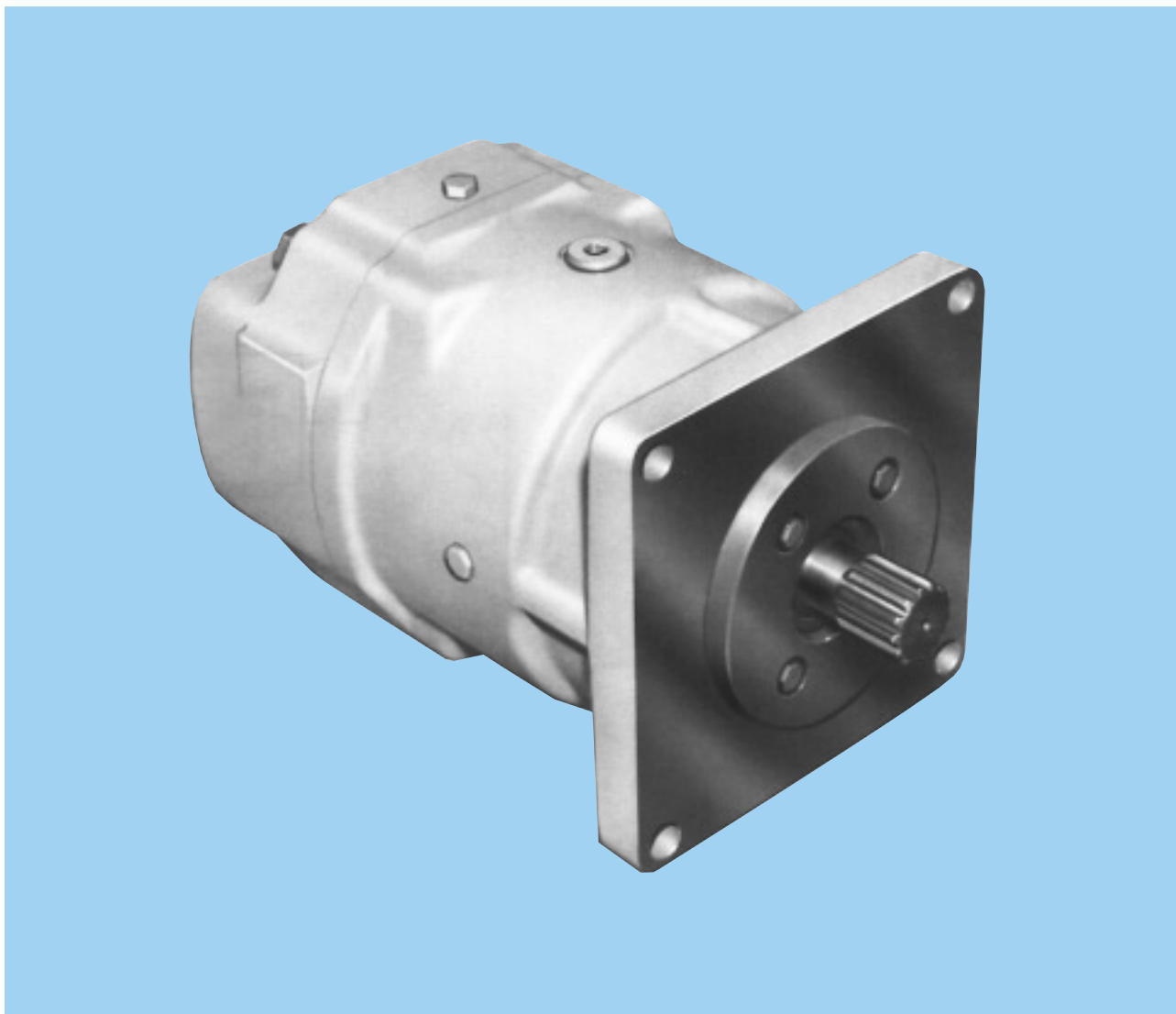


DENISON HYDRAULICS

axial piston motor, goldcup series

M11, M14 A-mod. service information



Publ. S2-AM125-A Replaces S2-AM125-A & 101-AM08 05-96

DENISON | **Hydraulics**

www.comoso.com

	PAGE
<i>introduction</i>	
<i>general</i>	3
<i>description</i>	3
<i>table 1 characteristics</i>	3
<i>installation</i>	
<i>mounting</i>	4
<i>pipng</i>	4
<i>service information</i>	4
<i>fluids</i>	4
<i>maintenance</i>	4
<i>start up procedure</i>	5
<i>table II fluid contamination</i>	5
<i>table III troubleshooting</i>	6
<i>disassembly</i>	8
<i>rework limits</i>	8
<i>assembly procedures</i>	9
<i>shuttle valve assembly</i>	
<i>figure 1 cross-section view</i>	11
<i>parts list</i>	11
<i>motor part list</i>	12
<i>motor exploded view fig. 2</i>	13
<i>shaft seal kits</i>	14
<i>motor ordering code</i>	15
<i>seal kit S23-00143</i>	

General

This manual contains installation, operation, maintenance and overhaul instructions for Denison Gold Cup 11 and Gold Cup 14 constant volume motors.

Description

The Gold Cup motor is a fixed displacement, axial piston design which uses hydrostatically balanced piston shoes. This feature serves to lubricate as well as absorb much of the force generated by the shoes pressing against the cam, thereby increasing service life of the unit. Rotation of the unit is bi-directional.

