

SERVICE MANUAL

A S D 8
HYDRAULIC CYLINDER SERVICE
FOR STEERING AND TRIM CYLINDERS

ASSEMBLIES COVERED BY THIS MANUAL :

TRIM
08301E

STEERING
08302D-1



1.0 Hydraulic System Servicing

1.1 General

A. Propeller steering and propeller trim are achieved through the use of hydraulic cylinders located outside the vessel as shown in Fig. 1. The cylinders are mounted on the transom with articulating ball joints. The trim cylinder is connected directly to the Drive at the top of the thrust tube. The steering cylinder is connected to the Drive either through the trim cylinder yoke when the steering cylinders are mounted outboard or through the trim yoke pin when the steering cylinders are mounted inboard.

B. Arneson Marine, Inc. recommends that the inboard hydraulic components and outboard flex hoses be serviced on a replacement basis only. Rebuilding of pumps, valves, hoses, etc., is not recommended.

C. Hydraulic system cleanliness must be maintained at all times. When assembling threaded fittings with sealant, avoid using excess material that could contaminate system. Teflon tape is not recommended.

D. Protect sealing surfaces of cylinders during all service operations.

E. Section 1.13 lists the special tools required for servicing the hydraulic system.

F. See Figs. 2 and 3 for a schematic of the hydraulic trim and steering system and associated parts list.

1.2 Cylinder Removal from Drive and Transom

A. Support the thrust tube and prop shaft assembly before removing hydraulic cylinders to prevent unit from rotating downward and damaging the thrust ball and socket.

B. Disconnect hose swivel fittings at the hydraulic cylinders (See Fig. 8). Plug or cap transom and cylinder fittings to prevent leakage and contamination of system. Plug hose ends to prevent contamination of hoses.

C. Remove steering cylinder clevis bolt, nut, and washers (See Fig. 4). While supporting steering cylinder, remove the four (4) transom bracket mounting bolts, nuts, and washers (See Fig. 6). Remove steering cylinder.

D. For twin drive installations using a mechanical tie bar, remove tie bar clevis bolts, nuts, and washers. Slide tie bar away from trim yoke (See Fig. 5).

E. Remove trim cylinder yoke pin, washers, and cotter pin. Remove the four (4) trim cylinder transom bracket bolts, nuts, and washers (See Fig. 6). Remove trim cylinder.

1.3 Trim Cylinder Disassembly

See the attached Trim Cylinder Assembly Drawing (Fig. 2) and the associated parts list for identification of the various trim cylinder components.

A. Remove all hydraulic fittings from trim cylinder tube prior to cylinder disassembly. Fittings must be removed to prevent damage to the piston as it is removed from the cylinder.

B. Drain oil from both ports by manually cycling cylinder.

C. Hold trim cylinder tube (Item 11) using a strap wrench or suitable padded split blocks and loosen rod guide (Item 6) using a wrench on the machined flats. Thread rod guide out of tube and slide rod/piston assembly from the tube.

D. Clamp the rod (Item 5) between rubber pads in a vise, remove piston set screw (Item 30) and remove piston (Item 7) from rod using a strap wrench. Use care to avoid scratching rod.

E. Slide rod guide (Item 6) off the rod. Remove guide towards piston end of rod.

F. Inspect for evidence of leakage past center plug (Item 8) or end plug (Item 13). If leakage is suspected or there is contamination trapped between center plug and cylinder wall, disassemble the remainder of trim tube assembly as follows. If no leakage or trapped contamination is noted, proceed to Item E under Section 1.4 (Trim Cylinder Rebuild).

1. Remove yoke/tube set screws (Item 29). Clamp yoke (Item 12) in vise and loosen trim tube using a strap wrench.

2. Slide center/end plug assembly out yoke end of tube.

1.4 Trim Cylinder Rebuild

- A. Remove and discard all O-rings, seals and rod wipers. Pre-clean all parts to be reused with clean solvent and a soft bristle brush. Air dry with compressed air.
- B. Inspect cylinder rod (Item 5), rod guide (Item 6), piston (Item 7), and cylinder bore (Item 11) for nicks, scratches, burrs, or uneven wear. Shallow nicks or scratches can be polished out from piston, rod guide and tube using fine sandpaper (400 grit). Replace ball/rod assembly if rod is scratched.
- C. Final clean all parts using a clean solvent rinse and air dry with compressed air.
- D. Lightly lube ball (Item 4), transom bracket (Item 1), and ball lock nut (Item 3) with #1 or #2 grease. Install ball/rod assembly through transom bracket. Install ball lock nut (Item 3) and tighten firmly against ball. Torque to 50 ft-lbs (6.91 kgm). Install transom bracket set screw (Item 28) using a suitable thread locking compound (Loctite 271 "Red" is recommended).
- E. Lightly lube the rod guide inner O-rings (Item 21), outer O-ring (Item 22), and wiper seal (Item 20). Install wiper with lip outward. Slide rod guide onto rod, taking care not to nick seals and wiper. Lubricate the rod guide I.D. and cylinder rod O.D. to allow a smooth fit.
- F. Lightly lube piston interior O-rings (Item 23) with ATF and install inside piston (Item 7). Thread piston onto rod and tighten with strap wrench against rod shoulder. Install piston locking set screw (Item 30) using a suitable thread locking compound (Loctite 242 "Blue" is recommended).
- G. Lube piston external O-rings (Item 24) with ATF and install on piston.
- H. If yoke and center plug are disassembled in Section 1.3-F, reassemble yoke/tube assembly as follows:
 - 1. Lightly lube O-rings (Item 25, 26) with ATF. Install O-ring on center plug (Item 8) and O-ring on end plug (Item 13).

Slide center/end plug assembly into cylinder tube from the yoke end.

2. Thread cylinder assembly into yoke and tighten using a strap wrench. Install yoke set screw (Item 29) using Loctite 271 thread locking compound.

I. Slide piston and rod assembly into cylinder tube and thread rod guide into cylinder. Hold cylinder tube using a strap wrench or suitable split blocks when tightening rod guide.

J. Cap or plug cylinder ports to maintain cleanliness.

1.5 Steering Cylinder Disassembly

See the attached Steering Cylinder Assembly Drawing (Fig. 3) and the associated parts list for identification of the various steering cylinder components.

A. Drain oil from both ports by manually cycling cylinder over container.

B. Hold cylinder tube using a strap wrench or suitable split blocks. Loosen rod guide (Item 9) using a suitable wrench. Thread rod guide out and slide entire rod/piston assembly from tube.

C. Clamp rod (Item 7) between soft pads or split blocks and remove piston retainer nut (Item 17). Slide piston (Item 6) and rod guide (Item 9) off of rod.

D. Inspect for evidence of leakage past end cap (Item 4) and port ring (Item 5). If leakage is suspected or if there is excessive contamination in the end cap/port ring area, disassemble as follows:

Hold cylinder tube as in Section 1.5-B and remove end cap/port ring using a suitable wrench on the flats machined into end cap. Turn end cap counterclockwise and cap will thread off.

E. After cap is removed, inspect and replace seals/O-rings as required. Inspect part for damages to threads, etc.

1.6 Steering Cylinder Rebuild

A. Remove and discard all O-rings, seals and rod wiper. Pre-clean all parts to be reused with clean solvent and a soft bristle brush. Air dry with compressed air.

B. Inspect cylinder rod (Item 7), rod guide (Item 9), piston (Item 12), and cylinder bore (Item 8) for nicks, scratches, burrs, or uneven wear. Shallow nicks or scratches can be polished out from piston, rod guide, and tube using fine sandpaper (400 grit). Replace rod/clevis assembly if damaged or worn.

C. Inspect transom bracket ball joint for looseness. Loosen set screw and tighten ball lock nut (Item 2) as required to remove axial play. Torque to 50 ft-lbs (6.91 kgm). Ball joint should still pivot with only moderate resistance. Reinstall set screw (Item 22) using Loctite 271 thread locking compound.

D. Final clean all parts using a clean solvent rinse and compress air dry.

E. Lightly lube O-rings (Items 14, 26) and wiper (Item 14) with ATF and install on rod guide, taking care not to nick or cut O-rings and wiper.

F. Lightly lube O-rings (Item 24) with ATF and install on piston. Carefully slide piston onto rod and install flexloc nut (Item 17). Carefully clamp rod assembly and torque nut to 75 ft-lbs (10.37 kgm).

G. If cylinder is disassembled as in Section 1.5, reassemble tube/end cap assembly as follows:

Lightly lube O-rings (Items 23, 24) with ATF and install on end cap. Slide port ring (Item 5) over end cap and thread end cap into cylinder tube. Orient port ring in-line with ball slot and tighten end plug using a wrench. Cylinder tube should be locked in suitable split blocks (Ref. Step B, Section 1.5).

