



Installation Manual P/N : 790-0748  
 Last Revised : December 1989  
 New Issue : May 1990

# PV140-xx-TR Pumpset

Marine Hydraulic Pumpset for Autopilot and power steering

- o Variable flow pumpset for 20-80 ft. boats
- For steering cylinders 4 in<sup>3</sup> to 60 in<sup>3</sup>
- o MOSFET control of motor direction
- Low power consumption
- o 15' (5m) 2#10 Cable
- o 30' (10m) Control cable & plug
- o Rudder speed adjustment knob

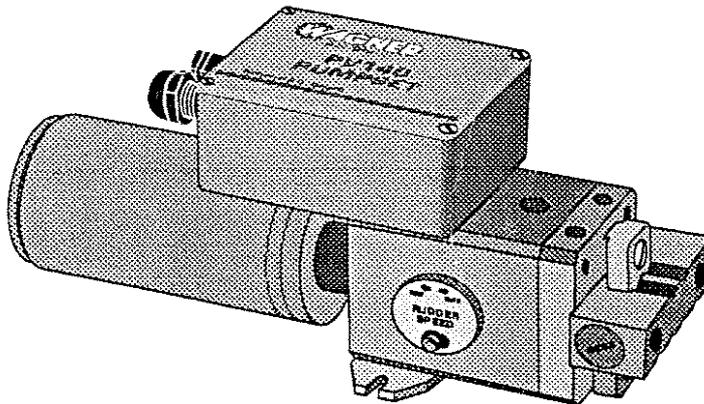
### TR Series Pumpsets available:

Mod	Part No.
PV140-12-TR	530-181
PV140-24-TR	530-182
PV140-32-TR	530-183

The Model PV140-xx-TR includes an electric motor driven variable volume axial piston pump. The motor direction is reversed by transistors to control the output direction of oil from the pump. The pumpset is suitable to interlace autopilots and non follow-up controllers to hydraulic steering systems. The low power consumption of the pumpset makes it ideal for vessels with limited battery capacity.

The pumpset consists of the following equipment:

- o Permanent magnet electric motor - 12, 24 or 32 VDC
- Variable volume axial piston pump with integral relief valves
- o Lockvalve
- Motor control box (TR box)



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### Technical Specifications

Model Number	PV140-12-TR	PV140-24-TR	PV140-32-TR
Assembly Part Number	530-181	530-182	530-183
Voltage	12 VDC	24 VDC	32 VDC
Maximum output flow (no load)	323 cu in/min (5291 cu cm/min)		
Maximum output flow (full load)	254 cu in/min (4162 cu cm/min)		
No load current - max. output flow	7A	6.3A	4.9A
Full load current - max. output flow	20A	12A	10A
Max. St'g cylinder displacement	60 cu in (983 cu cm)		
Relief Valve setting	600 psi		
Weight	21.0 lb (9.5 kg)		

# PV140-xxTR Pumpset

## Mounting Instructions



### !! WARNING !!

1. An autopilot is not intended to take the place of a helmsman, but rather assist him in steering the vessel.
2. It is the responsibility of the Helmsman (and a requirement by law) to ensure and maintain safe navigation and control of the vessel at all times in accordance with the rules of the road.
3. An autopilot is intended for operation in open waters, clear of all obstructions and other vessels.
4. It may be necessary to regain manual steering control quickly and to deactivate the autopilot pumpset if the vessel alters or fails to maintain the set course, or if the set course may jeopardize the vessel.
5. Wagner Type PV140-xx-TR pumpsets can be deactivated by disconnecting the power going to terminals 1 and 2 (on terminal block TB2) in the pumpset electrical connection boxes. Install a separate switch in a readily accessible location, if necessary. (See fig. 2 & fig. 4).
6. Be certain that all personnel operating the vessel know the location of this switch and its purpose.
7. Note that in an emergency situation when using Wagner hydraulic steering, it is possible to override the autopilot pumpset by turning any of the helm pumps quickly. This procedure will not cause any damage to the system. Try this procedure in an area free from hazardous conditions.



## Installation (See fig 1)

1. It is assumed that the steering system has been previously installed. If this pumpset was purchased at the same time as the steering system, the steering should be installed first (but not filled with oil.)

2. The tee fittings for the connection of the pumpset should be put in place during the installation of the steering lines. Flare-type fittings are recommended for problem-free connections rather than in-line compression-type fittings. Compression fittings may eventually leak due to vibration.

3. The pumpset should be mounted in a warm dry location to avoid condensation, and close to the steering line connections. A resilient base should be provided to isolate vibration and hydraulic noise from the hull of the boat.

4. Mount the pumpset horizontally, with the reservoir port facing up (see fig. 10 note 2).

5. Secure the unit to its seating, with two 1/4" bolts inserted into the holes in the mounting feet.

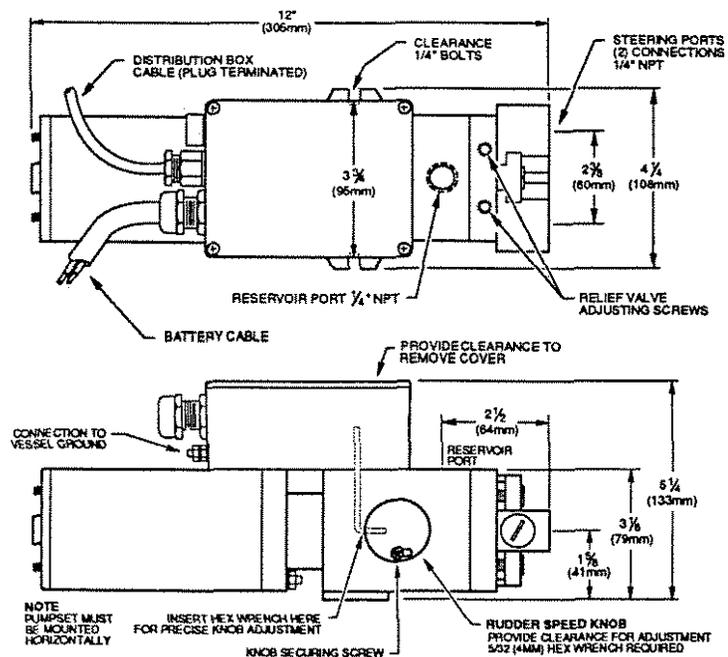


Fig. 7 - Pumpset dimensions

**Pumpset Power Supply** (See fig. 2)

1. To minimize radio interference, the pumpset should be electrically bonded to vessel ground (negative or neutral).

(a) Remove any paint or other contamination from the bonding surface to ensure a reliable connection.