TABLE 1 TYPICAL CHARACTERISTICS

Specification	Term	Gold Cup 11	Gold Cup 14
Displacement (theoretical) zero psi	in ³ /rev (cm ³ /rev)	11 (180)	14 (229)
Pressure, port A or B, max. continuous	psi (bar)	5000 (345)	5000 (345)
Intermittent (not to exceed 6 sec/min)	psi (bar)	6000 (414)	6000 (414)
Mounting standard, 4-bolt	SAE	E	E
Fluid connections, ports A & B SAE-4 bolt pad for 6000 psi split flange	in. mm	1-1/2" (38.1)	1-1/2" (38.1)
Speed, max., continuous at full displacement	rpm	2400	2400
Flow, theo. max. at 100 rpm at 2400	gpm (l/min) gpm (l/m)	4.75 (17.98) 114 (431.5)	6.01 (42.93) 145 (548.8)
Torque, theo. max. per 100 psi max. at 5000 psi max. at 6000 psi	in# (Nm) in# (Nm) in# (Nm)	175 (19.8) 8750 (989) 10500 (1187)	222 (25) 11100 (1254) 13300 (1503)
Power, theo. max. at 5000 psi per 100 rpm at 2400 rpm	HP (Kw) HP (Kw)	13.8 (10.28) 330 (246)	17.6 (13.11) 425 (317)
Efficiency torque, approx. stalled running	% theor. % theor.	81 93	81 93
Weight	lbs. (Kg)	250 (92.1)	250 (921)

Mounting

This motor is designed to operate in any position. The mounting hub and four bolt mounting flange are in full conformance with SAE standard. The motor shaft must be in alignment with the shaft of the driven load and should be checked with a dial indicator. The mounting pad or adaptor into which the fluid motor pilots must be concentric with the motor shaft within 0.010 (.254 mm) TIR to prevent bearing failure. This concentricity is particularly important if the fluid motor shaft is rigidly connected to the driven load without a flexible coupling.

Piping

Connect inlet and outlet lines to the port block of the motor. It is recommended that the case leakage line be connected to the top of the motor, but it may be connected to the bottom or to the port block between the inlet and outlet ports. The case leakage line must be of sufficient size to prevent back pressure in excess of 75 (5.2 bar) PSI and returned to the reservoir below the surface of the oil as far from the supply suction as possible. All fluid lines, whether pipe, tubing or hose must be adequate size and strength to assure free flow through the motor. An undersize inlet line will prevent the motor from reaching full speed and torque. An undersize outlet line will create back pressure in the motor and cause improper operation. Flexible hose lines are recommended. If rigid piping is used, the workmanship must be accurate to eliminate strain on the motor port block or to the fluid connections. Sharp bends in the lines must be eliminated wherever possible. All system piping must be cleaned with solvent or equivalent before installing motor. Make sure the entire hydraulic system is free of dirt, lint, scale and other foreign material.

Caution: Do not use galvanized pipe. Galvanized coating can flake off with continued use.

Service Information

These hydraulic products are designed to give long dependable service when properly applied and their systems properly maintained. These general instructions apply to typical systems. Specific instructions for particular equipment can be developed from them.

Recommended Fluids

The fluid recommended for use in these motors has a petroleum base and contains agents which provide oxidation inhibition and anti-rust, anti-foam and de-aerating properties as described in Denison standard HF-1. Where anti-wear additives fluids are specified, see Denison standard HF-O.

Viscosity:

Max, at cold start — 7500 SUS (1600 Cst)
 (at low pressure, low fluid, and, if possible, low speed)
 Max. at full power — 750 SUS (160 Cst)
 Optimum for max life — 140 SUS (30 Cst)
 Minimum at full power — 60 SUS (10 Cst)

Viscosity Index:

90 V.I. minimum. Higher values extend the range of operating temperature but may reduce the service life of the fluid.

Temperature

Determined by the viscosity characteristics of the fluid used. Because high temperatures degrade seals, reduce the service life of the fluid and create hazards, fluid temperatures should not exceed 180°F (82°C) at the case drain.

Alternate Fluids

Some applications require fire-resistant fluids. They will give good service if the system is originally designed for their use. Permissible fire resistant fluids include:

Type	Denison Standard
Water-in-oil invert emulsions	HF-3
Water glycol solutions	HF-4
Phosphate esters	HF-5

Consult Denison for design requirements and warranty limitations for service with this class of fluids.

See Denison bulletin SPO-AM305 for more information.

Maintenance

This pump is self-lubricating and preventative maintenance is limited to keeping system fluid clean by changing filters frequently. Keep all fittings and screws tight. Do not operate at pressures and speeds in excess of the recommended limit. If the pump does not operate properly check the Trouble Shooting Chart before attempting to overhaul the unit. Overhauling is relatively simple and may be accomplished by referring to the Disassembly, Rework Limits of Wear Parts and Assembly procedures.

Fluid Cleanliness

Fluid must be cleaned before and continuously during operation by filters that maintain a cleanliness level of NAS 1638 Class 8 (Class 9 for 15 Micron and smaller). This approximately corresponds to ISO 18.14. This fluid level cleanliness can usually be accomplished by effective use of 10 micron filters. Better cleanliness levels will significantly extend the life of the components. As contaminant generation may vary with each application, each must be analyzed to determine proper filtration to maintain the required cleanliness level.

Start Up Procedure for New Installation

1. Read and understand the instruction manual. Identify components and their function.
2. Visually inspect components and lines for possible damage.
3. Check reservoir for cleanliness and drain and clean as required.
4. Check fluid level and fill as required with filtered fluid at least as clean as that recommended. Fill motor case as necessary.
5. Check alignment of drive.
6. Check oil cooler and activate it, if included in circuit. Check fluid temperature.
7. Reduce pressure settings of relief valve. Make sure accurate pressure readings can be made at appropriate places.
8. If solenoids in system, check for actuation.
9. Start pump drive. Make sure pump and motor fill properly.
10. Bleed system of air. Recheck fluid level.
11. Cycle unloaded machine at low pressure and observe actuation (at low speed if possible).
12. Increase pressure settings gradually in steps. Check for leaks in all lines especially in pump and motor inlet lines.
13. Make correct pressure adjustments.
14. Gradually increase speed. Be alert for trouble as indicated by changes in sounds, system shocks and air in fluid.
15. Equipment is operational.