H. Slide port ring (Item 5) onto rod guide (Item 9) and carefully slide piston/rod assembly into cylinder tube. Using a strap wrench or suitable split blocks to hold tube, tighten rod guide. NOTE: Outboard port ring should be aligned with inboard port ring prior to tightening rod guide. Make sure rod guide is tight and port ring does not spin.

I. Cap or plug cylinder ports to maintain cleanliness.

1.7 Cylinder Installation

- A. Prior to installation, prime each cylinder with ATF. Using gravity as an aid, bleed as much air from cylinder as possible. Reinstall plugs or caps.
- B. Install trim cylinder bracket using 1/2-inch diameter stainless steel fasteners. Torque nuts to 50 ft-lbs (6.91 kgm). Attach trim yoke to thrust tube, taking care to use the proper shims between yoke and thrust tube. Trim yoke should have a small amount of side play when installed, not to exceed .020" (.51 mm).
- C. Install steering cylinder bracket using 1/2-inch diameter stainless steel fasteners. Torque nuts to 50 ft-lbs (6.91 kgm). Attach steering cylinder clevises and tie bar clevises (if applicable) per Section 1.5. Torque nuts to 50 ft-lbs (6.91 kgm).
- D. Prime outboard flex hoses with ATF and connect to transom and cylinder fittings. Avoid trapping air in the system. Verify that hose installation will allow adequate flexing of hoses when operating. Minimum hose bend radius is 3" for -4 hose and 4" for -6 hose.
- E. Bleed hydraulic system as described in Section 1.9.

1.8 Trim Pump Fluid Level

Check fluid level in the trim pump hydraulic reservoir at the beginning of each day of operation. Required fluid is Automatic Transmission Fluid (ATF). Fluid level should be checked with Drive(s) in the fully "down" position, fluid cold, and steering in the neutral position.

1.9 Bleeding Trim Hydraulic System

Should air enter the hydraulic system, the system must be bled. Air in the system may be evidenced by:

- a) Soft springy trim cylinder action.
- b) Cyclic up and down motion of the trim cylinder and associated unit vibration during operation.

NOTE: Prior to bleeding the system, the cause of air entering the system (leaking hose or fittings, low reservoir level, etc.) must be determined and the problem corrected.

A. In order to facilitate bleeding of the system each component and section of hose must be primed with automatic transmission fluid (ATF) prior to installation. Note: A small hand or garden pump provides a useful means for priming long sections of tubing.

B. The trim system is an unbalanced system. This means that more fluid is required from the pump at the fully extended position than at the fully retracted position. The cylinder rod reduces the volume requirement at the retract position. When the system is installed, it should be bled as follows:

1. Fill and maintain reservoir fluid level throughout the bleeding procedure to prevent further air from entering system.
2. Extend the trim cylinder to maximum position (down).
3. Fill reservoir on pump to minimum fluid level marked on tank. Do not fill above the minimum mark as the area over minimum is required when the cylinder is retracted, since the volume requirements differ between the two positions of contraction and extension. The additional space will be required as "fill space" since the system is an unbalanced system.
4. Fully compress the cylinder next. The level should rise in the reservoir as the fluid is displaced. Fluid level should not exceed the maximum level on tank.
5. Cycle cylinders in both directions to bleed air out of system. It is important that the cylinders reach maximum positions to purge air.

NOTE: Do not run trim pump for long periods of time as heat generation by the pump can cause damage. Normally, cycling time should not exceed 2 minutes actual running time.

Additional bleeding may be performed by loosening the uppermost hydraulic fitting at the thru hull location to purge trapped air. Perform this step only when hose is pressurized, or additional air will invade system.

1.10 Steering System Bleeding Procedures (Fig. 9)

The power steering kit is considered to be a self-bleeding system. Normal bleeding procedures are accomplished simply by running the engine and cycling the cylinders using the steering helm. Steering from port to starboard, lock-to-lock positions and back again for a specified period of time normally purges the system. However, certain precautions must be observed to assure proper bleeding.

Follow these steps for normal steering system bleeding.

A. Always maintain adequate fluid in reservoir. Periodic checking of level must be performed during the bleeding process.

NOTE: Do not run engine(s) for extended periods of time without an engine cooling source attached and power steering cooling source available.

B. Assure all fittings, hose connections, etc. are sufficiently tight to hold hydraulic pressure.

C. Run engine(s) at approximately 1000 RPM and cycle cylinders with a smooth even rhythm back and forth to remove air. Always check and maintain fluid level in reservoir.

D. Under normal applications, routine cycling of cylinders is all that is required to purge system of air.

To check for trapped air, a simple check can be performed as outlined in the following procedure:

- 1) Shut engines off and remove key.
- 2) Position steer cylinders in the center position and at the neutral running angle.
- 3) Let system "settle" for approximately 15 minutes.
- 4) At this point, push or pull side-to-side on the aft portion of Drive unit, near the propeller shaft, to see if cylinders are tight. There should be no spongy or springing action in the steering system. If some movement is noted, additional bleeding will be required by repeating the process above.

Special or non-standard packages may require different bleeding procedures. Special instructions are available as supplemental technical bulletins and available by contacting AMI.

1.11 Hydraulic Trim Pump (Fig. 10)

The hydraulic trim pump is a 12 volt DC electrically driven, self-contained system. The hydraulic fluid is held in a plastic or metal reservoir which is fastened to the bottom of pump body. The capacity of the plastic and metal tank are as follows:

- A. Plastic Reservoir - 28 cubic inch (15.5 oz.) capacity
- B. Metal Reservoir - 23 cubic inch (10.0 oz.) capacity

The hydraulic trim pump is designed to be a trouble free unit with very little maintenance required. Routine checks for the following areas must be performed at certain intervals as specified.

Ref. Fig. 10 for pump details.

A. Fluid level - Maintain levels using Dextron II Automatic Transmission Fluid (ATF). Check levels daily before operation.

B. Electrical connections - Check for good connections of all terminals and absence of corrosion build-up in critical areas.

C. Wiring - Maintain wiring condition.

D. Pump mounting location - Trim pump should be located away from heat sources and excessive moisture areas. Failure to locate pump in a suitable area voids the warranty.

1.12 Trouble Shooting Guide - Hydraulic Trim Pump

<u>Problem</u>	<u>Potential Solutions</u>
1. Pump will not activate.	Faulty wiring/check Switch bad/check, replace Fuse blown/replace Wiring corroded/clean Improper ground/correct Solenoids blown/check, replace
2. Pump activates - cylinder does not move	Air in system/bleed Fluid low/add Dirt, debris in hose/clean Dirt, debris in pump/clean, flush P/U screens clogged/remove res. and clean
3. Pump activates Cylinder operates in short jerky movements	Air in system/bleed Fluid level low/add *Pressure setting incorrect/adjust
4. Pump runs for short time	Pump run too long, temp build-up over thermal relief/let pump cool try again

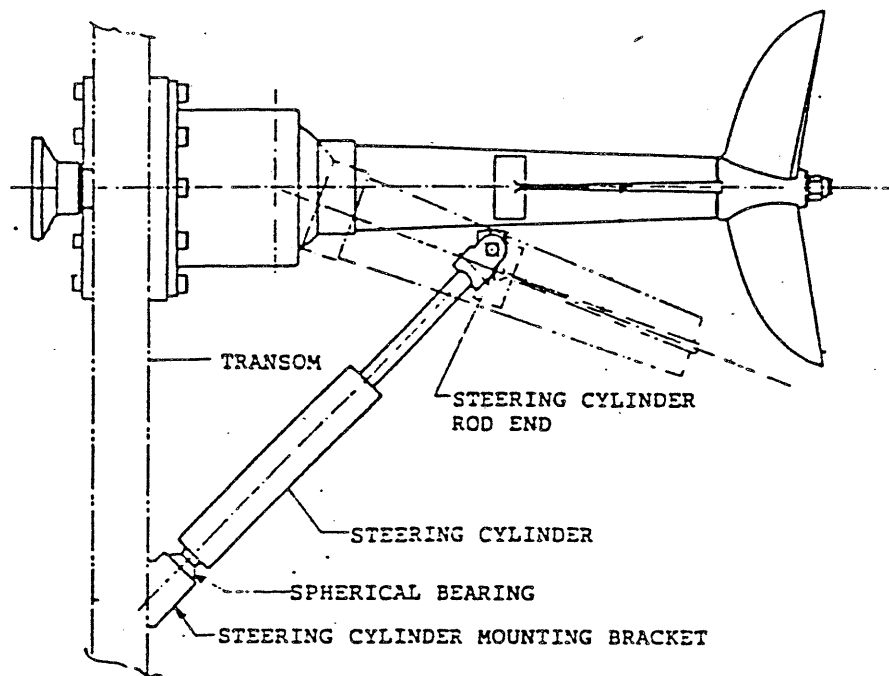
*Pump pressure settings are preset at AMI factory. Consult AMI for procedures and recommendations prior to adjusting or attempting to adjust pump pressures.

