Hydraulic Pump Division
P1/PD Models
075, 100, and 140
open-circuit axial piston pumps
280 bar rated pressure
Service information

Pub. LTE-00062-3-B Revised 6/05

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ISO 9001
DNV
DNV Certification, Inc.
REGISTERED FIRM

CONTENTS

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2. Payment: Payment shall be made by Buyer net 30 days from the date of delivery of the items purchased hereunder. Amounts not timely paid shall bear interest at the maximum rate permitted by law for each month or portion thereof that the Buyer is late in making payment. Any claims by Buyer for omissions or shortages in a shipment shall be waived unless Seller receives notice thereof within 30 days after Buyer's receipt of the shipment.

3. Delivery: Unless otherwise provided on the face hereof, delivery shall be made F.O.B. Seller's plant. Regardless of the method of delivery, however, risk of loss shall pass to Buyer upon Seller's delivery to a carrier. Any delivery dates shown are approximate only and Seller shall have no liability for any delays in delivery.

4. Warranty: Seller warrants that the items sold hereunder shall be free from defects in material or workmanship for a period of 18 months from date of shipment from Parker Hannifin Corporation. **THIS WARRANTY COMPRISES THE SOLE AND ENTIRE WARRANTY PERTAINING TO ITEMS PROVIDED HEREUNDER. SELLER MAKES NO OTHER WARRANTY, GUARANTEE, OR REPRESENTATION OF ANY KIND WHATSOEVER. ALL OTHER WARRANTIES, INCLUDING BUT NOT LIMITED TO, MERCHANTABILITY AND FITNESS FOR PURPOSE, WHETHER EXPRESS, IMPLIED, OR ARISING BY OPERATION OF LAW, TRADE USAGE, OR COURSE OF DEALING ARE HEREBY DISCLAIMED. NOTWITHSTANDING THE FOREGOING, THERE ARE NO WARRANTIES WHATSOEVER ON ITEMS BUILT OR ACQUIRED WHOLLY OR PARTIALLY, TO BUYER'S DESIGNS OR SPECIFICATIONS.**

5. Limitation Of Remedy: SELLER'S LIABILITY ARISING FROM OR IN ANY WAY CONNECTED WITH THE ITEMS SOLD OR THIS CONTRACT SHALL BE LIMITED EXCLUSIVELY TO REPAIR OR REPLACEMENT OF THE ITEMS SOLD OR REFUND OF THE PURCHASE PRICE PAID BY BUYER, AT SELLER'S SOLE OPTION. IN NO EVENT SHALL SELLER BE LIABLE FOR ANY INCIDENTAL, CONSEQUENTIAL OR SPECIAL DAMAGES OF ANY KIND OR NATURE WHATSOEVER, INCLUDING BUT NOT LIMITED TO LOST PROFITS ARISING FROM OR IN ANY WAY CONNECTED WITH THIS AGREEMENT OR ITEMS SOLD HEREUNDER, WHETHER ALLEGED TO ARISE FROM BREACH OF CONTRACT, EXPRESS OR IMPLIED WARRANTY, OR IN TORT, INCLUDING WITHOUT LIMITATION, NEGLIGENCE, FAILURE TO WARN OR STRICT LIABILITY.

6. Changes, Reschedules and Cancellations: Buyer may request to modify the designs or specifications for the items sold hereunder as well as the quantities and delivery dates thereof, or may request to cancel all or part of this order, however, no such requested modification or cancellation shall become part of the contract between Buyer and Seller unless accepted by Seller in a written amendment to this Agreement. Acceptance of any such requested modification or cancellation shall be at Seller's discretion, and shall be upon such terms and conditions as Seller may require.

7. Special Tooling: A tooling charge may be imposed for any special tooling, including without limitation, dies, fixtures, molds and patterns, acquired to manufacture items sold pursuant to this contract. Such special tooling shall be and remain Seller's property notwithstanding payment of any charges by Buyer. In no event will Buyer acquire any interest in apparatus belonging to Seller which is utilized in the manufacture of the items sold hereunder, even if such apparatus has been specially converted or adapted for such manufacture and notwithstanding any charges paid by Buyer. Unless otherwise agreed, Seller shall have the right to alter, discard or otherwise dispose of any special tooling or other property in its sole discretion at any time.

8. Buyer's Property: Any designs, tools, patterns, materials, drawings, confidential information or equipment furnished by Buyer or any other items which become Buyer's property, may be considered obsolete and may be destroyed by Seller after two (2) consecutive years have elapsed without Buyer placing an order for the items which are manufactured using such property, Seller shall not be responsible for any loss or damage to such property while it is in Seller's possession or control.

9. Taxes: Unless otherwise indicated on the face hereof, all prices and charges are exclusive of excise, sales, use, property, occupational or like taxes which may be imposed by any taxing authority upon the manufacture, sale or delivery of the items sold hereunder. If any such taxes must be paid by Seller or if Seller is liable for the collection of such tax, the amount thereof shall be in addition to the amounts for the items sold. Buyer agrees to pay all such taxes or to reimburse Seller therefore upon receipt of its invoice. If Buyer claims exemption from any sales, use or other tax imposed by any taxing authority, Buyer shall save Seller harmless from and against any such tax, together with any interest or penalties thereon which may be assessed if the items are held to be taxable.

10. Indemnity For Infringement of Intellectual Property Rights: Seller shall have no liability for infringement of any patents, trademarks, copyrights, trade dress, trade secrets or similar rights except as provided in this Part 10. Seller will defend and indemnify Buyer against allegations of infringement of U.S. Patents, U.S. Trademarks, copyrights, trade dress and trade secrets (hereinafter 'Intellectual Property Rights'). Seller will defend at its expense and will pay the cost of any settlement or damages awarded in an action brought against Buyer based on an allegation that an item sold pursuant to this contract infringes the Intellectual Property Rights of a third party. Seller's obligation to defend and indemnify Buyer is contingent on Buyer notifying Seller within ten (10) days after Buyer becomes aware of such allegations of infringement, and Seller having sole control over the defense of any allegations or actions including all negotiations for settlement or compromise. If an item sold hereunder is subject to a claim that it infringes the Intellectual Property Rights of a third party, Seller may, at its sole expense and option, procure for Buyer the right to continue using said item, replace or modify said item so as to make it noninfringing, or offer to accept return of said item and return the purchase price less a reasonable allowance for depreciation. Notwithstanding the foregoing, Seller shall have no liability for claims of infringement based on information provided by Buyer, or directed to items delivered hereunder for which the designs are specified in whole or part by Buyer, or infringements resulting from the modification, combination or use in a system of any item sold hereunder. The foregoing provisions of this Part 10 shall constitute Seller's sole and exclusive liability and Buyer's sole and exclusive remedy for infringement of Intellectual Property Rights. If a claim is based on information provided by Buyer or if the design for an item delivered hereunder is specified in whole or in part by Buyer, Buyer shall defend and indemnify Seller for all costs, expenses or judgments resulting from any claim that such item infringes any patent, trademark, copyright, trade dress, trade secret or any similar right.

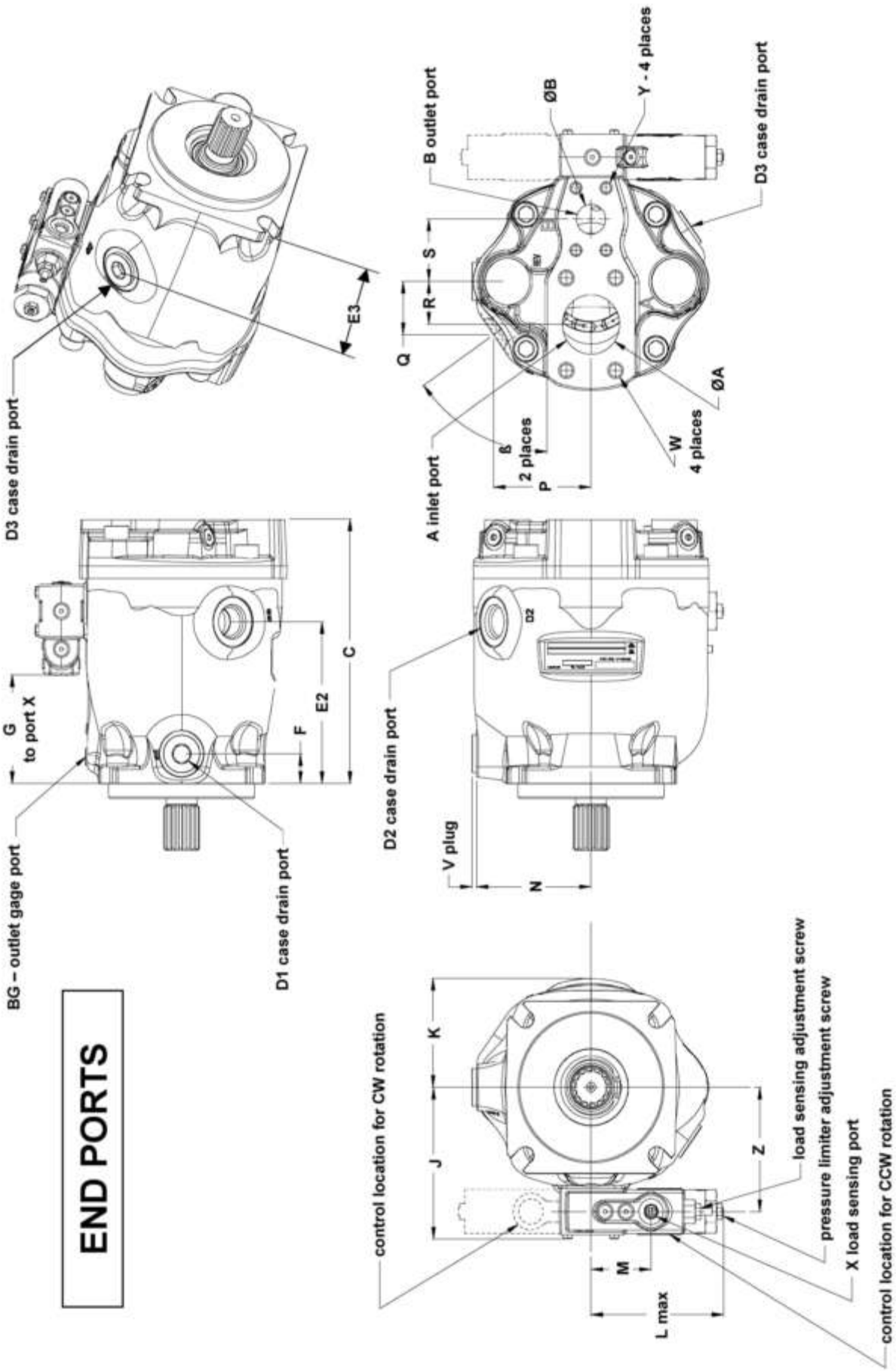
11. Force Majeure: Seller does not assume the risk of and shall not be liable for delay or failure to perform any of Seller's obligations by reason of circumstances beyond the reasonable control of Seller (hereinafter 'Events of Force Majeure'). Events of Force Majeure shall include without limitation, accidents, acts of God, strikes or labor disputes, acts, laws, rules or regulations of any government or government agency, fires, floods, delays or failures in delivery of carriers or suppliers, shortages of materials and any other cause beyond Seller's control.

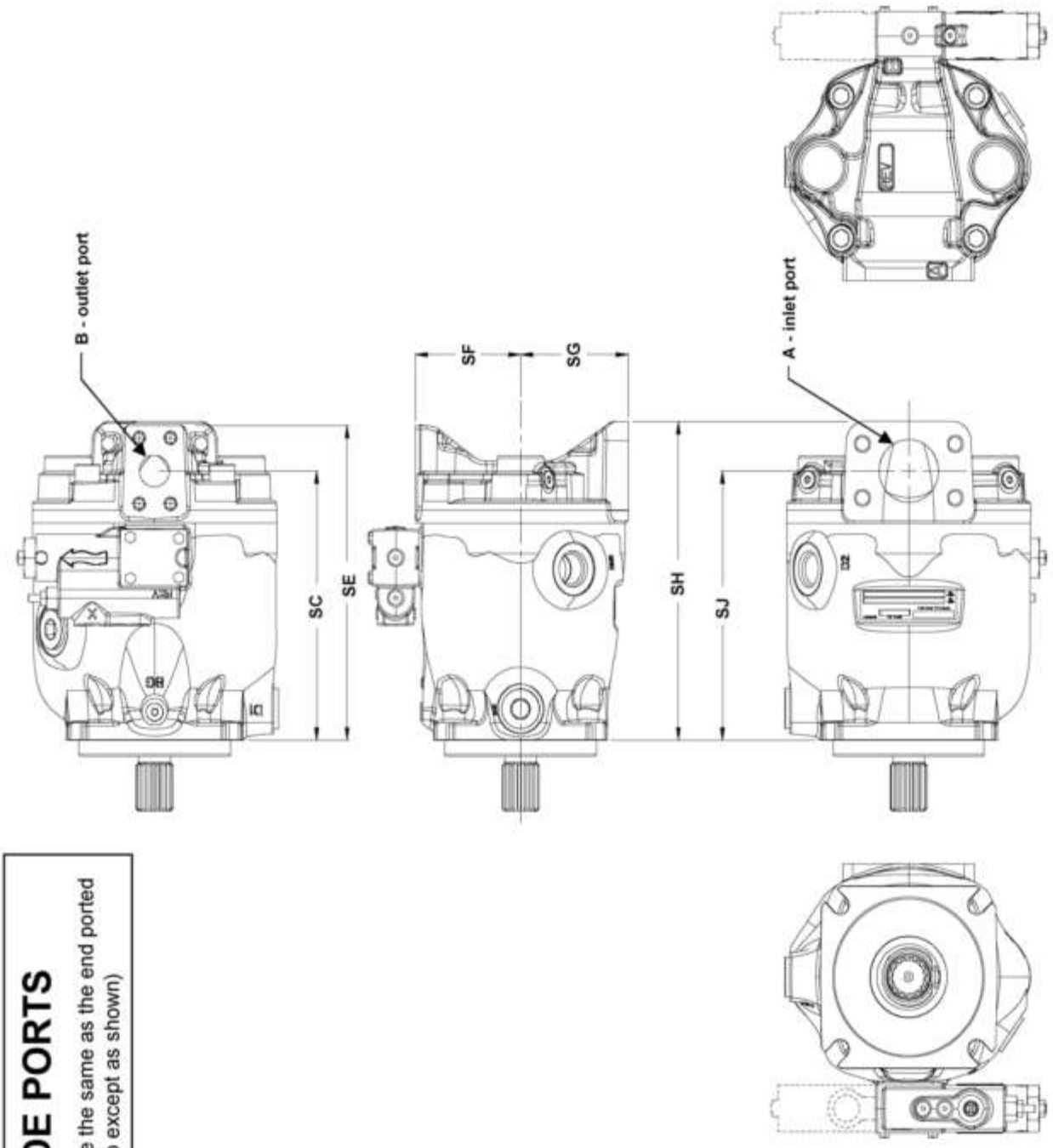
12. Entire Agreement/Governing Law: The terms and conditions set forth herein, together with any amendments, modifications and any different terms or conditions expressly accepted by Seller in writing, shall constitute the entire Agreement concerning the items sold, and there are no oral or other representations or agreements which pertain thereto. This Agreement shall be governed in all respects by the law of the State of Ohio. No actions arising out of the sale of the items sold hereunder or this Agreement may be brought by either party more than two (2) years after the cause of action accrues.