TABLE II FLUID CONTAMINATION CHARTS

COMPARISON OF SOLID CONTAMINATION CLASSIFICATION SYSTEMS

NATIONAL AEROSPACE STANDARD (NAS) 1638

		CLASS													
		00	0	1	2	3	4	5	6	7	8	9	10	11	12
PARTICLE SIZE RANGE	5-15 µm	125	250	500	1,000	2,000	4,000	8,000	16,000	32,000	64,000	128,000	256,000	512,000	1,024,000
	15-25 µm	22	44	89	178	356	712	1,425	2,850	5,700	11,400	22,800	45,600	91,200	182,400
	25-50 µm	4	8	16	32	63	126	253	506	1,012	2,025	4,050	8,100	16,200	32,400
	50-100 µm	1	2	3	6	11	22	45	90	180	360	720	1,440	2,880	5,760
	>150µm	0	0	1	1	2	4	8	16	32	64	128	256	512	1,024
MAXIMUM PARTICLES	>5 µm	152	304	609	1,217	2,432	4,864	9,731	19,462	38,924	77,849	155,698	311,396	622,792	1,245,584
	>15 µm	27	54	109	217	432	864	1,731	3,462	6,924	13,849	27,698	55,396	110,792	221,584

ISO:DIS 4406; SAE J1165

		ISO SOLID CONTAMINANT CODE														
		8/5	9/6	10/7	11/8	12/9	13/10	14/11	15/12	16/13	17/14	18/15	19/16	20/17	21/18	22/19
MAXIMUM PARTICLES	>5 µm	250	500	1,000	2,000	4,000	8,000	16,000	32,000	64,000	130,000	250,000	500,000	1,000,000	2,000,000	4,000,000
	>15 µm	32	64	130	250	500	1,000	2,000	4,000	8,000	16,000	32,000	64,000	130,000	250,000	500,000

NOTES: ALL MEASUREMENTS ARE FOR A 100 ML SAMPLE SIZE.

Trouble Shooting

Component problems and circuit problems are often inter-related. An improper circuit may operate with apparent success but will cause failure of a particular component within it. The component failure is the *effect*, not the *cause* of the problem.

This general guide is offered to help in locating and eliminating the causes of problems by studying their effects:

Effect of Trouble	Possible Cause	Fault Which Needs Remedy
Noisy motor	Air in Fluid	Leak in suction line Leak at shaft seal Low fluid level Turbulent fluid Return lines above fluid level Gas leak from accumulator Excessive pressure drop in the inlet line from a pressurized reservoir Suction line strainer acting as air trap
	Cavitation in motor rotating group	Fluid too cold Fluid too viscous Fluid too heavy Shaft speed too high Suction line too small Suction line collapsed Suction strainer too small Suction strainer too dirty Operating altitude too high Boost or replenishment pressure too low Replenishment flow too small for dynamic conditions
	Misaligned shaft	Faulty installation Distortion in mounting Axial interference Faulty coupling Excessive overhung loads
	Mechanical fault in motor	Piston and shoe looseness or failure Bearing failure
Erosion on barrel ports and port plate	Air in Fluid	See above
	Cavitation	See above
High wear in motor	Excessive Loads	Reduce pressure settings Reduce speeds
	Contaminant particles in fluid	Improper filter maintenance Filters too coarse Introduction of dirty fluid to system Reservoir openings Reservoir breather Improper line replacement

(Continued)

Effect of Trouble	Possible Cause	Fault Which Needs Remedy
	Improper fluid	Fluid too thin or thick for operating temperature range Breakdown of fluid with time/temperature/shearing effects Incorrect additives in new fluid Destruction of additive effectiveness with chemical aging
	Improper repair	Incorrect parts Incorrect procedures, dimensions, finishes
High wear in motor	Unwanted water in fluid	Condensation Faulty breather, strainer Heat exchanger leakage Faulty clean-up practice Water in makeup fluid
Pressure shocks	Cogging load	Mechanical Considerations
	Worn relief valve	Needed repairs
	Slow response in check valves	Replace or Relocate
	Excessive decompression energy rates	Improve decompression control
	Excessive line capacitance (line volume, line stretch, accumulator effects)	Reduce line size or lengths. Eliminate hose Bleed air
	Barrel blow-off	Recheck hold-down, rotating group, drain pressure
Heating of Fluid	Excessive motor leakage	Recheck case drain flow and repair as required Fluid too thin Improper assembly, port timing
	Reservoir	Too little fluid Entrained air in fluid Improper baffles Insulating air blanket that prevents heat rejection Heat pickup from adjacent equipment

General

The instructions contained in this section cover complete teardown of the motor. Disassemble as far as necessary to repair or replace worn parts. Drain all fluid from the motor and thoroughly clean the exterior surface. Prepare a clean, lint free surface on which to lay the internal parts for inspection and repair.

Barrel Holddown, Port Block and Shuttle Valve

1. Secure the motor in a vise or other suitable holding fixture with the shaft in a horizontal position.
2. Remove screws (49) that secure the shuttle valve (48) to the port block (10).
3. Remove the shuttle valve assembly and O-rings (47). The shuttle valve is a complete assembly and should not be disassembled.
4. Remove retaining ring (1), end cover (3) and O-ring (2).
5. Remove retaining ring (53), pins (4), holddown nut (5), thrust washers (6), bearing (7) and seal ring (8).
6. Remove four screws (9) that secure the port block (10) to the housing (33).
7. Remove port block and gasket (13). Remove port plate (15) and dowel pins (14).

Caution: When removing port block, the port plate can cling to the face plate because of oil film. Make sure it does not fall and become damaged.

Barrel and Holddown Shaft

1. Remove face plate (16) and two face plate pins (17).
2. Remove barrel assembly (23) by grasping the holddown shaft (22) and lifting the entire assembly from the housing (33).

Piston and Shoe Assembly

1. Remove retaining ring (25), thrust washer (26), and flange bearing (27).
2. Remove piston and shoe assembly (28).

Caution: Use extreme care when removing piston and shoe assembly. Shoe faces must not be scratched or marred.

3. Remove creep plate (29) from cam (30).

Drive Shaft and Seal

1. Remove four screws (45), gaskets (44), seal retainer (43) and seal retainer "o" ring (42) and seal stop (41a).

Note: Remove the screws in a criss-cross fashion, backing off the screws several turns at a time to relieve shaft seal spring tension from retainer.

2. Remove shaft seal assembly (41) from shaft (38).
3. Remove S.H.C. Screw (52) from cam (30).
4. Remove shaft and bearing assembly and cam (30) by grasping shaft and pulling out of housing from end of unit opposite mounting flange.
5. Carefully remove retaining ring (40) from back of cam. Remove shaft and bearing assembly from cam. Remove shim (39) if used.