1.13 Special Tooling/Handling Requirements

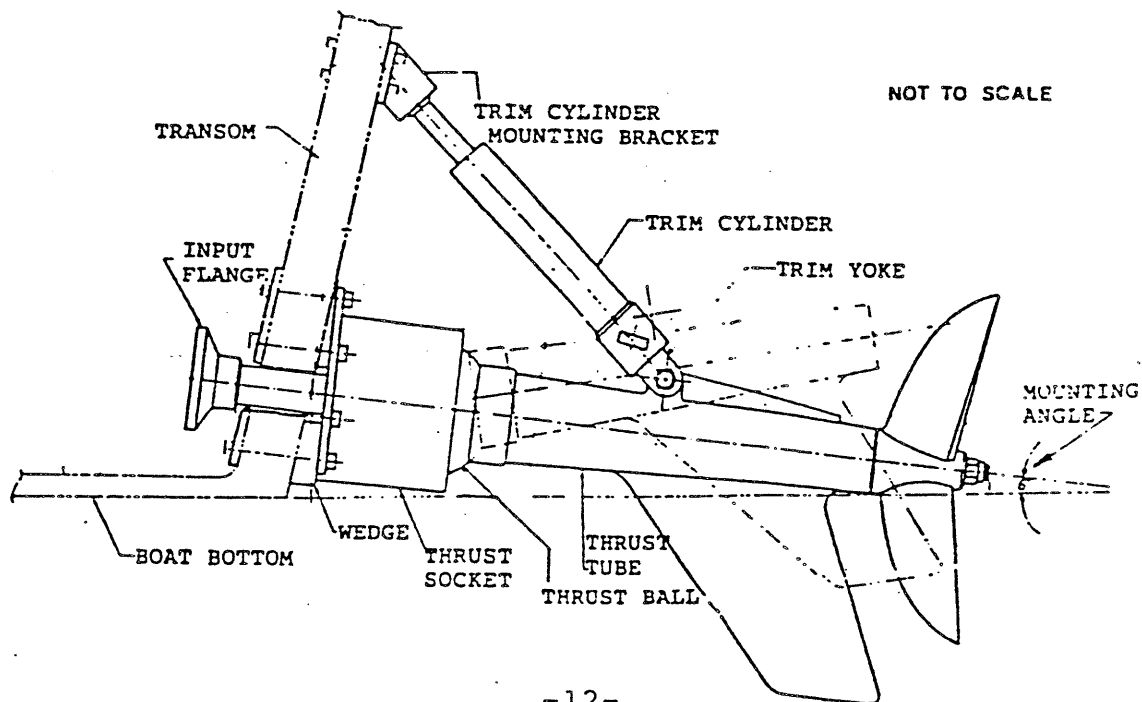
1. Strap Wrench - with 12" min. strap - fabric or nylon type
2. Bench mounted vise - jaw opening capacity of 5"
3. 2 strips re-enforced rubber pads - min. 1/4" thick - to line vise jaws
4. Loctite thread locking compound -
 - A. 271 "Red" - to be used on all external set screws exposed to outside environment
 - B. 242 "Blue" - used on all internal set screws not exposed to outside environment
5. Clean pressurized air supply - to maintain cleanliness of components

(hydsys/manual11)

FIG.1



TOP VIEW



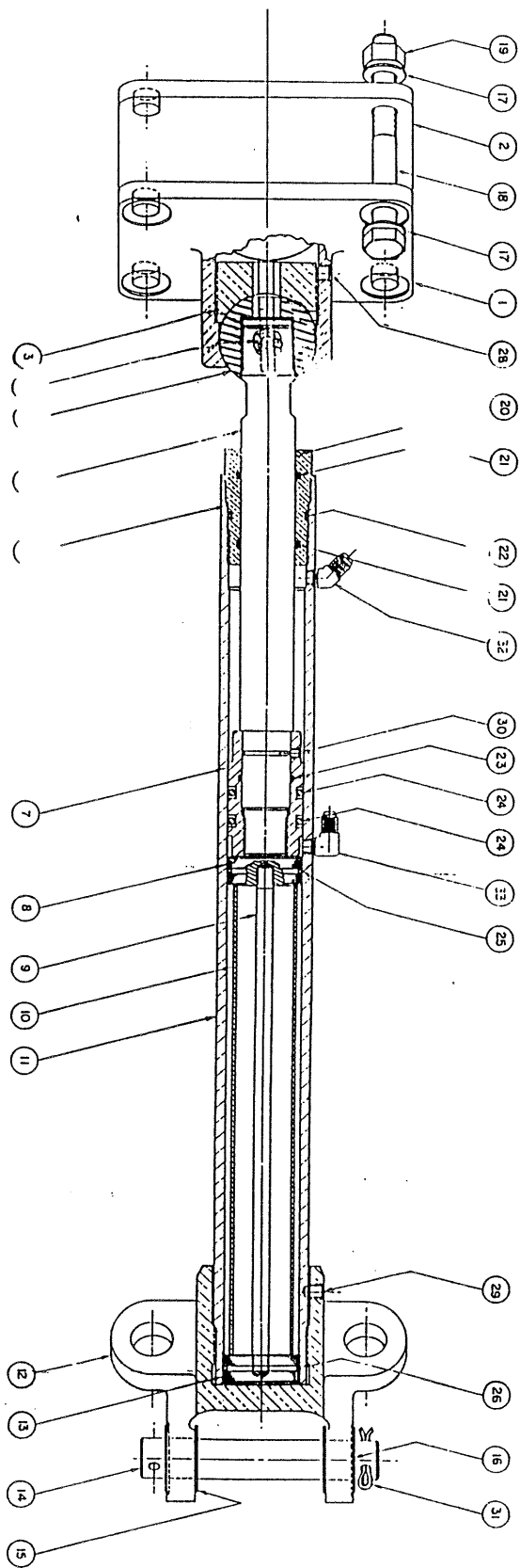
SIDE VIEW

ARNESON SURFACE DRIVE PART'S LIST

06-May-88

ASSEMBLY # 08301E REV.C
MODEL # ASD 8-1
DESCRIPTION TRIM CYLINDER ASSEMBLY

PART #	REF #	QTY	DESCRIPTION
08365D	01	1	TRANSOM BRACKET
22033	02	1	BACKING PLATE
21119	03	1	TRANSOM BALL RETAINER
08362C	04	1	TRANSOM SOCKET BALL
28008	05	1	ROD
22019	06	1	ROD GUIDE
29009	07	1	PISTON
38010-2	08	1	PLUG
08363B-1	09	1	SPACER ROD
21010-3	10	1	SPACER TUBE
08096C-3	11	1	CYLINDER TUBE
11505-2	12	1	YOKE
38010-1	13	1	PLUG
38005	14	1	YOKE PIN
22035 .040	15	3	WASHER, YOKE (INNER)
22035 .050	15	1	WASHER, YOKE (INNER)
22035 .060	15	1	WASHER, YOKE (INNER)
22035 .070	15	1	WASHER, YOKE (INNER)
F1600000C	16	2	AN WASHER
F0800000C	17	8	AN WASHER
C08CREFOC	18	4	MOUNTING BOLT
J08C0000B	19	4	NYLOCK NUT
00S04B-16	20	1	WIPER
00S01B-44	21	2	O-RING
00S01B-46	22	1	O-RING
00S01B-29	23	1	O-RING
00S01B-6	24	2	O-RING
00S01B-30	25	1	O-RING
00S01B-23	26	1	O-RING
22034	27	1	BALL PIVOT SCREW
B06C0060C	28	1	SET SCREW
B06C0080C	29	1	SET SCREW
B04C0040C	30	1	SET SCREW
V0300400C	31	2	COTTER PIN
00FAQ202324B	32	1	FITTING
00FAQ202424B	33	1	FITTING