9/91-P

P1/PD Series pump model			060	075	100	140
displacement	*maximum*	cm^3/r	60	75	100	140
outlet pressure	*continuous*	bar	280			
	** intermittent*	bar	320			
	peak	bar	350			
speed (mobile version)	*maximum – boosted inlet*	rpm	2800	2700	2500	2400
	maximum – 1.0 bar abs inlet	rpm	2400	2300	2100	2000
	maximum – 0.8 bar abs inlet	rpm	2000	1900	1700	1600
	minimum	rpm	600			
speed (industrial version)	*maximum – 1.0 bar abs inlet*	rpm	1800			
	maximum- 0.8 bar abs inlet	rpm	1800	1800	1800	1500
	minimum	rpm	600			
Inlet pressure	*maximum*	bar	10			
	rated	bar	1.0 absolute (0.0 gage)			
	minimum	bar	0.8 absolute (-0.2 gage)			
case pressure	*peak*	bar	4.0 absolute (3.0 gage) and less than 0.5 bar above inlet pressure			
	rated	bar	2.0 absolute (1.0 gage) and less than 0.5 bar above inlet pressure			
fluid temperature	*range*	°C	-40 to +95			
fluid viscosity	*rated*	cSt	6 to 160			
	maximum intermittent	cSt	5000 (for cold starting)			
	minimum intermittent	cSt	5			
fluid contamination	*rated*	ISO	18/14			
	maximum	ISO	19/16			
SAE mounting	*flange*	SAE	127-4 (C)			152-4 (D)
	key shaft	SAE	32-1 (C)		38-1 (C-C)	44-1 (D)
	spline shaft	SAE	14T–12/24P		17T-12/24P	13T-8/16P
ISO mounting	*flange*	ISO	125B4			180B4
	key shaft	ISO	E32N		E40N	E50N
	spline shaft	ISO	14T mod 2		18T mod 2	24T mod 2
weight	*end port*	kg		30	53	66
	side port	kg		31	55	67
	thru-drive	kg		35	51	82

* Intermittent pressure is defined as less than 10% of operation time, not exceeding 6 successive seconds.

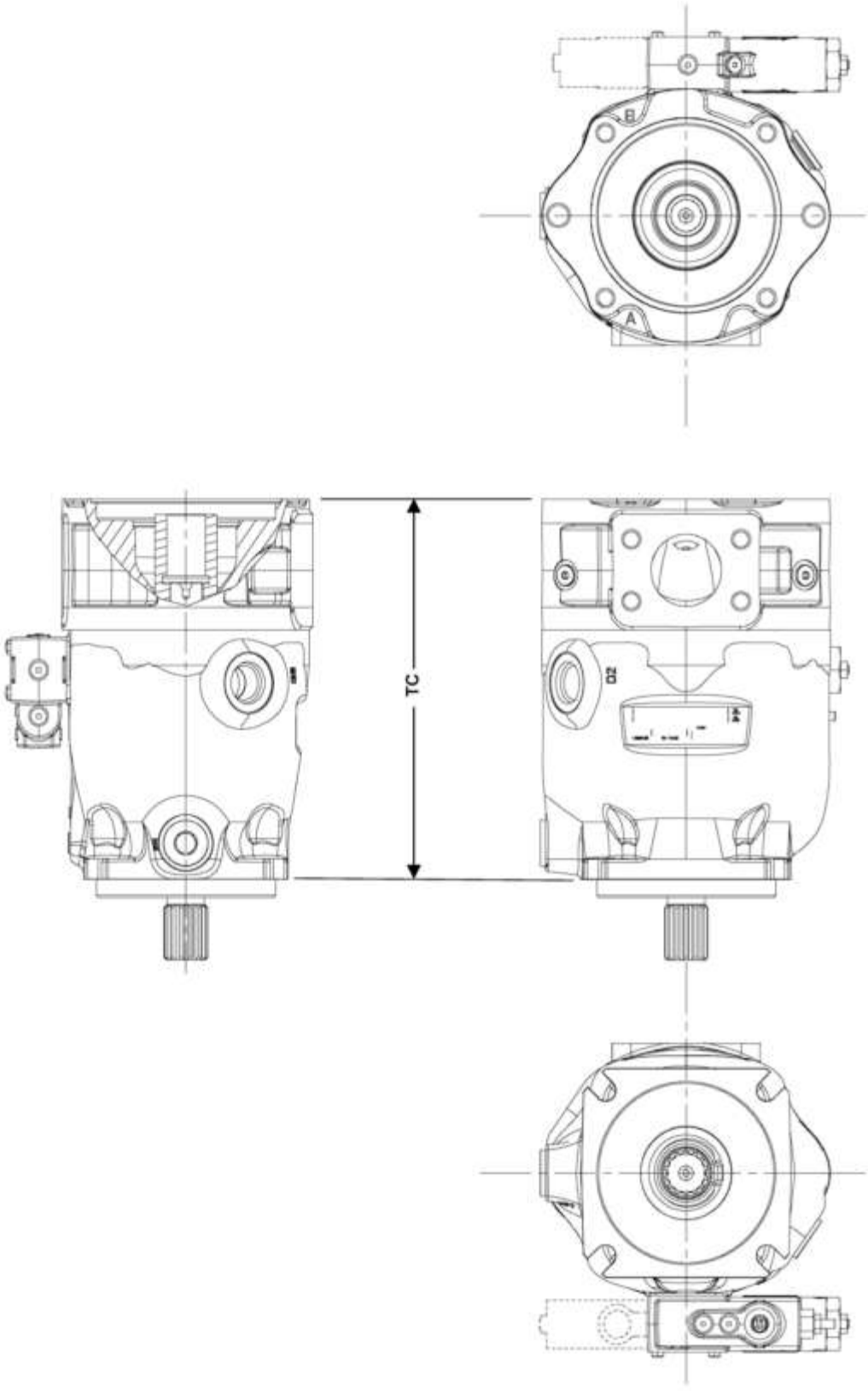

END PORTS
D3 case drain port
E3
B outlet port
ØB
Y - 4 places
D3 case drain port
S
R
Q
ØA
W
4 places
ß
2 places
P
A inlet port
G
to port X
F
E2
C
D2
D2 case drain port
V plug
N
BG – outlet gage port
D1 case drain port
control location for CW rotation
K
J
Z
load sensing adjustment screw
pressure limiter adjustment screw
X load sensing port
control location for CCW rotation
M
L max



SIDE PORTS

(dimensions are the same as the end ported pump except as shown)

THRU-DRIVE
(dimensions are the same as the side ported unit except as shown)



	port sizes							
	060		075		100		140	
	SAE	ISO	SAE	ISO	SAE	ISO	SAE	ISO
ØA inlet			50 mm	50 mm	63 mm	63 mm	63 mm	63 mm
W threads			1/2-13 UNC-2B	M12 x 1.75	1/2-13 UNC-2B	M12 x 1.75	1/2-13 UNC-2B	M12 x 1.75
ØB outlet			25 mm	25 mm	32 mm	32 mm	32 mm	32 mm
Y threads			3/8-16 UNC-2B	M10 x 1.5	1/2-13 UNC-2B	M12 x 1.75	1/2-13 UNC-2B	M12 x 1.75
BG			SAE – 4	M12 x 1.5[A]	SAE – 4	M12 x 1.5[A]	SAE – 4	M12 x 1.5[A]
D1 D2 D3			SAE – 12	M27 x 2 [A]	SAE – 12	M27 x 2 [A]	SAE –16	M33 x 2 [A]
X			SAE – 4	M12 x 1.5[A]	SAE – 4	M12 x 1.5[A]	SAE – 4	M12 x 1.5[A]

Note A: metric o-ring boss ports conform to ISO 6149-1

	pump dimensions (mm or °)			
	060	075	100	140
C		222.0	282.6	288.3
E2		136.0	173.2	193.8
E3		88.0	123.2	147.8
F		25.0	44.6	41.8
G		94.0	137.9	148.8
H		102.3	116.8	131.5
J		127.6	143.7	155.7
K		91.5	101.1	113.5
L max		121.0	121.0	121.0
M		52.3	52.3	52.3
N		99.5	116.1	129.0
P		83.9	104.5	112.7
Q		44.1	46.6	49.4
R		36.0	42.5	49.0
S		52.5	56.0	62.0
V		3.9	2.3	3.9
Z		104.5	120.5	132.5
SC		214.0	276	278.3
SE		250.0	322.1	326.3
SF		88.0	100.0	113.0
SG		90.0	100.0	113.0
SH		253.5	322.1	326.3
SJ		214.0	276	278.3
TC		263.5	339.6	364.3
ß		55°	71°	64°

MOUNTING

These pumps are designed to operate in any position. The pump shaft must be in alignment with the shaft of the source driver and should be checked with a dial indicator. The mating pilot bore and coupling must be concentric. This concentricity is particularly important if the shaft is rigidly connected to the driven load without a flexible coupling.

SHAFT INFORMATION

Splined: The shafts will accept a maximum misalignment of 0,06mm, 0.002 inch, total indicator reading when the pump is foot mounted and 0,03 mm, 0.001inch, when flange mounted. Angular misalignment at the external and internal spline axis must be less than ± 0,002 mm per mm of shaft radius, ± 0.002 inches per inch of shaft radius. The coupling interface must be lubricated. PARKER recommends lithium molydisulfide or similar grease. The internal coupling should be hardened to Rc 27-34 and must conform to SAE-J498c, class 5 flat root side fit.
Keyed: High strength heat treated keys must be used. Replacement keys must be hardened to 27-34 Rc. The key corners must be chamfered 0.81-1.0 mm, 0.032”-0.040”, at 45° to clear radii that exist in the keyway.

SIDE LOAD CAPABILITY

The P1/PD series is designed for inline-drive. Side loading on the shaft is not recommended. If this is unavoidable consult your nearest **PARKER** representative.

FLUID CONNECTIONS

Connect inlet and outlet lines to the port block of the pump. See pump dimension and port location drawings previously listed in this bulletin for port connections. The maximum case pressure is 2 bar (30 psi) continuous, 4 bar (60 psi) intermittent. Case pressure must never exceed inlet pressure by more than 1 bar (15 psi). When connecting case drain line make certain that drain plumbing passes above highest point of the pump before passing to the reservoir. If not, install a 0.3 bar (5 psi) case pressure check valve to be certain the case is filled with oil at all times. The case leakage line must be of sufficient size to prevent back pressure in excess of 2 bar (30 psi) and returned to the reservoir below the surface of the oil as far from the supply inlet as possible. All fluid lines, whether pipe, tubing, or hose must be adequate size and strength to assure free flow through the pump. An undersize inlet line will prevent the pump from operating properly at full rated speed. An undersize outlet line will create back pressure and cause heat generation. Flexible hose lines are recommended. If rigid piping is used, the workmanship must be accurate to eliminate strain on the pump port block or to the fluid connections. Sharp bends in the lines must be eliminated wherever possible. All system piping must be cleaned and flushed before installing pump. Make sure the entire hydraulic system is free of dirt, lint, scale, or other foreign material.
Caution: Do not use galvanized pipe. Galvanized coating can flake off with continued use.

SYSTEM RELIEF VALVES

Although the P1/PD series pumps have very fast off-stroke compensator response, system relief valves are recommended in all cases for safety considerations.

RECOMMENDED FLUIDS

The fluid recommended for use in these pumps has a petroleum base and contains agents which provide oxidation inhibition and anti-rust, anti-foam and de-aerating properties as described in **PARKER** standard HF-1. Where anti-wear additive fluids are specified, see **PARKER** standard HF-0.

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 temperature should not exceed 110°C (230°F) at the case drain.

MAINTENANCE

The 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 troubleshooting chart before attempting to overhaul the unit. Overhauling may be accomplished by referring to the disassembly, rework limits of wear parts, and assembly procedures as provided in this service manual.

FLUID CLEANLINESS

Fluid must be cleaned before and continuously during operation, by filters that maintain a cleanliness level of ISO 18/14. 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.

COMPARISON OF SOLID CONTAMINATION CLASSIFICATION SYSTEM

NATIONAL AERONAUTICS STANDARD (NAS) 1638

		class													
		00	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
particle size range	**5-15mm**	125	250	500	1000	2000	4000	8000	16000	32000	64000	128000	256000	512000	1024000
	15-25mm	22	44	89	178	356	712	1425	2850	5700	11400	22800	45600	91200	182400
	25-50mm	4	8	16	32	63	126	253	506	1012	2025	4050	8100	16200	32400
	50-100mm	1	2	3	6	11	22	45	90	180	360	720	1440	2880	5760
	>100mm	0	0	1	1	2	4	8	16	32	64	128	256	512	1024
maximum particles	>5mm	152	304	609	1217	2432	4864	9731	19462	38924	77849	155698	311396	622792	1245584
	>15mm	27	54	109	217	432	864	1731	3462	6924	13849	27698	55396	110792	221584

ISO:DIS 4406; SAE J1165

100 ml sample size		**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	**>5mm**	250	500	1000	2000	4000	8000	16000	32000	64000	130000	250000	500000	1000000	2000000	4000000
	>15mm	32	64	130	250	500	1000	2000	4000	8000	16000	32000	64000	130000	250000	500000

START UP PROCEDURE

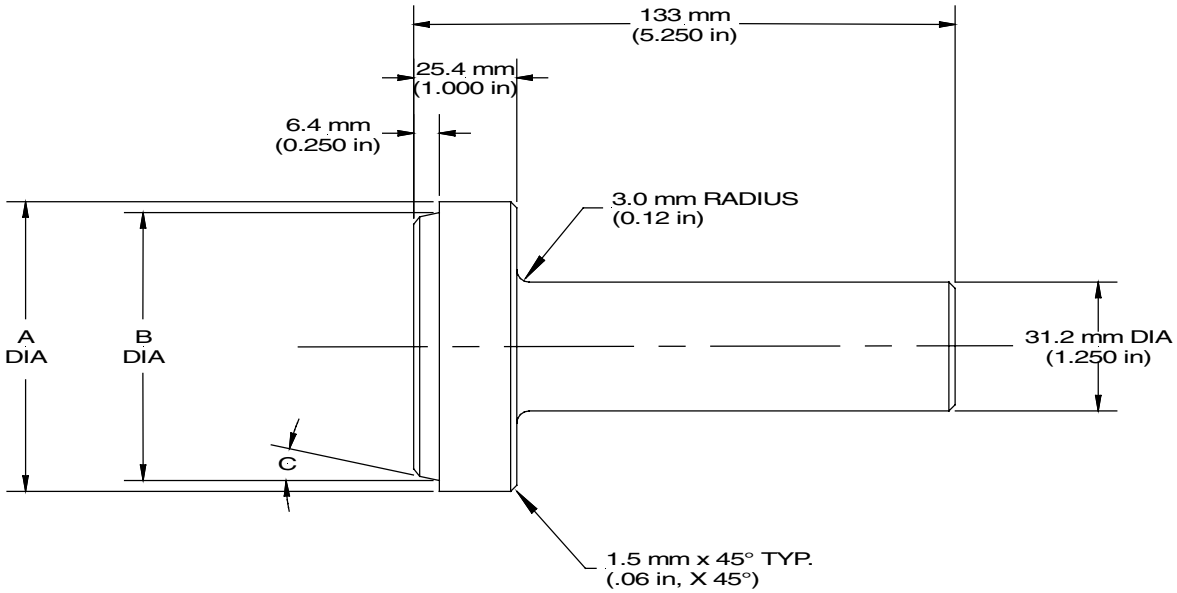
START UP PROCEDURE FOR NEW INSTALLATION

- Read and understand the instruction manual.
- Identify components and their function.
- Visually inspect components and lines for possible damage.
- Insure that all necessary ports are properly connected.
- Check reservoir for cleanliness. Drain and clean as required.
- Check fluid level and fill as required with filtered fluid to a minimum ISO cleanliness level of 18/14.
- Fill pump case with clean oil prior to starting.
- If pump is mounted vertically with the shaft up, bleed the air out the D1 drain port located near the mounting flange.
- Check alignment of drive.
- Check oil cooler and activate it, if included in circuit. Check fluid temperature.
- Reduce pressure settings of compensator and relief valve. Make sure accurate pressure readings can be made at appropriate places.
- If solenoids in system, check for actuation.
- Jog the pump drive. Check for proper shaft rotation. Make sure pump fills properly.
- Start the pump drive.
- Bleed system of air. Recheck fluid level.
- Cycle unloaded machine at low pressure and observe actuation (at low speed, if possible).
- Increase pressure settings gradually in steps. Check for leaks in all lines especially in pump and motor inlet lines.
- Make correct pressure adjustments.
- Gradually increase speed. Be alert for trouble as indicated by changes in sounds, system shocks, and air in fluid.
- Equipment is operational.