Caution: When removing retaining ring and shaft from cam, use extreme care not to damage seal surface of shaft. Any scratches or marks on this surface will cause leaks around shaft seal.

6. Remove dowel pins (31) from bottom of housing (33).

Note: Do not remove the bearing (24) from the housing unless damaged or worn and needs replacement.

Rework Limits of Wear Parts						
11 and 14 in. ³	Original Dimension		Max. Rework From Original Dimension		Min. Dimension After Rework	
	Port plate face	.725/.715"	(18.41/18.16 mm)	.010"	(.254 mm)	.705"
Cylinder barrel face	5.880"	(149.35 mm)	.010"	(.254 mm)	5.870"	(149.1 mm)
Shoe retainer face	.438/.437"	(12.27/11.09 mm)	.005"	(.127 mm)	.432"	(10.97 mm)
Piston shoe face (pocket)	.020"	(.508 mm)	.010"	(.254 mm)	.010"	(.254 mm)
Creep plate face	.251/.250"	(6.37/6.35 mm)	.010"	(.254 mm)	.240"	(6.10 mm)
Face plate			None		Replace	

Cleaning and Inspection

1. All parts must be inspected and be free of material defects, dirt, scratches or any foreign material.
2. All parts must be cleaned with a suitable cleaning solvent and all holes and passages blown out with dry, clean compressed air.
3. After cleaning and inspection, all parts must be covered with a light film of oil and protected from dirt and moisture. Excessive handling of internal parts should be avoided prior to assembly.
4. During assembly, lapped and ground surfaces must be lubricated with clean oil and protected from nicks or surface damage.

Drive Shaft Assembly

1. Install one retaining ring (37) in the groove near the shaft seal surface. **DO NOT PASS THE RING OVER THE SEAL SURFACE.**
2. Install the bearing (38) over the same end of the shaft and seat against the ring. Support only the inner race of the bearing and press on the coupling end of the shaft.

Note: Do not use excessive force that would damage or distort the retaining ring.

3. Install the other retaining ring (37) in the remaining groove, make sure both rings are fully seated.

Piston and Shoe Assembly

1. Place cam (30) flat side down on a clean surface.
2. Install creep plate (29), counterbored side first, over center post on cam until seated against face of cam.
3. Apply a light film of clean oil to face of creep plate and to the face of the piston shoes (28). Hold the piston and shoe assembly so the assembly will not fall from the retainer and lower over the center post of the cam. Gently seat face of shoes against face of creep plate.
4. Install flange bearing (27) and thrust washer (26) over cam center post and seat against retainer plate. The flat on I.D. of thrust washer and the flat on the center post of cam must match. The grooved side of thrust washer must face the piston and shoe retainer.
5. Secure the piston and shoe assembly by installing the thickest of the four retaining rings (25) that will fit in the groove on the cam center post. Check clearance between shoe faces and creep plate with a feeler gauge. Gap should be between .002 (.05 mm) and .004 (.10 mm). Assembly must be free to rotate by hand with approximate force of 5 ft. lbs. (6.8 Nm).

Housing and Cam

1. Install two dowel pins (31) into cam mounting surface of housing (33). Rest housing on pilot and locate cam assembly onto dowel pins (31) and seat against housing.

Note: Position the assembled rotating group so the thick part of the cam is at the bottom of the port block (shuttle valve side).

2. Lay the housing on its side and install screw (52) through housing and into cam.

Housing and Cylinder Barrel

1. Set barrel (23) with bores down on a flat surface. Install holddown spring (21) into counterbore of barrel. Install spring retainer (19) and seat against spring.
2. Press retaining ring (18) into groove in counterbore of barrel.
3. Install barrel stop (20) on holddown shaft.
4. Turn barrel on its side and slip shaft through the spline until it bottoms on the spring.
5. Rest the housing on its side so the thick part of the cam is at the bottom. Install cylinder barrel and holddown assembly onto the pistons and into the housing.

Port Block and Housing

1. Install two face plate pins (large ends) (17) in face of cylinder barrel. Make sure shoulder of pin is not above barrel face.
2. Apply a liberal amount of vaseline or grease to steel side of face plate (16) and place over dowel pins (bronze side up) and seat against barrel face.
3. Install two dowel pins (14) in face of port block (10). Apply liberal amount of vaseline or grease to back side of port plate. Position plate (bleed slot face up) on pins and seat. Plate must adhere to port block.
4. Place two dowel pins (31) in port block face of housing (33). Install gasket (13) over dowel pins against the housing face.
5. Install port block onto housing by slipping over the shaft and onto the dowels. Caution must be observed so the port plate does not separate from the port block.
6. Install the four screws (9). Torque evenly in 50 ft. lb. (67.8 Nm) increments to 350 ft. lbs. (474.6 Nm).

Barrel Holddown

1. Install seal ring (8) on shaft. Follow with one thrust washer (6), thrust bearing (7) and second thrust washer. Install nut (5) on shaft and carefully tighten until it bottoms out (10 ft. lbs. (13.56 Nm) max.). Then back nut off until second slot in nut aligns with pin hole in shaft. This determines the correct holddown clearance.
2. Install cotter pin (4) through nut and shaft and bend one tang over end of shaft. Install O-ring (2) in groove in end cover (3). Apply a light film of oil to O-ring and slip cover into the port block.

Shaft and Seal

1. Turn motor so it rests on port block face. For a rigid shaft application use the shim (39) that results in the least clearance around the shaft bearing. Do not use a shim with a floating shaft.
2. Install shaft and bearing assembly (38) through bores and engaging splines. If tolerance ring is used, a few light taps are required to engage and seat shaft. Install retaining ring (40).