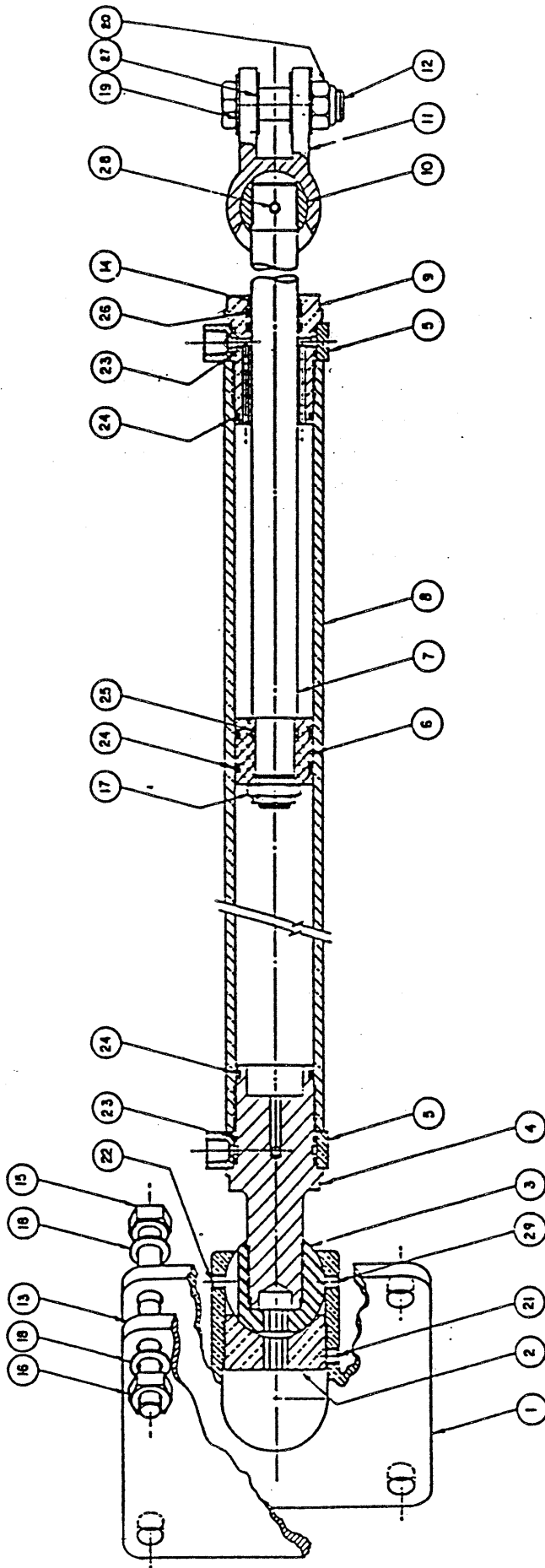


6-MAY-1988

FIG 2

ASD 7-3, ASD 8/10-1 STANDARD/HTB TRIM CYLINDER
 ASSEMBLY NUMMERS: 07303E, 08301E, 10301E-1





ARNESON SURFACE DRIVE ASSEMBLY

HYDRAULIC CYLINDER, STEERING STARTING SERIAL NUMBER: REFER TO PARTS PRICE LIST

ASD-1, ASD-1UB-1 ASSEMBLY DASH NUMBER: 7

ASSEMBLY NUMBER:

U8302D-3 Rev.C, 10302D Rev.C



08302D-1 STEERING CYLINDER ASSEMBLY (REV.D)

PART NO.	QTY.	REF.	DESCRIPTION	MATERIAL	VENDOR PART NO.
08366D	1	1	TRANSOM BRACKET	CDA 865	
21119	1	2	TRANSOM BALL RETAINER	BRASS	
08362C	1	3	BALL, TRANSOM SOCKET	316SS	
28004	1	4	TUBE CAP	BRASS	
28010	2	5	PORT RING	BRASS	
08356B****	1	6	PISTON	6061-T6 ALUM.	
08357B****	1	7	ROD, PISTON	17-4 PH H1150	
08095B-5****	1	8	CYLINDER TUBE	C33000 BRASS	
28003	1	9	ROD GUIDE	BRASS	
22031	1	10	PIVOT, CLEVIS	316SS	
41501	1	11	CLEVIS	CDA 865	
C12C0560C	1	12	HEX HEAD BOLT	316SS	
22033	1	13	BACKING PLATE	6061-T6 ALUM.	
00S04B-2	1	14	WIPER	POLYURETHANE 90 DM.	940-9
C08CREFOC	4	15	MOUNTING BOLT	316SS	
J08C0000B	4	16	NYLOCK NUT	BRASS	
I12F000CA	1	17	FLEXNUT, CAD PLATED	C-38 CARBON STEEL	
F0800000C	8	18	WASHER, AN	316SS	
F1200000C	2	19	WASHER, AN 3/4"ID*.060	316SS	
J12C0000C****	1	20	NYLOCK NUT	BRASS	
06C0050C	1	21	SET SCREW	316SS	
22034	1	22	SOCKET HEAD CAP SCREW	316SS	
00S01B-24	4	23	O-RING, BUNA 70	BUNA 70 DUROMETER	2-031
00S01B-45	4	24	O-RING, BUNA 70	BUNA 70 DUROMETER	2-222
00S01B-27	1	25	O-RING, BUNA 70	BUNA 70 DUROMETER	2-118
00S04B-9	2	26	T-SEAL	BUNA 70 DM W/ NYLON	TR-014
F120000TC	6	27	WASHER, CLEVIS (INNER) (.032)	316SS	
B05C0080C****	1	28	SET SCREW	316SS	
A05C0040C	1	29	SOCKET HEAD CAP SCREW	316SS	
00FAQ202346B	1	30	FITTING, 45 DEGREE EL	BRASS	
00FAQ202446B	1	31	FITTING, 90 DEGREE EL	BRASS	

PART # 8: LISTED AS 08095B-3

PART # 20: LISTED AS J12C0000B

PART # 28: LISTED AS B05C0100C

NEW PART NUMBERS ANNOTATED WITH **** (VERIFY W/ MATERIALS)