2. The PV140-xx-TR pumpset is supplied with 15' (5m) of 2 #10 power cable. If the power cord to the pumpset must be extended, a larger wire gauge than supplied must be used for the extension. Use No. 8 AWG wire for extensions of 10 to 20 feet.

(a) The positive (+) side of the battery connects to the white or red conductor in the pumpset power cable.

(b) The negative side of the battery connects to the black conductor in the power cable.

(c) Do not reverse the positive and negative connections. Failure to connect correctly could cause extensive damage to the electronics and void the warranty.

3. A circuit breaker or a slow-blow fuse (not supplied) and disconnect switch must be installed in the positive battery lead to protect the pumpset and provide a means for emergency shut-down (see 'Warning', page 2).

(a) Install the disconnect switch in the console at the helm position for immediate access in the event of an emergency.

(b) A thermal circuit breaker is preferred because it will tolerate a moderate overload before tripping, and also serves as a disconnect switch. Refer to Fig. 2 for wiring details. Select the correct size breaker or fuse according to the system voltage that is being used:

12 VDC	.....	20 amp
24 VDC	.....	12 amp
32 VDC	.....	10 amp

(c) When used with the Wagner MicroPilot or the MP-320 Autopilot, excessive current draw by the pumpset will be limited (but not cut-off) to a level that is pre-set at the factory.

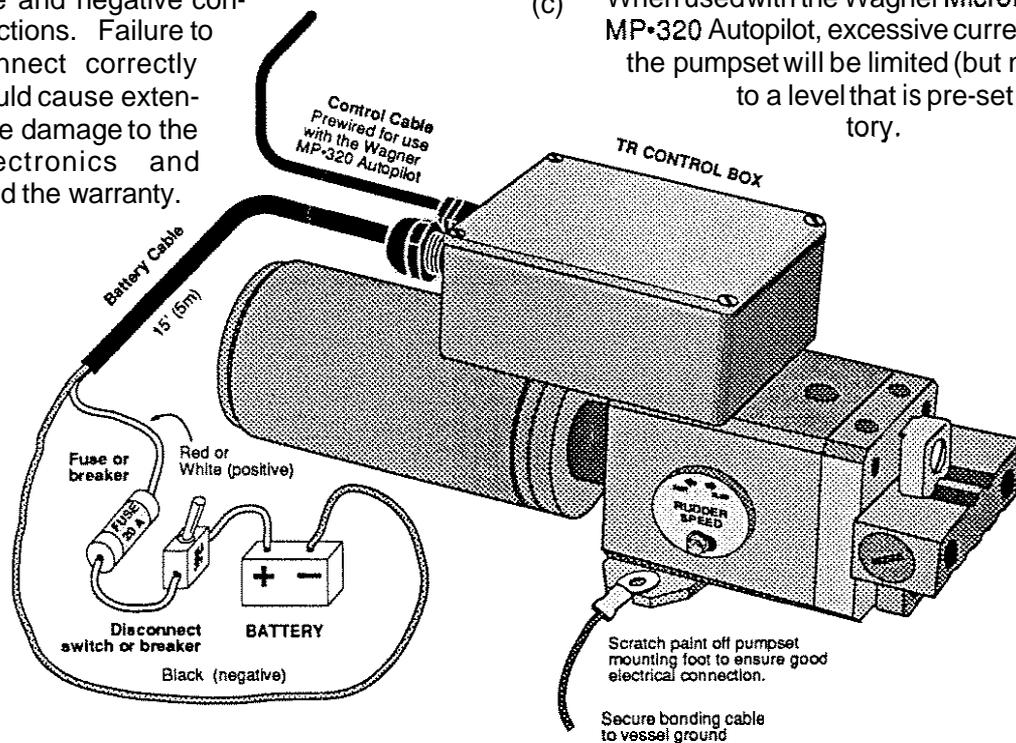


Fig. 2 - Pumpset power supply hookup

# PV140-xxTR Pumpset

## Control Cable Connections



- (d) To assist in determining emergency procedures, test the pumpset overload tolerance by intentionally running the pumpset until the rudder is in the hard over position, and holding it for several seconds.

connecting to Wagner SE, SEII and Mark 4 autopilots or a jog switch, this plug must be removed and wires bared. When connecting to the MP.320 Autopilot or the MicroPilot, refer to their respective manuals in the section 'Cables and Piping'.

## Control Cable Connections

The TR-box on the PV140-xx-TR pumpset is pre-wired with 30' (10m) of control cable and a plug suitable for direct connection to the Wagner MP.320 Autopilot or the MicroPilot. When

2. Refer to figs. 5 through 8 for wiring details for the type of pumpset controller you are using.

3. All cables should be routed away from areas which might be prone to damage from personnel or stored equipment. Damage to these cables could cause sudden loss of steering control.

