports are equipped with breathers which vent to the atmosphere and prevent dirt entry. All of the WM622 cylinders incorporate a spring which returns the piston to its normal position when pressure is released from the corresponding port. When pressure is applied to a port, the appropriate piston rod strokes in either the push or pull direction. The direction of stroke depends on the functional type of the cylinder, as shown in the functional diagram. Two functional types are available. Type 1 cylinders stroke in the push direction at both ends of the cylinder. On Type 2 models, one rod strokes in the push direction while the other rod has a pull-action stroke. On some models, the stroke length is adjustable and the customer must set the stroke to the desired length within the stroke range. Refer to the ordering information block for stroke length and direction specifications for each model.

APPLICATION The WM622 cylinder functions as a control device in many industrial and off-road vehicular applications. In air-over-hydraulic systems, these cylinders can be used to vary the positioning of hydraulic spool valves. In other applications, the cylinder is used for combination throttle controls which incorporate fast idle and multi-throttle functions. A compensating dual control valve or two single control valves are normally used to deliver pressure to the cylinder ports. WM622 series cylinders do not comply with FMVSS-124 regulations.

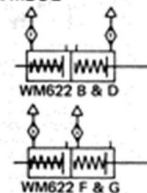


DOUBLE FEATHERING CYLINDER

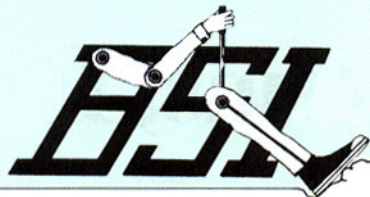
FUNCTIONAL DIAGRAM



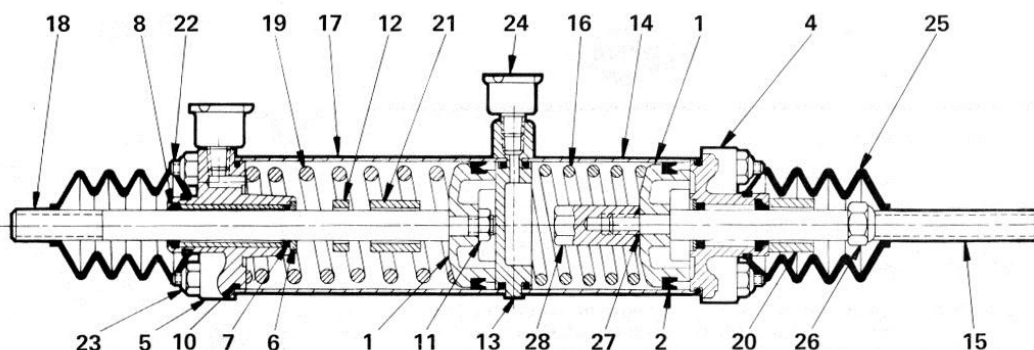
I. S. O. SYMBOL



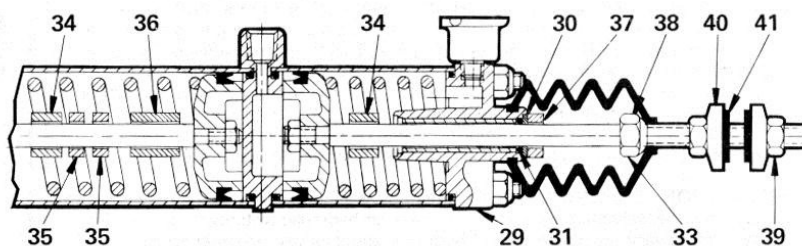
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Brake Systems, Inc.



WM622 F & G

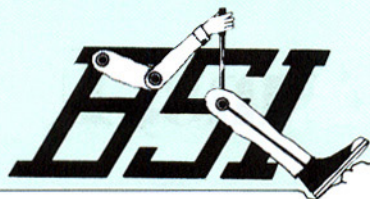


WM622 B & D

PARTS IDENTIFICATION									
ITEM	DESCRIPTION	QUANTITY			ITEM	DESCRIPTION	QUANTITY		
		B	D	F&G			B	D	F&G
1	PISTON (118391)	2	2	2	23	LOCKNUT (114592)	8	8	8
* 2	U-CUP	2	2	2	24	WM111B BREATHER (111412)	2	2	2
4	END CAP (105228)			1	* 25	DUST BOOT (103867)		2	2
5	END CAP			1	26	LOCKNUT (114631)			1
6	WASHER (115127)			2	* 27	WASHER SEAL			1
* 7	QUAD SEAL			2	28	PISTON STOP (103926)			1
* 8	WIPER SEAL			2	29	END CAP (103182)	2	2	
* 10	O-RING	4	4	4	30	WASHER (115107)	2	2	
11	LOCKNUT (114547)	2	2	1	* 31	O-RING	2	2	
12	SPACER (105223)			1	* 33	DUST BOOT (104039)	2		
13	CENTER BODY (103767)	1	1	1	34	SPACER (101498)	2		
14	CYLINDER SHELL	2	1	1	35	SPACER (103546)		2	
15	PISTON ROD	2	1	1	36	SPACER (103549)		1	
16	SPRING	2	1	1	37	SPACER (103183)		1	
17	CYLINDER SHELL		1	1	38	NUT (114608)		1	
18	PISTON ROD		1	1	39	LOCKNUT (114644)		2	
19	SPRING		1	1	40	RETAINER (103145)		2	
20	SPACER (110249)			1	41	WASHER (115122)		2	
21	SPACER (105224)			1					
22	TIE ROD	4	4	4					