STEERING CYLINDER INSTALLATION

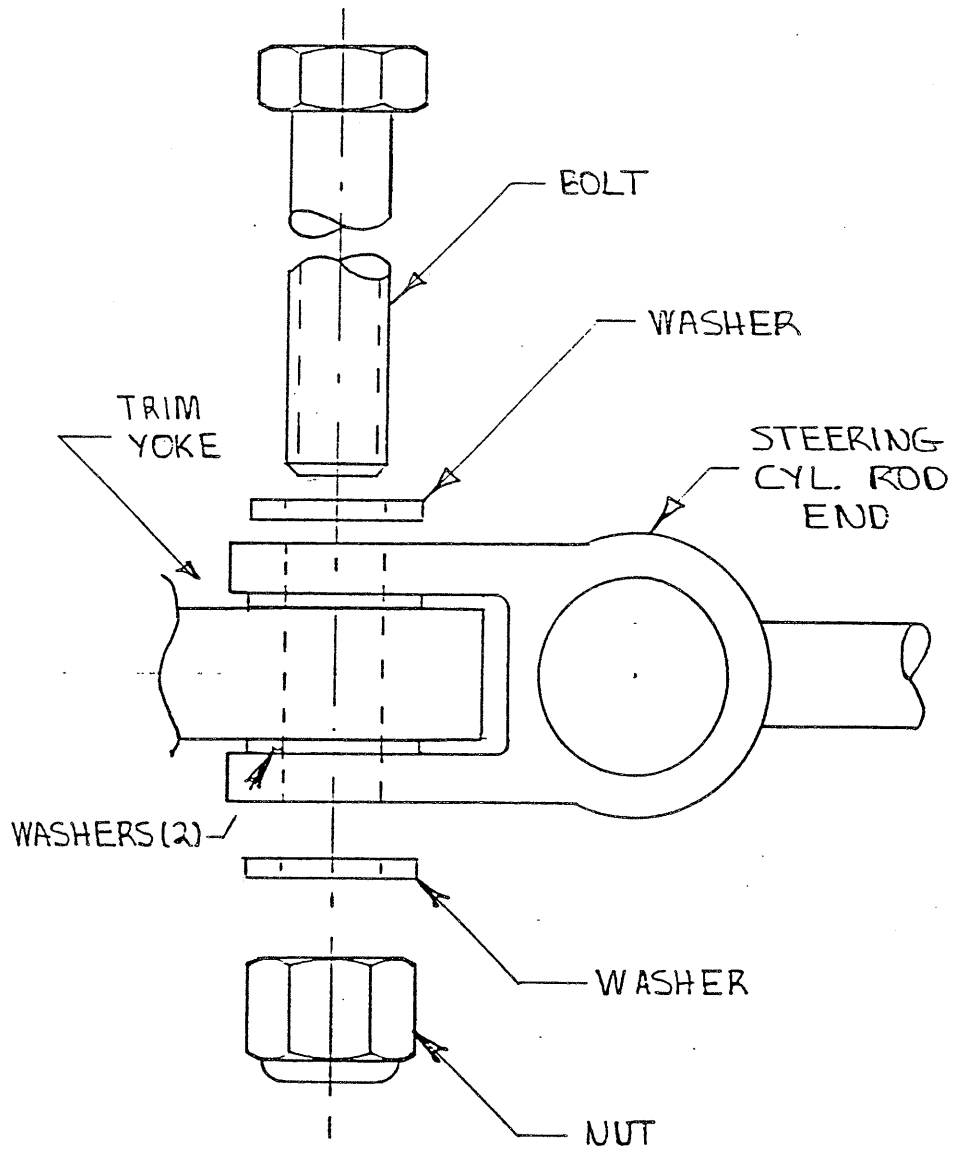
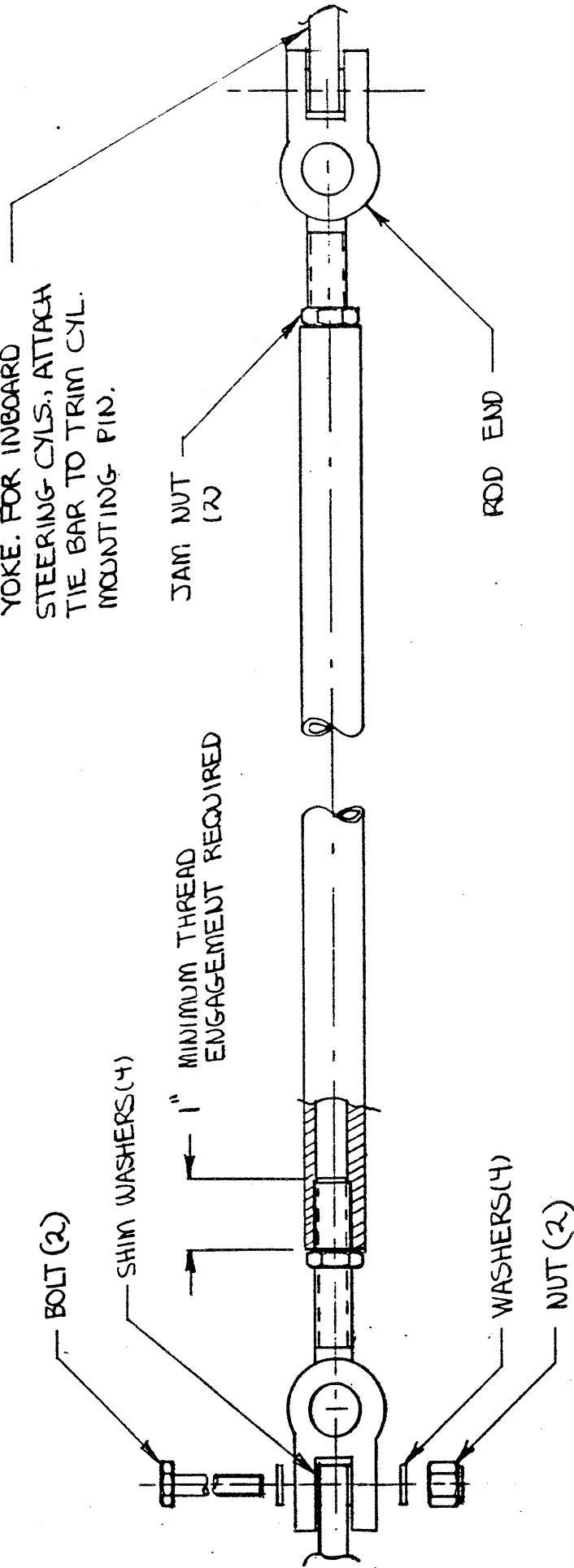


FIG 4

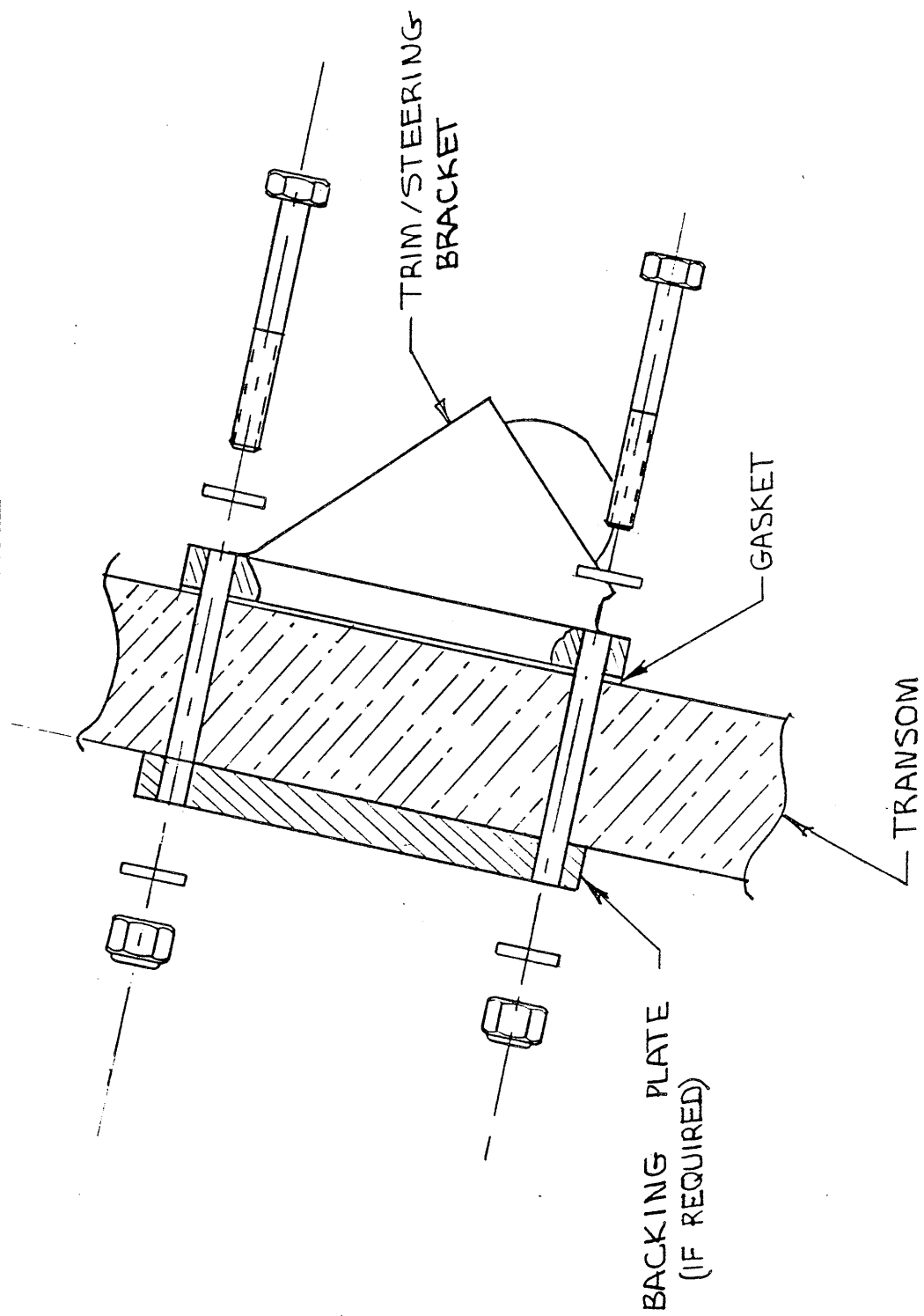
TIE BAR INSTALLATION

NOTE: FOR OUTBOARD STEERING CYLS., ATTACH TIE BAR TO TRIM CYL. YOKE. FOR INBOARD STEERING CYLS., ATTACH TIE BAR TO TRIM CYL. MOUNTING PIN.



NOTE: DO NOT OVERTIGHTEN NUT. ROD END CLEVIS SHOULD HAVE SLIGHT MOVEMENT AFTER INSTALLATION.