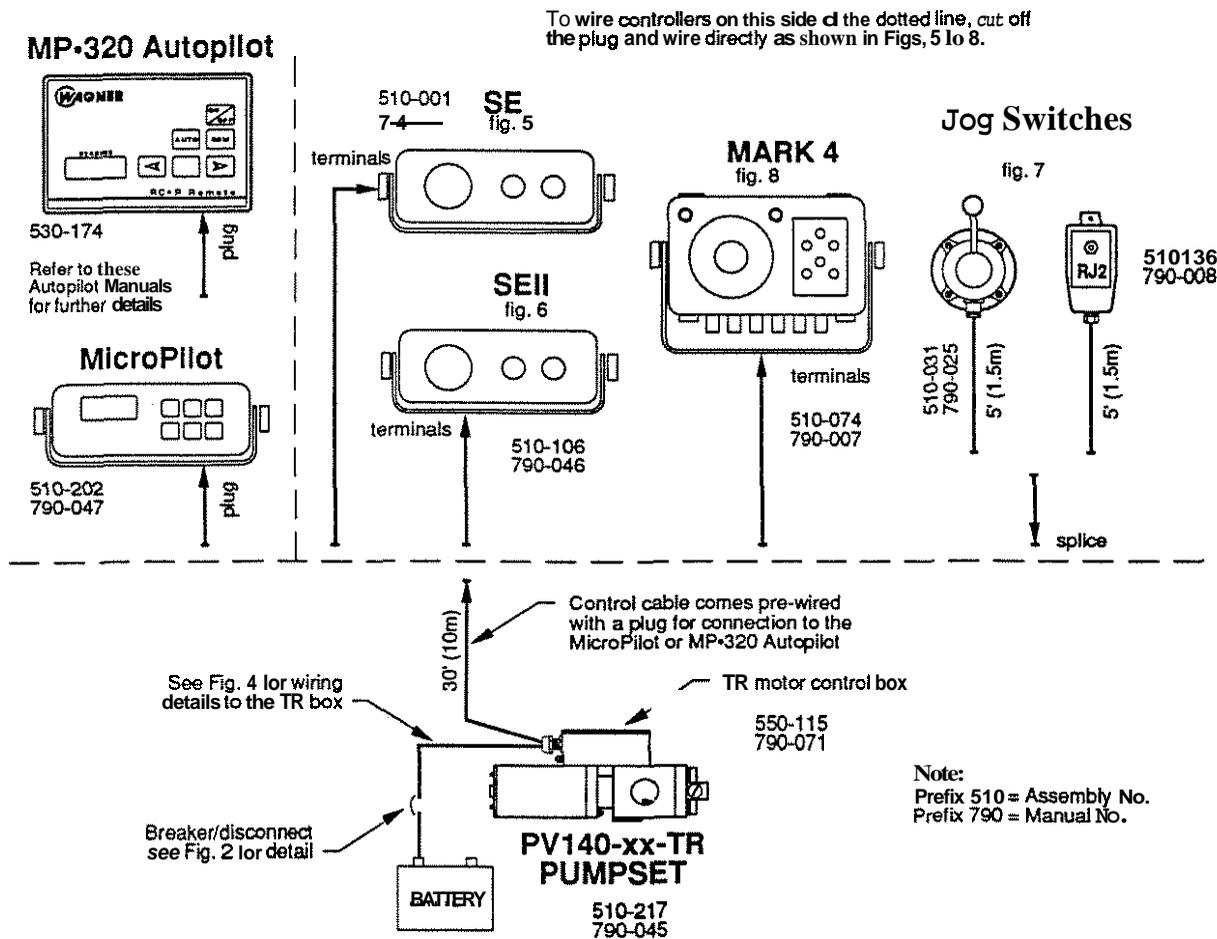


Fig. 3 - Singleline diagram - PV100-xx-TR pumpset and Wagner controllers

# PV140-xxTR Pumpset

## Control Cable Interface Diagrams

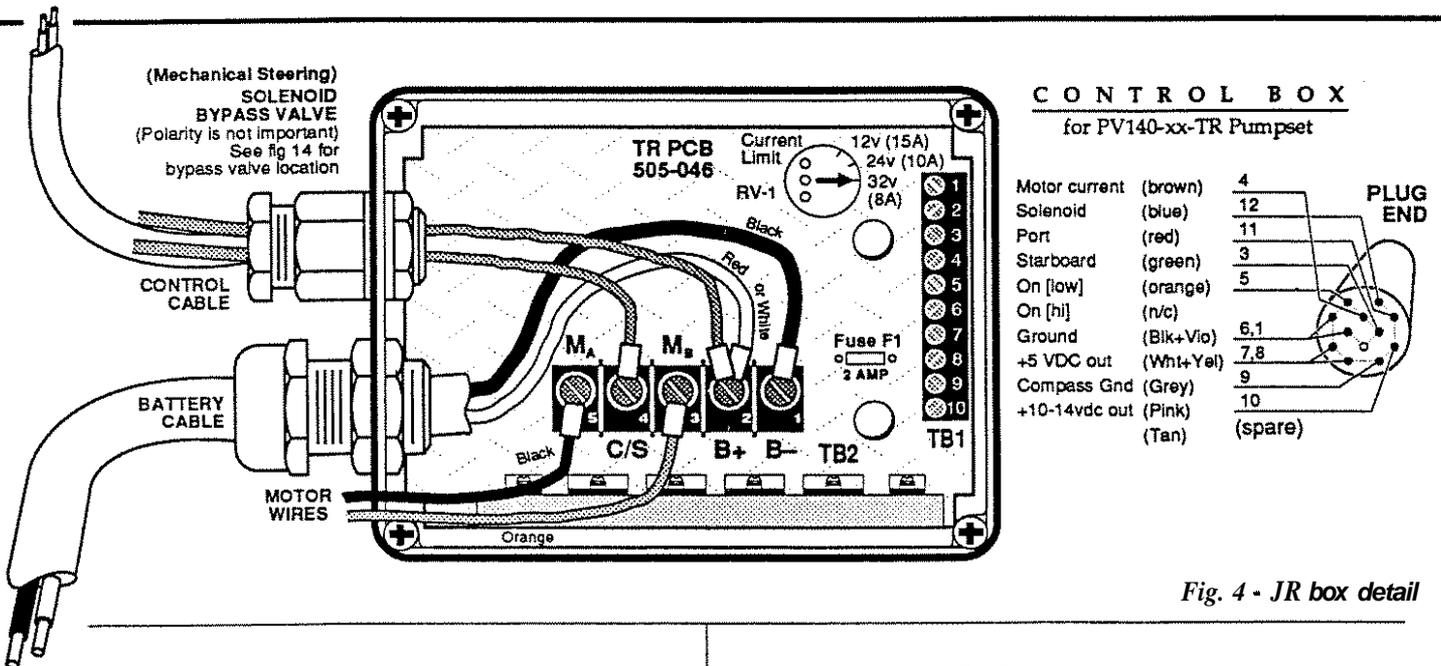


Fig. 4 - JR box detail

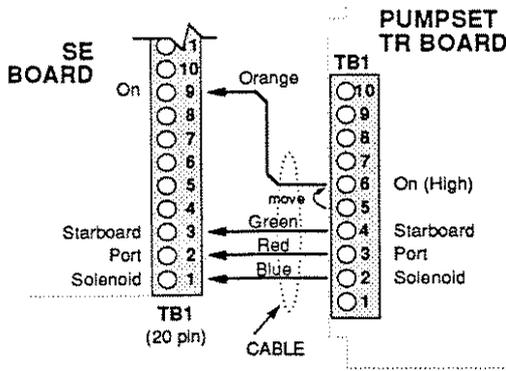


Fig. 5 - Wagner SE autopilot control head

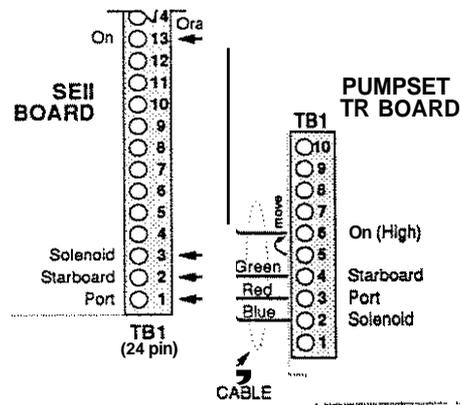


Fig. 6 - Wagner SEII autopilot control head

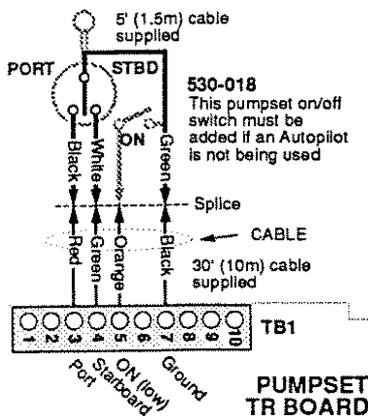


Fig. 7 - Wagner PN 530-018 jdg switch

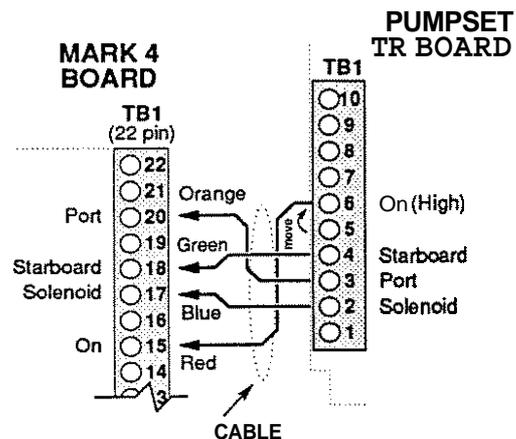


Fig. 8 - Wagner Mark 4 autopilot



### Steering Line Installation

1. Keep working conditions as clean as possible. Contamination of any form must be prevented from entering the system. It is essential that all hydraulic tubing is clean inside before starting the installation.

2. Teflon tape or pipe fitting compounds, (not supplied) commonly used to seal threaded NPT joints must be used sparingly and applied only to the male threads. The first two threads of the fitting should not be covered. If it is necessary to remove a fitting for any reason, the female thread must be cleaned before reinstalling the fitting.

3. Soft refrigeration-type copper tubing capable of withstanding 1000 psi working pressure is recommended and should be at least 3/8" outside diameter. Equivalent high pressure hose may also be used. (Tubing not supplied.)

4. The tubing should be installed with lengths as straight as possible. Bends should be as

gradual as possible. Goosenecks—(vertical bends resembling inverted drain traps, commonly used on the waste drain of a wash basin)—**must** be avoided, otherwise vent plugs must be installed at the high point of the bend to provide a means for removing entrapped air

5. Fig. 10 illustrates the Wagner PV-140-xx-TR pumpset connected to a two-line hydraulic system. When connecting the TR pumpset to Teleflex or Hynautic three-line steering systems, refer to Figs. 11-13. Fig. 14 illustrates the Wagner PV-140-xx-TR pumpset connected to a mechanical steering system. Fig. 4 shows terminal and fuse location.