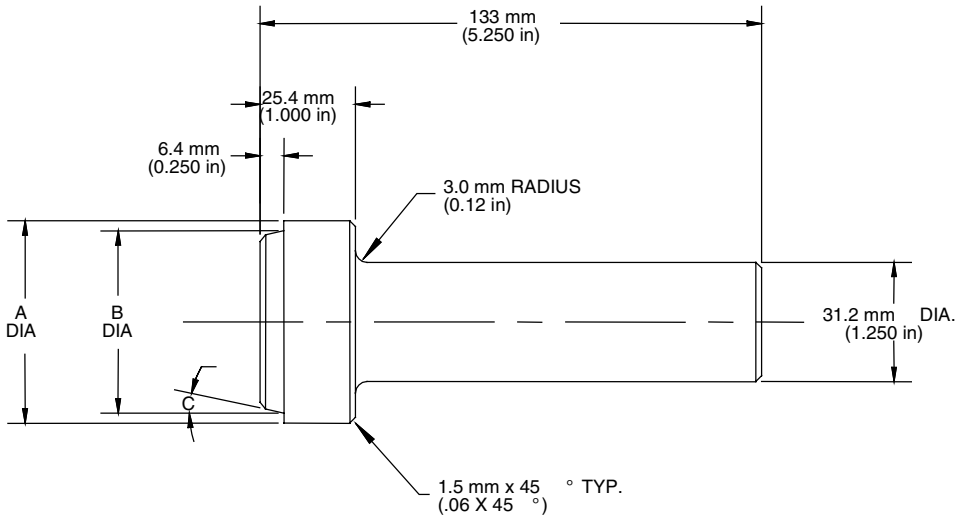
Component problems and circuit problems are often interrelated. An improper circuit may operate with apparent success but will cause failure of a particular component within it. The component failure can be the effect, not the cause of the problem. This general guide is offered to help in locating and eliminating the cause of problems by studying their effects.

effect of trouble	Possible cause	fault which needs remedy
noisy pump	air in fluid	leak in inlet line 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 inlet line strainer acting as air trap
	cavitation in rotating group	fluid too cold fluid too viscous fluid too heavy shaft speed too high inlet line too small inlet strainer too small inlet strainer too dirty operating altitude too high inlet pressure too low
	misaligned shaft	faulty installation distortion in mounting axial interference faulty coupling excessive overhung loads
	mechanical fault in pump	piston and shoe looseness or failure bearing failure incorrect port plate rotation eroded or worn parts in the displacement control
erosion on barrel ports and port plate	air in fluid	see noisy pump above
	cavitation	see noisy pump above
high wear in pump	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 improper reservoir breather improper line replacement
	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
	unwanted water in fluid	Condensation faulty breather/strainer heat exchanger leakage faulty clean-up practice water in makeup fluid

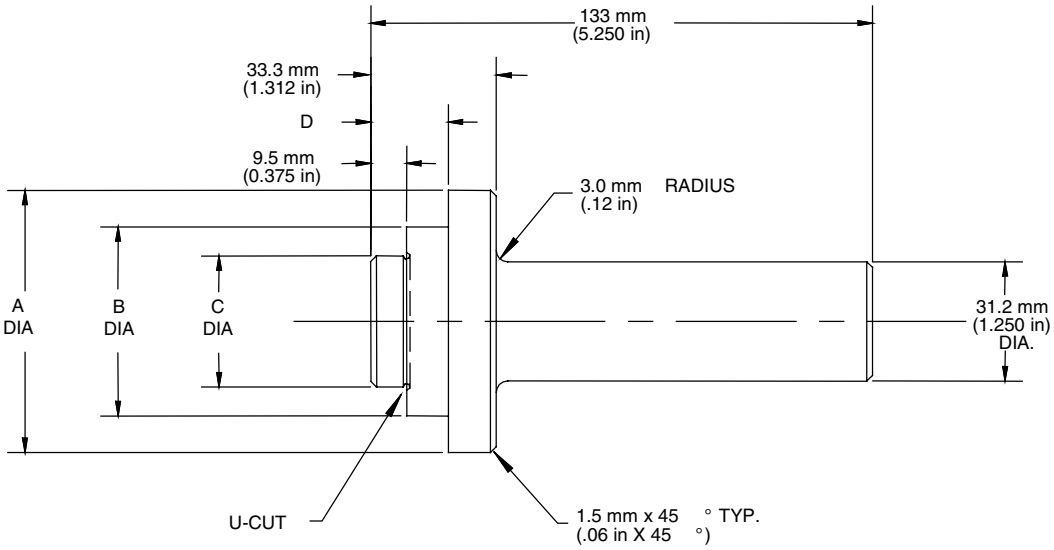
effect of trouble	possible cause	fault which needs remedy
pressure shocks	cogging load	mechanical considerations
	worn relief valve	needed repairs
	worn compensator	replace
	slow response in check valves	replace or relocate
	excessive de-compression energy rates	improve decompression control
	Barrel blow-off	rotating group worn, excessive case pressure
compensator instability	excessive line capacitance (line volume, line stretch, accumulator effects)	reduce line size or lengths eliminate hose
heating of fluid	excessive pump leakage	recheck case drain flow and repair as required fluid too thin improper assembly, port timing
	relief valve	set too low (compared to load or to compensator) instability caused by back pressure, worn parts
	compensator	set too high (compared to relief) worn parts
	pump too large for fluid needs	select smaller pump displacement
	heat exchanger	water turned off or too little flow water too hot fan clogged or restricted efficiency reduced by mud or scale deposits intermittent hydraulic fluid flow
	reservoir	too little fluid improper baffles insulating air blanket that prevents heat rejection heat pickup from adjacent equipment



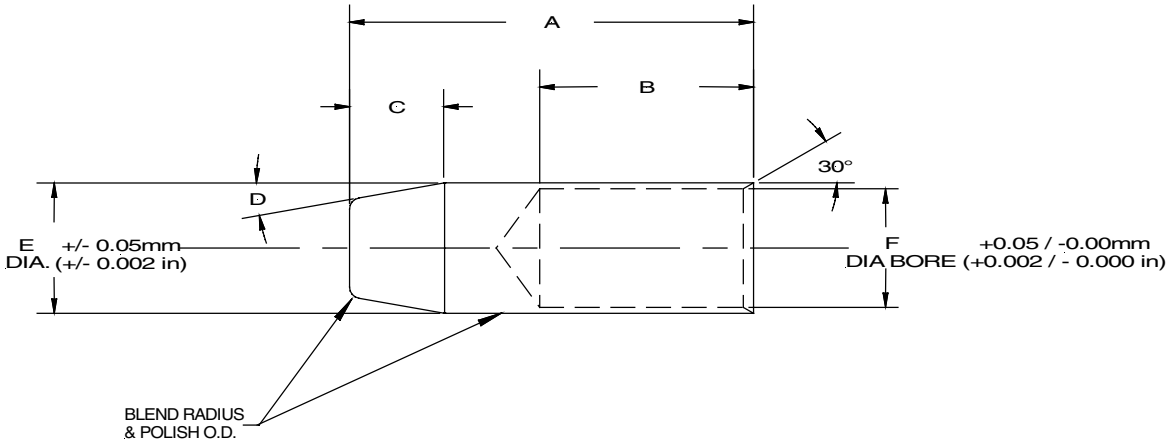
T2 Front bearing installation tool	A	B	C
213-0-004192 (075)	71.4 mm (2.812 in.)	660mm (2.60 in.)	12°
213-0-004204 (100)	92.1 mm (3.623 in.)	86.1 mm (3.390 in.)	15°
213-0-004197 (140)	93.7 mm (3.687 in.	89.3 mm (3.515 in.)	15°



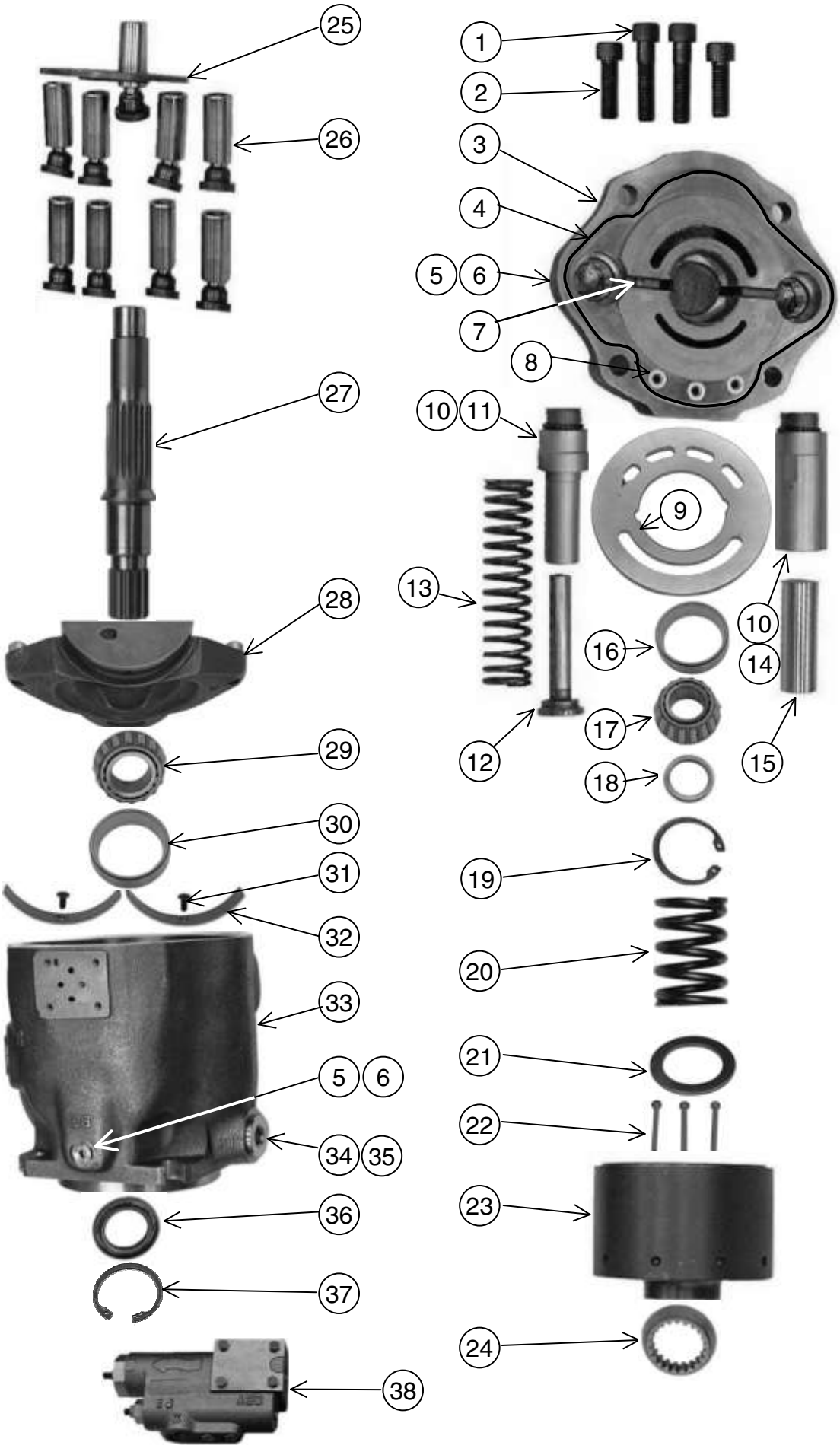
T5 Rear bearing installation tool	A	B	C
213-0-004193 (075)	53.8 mm (2.120 in.)	48.7 mm (1.918 in.)	12°
213-0-004205 (100)	65.1 mm (2.562 in.)	59.3 mm (2.335 in.)	15°
213-0-004198 (140)	71.1 mm (2.80 in.)	65.1 mm (2.562 in.)	15°



T1 Seal installation tool	A	B	C	D
213-0-004194 (075)	69.9 mm (2.750 in.)	50.3 mm (1.980 in.)	34.9 mm (1.375 in.)	20.3 mm (0.800 in.)
213-0-004208 (100)	63.5 mm (2.500 in.)	56.6 mm (2.230 in.)	43.3 mm (1.703 in.)	14.0 mm (0.550 in.)
213-0-04199 (140)	85.7 mm (3.375 in.)	70.6 mm (2.780 in.)	53.4 mm (2.10 in.)	19.1 mm (0.750 in.)