Service this unit with repair kit number 114496. To replace one end cap assembly (Items 4, 6, 7 & 8) on the WM622F or G, order part number 116964. To replace the other end cap assembly (Items 5, 6, 7 & 8), order part number 105092. To replace either end cap assembly (Items 29, 30 & 31) on the WM622B or D, order part number 104810. Other replaceable items are followed by part numbers. The cylinder shells, piston rods, tie rods, and springs (Items 14-19 & 22) are also replaceable although part numbers are not listed. *Asterisk designates parts included in repair kit 114496.

Manufactured in the USA by Brake Systems Inc.



Brake Systems, Inc.

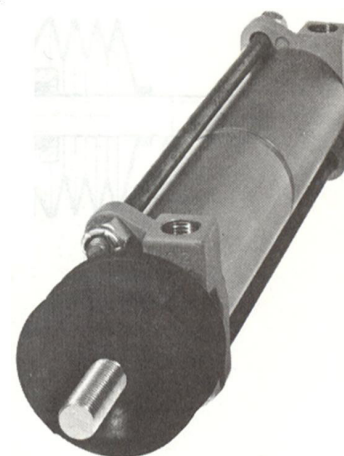
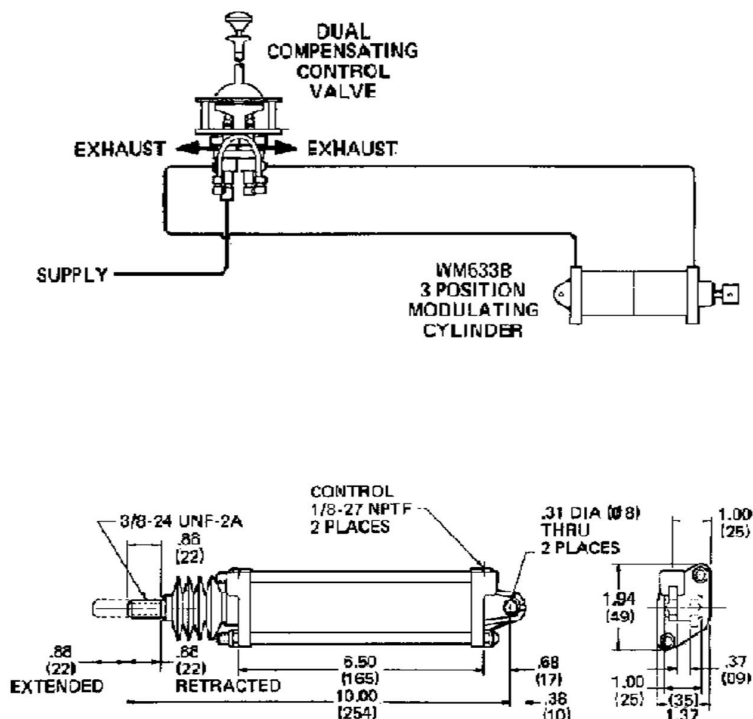
WM633B

PRODUCT DESCRIPTION

DESCRIPTION The WM633B is a spring-centered modulating cylinder with a 1.25 inch (32 mm) bore. The WM 633B is engineered for systems that require infinite positioning in either of two stroke directions for a fixed center position. The stationary end of the cylinder has an integral bushed trunnion for mounting with a customer-supplied 5/16 inch pin. The piston rod is threaded for installing a clevis or rod end.

OPERATION The WM633 modulating cylinder requires an air connection for each of its two ports. Pressure is normally supplied by a compensating dual control valve that can apply a variable pressure to either end of the cylinder. When pressure is applied to one port, the other port is in the exhaust mode. By regulating pressure to one or the other port, the piston can be positioned at any point between the maximum extension and retraction positions. When both ports are vented to the atmosphere the spring returns the piston to the center position.

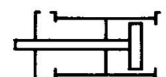
APPLICATION The WM633 is engineered primarily for the remote control operation of small hydraulic spool valves in air-over-hydraulic systems. Because of its compact size, this cylinder is ideal for applications where space is limited.