6. Follow the mounting instructions for the pumpset on page 2, 'Installation'.

7. Refer to separate instructions for more details on steering gear installation.

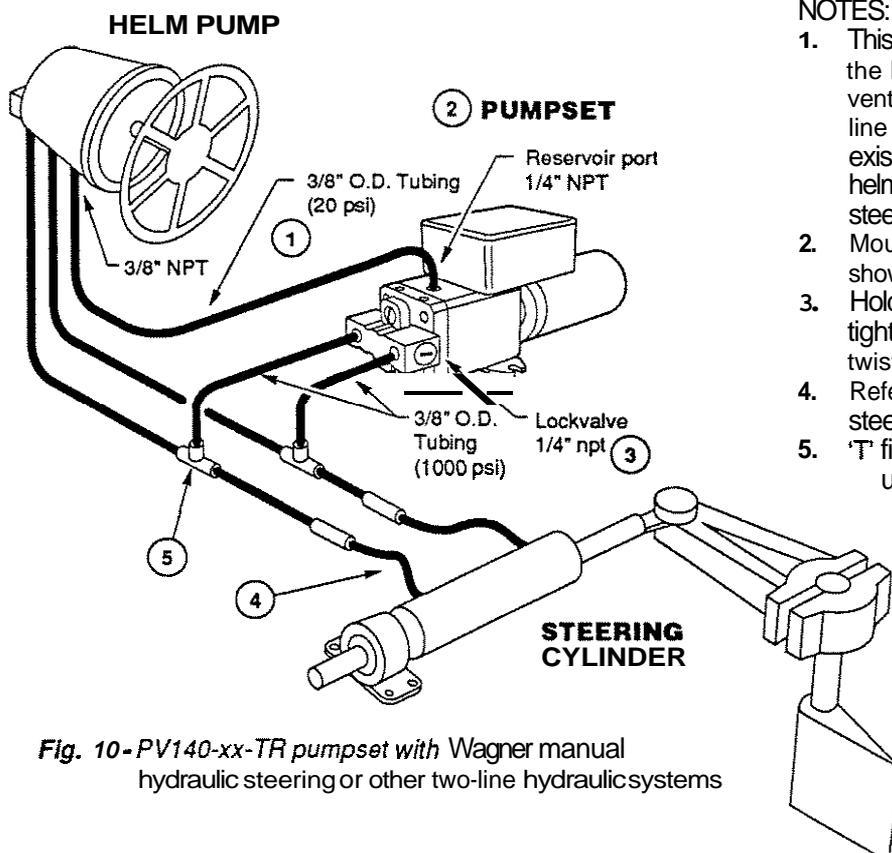


Fig. 10 - PV140-xx-TR pumpset with Wagner manual hydraulic steering or other two-line hydraulic systems

#### NOTES:

1. This line must have a gradual rise to the helm pump to permit self venting. Avoid goosenecks. This line may also be Tee'd into an existing interconnecting line between helm pumps in a multiple station steering system.
2. Mount pumpset horizontally as shown.
3. Hold lockvalve with wrench when tightening fittings to prevent it twisting out of alignment.
4. Refer to separate instructions for steering gear installation.
5. 'T' fittings must be installed pointing upward as shown.
6. Tubing, fittings and flex hose are not supplied with pumpset.
7. NPT - National Pipe Thread