T3 Seal Guard	A	B	C	D	E	F
213-0-004195 (075)	108 mm (4.25 in.)	57.1 mm (2.25 in.)	25.4 mm (1.00 in.)	10°	34.90 mm (1.373 in.)	31.75 mm (1.250 in.)
213-0-004206 (100 SAE)	108 mm (4.25 in.)	70.6 mm (2.78 in.)	25.4 mm (1.00 in)	10°	43.26 mm (1.703 in.)	38.1 mm (1.500 in.)
213-0-004207 (100 ISO)	114 mm ((4.50 in.)	76.2 mm (3.00 in)	22.4 mm (0.88 in.)	15°	43.26 mm (1.703 in.)	40.06 mm (1.577 in.)
213-0-004200 (140 SAE)	108 mm (4.25 in.)	70.6 mm (2.78 in.)	25.4 mm (1.00 in)	10°	53.04 mm (2.088 in.)	44.48 mm (1.751 in.)
213-0-004201 (140 ISO)	114 mm (4.50 in.)	86.1 mm (3.39 in)	22.4 mm (0.88 in.)	15°	53.09 mm (2.090 in.)	50.04 mm (1.970 in.)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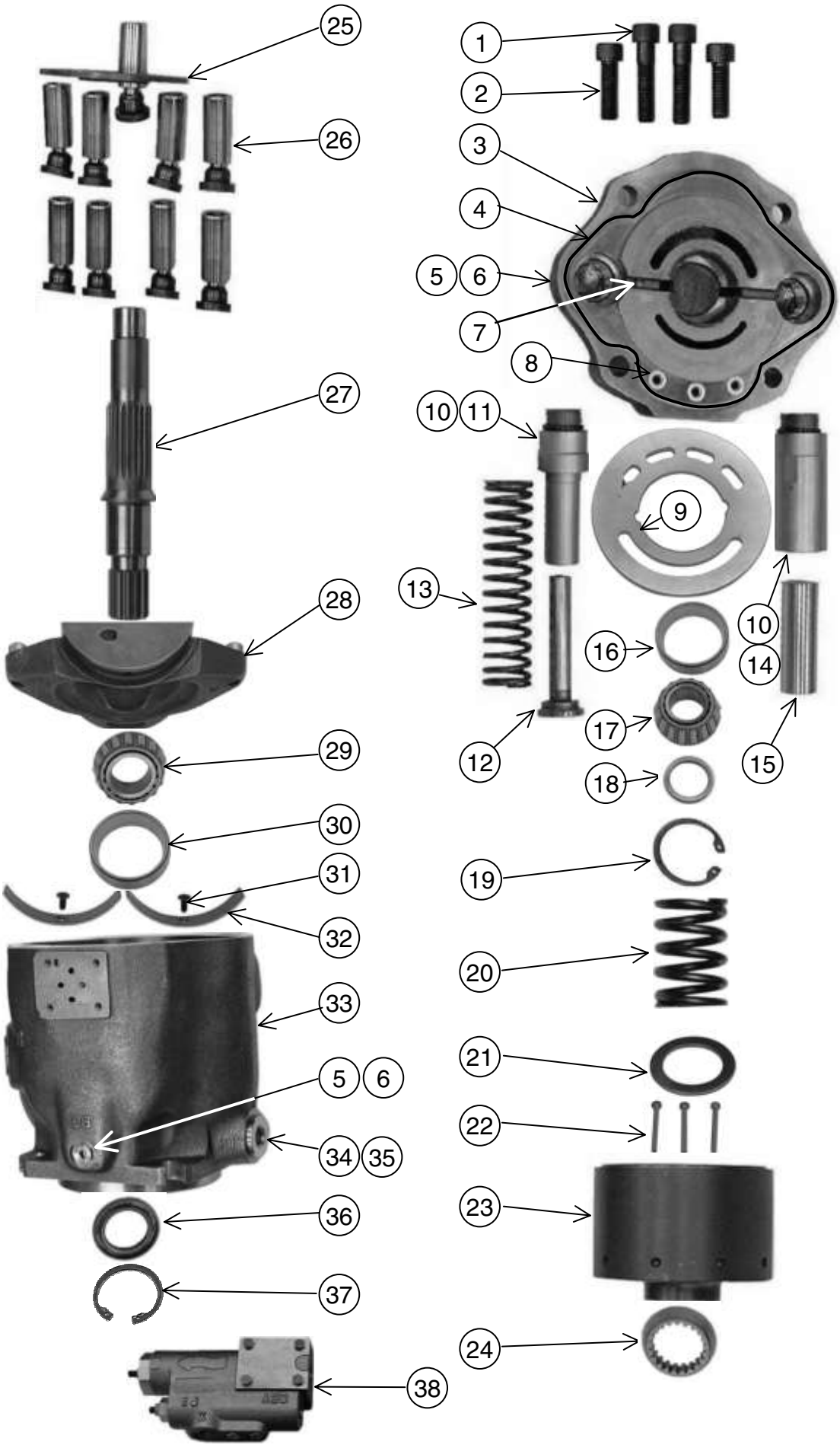
Item no.	Quantity	075 Part #	100 Part #	140 Part #	Description
1	4 (2: 075)	361-13270-0	361-14290-0	361-15270-0	Socket head cap screw
2	0 (2: 075)	361-13250-0	N/A	N/A	Socket head cap screw
3	1	03E-93090	03E-93774	03E-93192	Port block, end ported SAE
		03E-93092	03E-94316	03E-93199	Port block, end ported SAE w/ max. volume stop
		03E-93094	N/A	N/A	Port block, end ported SAE w/ case relief
		03E-93099	03E-94463	03E-94147	Port block, rear drive SAE-A
		03E-93100	03E-94461	03E-93206	Port block, rear drive SAE-B
		03E-93101	03E-93776	03E-93207-0	Port block, rear drive SAE-C
		03E-93107	N/A	N/A	Port block, rear drive SAE-C w/ case relief
		03E-93112	03E-93778	03E-93219	Port block, side ported SAE
		03E-93114	03E-94293	03E-93221	Port block, side ported SAE w/ max. volume stop
		03E-93115	N/A	03E-93222	Port block, side ported ISO w/ max. volume stop
		03E-93118	N/A	N/A	Port block, side ported SAE w/max. volume stop & case relief
4	1	675-00175-0	675-00169-0	675-00173-0	O-ring
5	2	488-35061-0	488-35061-0	488-35061-0	(not shown on port block) o-ring boss plug
6	2	695-00904-0	695-00904-0	695-00904-0	(not shown on port block) O-ring
7	1	324-30014-0	324-30014-0	324-30014-0	Port plate pin
8	3	605-10070-0	605-10070-0	605-10070-0	O-ring
9	1	03E-93172-0	03E-93788-0	03E-93255-0	Port plate, mobile, ccw rotation
		03E-93171-0	03E-93787-0	03E-93254-0	Port plate, mobile, cw rotation
		03E-93169-0	03E-93785-0	03E-93252-0	Port plate, industrial, cw rotation
		03E-93170-0	03E-93786-0	03E-93253-0	Port plate, industrial, ccw rotation
10	2	695-00912-0	695-00914-0	695-00916-0	O-ring
11	1	03E-93150-0	03E-93800-0	03E-93248-0	Bias guide
12	1	03E-93149-0	03E-93799-0	03E-93247-0	Bias piston
13	1	03E-93151-0	03E-93801-0	03E-93963-0	Bias spring
14	1	03E-93148-0	03E-93798-0	03E-93246-0	Control guide
15	1	03E-93147-0	03E-93799-0	03E-93245-0	Control piston
16	1	230-82237-0	230-82244-0	230-82241-0	Tapered roller bearing cup
17	1	230-82238-0			Tapered roller bearing cone
18	1	03E-93180-0	03E-94148-0	03E-93260-0	Bearing shim 3.28 mm (0.1291 in)
		03E-93566-0	03E-94149-0	03E-93970-0	Bearing shim 3.36 mm (0.1323 in)
		03E-93567-0	03E-94150-0	03E-93971-0	Bearing shim 3.44 mm (0.1354 in)
		03E-93568-0	03E-94151-0	03E-93972-0	Bearing shim 3.52 mm (0.1386 in)
		03E-93569-0	03E-94152-0	03E-93973-0	Bearing shim 3.60 mm (0.1417 in)
		03E-93570-0	03E-94153-0	03E-93974-0	Bearing shim 3.68 mm (0.1449 in)
		03E-93571-0	03E-94154-0	03E-93975-0	Bearing shim 3.76 mm (0.1480 in)
		03E-93572-0	03E-94155-0	03E-93976-0	Bearing shim 3.84 mm (0.1512 in)
		03E-93573-0	03E-94156-0	03E-93977-0	Bearing shim 3.92 mm (0.1539 in)
		03E-93574-0	03E-94157-0	03E-93978-0	Bearing shim 4.00 mm (0.1575 in)
		03E-93575-0	03E-94158-0	03E-93979-0	Bearing shim 4.08 mm (0.1606 in)
		03E-93576-0	03E-93864-0	03E-93980-0	Bearing shim 4.16 mm (0.1638 in)
19	1	356-65144-0	356-65146-0	356-65148-0	Retaining ring, internal
20	1	03E-93145-0	03E-93795-0	03E-93959-0	Barrel hold down spring
21	1	03E-93146-0	03E-93796-0	03E-93244-0	Barrel hold down washer
22	3	03E-93263-0	03E-93845-0	03E-93267-0	Barrel hold down pin
23	1	03E-93129-0	03E-93783-0	03E-93242-0	Barrel
24	1	03E-93142-0	03E-93794-0	03E-93241-0	Spherical washer
25	1	03E-93139-0	03E-93793-0	03E-93240-0	Retainer plate
26	9	S2E-17003-0	S2E-17912-0	S2E-17323-0	Piston and shoe assembly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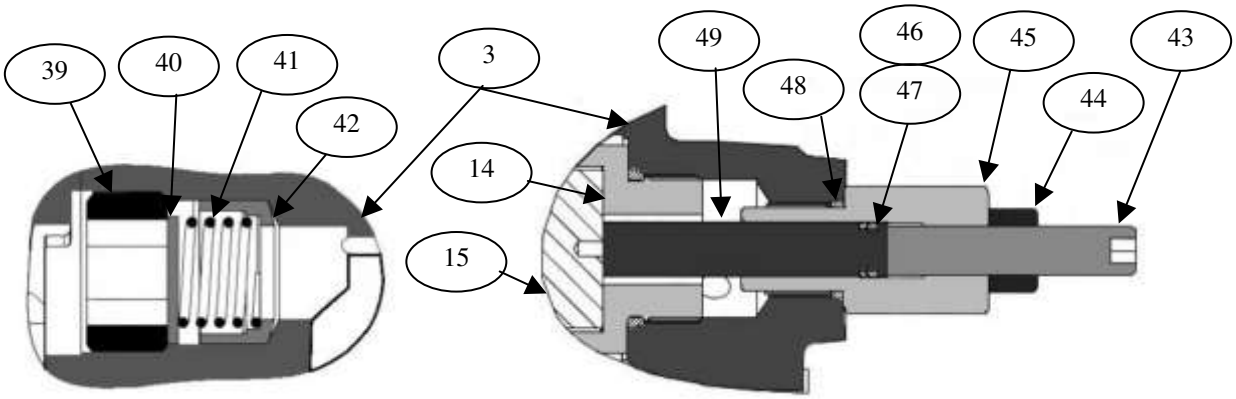
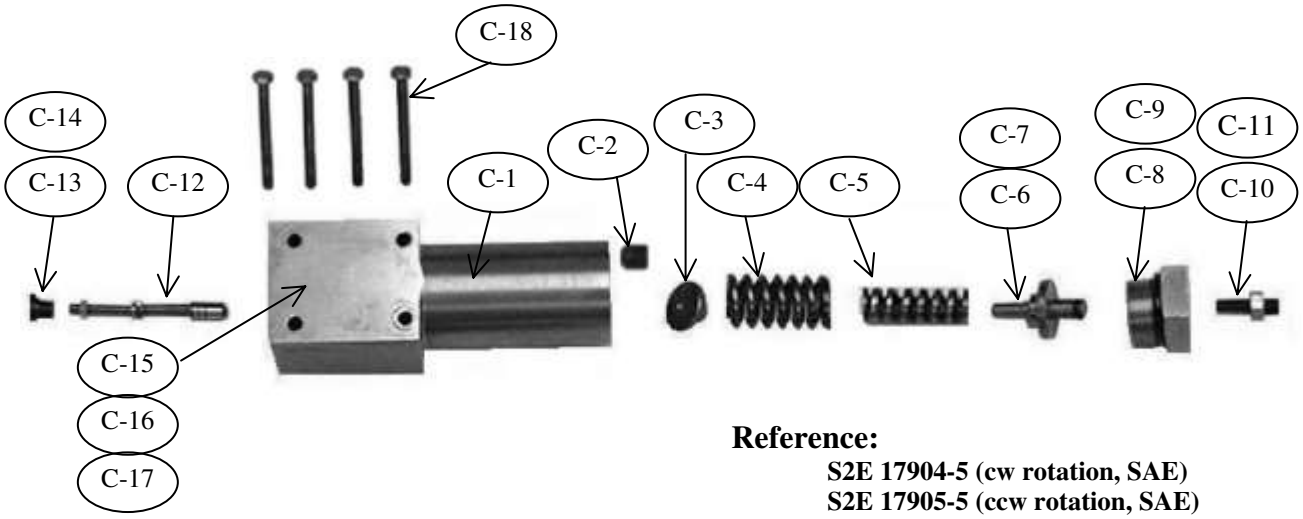
Item no.	Quantity	075 Part #	100 Part #	140 Part #	Description
27	1	03E-93999-0	03E-93779-0	03E-93227-0	-01 Drive shaft, SAE spline, no rear drive
		03E-94001-0	03E-93781-0	03E-93231-0	-02 Drive shaft, SAE keyed, no rear drive
		03E-93122-0	N/A	N/A	-03 Drive shaft, ISO spline, no rear drive
		03E-94003-0	N/A	N/A	-04 Drive shaft, ISO keyed, no rear drive
28	1	S2E-17443-0	S2E-17961-0	S2E-17957-0	Cam
29	1	230-82236-0	230-82245-0	230-82239-0	Tapered roller bearing cone
30	1	230-82237-0			Tapered roller bearing cup
31	2	03E-93763-0	03E-93763-0	03E-93960-0	Bearing retainer orifice screw
32	2	03E-93934-0	03E-93952-0	03E-93953-0	Cam bearing
33	1	03E-93081-0	03E-93769-0	03E-93183-0	Pump housing SAE
		03E-93082-0	N/A	N/A	Pump housing ISO-Metric
		03E-93894-0	N/A	03E-93964	Pump housing ISO-BSPP
34	2	488-35014-0	488-35014-0	488-35024-0	O-ring boss plug
35	2	695-00912-0	695-00912-0	695-00916-0	O-ring
36	1	620-82118-5	620-82121-5	620-82120-5	Shaft seal
37	1	356-65146-0	356-65147-0	356-65147-0	Retaining ring, internal
38	1	S2E-17904-5	S2E-17904-5	S2E-17904-5	Standard pressure compensator assembly, CW rotation
		S2E-17905-5	S2E-17905-5	S2E-17905-5	Standard pressure compensator assembly, CCW rotation
		S2E-17958-5	S2E-17958-5	S2E-17958-5	RN Remote pressure control assembly, CW rotation
		S2E-17924-5	S2E-17924-5	S2E-17924-5	RN Remote pressure control assembly, CCW rotation
		S2E-17823-5	S2E-17823-5	S2E-17823-5	Load sense compensator assembly, CW rotation SAE
		S2E-17824-5	S2E-17824-5	S2E-17824-5	Load sense compensator assembly, CCW rotation SAE
		S2E-17937-5	S2E-17937-5	S2E-17937-5	Load sense compensator assembly, CW rotation BSPP
		S2E-17936-5	S2E-17936-5	S2E-17936-5	Load sense compensator assembly, CCW rotation BSPP



CASE TO INLET CHECK VALVE					
Item no.	Quantity	075 Part #	100 Part #	140 Part #	Description
39	1	314-10000-0	314-10000-0	314-10000-0	Hollow set screw
40	1	03E-93931-0	03E-93931-0	03E-93931-0	Check valve poppet
41	1	03E-93987-0	03E-93987-0	03E-93987-0	Spring
42	1	03E-93988-0	03E-93988-0	03E-93988-0	Check valve stop