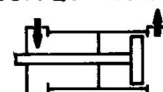
3 POSITION MODULATING CYLINDER

FUNCTIONAL DIAGRAM

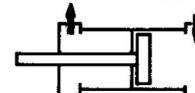
**CENTERED
(NORMAL)**



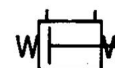
**RETRACTED
SUPPLY EXHAUST**



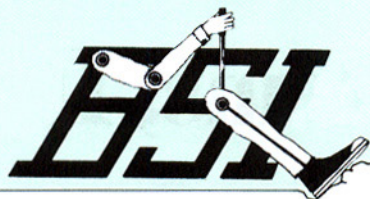
**EXTENDED
EXHAUST SUPPLY**



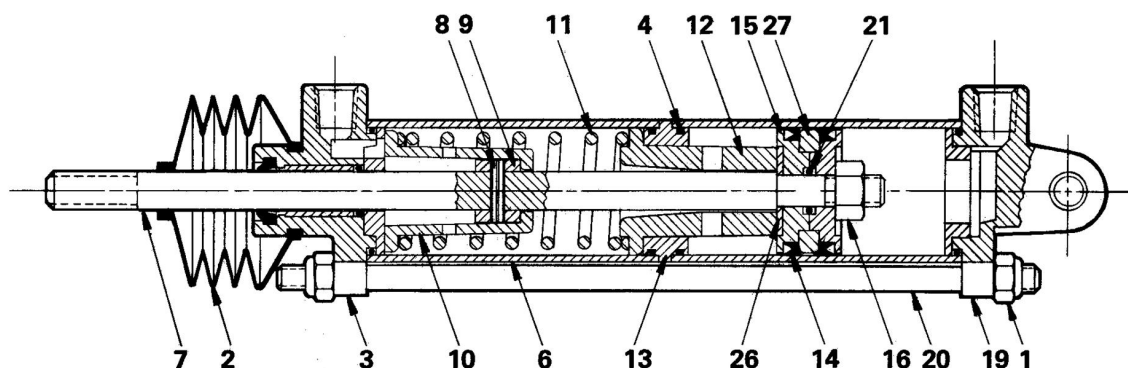
I.S.O. SYMBOL



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Brake Systems, Inc.



PARTS IDENTIFICATION

ITEM	DESCRIPTION	QTY.
1	LOCKNUT (114592)	4
*2	DUST BOOT (103867)	1
3	END CAP ASSY. (104850)	1
*4	O-RING	4
6	CYLINDER SHELL (105258)	2
7	PISTON ROD (104857)	1
8	ROLL PIN (115349)	1
9	STOP RING (104852)	1
10	STOP TUBE (104853)	1
11	SPRING (104815)	1
12	SPRING RET. (104854)	1
13	CENTER BODY	1
*14	U-CUP	2
15	PISTON BODY (104862)	2
16	LOCKNUT (114547)	1
19	END CAP ASSY. (104851)	1
20	TIE ROD (115419)	2
*21	O-RING	1
26	WASHER (115125)	1
*27	PISTON RING	1

Service this unit with repair kit number 114508.
Replaceable items are followed by part numbers.
*Asterisk designates parts included in repair kit 114508.

SPECIFICATIONS

PORT SIZE.....1/8 - 27 NPTF
 MAXIMUM OPERATING PRESSURE.....150 PSI (1034, 2kPa)
 OPERATING TEMPERATURE*.....-20°F to 200°F (-28.9°C to 93,3°C)
 CYLINDER BORE.....1.25 in. (32mm)
 CYLINDER STROKE Retracted.....0.87 in (22mm)
 Extended.....0.87 in (22mm)
 APPLICATION PRESSURE (No External Force):
 To Begin Stroke.....15 PSI (103,4 kPa)
 For Full Stroke.....60 PSI (413,7 kPa)
 EFFECTIVE PISTON AREA: Rod End.....1.11 sq. in. (716 mm²)
 Piston End.....1.22 sq. in. (787 mm²)
 MOUNTING.....With Integral Bracket and 5/16 Inch Pin
 MOUNTING ATTITUDE.....Optional
 MATERIALS: Cylinder Shell.....Hard Anodized I.D. Aluminum
 Piston Rod.....Stainless Steel
 Piston.....Die Cast Aluminum w/Acetal Resin Ring
 End Caps & Center Body.....Die Cast Zinc Alloy
 Dust Boot.....Chlosoprene Rubber
 O-Rings & U-Cup Seals.....Buna N
 NET WEIGHT.....1 lb. 4 oz. (0,6 kg)

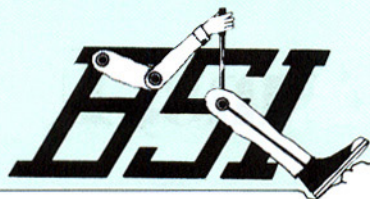
*For continuous operation beyond this range, contact factory.

TO ORDER, SPECIFY

WM633B

Model Number

PART NUMBER 113911



Brake Systems, Inc.