B-7-964

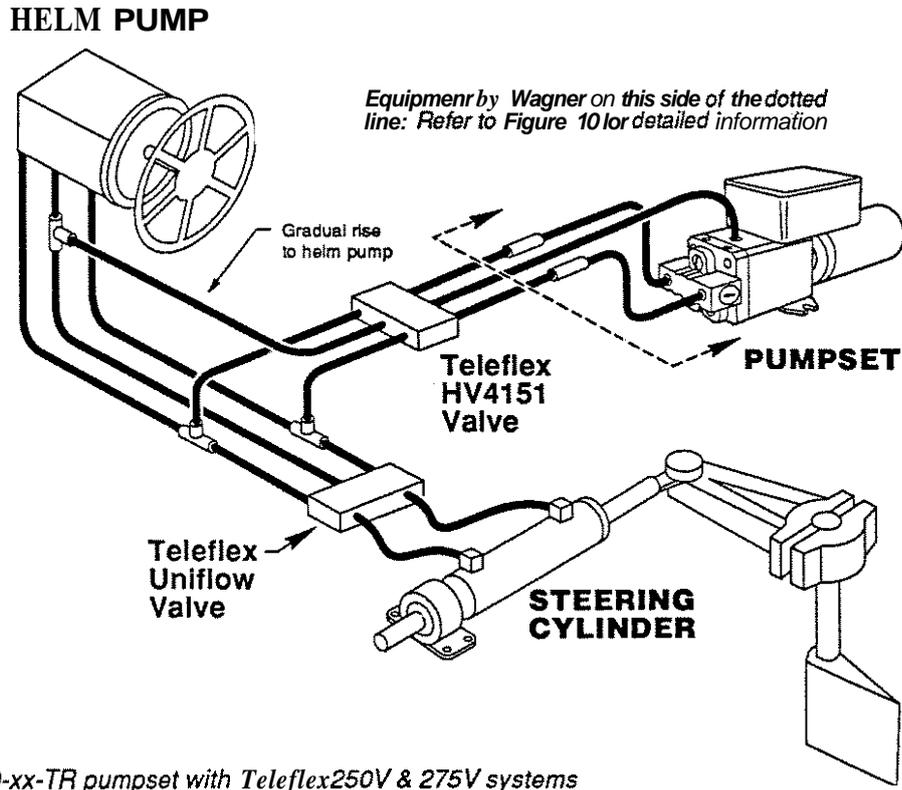


Fig. 11 - PV140-xx-TR pumpset with Teleflex 250V & 275V systems

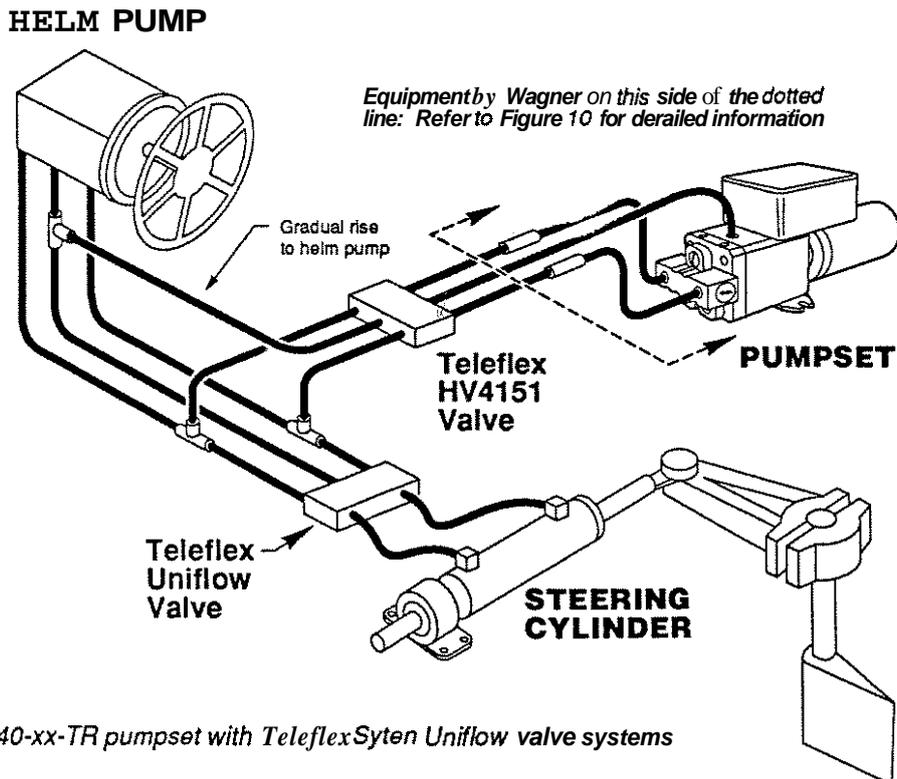


Fig. 12 - PV140-xx-TR pumpset with Teleflex Syten Uniflow valve systems

# PV140-xxTR Pumpset

## Teleflex, Bypass Solenoid Piping

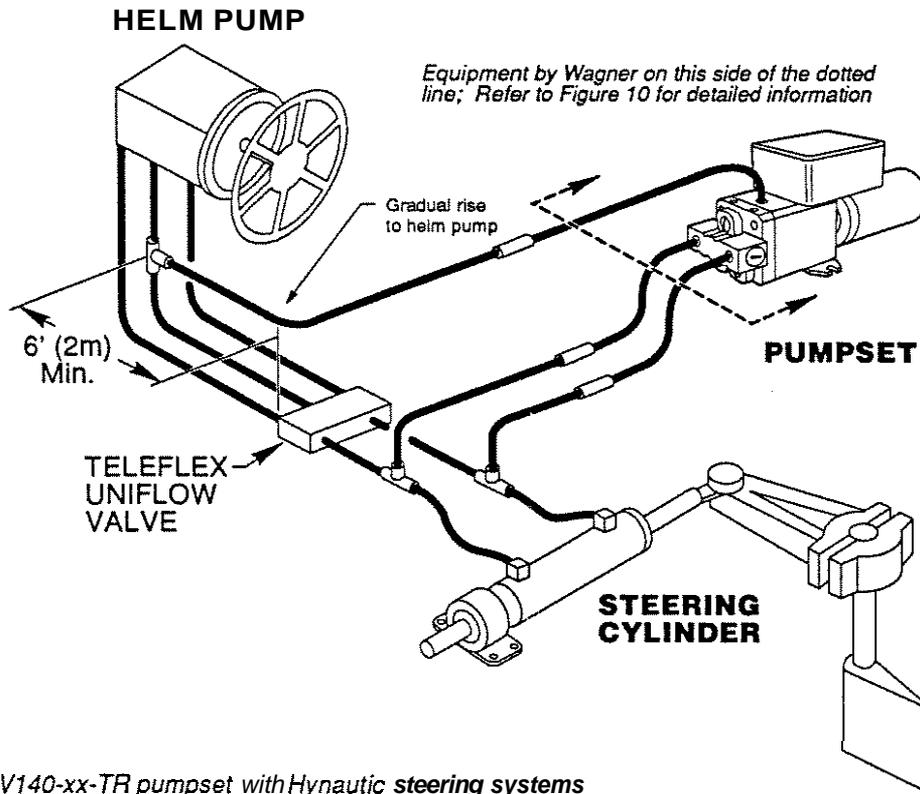


Fig. 13 - PV140-xx-TR pumpset with Hynautic steering systems

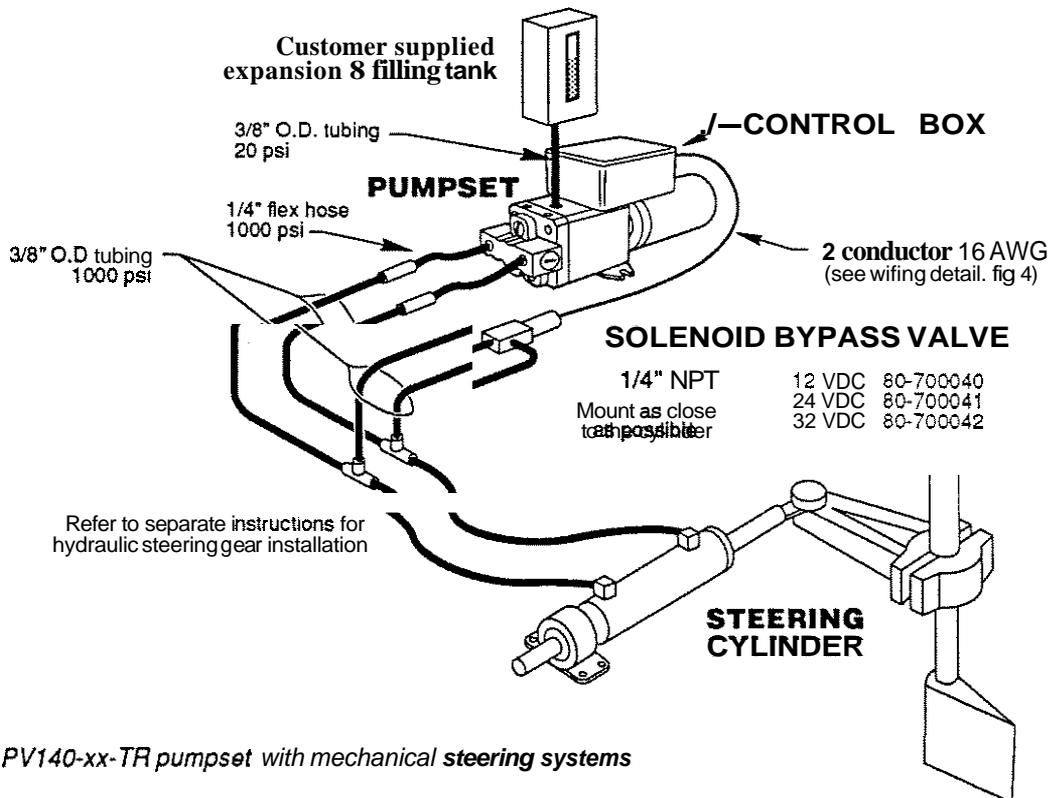


Fig. 14 - PV140-xx-TR pumpset with mechanical steering systems



## Recommended Oils

1. The following listed oils are recommended for use with Wagner type steering systems, due to their superior qualities. Limited supplies of the preferred oil are available from Wagner dealers.