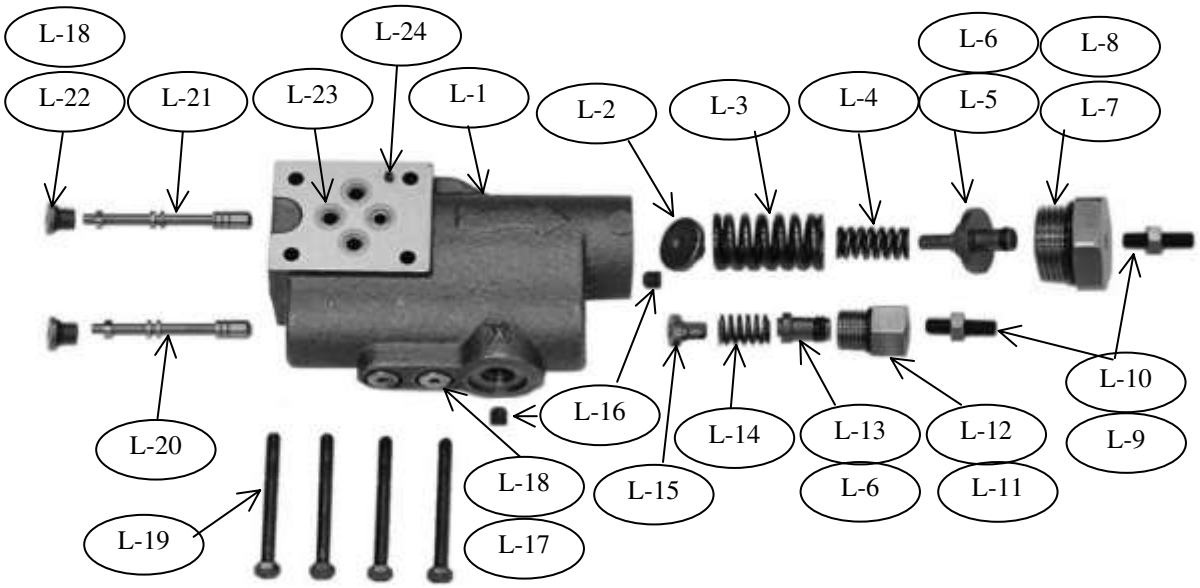
MAXIMUM VOLUME STOP					
Item no.	Quantity	075 Part #	100 Part #	140 Part #	Description
43	1	311-50009-0	311-50009-0	311-50009-0	Adjusting screw
44	1	334-00011-0	334-00011-0	334-00011-0	Adjusting screw locknut
45	1	03E-93181-0	03E-93181-0	03E-93181-0	Maximum volume stop plug torque to 64 ± 3 Nm (570 ± 25 in-lb.)
46	1	695-00011-0	695-00011-0	695-00011-0	O-ring
47	1	618-15023-0	618-15023-0	618-15023-0	Back-up ring
48	1	03E-93262-0	03E-93262-0	03E-93262-0	Maximum volume stop rod
49	1	695-00908-0	695-00908-0	695-00908-0	O-ring



Reference:

S2E 17904-5 (cw rotation, SAE)
S2E 17905-5 (ccw rotation, SAE)

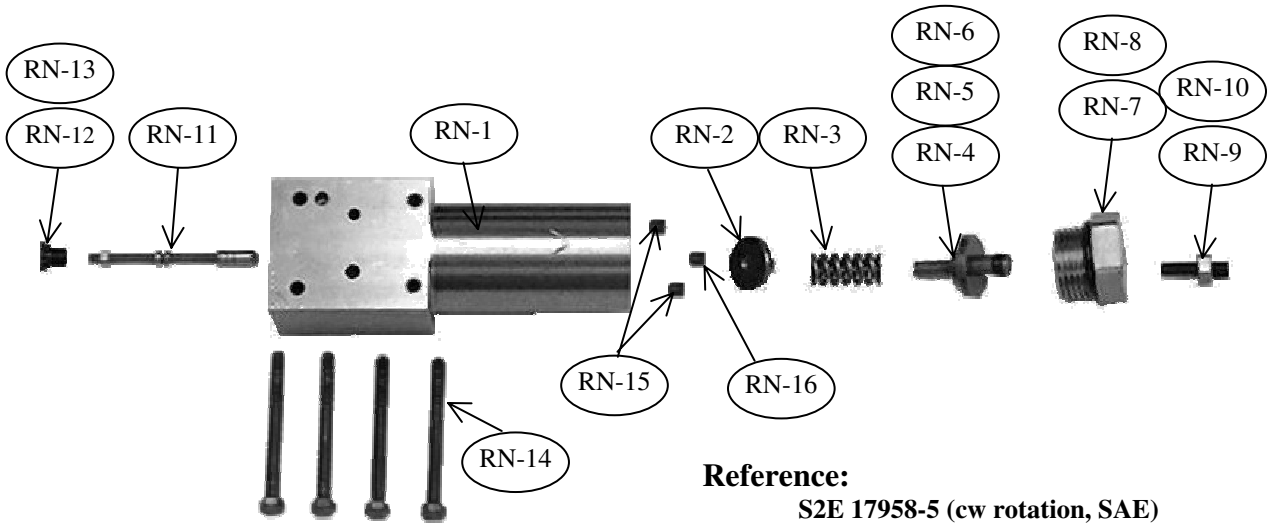
Item no.	Quantity	Part no.	Description
C-1	1	03E-93695	Compensator body (cw rotation)
		03E-93696	Compensator body (ccw rotation)
C-2	1	311-50006	Socket set screw
C-3	1	03E-93165	Spring seat
C-4	1	03E-93158	Outer spring
C-5	1	03E-93159	Inner spring
C-6	1	03E-93164	Spring seat & piston
C-7	1	675-00009	Seal piston o-ring
C-8	1	03E-93173	Spring cap
C-9	1	695-00912	Spring cap o-ring
C-10	1	311-50003	Adjusting screw
C-11	1	340-00056	Adjusting screw locknut
C-12	1	03E-93156	Spool
C-13	1	03E-93163	Hardened SAE #2 o-ring boss plug
C-14	1	695-00902	SAE #2 o-ring
C-15	4	605-10069	Teflon O-ring (not shown)
C-16	1	605-10058-5	O-ring (not shown)
C-17	1	325-36002	Roll pin (not shown)
C-18	4	363-10025	Hex mounting screw
NOTE: Individual parts are not available. Sold as complete assembly only.			



Reference:

S2E 17823-5 (cw rotation, SAE)
S2E 17824-5 (ccw rotation, SAE)

Item no.	Quantity	Part no.	Description
L-1	1	03E-93155	Compensator body (cw rotation)
		03E-93154	Compensator body (ccw rotation)
L-2	1	03E-93165	Main compensator spring seat
L-3	1	03E-93158	Main compensator outer spring
L-4	1	03E-93159	Main compensator inner spring
L-5	1	03E-93164	Main compensator spring seat & piston
L-6	2	675-00009	Compensator seal piston o-ring
L-7	1	03E-93173	Main compensator spring cap
L-8	1	695-00912	Main compensator spring cap o-ring
L-9	2	311-50003	Compensator adjusting screw
L-10	2	340-00056	Compensator adjusting screw locknut
L-11	1	03E-93174	Load sense compensator spring cap
L-12	1	695-00906	Load sense compensator spring cap o-ring
L-13	1	03E-94142	Load sense compensator seal piston
L-14	1	03E-94141	Load sense compensator spring
L-15	1	03E-94143	Load sense compensator spring seat
L-16	2	311-50006-0	Socket set screw
L-17	2	488-35046	SAE #2 o-ring boss plug
L-18	4	695-00902	SAE #2 o-ring
L-19	4	363-10025	Hex mounting screw
L-20	1	03E-93157	Load sense compensator spool
L-21	1	03E-93156	Main compensator spool
L-22	2	03E-93163	Hardened SAE #2 o-ring boss plug
L-23	4	605-10069	Teflon o-ring
L-24	1	325-36002	Roll pin
NOTE: Individual parts are not available. Sold as complete assembly only.			



Reference:

S2E 17958-5 (cw rotation, SAE)
S2E 17924-5 (ccw rotation, SAE)

Item no.	Quantity	Part no.	Description
RN-1	1	03E-93694	Compensator body (cw rotation) [SEE NOTE 2]
		03E-93688	Compensator body (ccw rotation) [SEE NOTE 2]
RN-2	1	03E-93165	Spring seat
RN-3	1	03E-94203	Bias spring
RN-4	1	03E-94202	Spring seat & piston
RN-5	1	675-00009	Seal piston o-ring
RN-6	1	618-15022	Seal piston back-up ring
RN-7	1	03E-94227	Spring cap
RN-8	1	695-00912	Spring cap o-ring
RN-9	1	311-50003	Adjusting screw
RN-10	1	340-00056	Adjusting screw locknut
RN-11	1	03E-93156	Spool
RN-12	1	03E-93163	Hardened SAE #2 o-ring boss plug
RN-13	1	695-00902	SAE #2 o-ring
RN-14	4	SEE NOTE 3	Hex mounting screw
RN-15	3	03E-93270	Orifice plug (1 not shown)
RN-16	1	311-50006	Socket set screw
RN-17	4	605-10069	Teflon O-ring (not shown)
RN-18	1	325-36002	Roll pin (not shown)
NOTE 1	Individual parts are not available. Sold as complete assembly only.		
NOTE 2	D03 Mount on top of body.		
NOTE 3	Dependent on top valve.		

Seal kit part number	Description
S2E-18004-4K	S-4 seal kit (075)
S2E-18004-5K	S-5 seal kit (075)
S2E-18460-5K	S-5 seal kit (100)
S2E-18158-5K	S-5 seal kit (140)

Repair kit part number	Description	Component part no.	Quantity	Item
Included in kits for 075	075 Rotating group kit, common parts	356-65144-0 03E-93145-0 03E-93146-0 03E-93263-0 03E-93129-0 03E-93142-0 03E-93139-0 S2E-17003-0	1 1 1 3 1 1 1 9	19 20 21 22 23 24 25 26
S2E-18032-0K	075 mobile - cw	03E-93171-0	1	9
S2E-18033-0K	075 mobile – ccw	03E-93172-0		
S2E-18483-0K	075 industrial - cw	03E-93169-0		
S2E-18484-0K	075 industrial – ccw	03E-93170-0		
Included in kits for 100	100 Rotating group kit, common parts	356-65146-0 03E-93795-0 03E-93796-0 03E-93845-0 03E-93783-0 03E-93794-0 03E-93793-0 S2E-17912-0	1 1 1 3 1 1 1 9	19 20 21 22 23 24 25 26
S2E-18485-0K	100 mobile - cw	03E-93787-0	1	9
S2E-18486-0K	100 mobile – ccw	03E-93788-0		
S2E-18487-0K	100 industrial – cw	03E-93785-0		
S2E-18488-0K	100 industrial – ccw	03E-93786-0		
Included in kits for 140	140 Rotating group kit, common parts	356-65148-0 03E-93959-0 03E-93244-0 03E-93267-0 03E-93242-0 03E-93241-0 03E-93240-0 S2E-17323-0	1 1 1 3 1 1 1 9	19 20 21 22 23 24 25 26
S2E-18489-0K	140 mobile – cw	03E-93254-0	1	9
S2E-18490-0K	140 mobile – ccw	03E-93255-0		
S2E-18491-0K	140 industrial – cw	03E-93252-0		
S2E-18492-0K	140 industrial – ccw	03E-93253-0		

Pump disassembly for inspection should be limited to the following cases:
a) Malfunction or oil leakage resulting from damage or wear and tear.
b) Trouble-shooting procedures previously listed do not solve the problem.

For rotation change or shaft conversion, disassembly should be done only as far as necessary to complete conversion.

Disassembly and reassembly should be performed in a clean environment.

Caution: Spring assemblies in the pump are normally set under high compression and bodily injury may occur if caution is not taken during disassembly.

It is usually not necessary to replace spring (20) fitted in cylinder barrel. Do not replace the spring unless absolutely necessary.

After disassembly, the internal parts should be coated with a film of clean oil and protected from dirt and moisture.

It is recommended that the length of the protruding portion of the compensator adjusting screws, on the control 38 be measured and noted as this information will prove useful during assembly.

Care must be taken to avoid dropping, damaging or contaminating the machined parts and the control valve.

For complete overhaul, all o-rings and seals should be discarded and replaced.

1. Identify the pump from information on the data tag. Figure 1

Figure 1

2. Drain fluid from housing. Fluid drained from pump should be disposed of properly.

3. Mount pump in fixture to prevent movement while removing main housing bolts

4. Remove bolts holding the compensator assembly on the pump housing. Additional fluid may drain out of the passages when the compensator is removed. Set compensator aside for later disassembly and inspection

5. Remove the bolts attaching the port block to the main housing.

6. Carefully remove the port block. Use caution to avoid dropping the port plate. Note the location of the bias spring - piston assembly and the control piston assembly. The control piston, bias piston and bias spring may remain in pump when port block is removed. Remove and discard the three white Teflon seals on the port block. These seals should be replaced each time the pump is disassembled.

7. Remove the control piston and the bias piston - spring assembly.
NOTE: For rotation change only, do not disassemble further, proceed to step 16.

8. Remove the tapered roller bearing cone and shim from the end of the shaft.

9. Position the pump horizontally and remove the rotating group. Avoid separating the pistons from the barrel if possible. This will assist in identifying damage between an individual piston and bore during component inspection.

10. Remove the drive shaft.
NOTE: For shaft change only, no further disassembly is required. Proceed to assembly procedure step 5.

11. Remove the cam by rotating it 90 degrees and carefully extracting it from the pump housing. Note the large pocket under the cam fits on the pressure control side of the pump housing (same side as the three seals on the housing flange). Figure 2

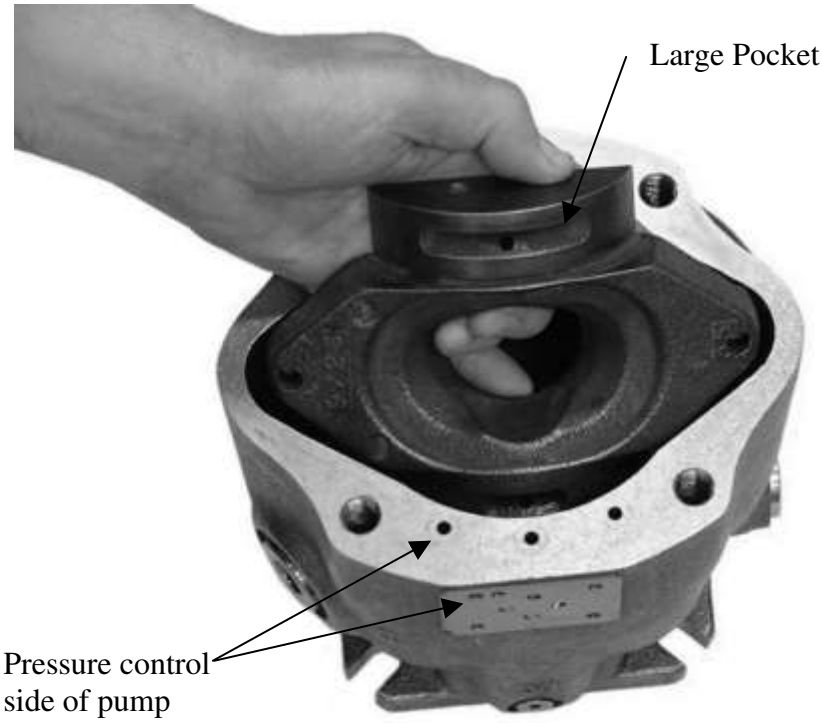


Figure 2

DISASSEMBLY PROCEDURES Continued

12. Remove the front tapered roller bearing cone.

13. If there is excessive wear or damage, remove the tapered roller bearing cup from the bottom of the housing.

14. If completing a seal change or complete overhaul, turn the housing over and remove the snap ring and shaft seal from the housing. Note: do not reuse the shaft seal.