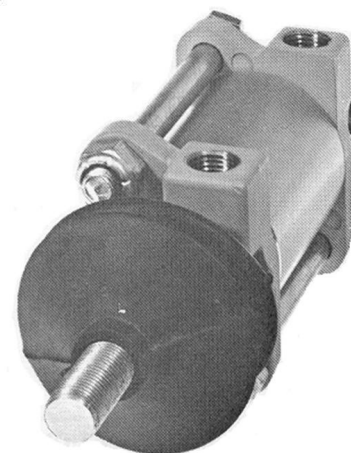
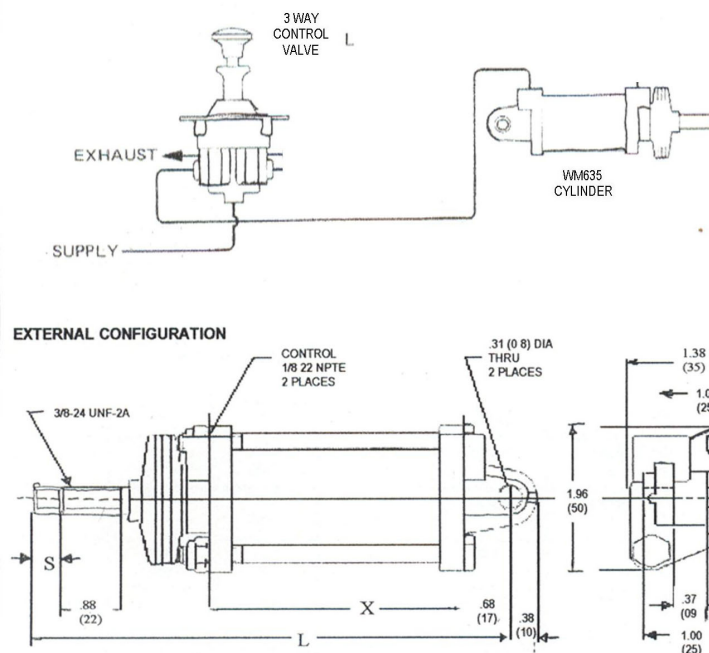
WM635 SERIES

DESCRIPTION The WM635 series single acting cylinder is a heavy duty, two-position pneumatic actuator device. Engineered for vehicular or industrial applications where space is limited, the WM635 is a 1.25 inch (32mm) diameter cylinder that is available with a variety of fixed stroke lengths. The stationary end of the cylinder incorporates a bushed trunnion for mounting, and the piston rod is threaded for installing a clevis or rod end.

OPERATION The WM635 cylinder requires an air connection at one end. The cylinder port is normally pressurized by a three-way control valve or three-way valve and a three-way relay valve. Pressure must be applied to one side of the cylinder piston to effect piston movement. When pressure is applied to one port, the other port exhausts and the piston strokes a fixed amount. An internal spring returns the piston when application air is released.

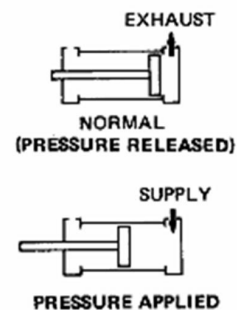
APPLICATION The WM635 cylinder is engineered for applications where working force is required in one direction only. Typical applications include remote actuation of multiple spool hydraulic valves and latching/unlatching functions.

TYPICAL APPLICATION



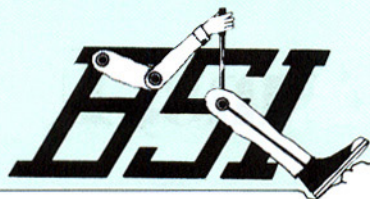
1.25 INCH SINGLE ACTING CYLINDER

FUNCTIONAL DIAGRAM

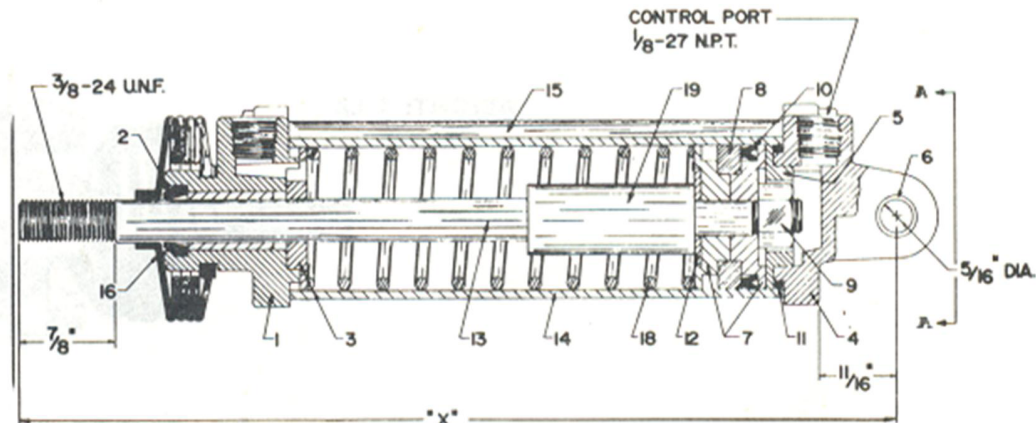


I.S.O. SYMBOL

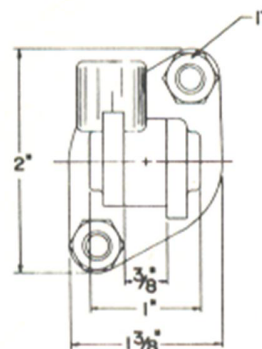




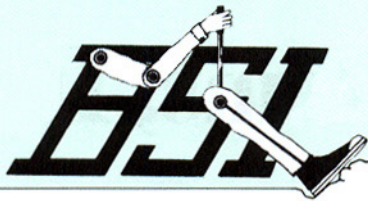
Brake Systems, Inc.



PRESSURE REQUIRED FOR EXTENSION
WM-635-B3: 0-43 P.S.I.