2. Use oils recommended for steering gear made by other manufacturers for their systems.

Tabla 1

Preferred Oils for use with Wagner Systems	
Chevron ...	AW Machine 32, EP Hydraulic MV
Esso .....	Nuto H32, Nuto A10
Gulf .....	Harmony AW32, Harmony HVI36 Harmony 10
Mobile .....	DTE 24, DTE 13
Shell .....	Tellus 32, Tellus T37, Tellus 10
Texaco .....	Rando HD32, Rando HD AZ
<b>Do NOT use brake fluid. If in doubt, please contact the factory.</b>	

## Filling the Wagner Hydraulic System

### Setting Rudder Speed Knob

1. Before filling the system, adjust the rudder speed knob (see 'Pumpset Adjustment' and fig 1) to the maximum counterclockwise position and secure the knob by tightening the knob securing screw. This will speed the filling process.

### General Filling Procedure (see your steering gear manual for more details)

2. The main steering lines between the helm pump(s) and cylinder must be filled first. A Wagner system is filled through the highest (or only) helm pump in the system. The filler hole on all other helm pumps must be closed with a pipe plug. (Refer to the piping diagram, fig. 10.) When connecting to a mechanical steering system (see fig. 14), oil is filled through the expansion tank (customer supplied). Instructions 3 to 5 following are to be ignored. If a non-Wagner system is being installed, refer to the owner's manual for filling instructions.

3. Pour oil slowly into the headertank or filler tube of the highest helm pump and begin turning the steering wheel at this highest (or only) helm pump

steadily in one direction only, checking the oil level periodically to prevent pumping air, until the system begins to feel solid.

4. If the steering system is a Wagner Type N with bleed fittings at the cylinder ports, one fitting can be opened slightly (on the side being filled) to purge entrapped air from the lines quickly. If the system does not contain these fittings, the cylinder tubing fitting can be backed out slightly, but wiping rags must be placed under the cylinder to contain the expelled oil.

5. Turn the helm pump steadily in the opposite direction until the system again begins to feel solid. Loosen the lower helm reservoir plug to confirm that it is full of oil. Close this plug when oil comes out. Repeat this procedure for the next lowest helm pump. Remember to periodically check the oil level in the headertank or highest helm pump. When all pumps have been turned as described, the steering system should be filled sufficiently for the pumpset to operate.



### Operating the Pumpset for the First Time

6. Do not operate the pumpset until the drive unit pump is filled with oil. Loosen the reservoir port fitting (fig. 1) to ensure that oil is available. This will also accelerate the bleeding of air from the pump.

(a) Turn on the power supply to the pumpset and press a Port or Starboard steering button if you are using an Autopilot, or move the Jog lever if it is installed. This will cause the pumpset to operate and start oil circulation through the system.

(b) If the pump seem extremely noisy, operate it in 30 second intervals to purge more air from the system. Cycle the system (using the Port or Starboard steering buttons or the Jog lever) for 5-10 minutes, then allow it to rest for 1/2 hour. Repeat until the system responds smoothly. This will indicate that most of the air has been expelled. Top up the highest helm pump reservoir if necessary.

7. Tighten the pumpset reservoir fitting.



**Pumpset Adjustment** (see fig. 15)

1. The pump is normally adjusted to achieve a hard over to hard over rudder speed of approximately 14 seconds ( $\pm 1$  second). This adjustment may be made by loosening the knob securing screw and turning the flow control knob counterclockwise to reduce hard over time (increasing rudder speed), and clockwise to increase hard over time (reducing rudder speed).

2. For accurate adjustment, a slot has been provided in the side of the knob so that a hex wrench (the one used to loosen the knob securing screw) may be insetted and used as a lever.

3. A hard over time of up to 18 seconds may be acceptable with minimum loss of performance on large steering systems. A larger pumpset is required if 18 seconds cannot be achieved.

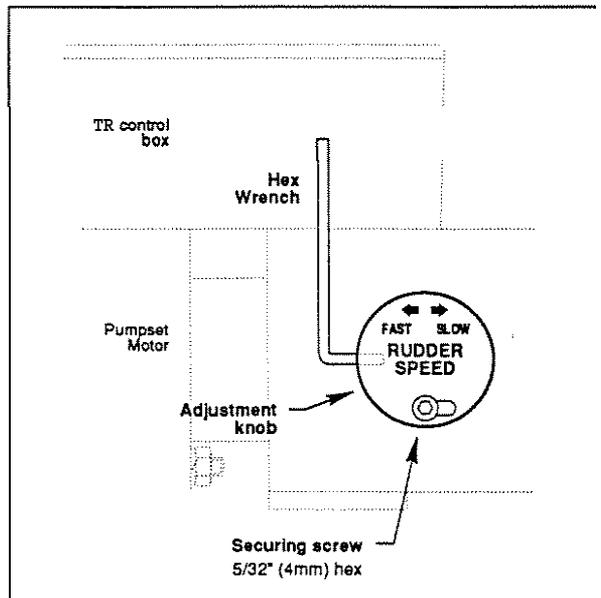


Fig. 15- Rudder Speed knob adjustment

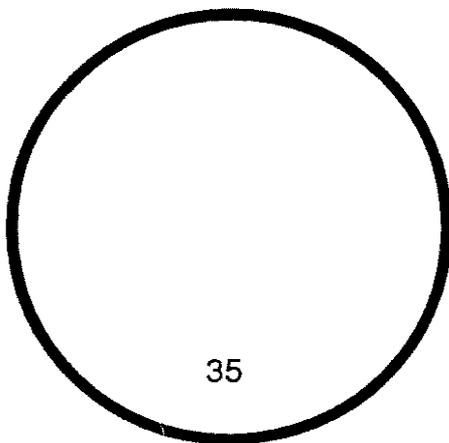


**Accessories / Replacements**

Description	Wagner P/N
Fuse 2 Amp "Pico" .....	420-007
Power Cable P/N .....	550-304
Control Cable PIN .....	550-428
Extension Cable (control) 10' .....	550-414
Extension Cable (control) 20' .....	550-408
Extension Cable (control) 35' .....	550-415
Circuit Board P/N .....	505-0468
Control Box PIN .....	550-115B