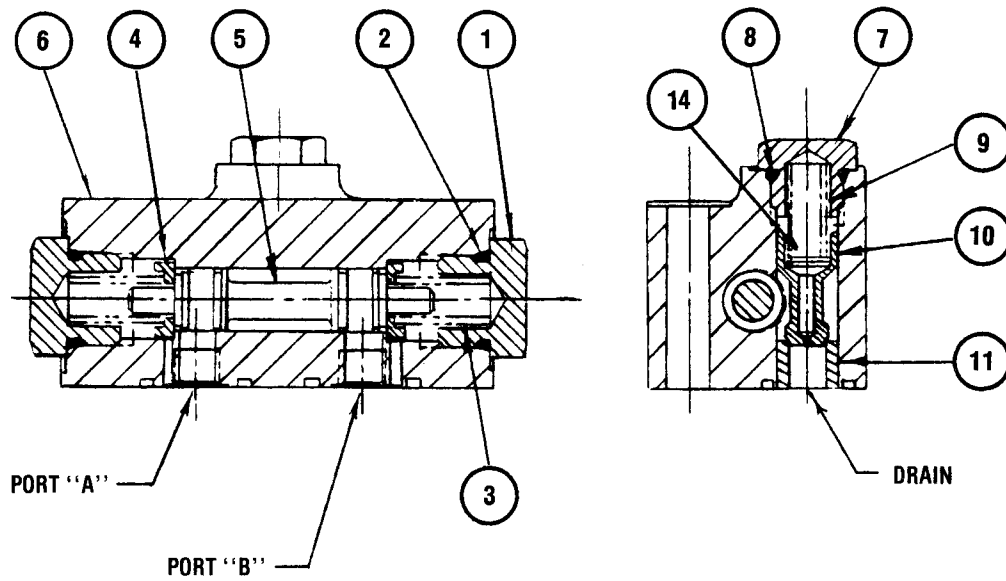
Caution: The seal assembly (41) must be replaced as a complete assembly only. Before installing, inspect all the parts for damage. The lapped seal seat and the carbon ring have a precision finish and must be handled with care. Be sure both parts are free of scratches, marks or cracks.

3. Lubricate the shaft with STP or equivalent slippery lubricant. Install the spring retainer (e) over the shaft and seat against the retaining ring (40). Place spring (d) against the retainer. Position the ring (f) and carbon ring (c) over the shaft the carbon face exposed. Apply grease to the square section seal (a) and install on seat (b). Press the seat and seal into the retainer (43) with the lapped face of the seat in position to contact the carbon seal. Install the gaskets (44) on the screws (45) and secure the seal retainer. Depress the retainer far enough to start the four screws and tighten evenly. Torque to 30 ft. lbs. Check if shaft rotates smoothly by using a strap wrench on shaft.

Shuttle Valve Assembly

S15-48273 Internal Drain

1. Place valve assembly (45) in a horizontal position with the O-ring groove up.
2. Press seat (11) in the .500" (12.7 mm) diameter bore until it is flush with the body surface.
3. Install spool (5) in body bore.
4. Install spring centering washer (4) over each end of spool.
5. Install springs (3) over ends of spool and into sockets of centering washers.
6. Lubricate O-rings (2) and install over plugs (1). Install the plugs over springs and into body.
7. Install spool (10) in bore against seat (11).
8. Install spring (9) in spool (10).
9. Lubricate O-ring (8) and install in groove of plug (7) on internally drained shuttle.
10. Install plug (7) over spring (9) and tighten.
11. Install seal (43) in counterbore in the center of shuttle valve assembly. Hold in place with a coating of grease. Install two seals in remaining counterbores.
12. Install shuttle valve assembly on port block pad and secure with screws (44). Torque screws to 20 ft. lbs. (27.12 Nm).



S15-48273

Assembly Shuttle Valve

ITEM	DESCRIPTION	PART NO.	QTY.
1	Plug	488-35002	2
2	O-Ring	691-00908	2
3	Spring	035-70515	2
4	Washer, Spring Centered	035-70495	2
5	Spool	035-70529	1
6	Body	035-53117	1
7	Plug	035-72129	1
8	O-Ring	691-00906	1
9	Spring, Relief Valve	035-71923	1
10	Spool, Relief Valve	035-71925	1
11	Seat	035-53154	1
12			Not Shown
13			Not Shown
14	Shim Washer	345-20004	2
Reference — Orifice P / N 035-53523 for Shuttle S15-48776			

FIGURE I

ITEM	DESCRIPTION	PART NO.	QTY.
1	Retaining Ring	356-65082	1
2	O-Ring	671-00147	1
3	End Cover	033-72100	1
4	Cotter Pin	322-03324	1
5	Holddown Nut	033-72026	1
6	Thrust Washer	350-10081	2
7	Thrust Bearing	230-82164	1
8	Seal Ring	033-72101	1
9	Hex Hd Cap Screw 3/4-10 X 3-1/2	306-40024	4
10	Port Block	033-53847	1
11	Plug, Hex Soc	488-35041	1
12	O-Ring	691-00906	1
13	Gasket	033-71579	1
14	Dowel Pin	324-21610	2
15	Port Plate (11 only)	033-71916	1
	Port Plate (14 only)	033-71551	1
16	Face Plate (11 only)	033-71921	1
	Face Plate (14 only)	033-71575	1
17	Face Plate Pin	033-49825	3
18	Retaining Ring	033-71564	1
19	Spring Retainer	033-71560	1
20	Holddown Stop	033-71561	1
21	Holddown Spring	033-71562	1
22	Holddown Shaft	033-71573	1
23	Barrel & Sleeves (11 only)	S13-45381	1
	Barrel & Sleeves (14 only)	S13-43965	1
24	Barrel Bearing	033-71516	1
25	Retaining Ring (use one only)		
	.102/.101 (2.59/2.56 mm) (blue)	033-71559	
	.104/.103 (2.64/2.61 mm) (red)	033-71558	
	.106/.105 (2.69/2.66 mm) (green)	033-71557	
	.108/.107 (2.74/2.71 mm) (yellow)	033-71556	
26	Thrust Washer	033-71565	1
27	Flange Bearing	033-71563	1
28	Piston & Shoe Assy. (11 only)	S13-45544	1
	Piston & Shoe Assy. (14 only)	S13-43970	1
29	Creep Plate	033-71569	1
30	Cam	033-57880	1
31	Dowel Pin	324-23216	2
32	Dowel Pin	033-70509	2
33	Housing	033-71519	1
34	Plug, Hex Soc	488-35024	2
35	O-Ring	691-00916	2
36	Splined Drive Shaft	033-71572	1
	Keyed Drive Shaft	033-71552	1
	Shaft Key	033-71514	1
37	Retaining Ring	033-71641	2
38	Shaft Bearing	230-82148	1
39	Shim (use only one) .008 (.2 mm)	033-53983	1
	Shim (use only one) .007 (.18 mm)	033-53984	1
40	Retaining Ring	356-65013	1
41	Shaft Seal	623-00016	1
42	O-Ring	671-00249	1
43	Seal Retainer	033-57852	1
44	Gasket	631-45007	4
45	Screw, Hex Hd	306-40021	4
46	Washer	350-10109	4
47	Seal	691-10016	3
48	Shuttle valve w/2 orifices	S13-48776	1
	Shuttle valve, Int. Drained	S13-48273	
49	Screw, Hex Hd	306-40106	3
50	Cam Retainer	033-24908	2
51	O-Ring	691-00904	2
52	Screw, Soc Hd	358-10180	1