TRIM/STEERING BRACKET MOUNTING DIAGRAM



TRANSOM FITTING LOCATION
(ALL DIMENSIONS APPROXIMATE)

— DRILL THRU TRANSOM WITH A $1\frac{1}{16}$ IN.
DRILL IN 4 PLACES AS SHOWN

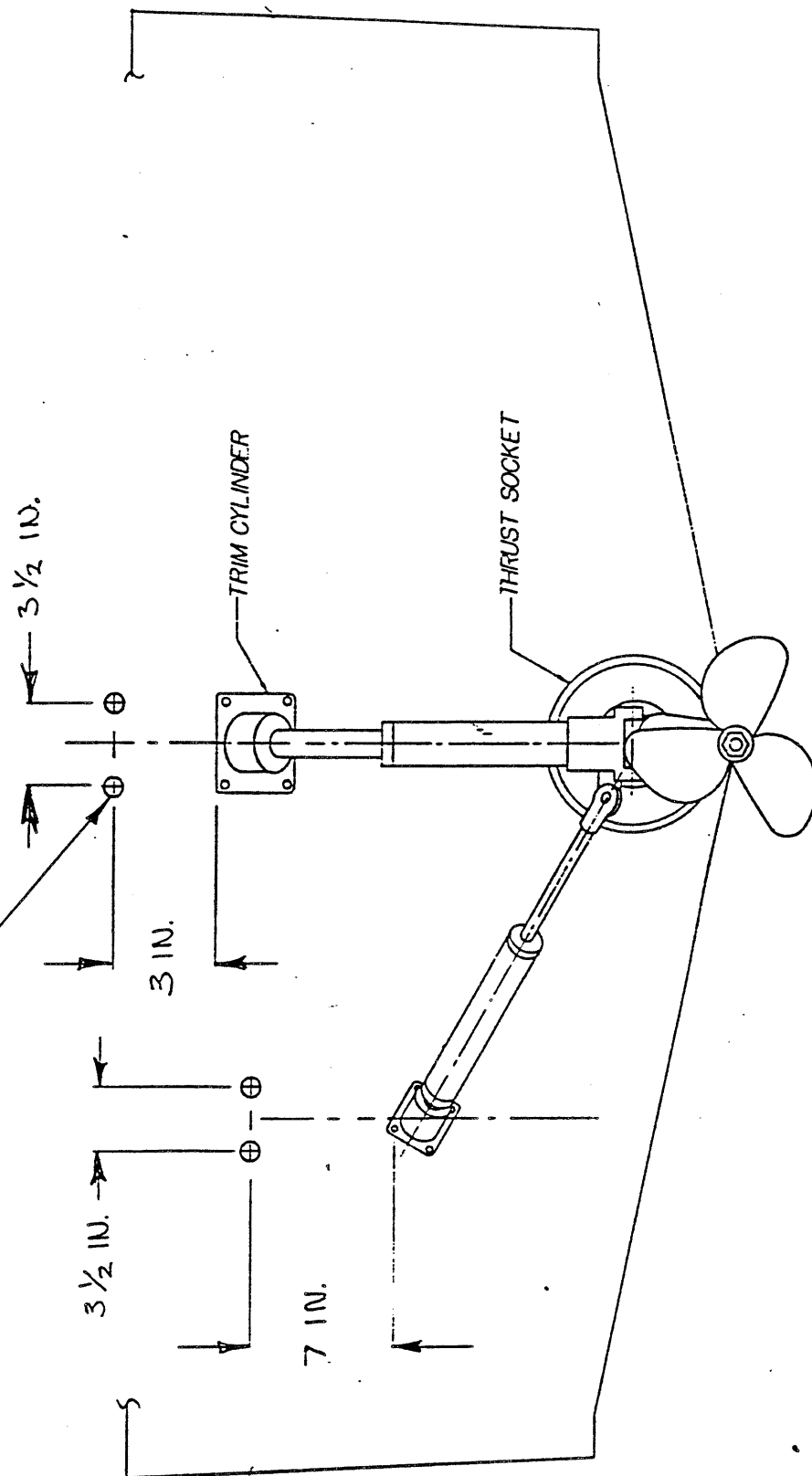
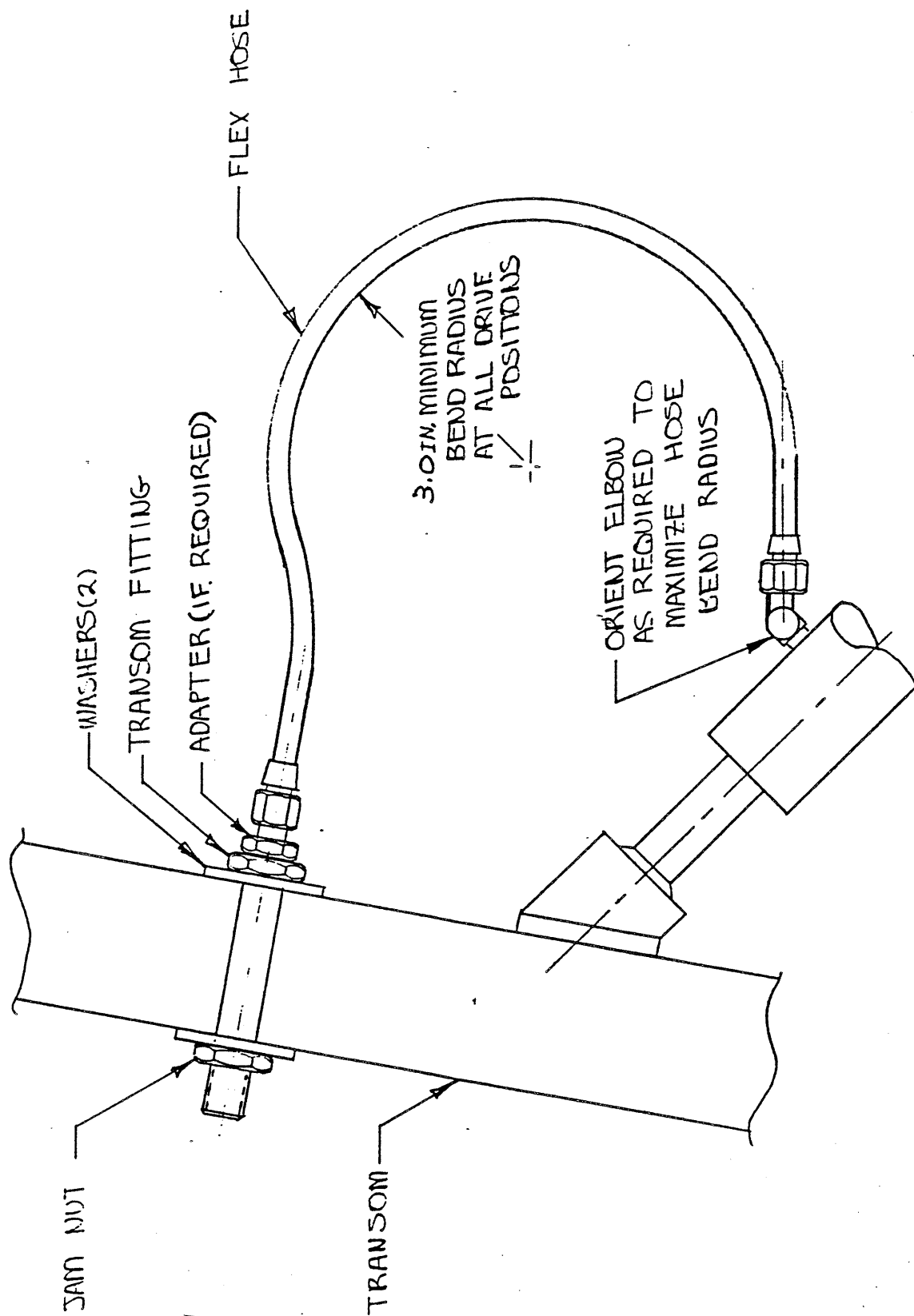