15. If there is excessive wear on the port block bearing cup, cone, or both; remove the tapered roller bearing cup from the port block.

16. If complete overhaul or rotation change, remove control piston and bias piston guides.

COMPENSATOR DISASSEMBLY

NOTES: Access plugs on end of compensator spool bores are hardened plugs. Do not interchange with other plugs in the control. For rotation change, the complete compensator assembly will need to be replaced.

1. Measure and record the extension of the two pressure adjusting screws.

2. Carefully remove the main compensator spring cap. Remove the two springs. Remove the seal piston and spring seat. Remove the o-ring boss access plug on the opposite side of the compensator. Remove the compensator spool. **NOTE:** the compensator spool and inner spring **are not** interchangeable with the load sense compensator spool and spring.

3. Load sense compensator: Carefully remove the load sense compensator spring cap with spring seat/seal piston. Remove the spring. Remove the spring seat. Remove the o-ring boss access plug on the opposite side of the compensator. Remove the load sense compensator spool. **NOTE:** the load sense compensator spool and spring **are not** interchangeable with the main compensator spool and inner spring of the main compensator.

4. Remove all SAE o-ring boss access plugs.

Proceed to inspection section of this manual.

INSPECTION

Carefully clean and dry all parts prior to inspection. Refer to chart 1 for dimensional information regarding allowable tolerances.

1. Examine piston diameters for scratches or gouges. If any piston is severely damaged, note which piston bore it came out of. Extra attention should be given to that bore in step 2. Check end play of piston shoe assembly. Check the bottom surface of the shoes for damage. The shoe surface should be square and flat. Measure the depth of the pocket of the shoe. Shoes may be lapped as a set if the pocket depth is within allowable limits. Confirm pocket depth after lapping to insure it is still within limits.

2. Examine bores in cylinder for scratches Check diameter of bores in 4 different locations, including near the bottom of the barrel where the piston does not travel. If the dimensions vary by more than 0.0102 mm (0.0004 in.) or any dimension exceeds the allowable limit, the barrel needs to be replaced. Examine the barrel face for scratches and gouges. The barrel can be reworked if dimensions are with specifications listed in chart 1.

3. The port plate can be lapped lightly if the face is only lightly scratched, otherwise it should be replaced.

4. Examine the retainer plate in the area of contact with the piston shoes. Any marks beyond light polishing indicate that replacement is necessary. Check the surface of the spherical area of the retainer plate and the spherical guide ball. Inspect the back surface of the spherical guide ball where the load pins make contact. If indentations are present replace the guide ball.

5. Examine cam on top and bottom surface. If scratches or gouges appear to penetrate the surface treatment, the cam must be replaced.

6. The cam bearings cannot be reworked and should be replaced if worn through the Teflon surface.

7. Both the bias piston and the compensator piston should move freely in their respective bores. The pistons and bores should be free of scratches or gouges.

8. The seal area of the drive shaft should be smooth and not have marks due to seal wear. The bearing surfaces should not have any indication of the bearing cone spinning on the shaft. Keyed shafts should be inspected for signs of brinelling and damage to the key area. Splined shafts may have a contact wear pattern but should not show excessive wear on the spline area.

COMPENSATOR INSPECTION

NOTE: The compensator is supplied as an assembly. Individual parts are not available. If there is significant damage to any of the parts, the complete compensator will need to be replaced.

1. Inspect the main compensator spool and the load sense spool for scratches or other damage.

2. Inspect the springs for proper free extension length (see chart).

3. Inspect the spool bores for damage. Apply a light oil film on the appropriate spool and check its fit in the bore. The spool should fit snugly in housing and not have any radial play.

CHART 1
REWORK LIMITS

Item number	Component	075 Part #	100 part #	140 Part #	Tolerances
20	Barrel hold down spring	03E-93145-0 63.7 mm (2.50 in.)	03E-93795-0 72.2 mm (2.84 in.)	03E-93959-0 68.6 mm (2.70 in.)	Free height ± 0.51 mm ± (0.020 in.)
13	Bias spring	03E-93151-0 141.5 mm (5.57 in.)	03E-93801-0 174.6 mm (6.87 in.)	03E-93963-0 212.3 mm (8.36 in.)	Free height: ± 0.51mm ± (0.020 in.)
26	Piston	Maximum end play 0.10 mm (0.004 in.) Minimum shoe flange thickness 5.91mm (0.233 in)	Maximum end play 0.13 mm (0.005 in.) Minimum shoe flange thickness 6.41 mm (0.252 in.)	Maximum end play 0.13 mm (0.005 in.) Minimum shoe flange thickness 6.41 mm (0.252 in.)	Measure OD in 3 places top, middle, and bottom. Measurements should not vary by more than 0.010 mm (0.0004 in.) End play between piston and shoe should not exceed values shown. Total material removal allowed is 0.076 mm (0.003 inch)
23	Barrel	03E-93129-0	03E-93783-0	03E-93242-0	Measure piston bore I.D.'s in 3 places: top, middle, and bottom. Measurements should not vary by more than 0.0102 mm (0.0004 inch) Maximum material to be removed when lapping is 0.0051mm (0.0002 inch)
C-3 L-3	Main compensator spring - outer	03E-93158-0	03E-93158-0	03E-93158-0	Free height: 39±0.7mm (1.535± 0.028 in.)
C-4 L-4	Main compensator spring – inner	03E-93159-0	03E-93159-0	03E-93159-0	Free height: 25.9±0.5 mm (1.020±0.020 in.)
L-17	Load sense spring	03E-93825-0	03E-93825-0	03E-93825-0	Free height: 14±0.4 mm (0.551±0.016 in.)

For major overhauls, all plugs should be removed, and the seals replaced. Prior to assembly, all parts should be thoroughly cleaned. Assembly should be performed in a clean work environment.

Do not use bearing grease during installation. Grease does not dissolve in hydraulic oil and may plug orifices or filters in the system. Clean petroleum jelly is preferred to lubricate o-rings and seals, and to adhere parts for assembly.

NOTE: For fluids other than petroleum based hydraulic oil, insure that petroleum jelly is compatible with the fluid. If not compatible, another product should be used instead.

Inspect all bearing surfaces and seal areas to insure that they are free from nicks, dings, scratches, and rust.

1. Using installation tool T2, press the front bearing cup into the bottom of the housing. Make sure the cup is seated firmly against the bottom of the housing.

2. Turn housing over. Using installation tool T1, press the shaft seal in the seal bore. Install the snap ring into the groove in the seal housing bore.

3. Using installation tool T5, press the rear bearing cup into the port block. Insure that the cup is seated firmly against the bottom of the housing.

SELECTING THE TAPERED BEARING PRELOAD SHIM

1. Install the front bearing cone and shaft into the housing.

2. Install the rear bearing cone on the shaft.

3. Install the port block onto the housing using housing bolts and tighten to 27 ± 1.3 Nm (20 ± 1 ft. lb.).

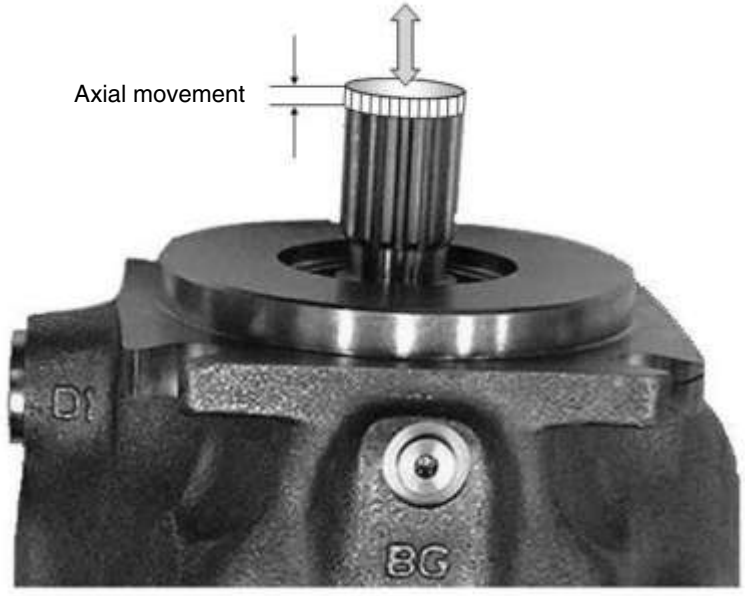
4. Position the pump so shaft end is up.

5. Lay a parallel bar on the pump pilot.

6. Press down on the shaft and rotate it 3-5 times then measure the height of the shaft end to the parallel bar using dial calipers or a dial indicator.

7. Grasp the shaft and pull it up and rotate it 3-5 times. Measure the height of the shaft end to the parallel bar. **Note:** If the shaft slips or falls, the steps must be repeated to get an accurate measurement.

8. Subtract the larger from the smaller to get the axial movement of the shaft.



ASSEMBLY PROCEDURE CONTINUED

9. Repeat the procedure three times. Once recorded, take the average of the three measurements.

10. With the average, use chart 2 to determine the correct shim to install in the pump.

11. If barrel hold down spring was removed during disassembly process, install three pins to slots in barrel spline. Petroleum jelly can be used to hold pins in place while installing remaining parts. (Figure 4) Place barrel on fixture with pin side down. Install backup washer and hold down spring. Compress spring in press and install snap ring. **Caution:** Make sure snap ring is properly seated in groove prior to removing barrel from press.

Figure 4

CHART 2					
Measured differential		Shim			
minimum	maximum	thickness	075 part #	100 part #	140 part #
3.30mm (0.130 in)	3.36 mm (0.132 in)	3.28 mm (0.1291 in)	03E-93180	03E-94148	03E-93260
3.37 mm (0.133 in)	3.44 mm (0.135 in)	3.36 mm (0.1323 in)	03E-93566	03E-94149	03E-93970
3.45 mm (0.136 in)	3.51 mm (0.138 in)	3.44 mm (0.1354 in)	03E-93567	03E-94150	03E-93971
3.52 mm (0.139 in)	3.62 mm (0.142 in)	3.52 mm (0.1386 in)	03E-93568	03E-94151	03E-93972
3.63 mm (0.143 in)	3.70 mm (0.145 in)	3.60 mm (0.1417 in)	03E-93569	03E-94152	03E-93973
3.71 mm (0.146 in)	3.77 mm (0.148 in)	3.68 mm (0.1449 in)	03E-93570	03E-94153	03E-93974
3.78 mm (0.149 in)	3.85 mm (0.151 in)	3.76 mm (0.1480 in)	03E-93571	03E-94154	03E-93975
3.86 mm (0.152 in)	3.92 mm (0.154 in)	3.84 mm (0.1512 in)	03E-93572	03E-94155	03E-93976
3.93 mm (0.155 in)	4.00 mm (0.157 in)	3.92 mm (0.1539 in)	03E-93573	03E-94156	03E-93977
4.01 mm (0.158 in)	4.10 mm (0.161 in)	4.00 mm (0.1575 in)	03E-93574	03E-94157	03E-93978
4.11 mm (0.162 in)	4.18 mm (0.164 in)	4.08 mm (0.1606 in)	03E-93575	03E-94158	03E-93979
4.19 mm (0.165 in)	4.25 mm (0.167 in)	4.16 mm (0.1638 in)	03E-93576	03E-93864	03E-97980

13. Apply a light film of oil into the piston bores. Lightly lubricate the spherical surface of the guide ball. Install the nine pistons into the bores in the hold down plate. Install the spherical guide ball into the hold down plate. While holding the guide ball against the hold down plate, install the pistons into the barrel.

14. Install the locating pin on the port block face.

15. Apply Loctite Primer Grade T to guide threads and allow to dry. Install unlubricated o-rings on the control guide and bias guide. Apply Loctite 271to guide threads. For left hand rotation the bias guide is installed nearest to the dowel pin (figure 5A.) For right hand rotation the control guide is installed nearest to the dowel pin (figure 5B.) Torque the control and bias guides as specified in Chart 3.

Chart 3	
Pump	Control and bias guide torque
075	142 ± 6.5 N-m (105 ± 5 ft-lbs).
100	184 ± 8 N-m 136 ± 6 ft-lbs
140	203 ± 8 N-m 150 ± 6 ft-lbs

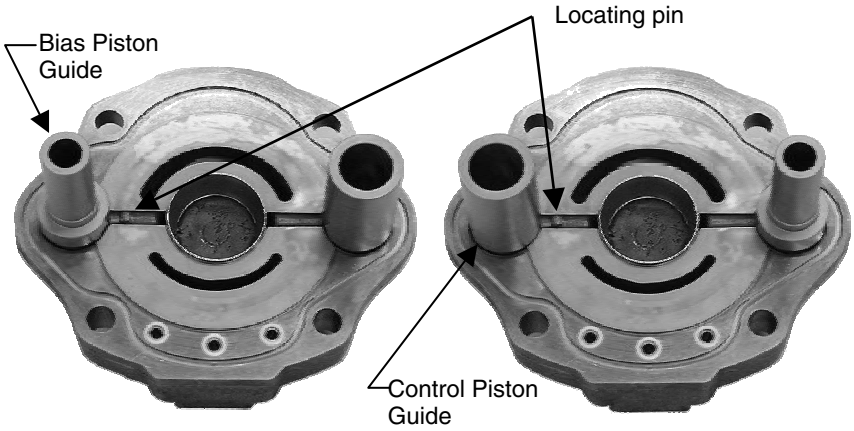


Figure 5A
Port Block with Left Hand configuration

Figure 5B
Port Block with Right Hand configuration

16. Apply light oil film to control piston and install it in the control guide bore. **NOTE**: The 140 had a lubrication hole in the piston. Confirm that the hole is facing the port block. The control guide has nonsymmetrical lubrication grooves. The end with the closest grooves must be installed towards the port block.

17. Apply light oil film to the bias piston. Install the bias spring and the bias piston in the bias piston guide bore.

18. Apply a light layer of petroleum jelly to the back surface of the port plate. Install the port plate on the port block, lining up the slot on the port plate with the locating pin.

19. Install the large o-ring in the groove on the pump housing. Install the three Teflon o-rings in the pressure communication ports on the pump housing.

20. Install the cam bearings in the cradle area of the housing. The chamfer on the back of the bearing must face the outer wall of the housing. Use Loctite Primer Grade “T” or other suitable primer on screws and mating threads in housing. Apply Loctite #242 (use sparingly) to screw threads and install orifice screws to hold bearings in place. Torque screws to 3.4 ± 0.25 Nm (33 ± 3 in-lb).