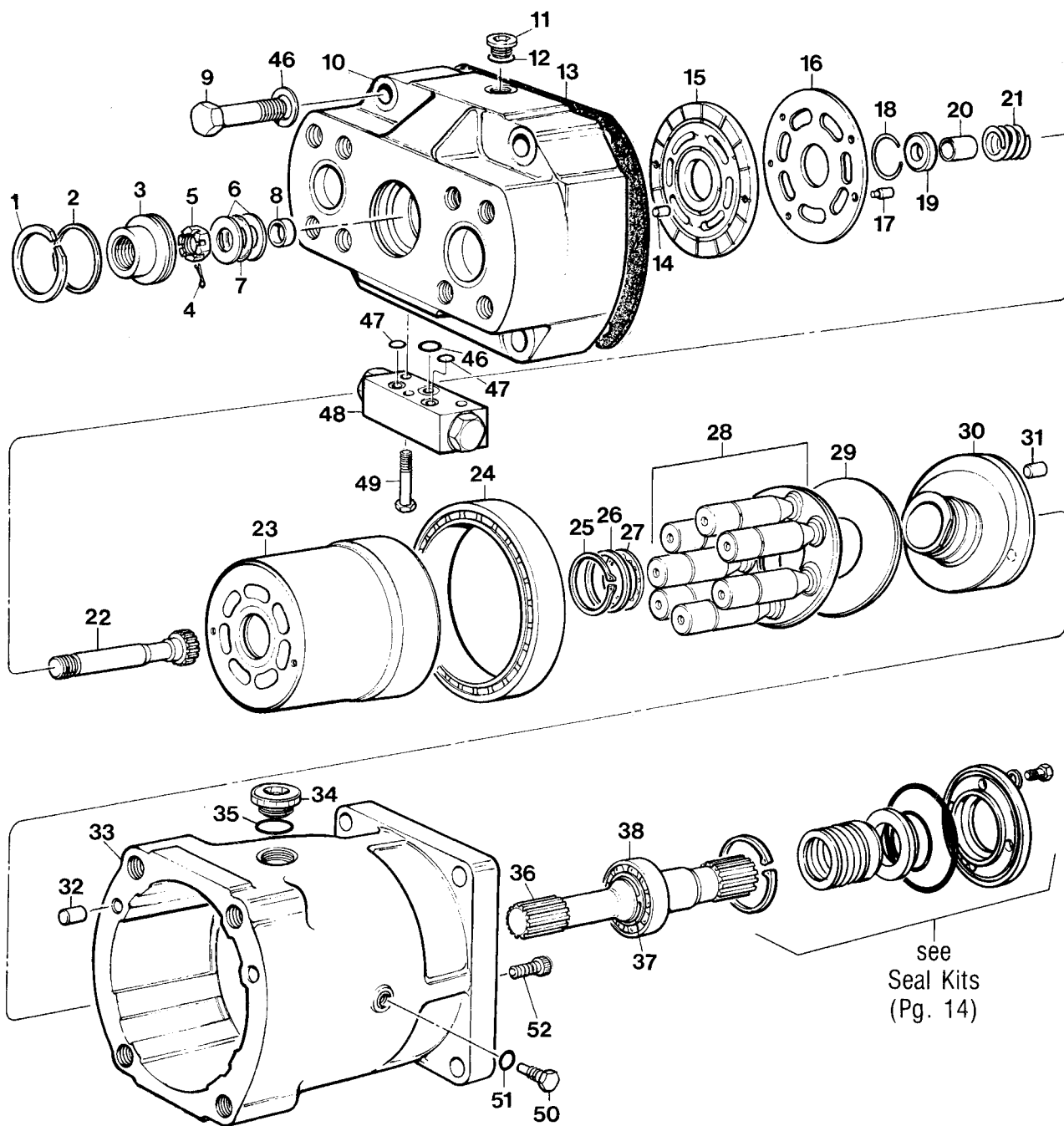
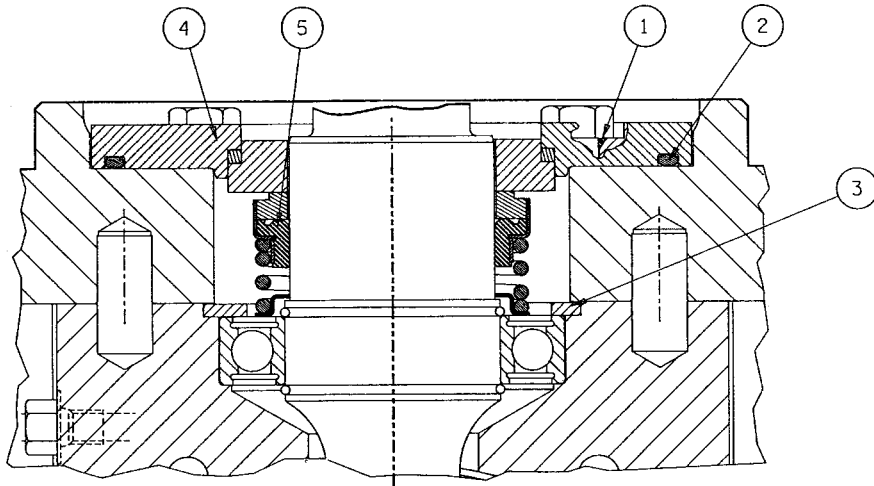