FIG 7

TYPICAL HOSE INSTALLATION



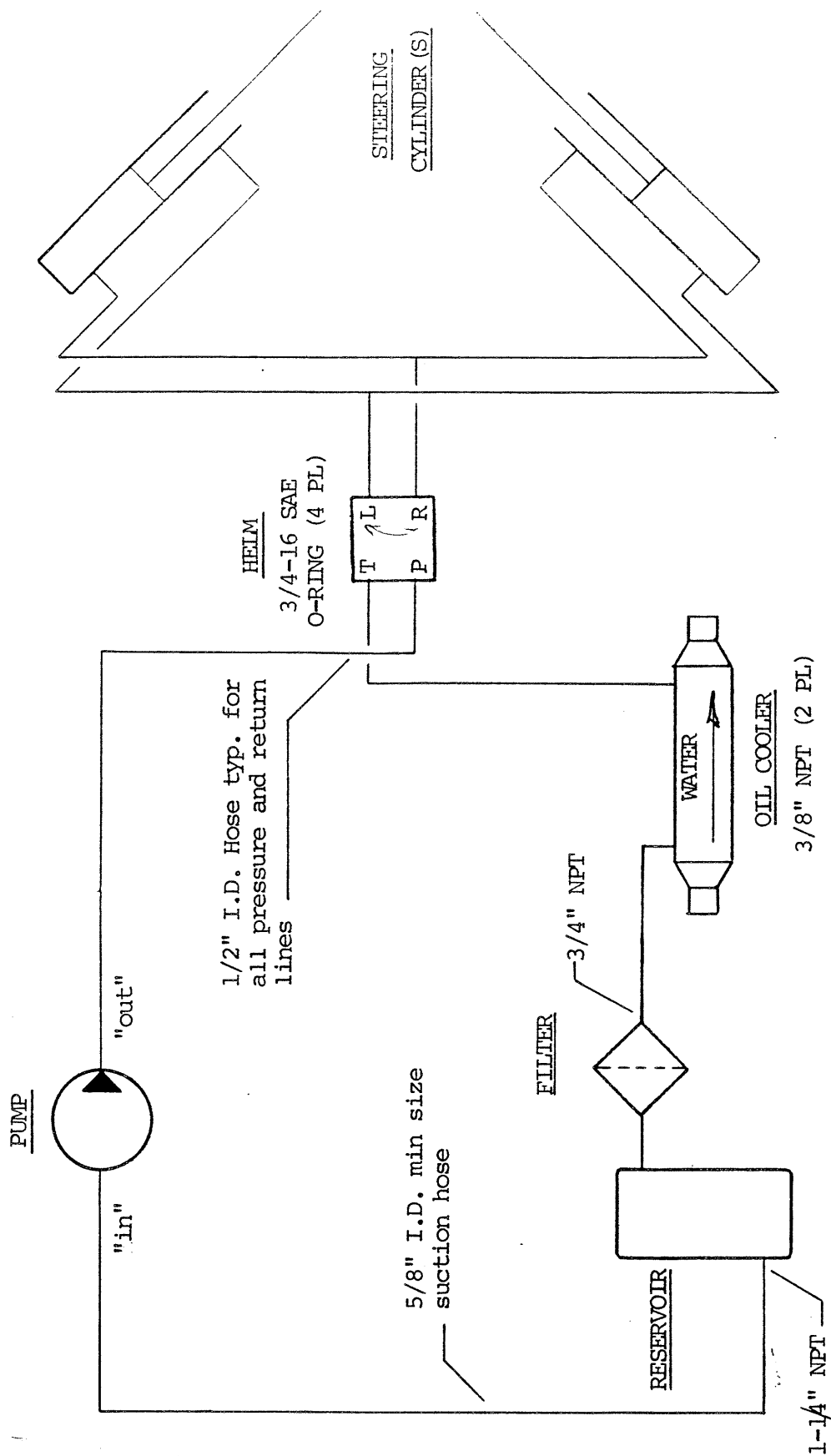


FIG. 9

PRINCE ENGINEERING KOCH RD. CORTE MADERA CA 94925			DATE 06/13/84	MATERIAL	SHEET
HYDRAULIC SYSTEM FOR 1981 M1414 OVEN M1414			SCALE None	DRAWN DEE	REV.
				ENGR.	
				DRAWING NO. REF 07552 PARTIAL	