PARTS LIST					
ITEM NO.	DESCRIPTION	QTY.	WM635-A3	WM635-B3	WM635-B3B-100
1-3	FRONT END CAP ASSY.	1	104850	104850	104850
*2	ROD WIPER	1	116547	116547	116547
3	RETAINER RING	1	104856	104856	104856
4-6	REAR END CAP ASSY.	1	104851	104851	104851
5	RETAINER RING	1	104956	104850	-
*6	BUSHING	2	116476	116476	116476
7	PISTON HALF	2	104862	104862	104862
8	PISTON RING	1	104890	104890	104890
9	LOCK NUT	1	114547	114547	114547
*10	U-CUP	1	116408	116408	116408
*11	O-RING	1	116370	116370	116370
12	WASHER	1	115125	115125	115125
13	PISTON ROD	1	104006	102738	104008
14	SHELL	1	104860	105123	105260
15	TIE BOLT	2	114891	114891	114891
16	DUST BOOT	1	103867	103867	103867
17	LOCK NUT	(*)	114592	114592	114592
18	SPRING	1	104682	104536	104536
19	SPACER	1	105178	105124	105183
STROKE			1 IN.	2 IN.	2 IN.
"X" LENGTH			6 5/16 IN.	7 7/8 IN.	7 3/4 IN.
*PARTS INCLUDED IN R-635-637 REPAIR KIT					



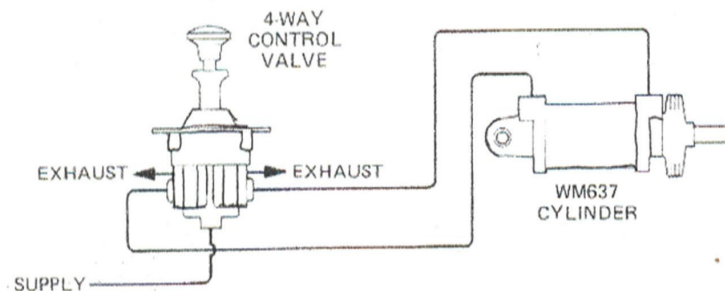
WM637 SERIES

DESCRIPTION The WM637 series double acting cylinder is a heavy duty, two-position pneumatic actuator device. Engineered for vehicular or industrial applications where space is limited, the WM637 is a 1.25 inch (32mm) diameter cylinder that is available with a variety of fixed stroke lengths. The stationary end of the cylinder incorporates a bushed trunnion for mounting, and the piston rod is threaded for installing a clevis or rod end.

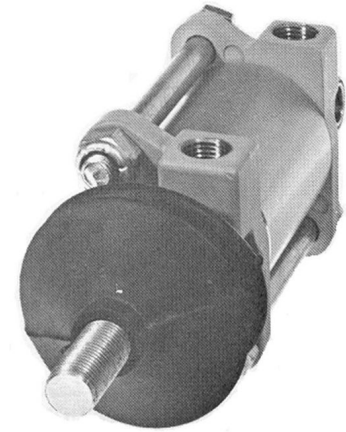
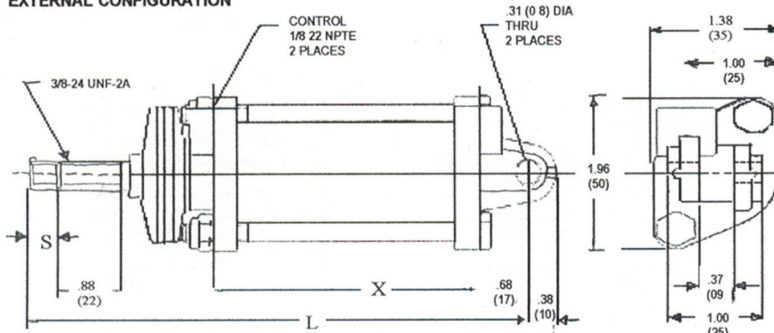
OPERATION The WM637 cylinder requires an air connection at each end. The cylinder ports are normally pressurized by a four-way control valve or three-way valve and a three-way relay valve. Pressure must be applied to one side of the cylinder piston to effect piston movement. When pressure is applied to one port, the other port exhausts and the piston strokes a fixed amount.

APPLICATION The WM637 cylinder is engineered for applications where working force is required in both directions of stroke. Typical applications include remote actuation of multiple spool hydraulic valves and latching/unlatching functions. The WM637 series cylinders are not designed for modulating or "feathering" applications.