21. Place thin film of clean oil on cam bearing surfaces. Install cam in housing. The cam must be tilted to permit entry into the housing. (Figure 2) **NOTE:** The large pocket on the bottom surface of the cam must be on the same side as the three pressure communication holes on the main housing. Pump rotation does not affect the assembly of the cam.

22. Install the drive shaft into the pump housing. Position pump horizontally. Install the rotating group over the pump shaft. Rotate the barrel to insure that it is seated against the cam. Insure that the pump shaft is seated properly in the front bearing.

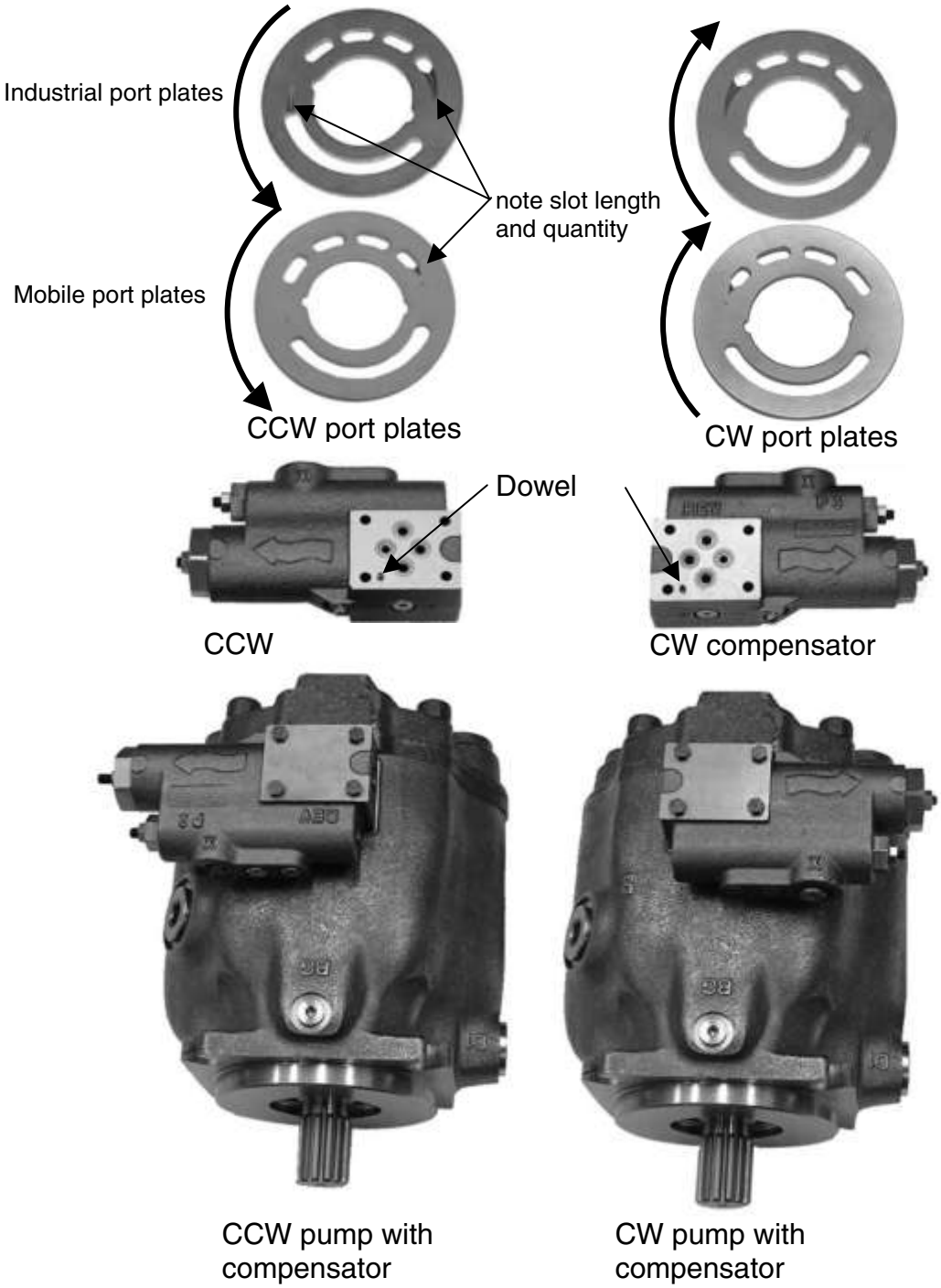
Chart 4	
Pump	Housing bolt torque
075	135.6 ± 5 Nm (100 ± 4 ft-lbs)
100	229 ± 7 Nm (170 ± 5 ft-lbs).
140	278 ± 7 Nm (205 ± 5 ft-lbs).

23. Install bearing spacer as determined from the chart (see step 11.) Install the rear bearing on the drive shaft.

24 Confirm that compensator rotation, port plate rotation, control and bias piston location indicate same direction of rotation.

25 Carefully install the assembled port block on the pump housing. Press the port block to compress the bias spring and install housing bolts. Tighten the bolts in a cross pattern to insure the port block does not get cocked on the housing. When port block is seated on the housing, torque bolts in a cross pattern as specified in chart 4.

26. Install o-ring seals and assembled compensator on side of pump housing. Pump rotation is indicated by arrow on compensator housing. Torque bolts to 5 ± 0.25 Nm (45 ± 3 in-lb).



COMPENSATOR ASSEMBLY

NOTE: instructions are for load sense compensator. for other compensator types disregard steps related to extra spool assembly.

Carefully clean and dry all parts prior to assembly. Use caution to insure that spools and other parts are not damaged during cleaning process. Use clean oil to lubricate seals and spools for easier assembly.

1. Remove and discard all o-rings. Install new o-rings on SAE boss plugs and seal pistons.

2. Apply a light film of oil to the o-ring on the main compensator seal piston. Install the main compensator seal piston in the main compensator spring cap.

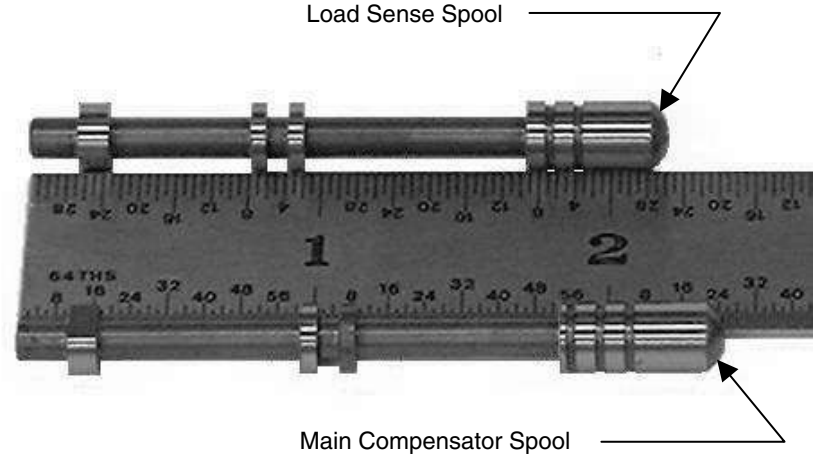
3. Place inner compensator spring on seal piston. Install the outer compensator spring over the inner spring on the seal piston. Position the spring seat over the springs. Insert this assembly into the main compensator housing bore. Torque the main compensator spring cap to 169-183 Nm (125-135 ft.-lb.).

4. Apply a light film of oil on the main compensator spool (the longer of the 2 spools). Insert the spool into the spool bore opposite the main compensator spring assembly in the compensator body. The rounded end of the spool should be installed first so it will contact the spring seat. Install a new o-ring on the hardened SAE boss fitting and place it into the port. Torque fitting to 4 ± 0.5 Nm (37 ± 5 in-lb).

5. Apply a light film of oil to the o-ring on the load sense seal piston. Install the load sense compensator seal piston seat in the load sense spring cap. Install the load sense spring over the seal piston. Position the spring seat over the spring. Install this assembly into the load sense bore of the compensator housing. Torque the load sense spring cap to 35-38 Nm (26-28 ft. lb.).

6. Apply a light film of oil to the load sense compensator spool (the shorter of the 2 spools). Insert the spool into the spool bore opposite the load sense spring assembly. The spool should be installed with the rounded end in first so it will contact the load sense spring seat. Install a new o-ring on the hardened SAE boss fitting and place it into the port. Torque fitting to 4 ± 0.5 Nm (37 ± 5 in-lb).

7. Install o-rings on remaining SAE boss fittings and install into housing. Torque SAE-2 fittings to 4 ± 0.5 Nm (37 ± 5 in-lb).



PUMP TEST PROCEDURE

Test criteria based on hydraulic oil ISO 32 per Parker HF-0 specifications.
Oil temperature: 50°C ± 2°C (120°F ±10°F). **NOTE:** insure that the hydraulic system does not overheat during this test procedure.
Operating speed: 0 - 2300 rpm ± 30 rpm.
Case pressure: Maximum 14.5 psi (1 bar)

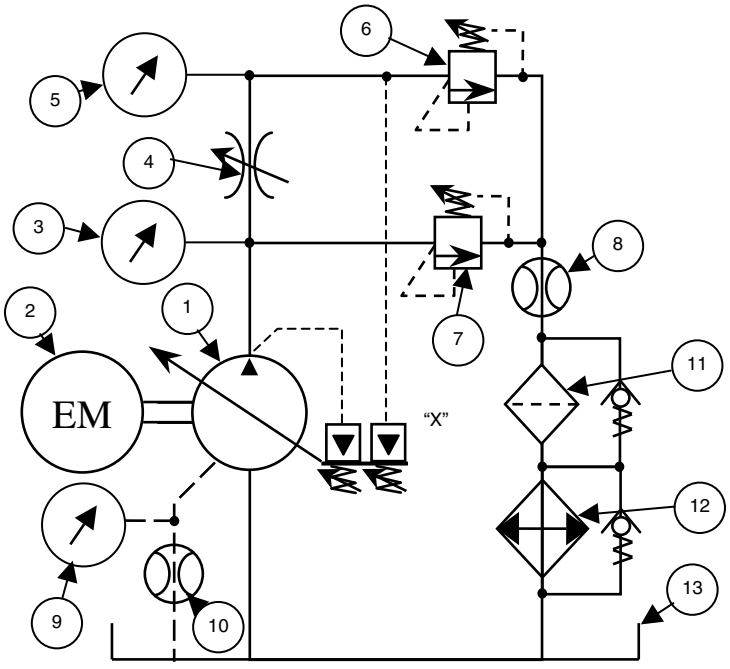
1. Mount pump on test fixture. Insure that shaft alignment is within specified tolerances.
2. Fill case with clean oil. Connect upper drain port to reservoir with no restrictions. Insure other drain ports are properly plugged.
3. Connect inlet and pressure lines. Insure that lines are filled with oil. Refer to circuit on page 30. For units with “L” compensators, connect a suitable pilot line from port “X” to the pump discharge pressure line, down stream of the non-compensating flow valve.
4. Confirm direction of rotation for pump and drive are correct.
5. Reduce the main compensator setting to minimum. For units with “L” compensators, advance the load sense compensator adjustment until it bottoms out, and lock into position.
6. Set maximum volume stop (if included) to full displacement.
7. If possible, gradually increase pump speed to 1800 ± 30 rpm with no load.
8. Screw in compensator adjusting screw until it bottoms out, with no pressure on system load-relief valve.
9. Break-in pump at times and pressures listed below. Adjust the load-relief valve to the pressure listed for the times indicated. After break-in, reduce compensator setting to 280 bar (4060 psi), and adjust system load relief to cause pump to compensate three times to verify that pump compensates on and off stroke properly.

Time	30 seconds	30 seconds	30 seconds
Pressure	62-69 bar 900-1000 psi	200-207 bar 2900-3000	269-276 bar 3900-4000 psi

TEST CIRCUIT

1. Test pump
2. Test stand prime mover
3. Pump pressure gauge
4. Non-compensating flow control
5. Load pressure gauge
6. Load relief valve
7. Safety bypass relief valve
8. Main flow meter
9. Case drain pressure gauge
10. Case drain flow meter
11. Filter assembly with bypass
12. Cooler assembly with bypass
13. Reservoir

NOTE: Items 4 and 5 are required for load sense pump test.