FIGURE 2

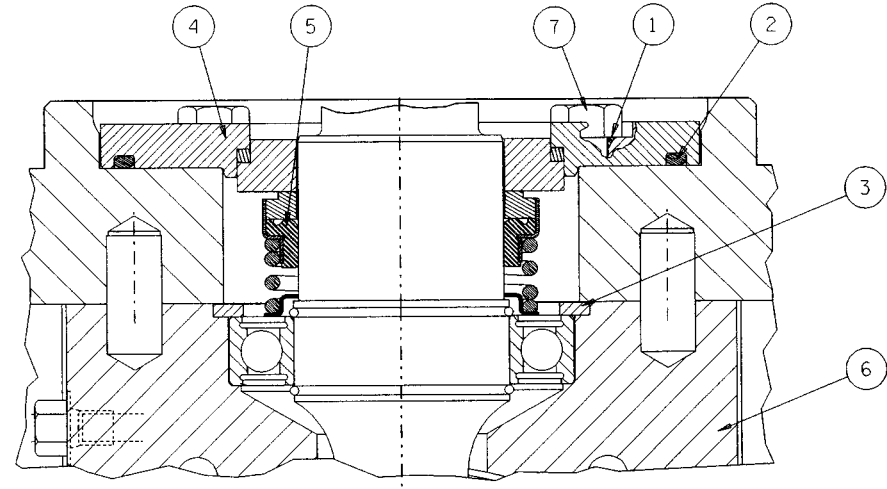


"Field Kit"

S23-12113 — For repair of units shipped prior to April, 1990

ITEM	DESCRIPTION	PART NO.	QTY.
1	Gasket Nylite	631-45007	4
2	O-Ring	671-00249	1
3	Retaining Ring-Special	033-57875	1
4	Seal Retainer	033-57872	1
5	Shaft Seal	623-00016	1

Note: Shaft Seal Field Repair Kit S23-12113 to be used for all Shaft Seal Replacements prior to April 1990

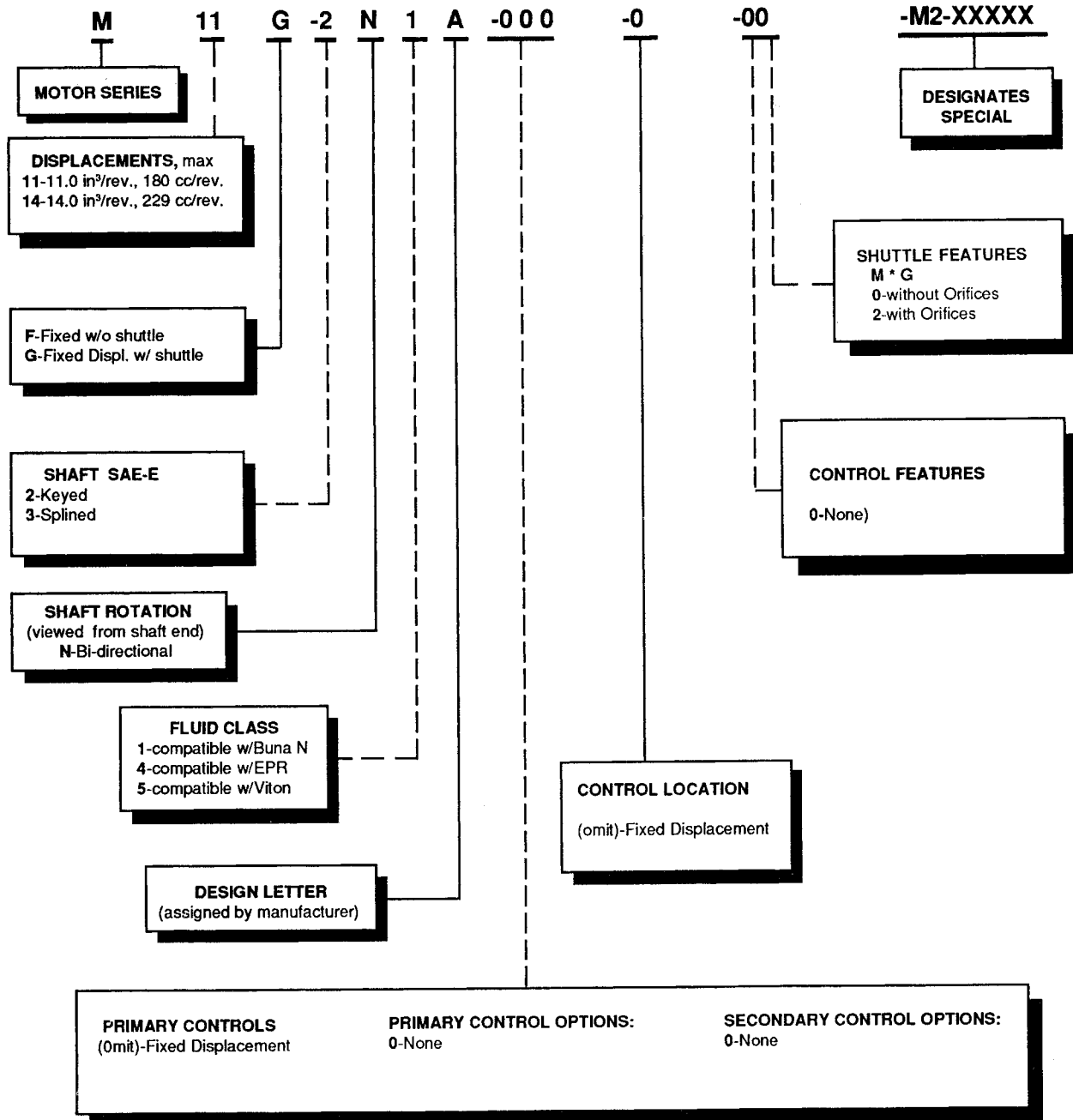


"Production Kit"