TYPICAL APPLICATION

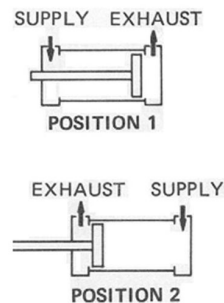


EXTERNAL CONFIGURATION



1.25 INCH DOUBLE ACTING CYLINDER

FUNCTIONAL DIAGRAM



I.S.O. SYMBOL





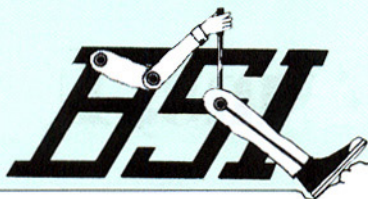
PORT SIZE.....	1/8-27 NPTF
MAXIMUM OPERATING PRESSURE.....	150 PSI (1034, 2kPa)
OPERATING TEMPERATURE*.....	-20 F to 200 F (-28.9 C to 93, 3 C)
CYLINDER BORE.....	1.25 in. (32 mm)
CYLINDER STROKE.....	Refer to Ordering Information Block
EFFECTIVE PISTON AREA: Piston End.....	1.22 sq. in. (787 mm ²)
..... Rod End.....	1.11 sq. in. (716 mm ²)
MOUNTING.....	With Integral Bracket and 5/16 in. dia. Pin
MOUNTING ATTITUDE.....	Optional
MATERIALS: Cylinder Shell.....	Hard Anodized I.D. Aluminum
Piston Rod.....	Stainless Steel
Piston.....	Die Cast Aluminum W/Acetal Resin Ring
End Caps.....	Die Cast Zinc Alloy
Dust Boot.....	Buna N
O-Rings & U-Cup Seals.....	Buna N
NET WEIGHT: WM637A3, B3, Or C3.....	10-12 oz (0.3 kg)
WM637D3 or E3.....	13-14 oz (0.3 kg)

*For continuous operation beyond this range, contact factory.

*Asterisk designates parts included in repair kits

Model Number	Suffix
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SUFFIX	CATALOG NUMBER	BODY LENGTH X	MAX. LENGTH X	STROKE S	DUST BOOT (ITEM 14)
WM637 A3	113923	2.56 (65)	6.31 (162)	1.00 (25)	P/N 104039
WM637 B3	113925	3.56 (90)	7.31 (186)	2.00 (51)	P/N 103867
WM637 C3	113927	4.56 (116)	8.31 (211)	3.00 (76)	P/N 103943
WM637 D3	113928	5.56 (141)	9.31 (236)	4.00 (102)	P/N 103943
WM637 E3	113929	6.56 (167)	10.31 (262)	5.00 (127)	Not Included



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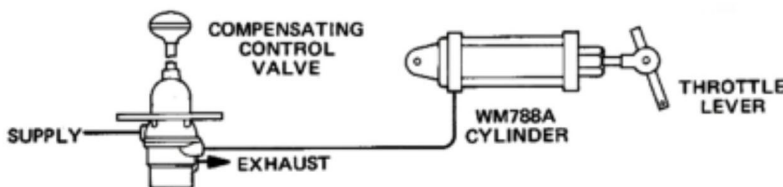
WM637 SERIES

PRODUCT DESCRIPTION

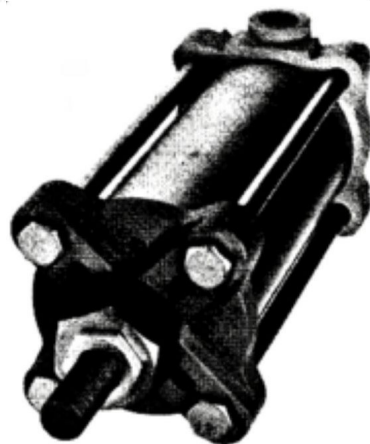
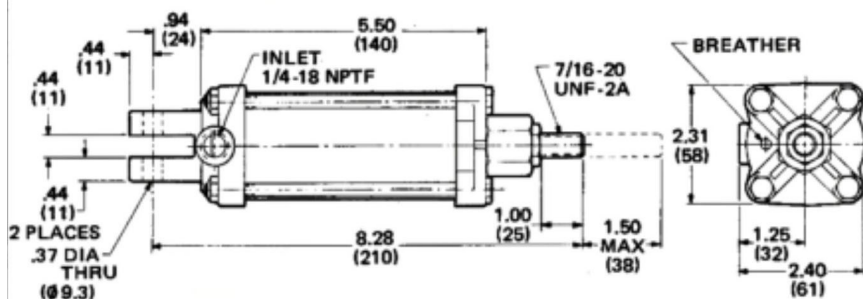
DESCRIPTION The WM788A is a single acting, spring-returned cylinder engineered for industrial throttle control applications. It has a nominal stroke length of 1.5 inches (38,1 mm), and an adjustable preload regulated by a threaded stop nut. The WM788A's stationary end is equipped with a trunion for mounting and its piston rod end is attached to an engine's throttle lever with linkage supplied by the customer.

OPERATION The WM788A is used in conjunction with a compensating control valve to regulate the position of an engine's throttle lever. When the con