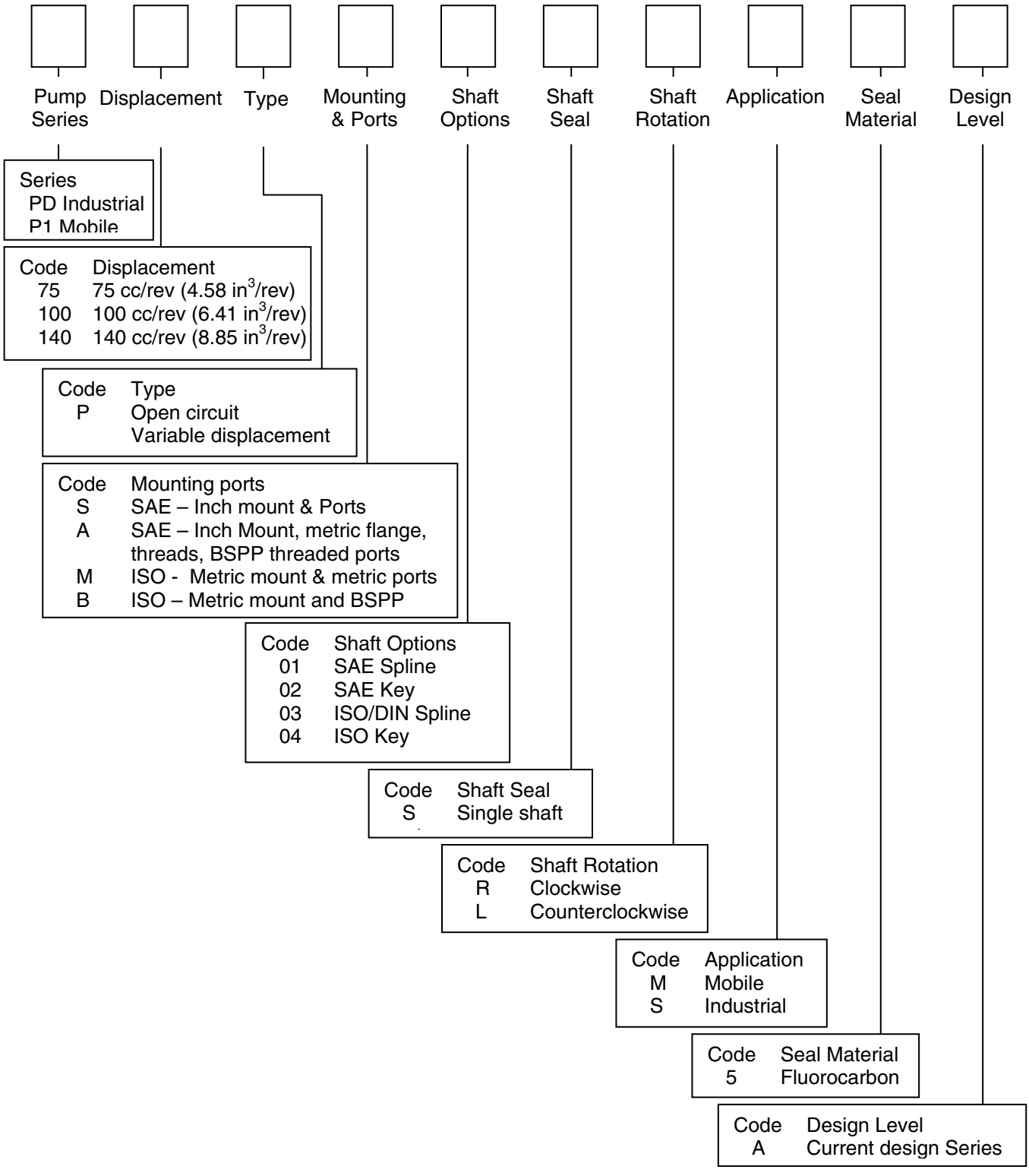
Circuit 1

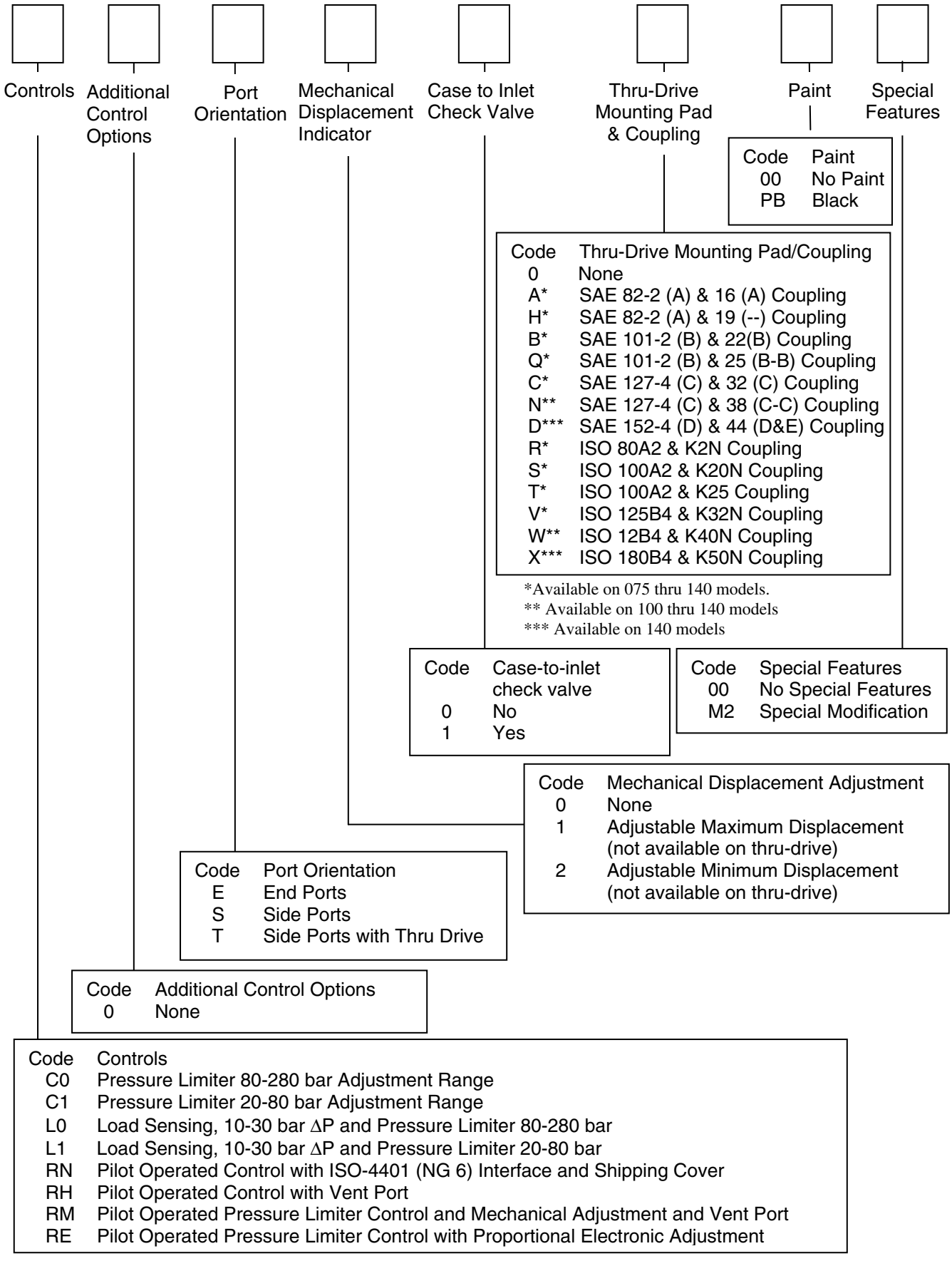
PERFORMANCE SPECIFICATIONS PUMP WITH PRESSURE COMPENSATOR				
STEP REFERENCE	CONDITION	075	100	140
1	Rated Speed	1800 RPM	1800 RPM	1800 RPM
4	Output flow at minimum pressure	132-138 lpm (34.9-36.5 gpm)	174-182 lpm (46.0-48.1gpm)	243-257 lpm (62.4-67.9 gpm)
5	Output flow at rated pressure of 280 ± 2 bar (4060 ± 30 psi)	126 lpm (33.3 gpm) minimum	165 lpm (43.6 gpm) minimum	233 lpm (61.6 gpm) minimum
6	Case leakage at rated pressure of 280 ± 2 bar (4060 ± 30 psi)	7.5 lpm (2.0 gpm) maximum	9 lpm (2.3 gpm) maximum	14 lpm (3.7 gpm) maximum
9	Case leakage when compensated at 280 ± 2 bar (4060 ±30 psi)	11.5 lpm (3.0 gpm) maximum	11 lpm (2.9 gpm) maximum	16.2 lpm (4.3 gpm) maximum
10	Input torque when compensated at 280 ± 2 bar (4060 ± 30 psi)	49.6 Nm (36.6 ft-lb / 439 in-lb) maximum	67 Nm (49.4 ft-lb / 593 in-lb) maximum	96.6 Nm (78.3 ft-lb / 940 in-lb) maximum
11	Output flow when pressure reduced to 273 ± 2 bar (3960 ± 30 psi) with compensator setting of 280 bar	126 lpm (33.3 gpm) minimum	165 lpm (43.6 gpm) minimum	233 lpm (61.6 gpm) minimum

TEST PROCEDURE PUMP WITH PRESSURE COMPENSATOR			
STEP	CONDITION	REQUIRED VALUE	MEASURED VALUE
1	Set the pump speed to 1800 RPM	1800 rpm	
2	Increase pump pressure compensator adjustment to maximum.	n/a	
3	Record input oil temperature	43-54 ° C (110 – 130 °F)	
4	Set output load pressure to minimum. Record output flow	see performance chart	
5	Set output load pressure to 280 ± 2 bar (4060 ± 30 psi) Record output flow	see performance chart	
6	Record case leakage	see performance chart	
7	Set output pressure to 290 ± 2 bar (4200 ± 30 psi)	n/a	
8	Set pressure compensator to 280 ± 2 bar (4060 ± 30 psi)	n/a	
9	Record case leakage	see performance chart	
10	Record input torque	see performance chart	
11	Reduce output pressure to 273 ± 2 bar (3960 ± 30 psi) Record output flow	see performance chart	
12	Verify no external leaks	No leakage permitted	

PERFORMANCE SPECIFICATIONS PUMP WITH LOAD SENSE COMPENSATOR				
STEP REFERENCE	CONDITION	075	100	140
1	Rated Speed	1800 RPM	1800 RPM	1800 RPM
4	Load sense output flow setting at 50 ± 2 bar (725 ± 30 psi)	77-79 lpm (20.3-20.9 gpm)	103-105 lpm (27.2 -27.2 gpm)	145-147 lpm (38.3 - 38.8 gpm)
5	Allowable flow variation from 50 to 260 ± 2 bar (725 to 3770 ± 30 psi)	73-83 lpm (19-22 gpm)	99-109 lpm (26.6-28.8 gpm)	136-156 lpm (35.9-41.2 gpm)

TEST PROCEDURE PUMP WITH LOAD SENSE COMPENSATOR			
STEP	CONDITION	REQUIRED VALUE	MEASURED VALUE
1	Set the pump speed to 1800 RPM	1800 rpm	
2	Record input oil temperature	43-54 ° C (110 – 130 °F)	
3A	Set output load pressure to 50 ±2 bar (725 ± 30 psi)	n/a	n/a
3B	Close throttle valve, and adjust differential setting until pressure at pump outlet is 20 ± 2 bar (290 ± 30 psi) higher than the load pressure gage.	n/a	n/a
4	Adjust throttle valve to required flow rate. Adjust output load pressure valve if necessary to maintain 50 ± 2 bar (725 ± 30 psi)	see performance chart	
5	Increase the output tpressure to 260 ± 2 bar (3770 ± 30 psi). Verify that th e flow remains within specified limits.	see performance chart	
6	Lock the load sense adjustment screw. Confirm differential pressure at 20 ± 2 bar (290 ± 30 psi)	n/a	n/a
7	Verify no external leaks	No leaks permitted	


Pump Series
Displacement
Type
Mounting & Ports
Shaft Options
Shaft Seal
Shaft Rotation
Application
Seal Material
Design Level
Series
PD Industrial
P1 Mobile
Code Displacement
75 75 cc/rev (4.58 in3/rev)
100 100 cc/rev (6.41 in3/rev)
140 140 cc/rev (8.85 in3/rev)
Code Type
P Open circuit
Variable displacement
Code Mounting ports
S SAE – Inch mount & Ports
A SAE – Inch Mount, metric flange, threads, BSPP threaded ports
M ISO - Metric mount & metric ports
B ISO – Metric mount and BSPP
Code Shaft Options
01 SAE Spline
02 SAE Key
03 ISO/DIN Spline
04 ISO Key
Code Shaft Seal
S Single shaft
Code Shaft Rotation
R Clockwise
L Counterclockwise
Code Application
M Mobile
S Industrial
Code Seal Material
5 Fluorocarbon
Code Design Level
A Current design Series


Controls
Additional Control Options
Port Orientation
Mechanical Displacement Indicator
Case to Inlet Check Valve
Thru-Drive Mounting Pad & Coupling
Paint
Special Features
Code Paint
00 No Paint
PB Black
Code Thru-Drive Mounting Pad/Coupling
0 None
A* SAE 82-2 (A) & 16 (A) Coupling
H* SAE 82-2 (A) & 19 (--) Coupling
B* SAE 101-2 (B) & 22(B) Coupling
Q* SAE 101-2 (B) & 25 (B-B) Coupling
C* SAE 127-4 (C) & 32 (C) Coupling
N** SAE 127-4 (C) & 38 (C-C) Coupling
D*** SAE 152-4 (D) & 44 (D&E) Coupling
R* ISO 80A2 & K2N Coupling
S* ISO 100A2 & K20N Coupling
T* ISO 100A2 & K25 Coupling
V* ISO 125B4 & K32N Coupling
W** ISO 12B4 & K40N Coupling
X*** ISO 180B4 & K50N Coupling
*Available on 075 thru 140 models.
** Available on 100 thru 140 models
*** Available on 140 models
Code Case-to-inlet check valve
0 No
1 Yes
Code Special Features
00 No Special Features
M2 Special Modification
Code Mechanical Displacement Adjustment
0 None
1 Adjustable Maximum Displacement (not available on thru-drive)
2 Adjustable Minimum Displacement (not available on thru-drive)
Code Port Orientation
E End Ports
S Side Ports
T Side Ports with Thru Drive
Code Additional Control Options
0 None
Code Controls
C0 Pressure Limiter 80-280 bar Adjustment Range
C1 Pressure Limiter 20-80 bar Adjustment Range
L0 Load Sensing, 10-30 bar ΔP and Pressure Limiter 80-280 bar
L1 Load Sensing, 10-30 bar ΔP and Pressure Limiter 20-80 bar
RN Pilot Operated Control with ISO-4401 (NG 6) Interface and Shipping Cover
RH Pilot Operated Control with Vent Port
RM Pilot Operated Pressure Limiter Control and Mechanical Adjustment and Vent Port
RE Pilot Operated Pressure Limiter Control with Proportional Electronic Adjustment

DEFINITION & UNIT

displacement	in^3/rev x 16.387 = cm^3/rev	cm^3/rev x 0.06102 = in^3/rev
flow	gpm x 3.78 = L/min	L/min x 0.2642 = gpm
power	hp x 0.7457 = kW	kW x 1.341 = hp
torque	lb-ft x 1.3567 = Nm	Nm x 0.7376 = lb-ft
pressure	lbs/in^2 (psi) x 0.06895 = bar lbs/in^2 (psi) x 6.895 = kPa	bar x 14.50 = lbs/in^2 (psi) kPa x 0.1450 = lbs/in^2 (psi)
weight	lb x 0.4536 = kg	kg x 2.205 = lbs
force	lb x 4.448 = N	N x 0.2248 = lbs
volume	in^3 x 16.387 = cm^3	cm^3 x 0.06102 = in^3
area	in^2 x 6.452 = cm^2	cm^2 x 0.1550 = in^2
length	in x 25.4= mm	mm x 0.03937 = in
temperature	degree F-32 = °C 1.8	1.8 x °C+32 = ° F
viscosity	*c*St x 1.0 = mm^2/sec SSU = cSt x 4.25 + 14	mm^2/sec x 1.0 = *c*St 20 cSt = 99 SSU

FLUID POWER FORMULAS

Pump input torque	*lbs. in.*	$\frac{\text{pressure(psi) x displacement } (in^3/rev)}{2\pi \text{ x mech. eff.}}$
Pump input power	*hp*	$\frac{\text{rpm x } (in^3/rev) \text{ x (psi)}}{395934 \text{ x overall eff.}}$
Pump output flow	*U.S. gpm*	$\frac{\text{rpm x } (in^3/rev) \text{ x volumetric eff.}}{231}$
Fluid motor speed	*rpm*	$\frac{231 \text{ x flow rate(U.S. gpm) x volumetric eff.}}{\text{displacement } (in^3/rev)}$
Fluid motor torque	*lbs. in.*	$\frac{\text{pressure(psi) x displacement } (in^3/rev) \text{ x mech. eff.}}{2\pi}$
Fluid motor power	*hp*	$\frac{\text{rpm x } (in^3/rev) \text{ x (psi) x overall eff.}}{395934}$
(metric)		
Pump input torque	*Nm*	$\frac{\text{pressure(bar) x displacement } (cm^3/rev)}{20\pi \text{ x mech. eff.}}$
Pump input power	*kW*	$\frac{\text{rpm x } (cm^3/rev) \text{ x (bar)}}{600000 \text{ x overall eff.}}$
Pump output flow	*Lpm*	$\frac{\text{rpm x } (cm^3/rev) \text{ x volumetric eff.}}{1000}$
Fluid motor speed	*rpm(min^{-1}) (tr/mn)*	$\frac{1000 \text{ x flow rate (Lpm) x volumetric eff.}}{\text{displacement } (cm^3/rev)}$
Fluid motor torque	*Nm*	$\frac{\text{pressure(bar) x displacement } (cm^3/rev) \text{ x mech. eff.}}{20\pi}$
Fluid motor power	*kW*	$\frac{\text{rpm x } (cm^3/rev) \text{ x (bar) x overall eff.}}{600000}$

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