PUMPS

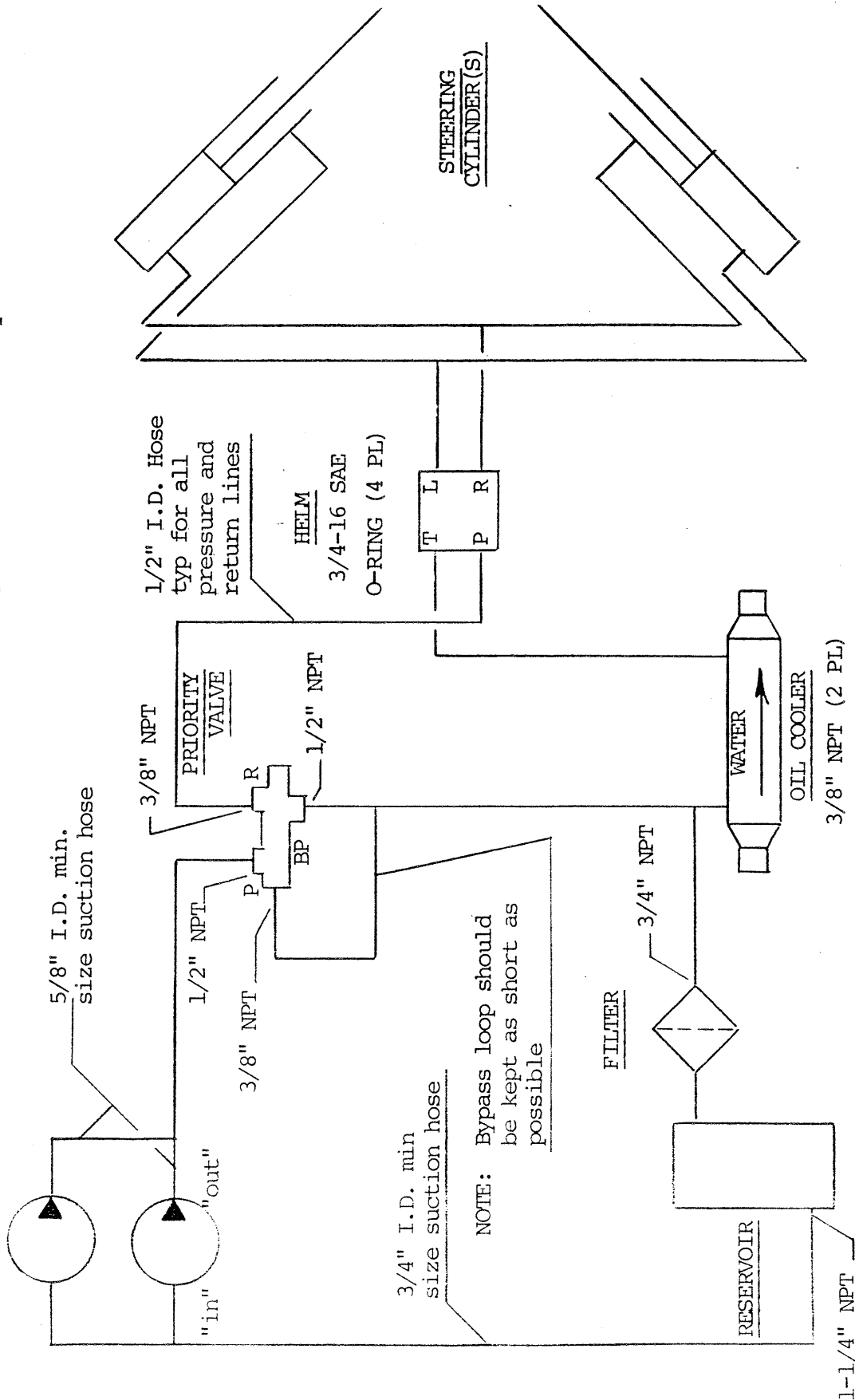


FIG. 10

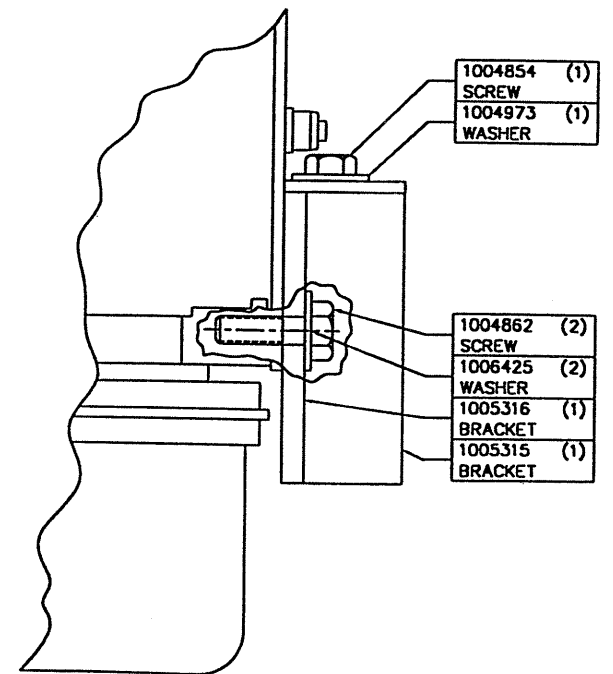
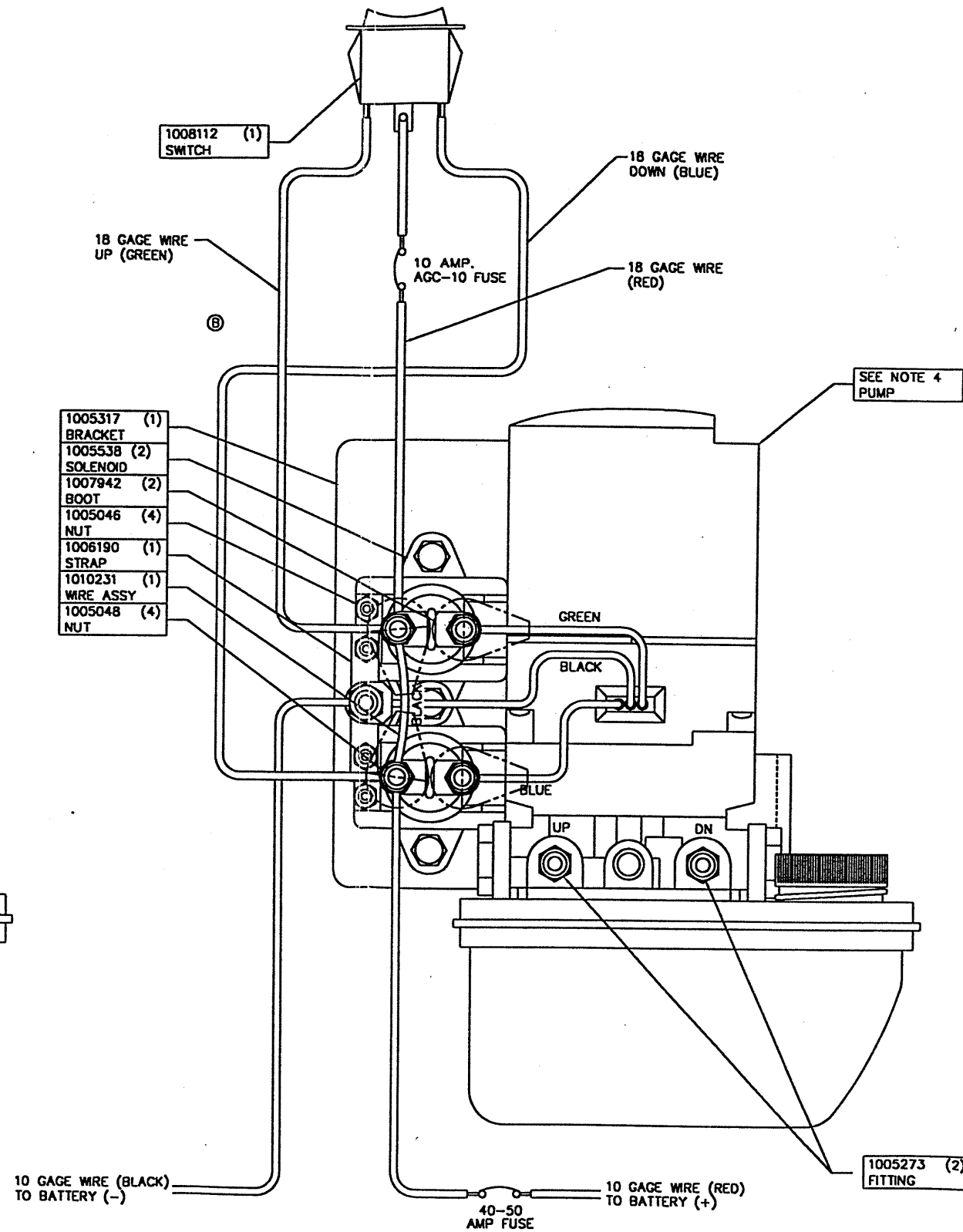
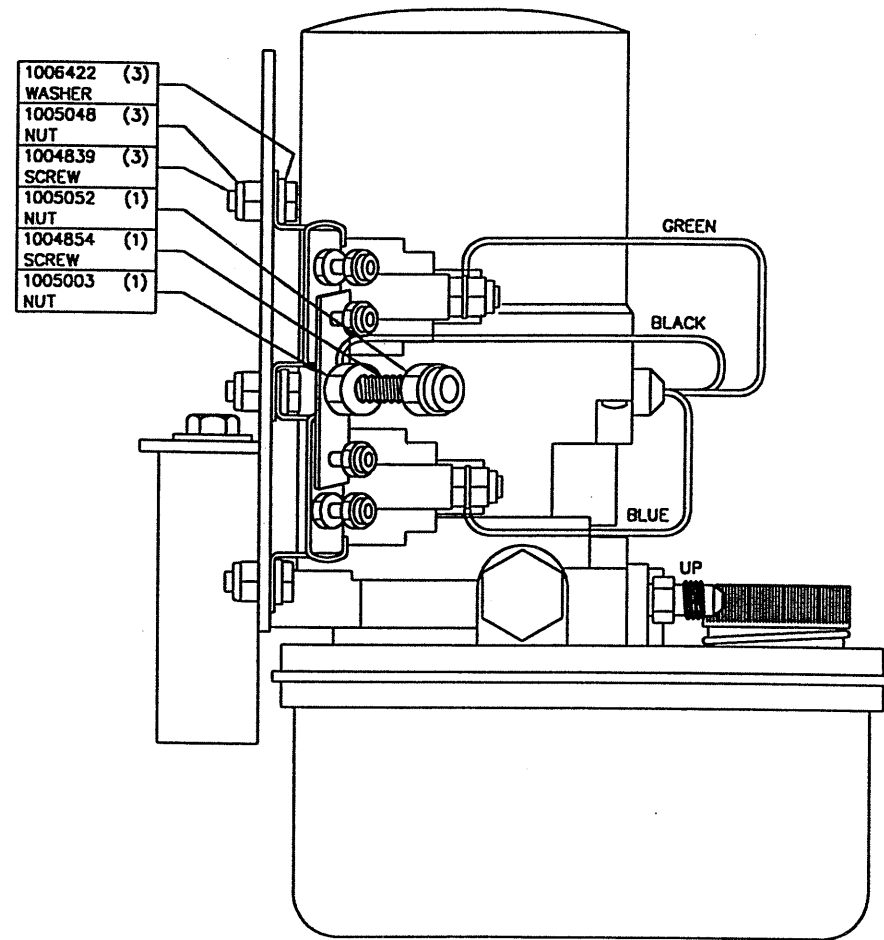
ALL DIMENSIONS IN INCHES WITH FOLLOWING TOLERANCES UNLESS OTHERWISE NOTED:		ARNESON ENGINEERING Koch Rd. Corte Madera CA 94925		DATE 11/26/84	MATERIAL	SHEET
		DUAL PUMP HYDRAULIC SYSTEM FOR OWNERS MANUAL INSTALLATION MANUAL		SCALE NONE		
Decimals	Fractions	Angles	DRAWN CV	ENGR.	DRAWING NO.	REV.
±	±	±				
±	±	±				
±	±	±				

NOTES:

- 1) TWO PLUGS (P/N 1005250) USED ON FITTINGS (P/N 1005273) TO PROTECT THREADS.
- 2) ONE SWITCH (P/N 1008112) SHIPPED LOOSE.
- 3) TORQUE ALL SCREWS ACCORDING TO TWIN DISC S574C.
- 4) PUMP VENDOR: OILDYNE
4301 QUEBEC AVE. NORTH
MINNEAPOLIS, MN. 55428-4998

5)

PUMP ASSY.	PUMP	MODEL	OILDYNE P/N
1006176	1007958	ASD 6/8/10	108AM10-CL-2VT
1006178	1006179	ASD 12/14	108AM32-CL-3VT



12 VOLT TRIM PUMP

REV	SHEET	ZONE	CH. NO.	DATE
B	1		29185	3-11-99
A	1		27545	1/27/97

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MATERIAL	
HEAT TREAT	
SURFACE TREATMENT	

NAME	DATE	SCALE	DATE
SEE CHART	1/22/97	NONE	1/22/97
	J. KJAER		
	GAM		
	GAM		

DATE	SCALE	DATE	SCALE
1/22/97	NONE	1/22/97	NONE
J. KJAER		J. KJAER	
GAM		GAM	
GAM		GAM	

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GAM		GAM	
GAM		GAM	

DATE	SCALE	DATE	SCALE
1/22/97	NONE	1/22/97	NONE
J. KJAER		J. KJAER	
GAM		GAM	
GAM		GAM	