TYPICAL APPLICATION

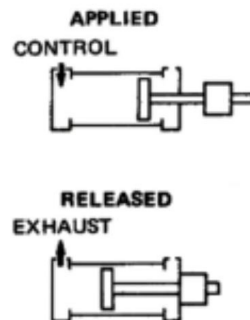


EXTERNAL CONFIGURATION



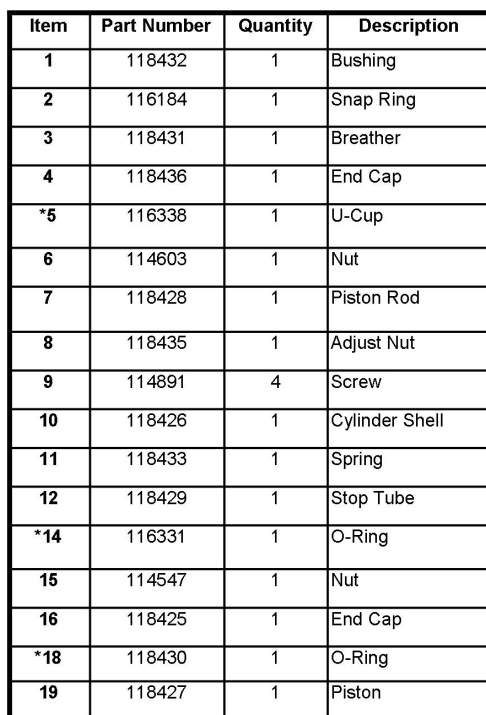
THROTTLE POSITIONING CYLINDER

FUNCTIONAL DIAGRAM



I.S.O. SYMBOL



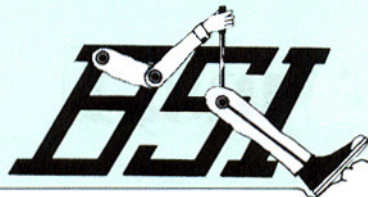


SPECIFICATIONS

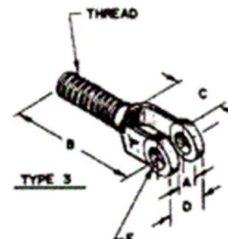
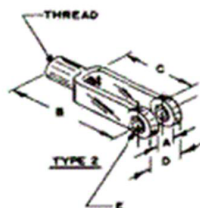
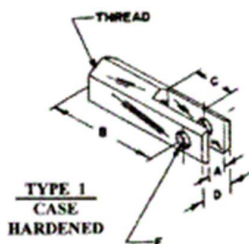
BORE SIZE.....	1.75
MAXIMUM OPERATING PRESSURE.....	150 PSI (1034, 2kPa)
PRESS TO BEGIN STROKE.....	6-12 PSI (41,3-82,7 kPa)
MIN. PRESS. FOR FULL STROKE.....	55-65 PSI (379,0-447,9 kPa)
EFFECTIVE AREA OF PISTON.....	2.40 in. ² (15,48 cm ²)
OPERATING TEMPERATURE.....	40°F to 250°F (-40°C to 121,1°C)
MOUNTING.....	Trunion for 3/8" Dia. Pin at 1 End Rod w/ 7/16-20 UNF Male Thread at Other
MOUNTING ATTITUDE.....	Optional
MATERIALS: End Caps.....	Anodized Aluminum
Cylinder Shell.....	Anodized Aluminum
Piston Rod.....	Stainless Steel
Piston.....	Acetal Resin
Bearing.....	Bronze Impregnated Teflon
Seals.....	Buna N
NET WEIGHT.....	2lb. 3 oz. (1.0 kg)

WM788A
118421





Brake Systems, Inc.



CLEVISES

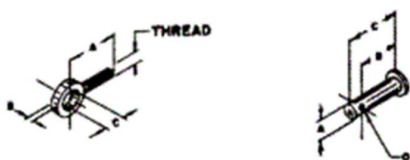
PART NO.	TYPE	THREAD	PIN DIA.	A	B	C	D
115382	1	3/8-24	5/16"	1/4"	1-7/32"	21/32"	5/8"
115383	1	3/8-24	3/8"	3/8"	1-5/16"	3/4"	3/4"
115384	2	3/8-24	3/8"	7/16"	2-1/2"	1-5/8"	7/8"
115385	1	3/8-24	5/16"	3/8"	1-7/32"	21/32"	3/4"
115386	1	3/16 Drill	5/16"	3/8"	1-7/32"	21/32"	3/4"
115387	2	7/16-20	1/2"	9/16"	3-1/2"	1"	1-1/8"
115388	1	3/8-24	1/4"	1/4"	1"	1/2"	9/16"
115389							
115390							
115391	2	5/8-18	5/8"	9/16"	2-1/2"	1-3/8"	1-1/8"
115392	3	3/8-24	5/16"	1/4"	1-1/2"	9/16"	5/8"
*115393	3	3/8-24	5/16"	1/4"	1-1/2"	9/16"	5/8"
115394	1	1/2-20	5/16"	1/4"	1-1/4"	5/8"	3/4"
115395	1	3/8-24	1/2"	9/16"	1-1/4"	5/8"	1-1/8"
115396	1	3/8-24	3/8"	.415"	1-1/4"	5/8"	3/4"
115397	2	1/2-20	1/2"	1-1/8"	3"	1-7/8"	1-1/8"
115398	2	5/8-18	1/2"	1-3/8"	2-1/2"	1-3/8"	1-3/8"
115399	3	1/2-20	1/2"	9/16"	3-1/8"	1-1/16"	1-1/8"
115400	1	3/8-24	7/16"	1/4"	1-1/4"	13/16"	3/4"
115401	1	1/2-20	3/8"		1.3"		
115403	1	1/2-20	1/2"		1.2"		

*Threaded Portion of Part is offset 1/8" Along Center Line of Pin Hole.