S23-05992 — After April 1990

ITEM	DESCRIPTION	OLD PART NO.	NEW PART NO.
1	Gasket Nylite	631-45007	671-45007 *
2	Gasket O-Ring	033-71567	671-00249 674-00249 675-00249 *
3	Retaining Ring	033-57875	356-65013
4	Seal Retainer	033-71574	033-57872
5	Shaft Seal	623-00008	623-00016-0 623-00016-4 623-00016-5 *
6	Fixed Cam	033-53989	033-57880
	Rocker Cradle	033-53988	033-57879
7	Screw (4)	353-25021	352-25021

*Shaft Seal Kit



International Distributors

In Europe:

Cyprus
Eastern Europe
The Faroe Islands
Finland
Greece
Iceland
Norway
Portugal
Switzerland
Turkey

In Africa:

Algeria
Egypt
Ivory Coast
Morocco
Nigeria
South Africa
Togo
Tunisia

In Middle East:

Iran
Israel
Lebanon
Pakistan
Qatar
Saudi Arabia
Syria
United Arab Emirates

In Far East:

China
Indonesia
Korea
Malaysia
New Zealand
Philippines
Taiwan
Thailand

Australia

DENISON HYDRAULICS Pty. Ltd.
41-43 St. Hillers Road
P.O. Box 192
Auburn, N.S.W. 2144
Australia
Tel. (612) 646 5200
Fax (612) 643 1305

Other sales offices:

Queensland
South Wantirna Victoria
Western Australia

Austria

DENISON HYDRAULIK GmbH
Zweigniederlassung Linz
Haidbachstraße 69
A-4061 Pasching
Austria
Tel. (43) 7229 4887
Fax (43) 7229 63092

Benelux

DENISON HYDRAULICS
BENELUX B. V.
Pascalstraat 100
3316 Dordrecht
Holland
Tel. (31) 786179 900
Fax (31) 786175 755

Canada

DENISON HYDRAULICS
CANADA Inc.
2320 Bristol Circle, Unit 1
Oakville, ON L6H 5S2
Canada
Tel. (905) 829 5800
Fax (905) 829 5805

Other sales offices:

Montreal, QC
Richmond, BC

Denmark

DENISON HYDRAULIK
DENMARK A/S
Industrikrogen 2
DK-2635 Ishøj
Denmark
Tel. (45) 4371 15 00
Fax (45) 4371 15 16

Finland

DENISON HYDRAULICS
P.O. Box 1096
Alhotie 24
FIN-04431 Järvenpää
Finland
Tel./Fax (358) 0 2710 588

France

DENISON HYDRAULICS
FRANCE SA
14, route du Bois Blanc
BP 539
18105 Vierzon
France
Tel. (33) 48 75 33 91
Fax (33) 48 75 02 91

Other sales offices:

Bordeaux
Lyon
Paris

Germany

DENISON HYDRAULIK GmbH
Gerresheimer Straße 93
D-40721 Hilden
Germany
Tel. (49) 2103 3090
Fax (49) 2103 309211

Other sales offices:

Dresden
Hanover
Stuttgart

Great Britain

DENISON HYDRAULICS U.K.
Ltd.
Kenmore Road
Wakefield 41, Industrial Estate
Wakefield, WF20XE
West Yorkshire
England
Tel. (44) 19 24 826 021
Fax (44) 19 24 826 146

Other sales offices:

Burgess Hill

Hong Kong & P. R. China

DENISON HYDRAULICS Ltd.
Unit 2, 25/F Wharf Cable Tower
9 Hoi Shing Road
Tsuen Wan
N.T., Hong Kong
Tel. (852) 24988381
Fax (852) 24991522

India

DENISON HYDRAULICS
INDIA, Ltd.
Balanager, Hyderabad 500 037
India
Tel. (91) 40 272794/272795
Fax (91) 40 273963

Other sales offices:

Banalore
Bombay
Calcutta
Patancheru

Italy

DENISON HYDRAULICS S.r.l.
Via Donizetti 18
20020 - Lainate (MI) Milanese
Italy
Tel. (39) 29 3758 1
Fax (39) 29 3713 42

Japan

DENISON JAPAN Inc.
4-2-1 Tsujido-Shinmachi
Fujisawa 251,
Japan
Tel. (81) 466 35 3257
Fax (81) 466 35 2029

Mexico, Central America, South America and Caribbean Countries Contact

DENISON HYDRAULICS Inc.
6167 NW 181 Terrace Circle North
Miami, FL 33015
USA
Tel. (305) 362 2246
Fax (305) 362 6220

Singapore

DENISON HYDRAULICS S.E.A. Pte.
Ltd.
No. 11 Lorong Tukang Dua
Singapore 2261
Tel. (65) 2687840
Fax (65) 2687847

Spain

DENISON HYDRAULICS, S.A.
Gomis, I
08023 Barcelona
Spain
Tel. (34) 3418 46 87
Fax (34) 3211 65 07

Other sales offices:

San Sebastian

Sweden

DENISON HYDRAULICS
SVENSKA AB
Sporregatan 13
213 77 - Malmö
Sweden
Tel. (46) 40 21 04 40
Fax (46) 40 21 47 26

Other sales offices:

Spånga

USA

DENISON HYDRAULICS Inc.
14249 Industrial Parkway
Marysville, OH 43040
USA
Tel. 513 644 3915
Fax 513 642 3738
For nearest Distributor:
Call toll free 1 800 551 5956
E-Mail address:
DENISONHYD@AOL.COM
WWW address-
<http://www.DenisonHydraulics.com>

Other sales offices:

Trabuco Canyon, CA
Mulberry, FL
Moline, IL
Cincinnati, OH
Medina, OH
Portland, OR
W. Conshohocken, PA
Arlington, TX
Houston, TX

Other European, Middle East and African Countries Contact

DENISON HYDRAULICS
FRANCE SA
14, route du Bois Blanc
BP 539
18105 Vierzon Cedex
France
Tel. (33) 48 75 33 91
Fax (33) 48 71 81 55

Your local DENISON representative

DENISON Hydraulics