CLEVIS PINS

PART NO.	A	B	C	D (DIA)
115152	5/16	13/16	15/16	7/16
115153	5/16	1-5/8	1-3/4	7/64
115154	5/16	19/32	23/32	7/64
115155	1/2	1-13/64	1-11/32	9/64
115157	3/8	1-1/8	1-1/4	3/32
115158	1/2	7 hole	2	5/32
115159	3/8	27/32	1	5/32
115160	1/4	41/64	3/4	1/16
115161	1/4	57/64	1	1/16
115162	3/8	1-11/32	1-1/2	3/32
115163	1/2	1-11/32	1-1/2	1/8
115164	3/16	21/32	3/4	3/32
115166	5/8	1-19/32	1-3/4	5/32
115167	3/8	15/16	1-1/16	3/32
115168	7/16		3/4	
115169	1/2		1-3/8	

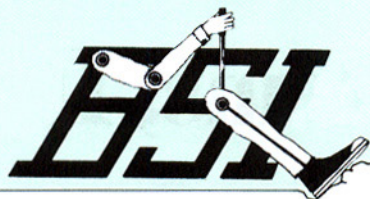
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THREADED ROD EYES

PART NO.	THREADS	A	B	C
115375	5/16-24	1-3/8	11/32	5/16
115380	3/8-24	1-1/2	7/16	3/8
115381	1/2-20	1-3/4	9/16	1/2





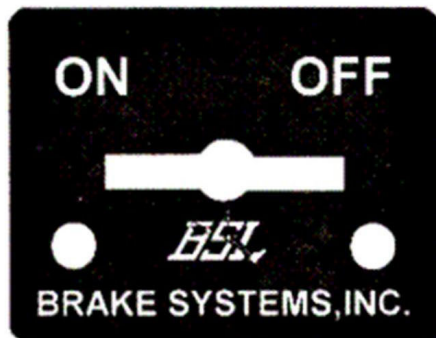
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ESCUTCHEON PLATES

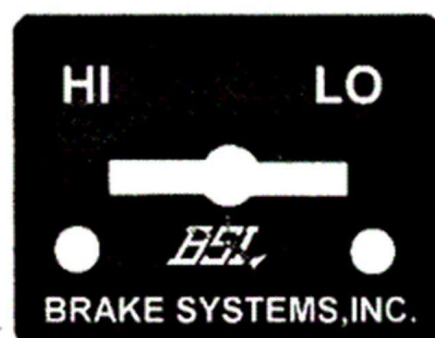
USED ON WILLIAMS WM219 SERIES
BENDIX TW-1 MIDLAND KN20000 SERIES



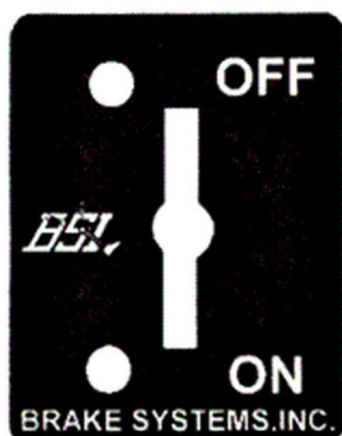
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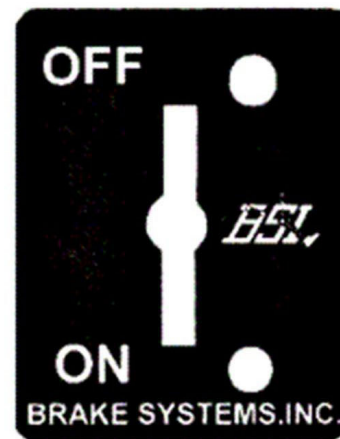
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103644



103645



104584

2EA. MOUNTING SCREW PART NUMBER 114757

CUSTOM PLATES ARE AVAILABLE

020199

BRAKE SYSTEMS, INC.
WARRANTY POLICY TERMS AND CONDITIONS
For New Pneumatic Systems

Brake Systems, Inc. warrants that products furnished by it will be free from defects in materials and workmanship until the first of the following occurs:

One (1) year after delivery of the product to the ultimate user;

50,000 miles of operation on highway vehicles;

1000 hours of operation on other types of equipment.

This warranty does not extend to 1.) any losses due to misuse, accident, abuse, neglect, normal wear and tear, or improper installation, maintenance or application; 2.) products that have been repaired or altered outside of Brake Systems, Inc. factory unless authorized in writing by Brake Systems, Inc.; or 3.) any labor charges for removal and/or replacement of the nonconforming or defective product or part thereof.

In the event that claims are made with regard to the defective product, the responsibility of Brake Systems, Inc. is limited to repairing or replacing any units which shall, within the provisions of the warranty specified above, be returned with transportation charges prepaid, and found to be defective. All warranty claims shall be presented within thirty (30) days after the defect is discovered. In no event shall Brake Systems, Inc. be liable for consequential damages related to misuse or misapplication of products.

The foregoing states Brake Systems Inc. sole responsibility for breach of this warranty. In no event shall Brake Systems be liable for consequential damages.

No other warranty, whether expressed or implied by operation of law or otherwise (including any warranty of merchantability, fitness or performance), shall exist in connection with the sale or use of any product sold by Brake Systems, Inc.

2221 N.E. Hoyt Street s Portland, Oregon 97232 s (503) 236-2116



BRAKE SYSTEMS, INC.



2221 N.E. HOYT PORTLAND, OR 97232

503-236-2116 FAX 503-239-5005

TOLL FREE 1-800-452-5734



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