**PV140xx Seal Kit (PN 119-0144)**

For complete instructions for removing and installing new seal components, refer to Wagner Manual PIN 190-0050 "Seal Kit for PV140xx Pumpset". Figure 17 on page 12 is a cutaway drawing showing seal locations.



Item	119-0144	Qty	Seal Description
15	11-106114	1	Knob O-Ring 1/2 x 5/8
17	11-106010	1	Swash plate pivot seal O-Ring 1/4 x 3/8
22	11-106006	3	Relief valve/Lockvalve O-Ring 1/8 x 1/4
27	11-106017	2	Pump body to L/valve O/R 11/16 x 13/16
35	11-106034	1	Pump front cover O-Ring 2-1/8 x 2-1/4
39	10-500017	1	Pump Shaft Seal BAB 5L 0.5-8-2
45	11-106015	2	Small seal lockvalve O-Ring 9/16 x 11/16
46	11-106114	2	Large seal lockvalve O-Ring 5/8 x 13/16

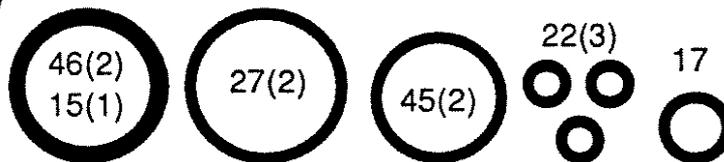


Fig. 16 - O'Rings shown full-size

# PV140-xxTR Pumpset

## Pumpset Sectional 8 Parts List



1	1	MOTOR
2	2	SETSCREW
3	1	MOTOR COUPLING
4	1	PUMP COUPLING ASS'Y
5	1	SNAP RING
6	1	BEARING
7	1	PUMP BODY
8	5	PISTON
9	5	PISTON INSERT
10	5	SPRING
11	1	SHAFT
12	2	CLAMP
13	1	SWASH PLATE KNOB
14	1	LABEL
15	1	O-RING *
16	1	SWASH PLATE
17	1	O-RING *
18	2	SWASH PLATE PIN
19	2	SCREW

20	2	SPRING
21	2	SETSCREW
22	3	O-RING *
23	2	SEAL PLUG
24	2	BALL
25	4	CAPSCREW
26	2	BALL
27	2	O-RING *
28	1	BACKPLATE
29	1	MOUNTING BRACKET
30	2	SCREW
31	1	WASHER
32	1	SCREW
33	1	LOCKVALVE ASSY

34	2	SCREW
35	1	O-RING *
36	1	ROTOR
37	1	ROTOR KEY
38	1	BEARING
39	1	SEAL *
40	4	DRIVE PIN
41	2	STUD
42	2	& NUT
43	2	LOCKWASHER
44	2	& WASHER
45	2	O-RING *
46	2	O-RING *
47	1	O-RING *

\*Seal kit  
P/N 119-0144

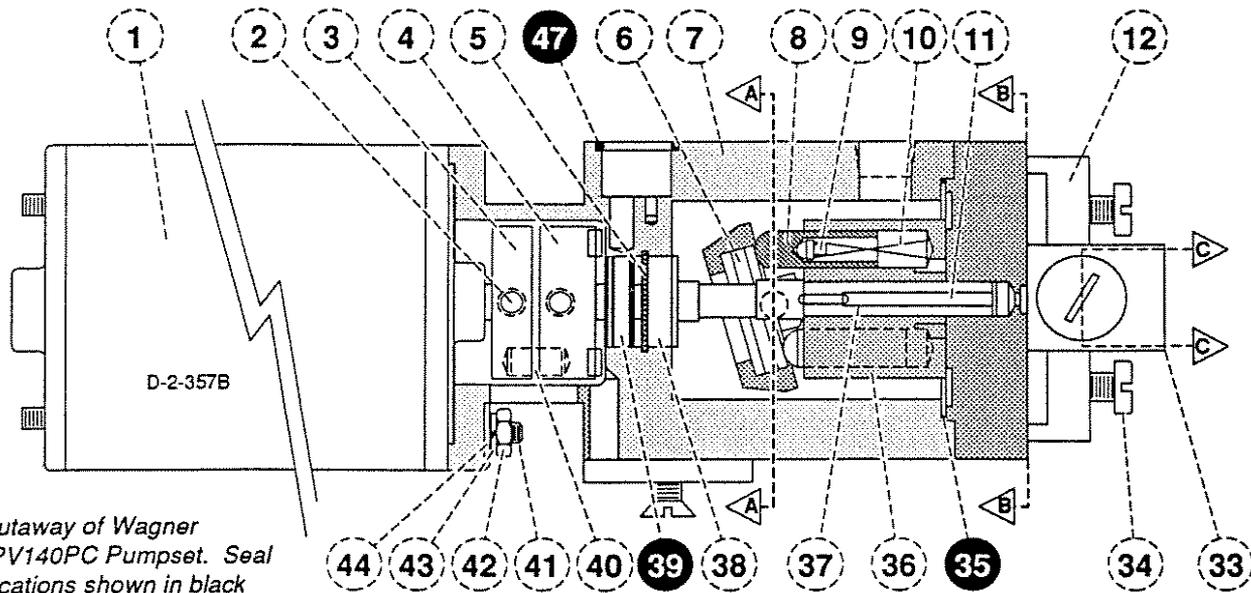
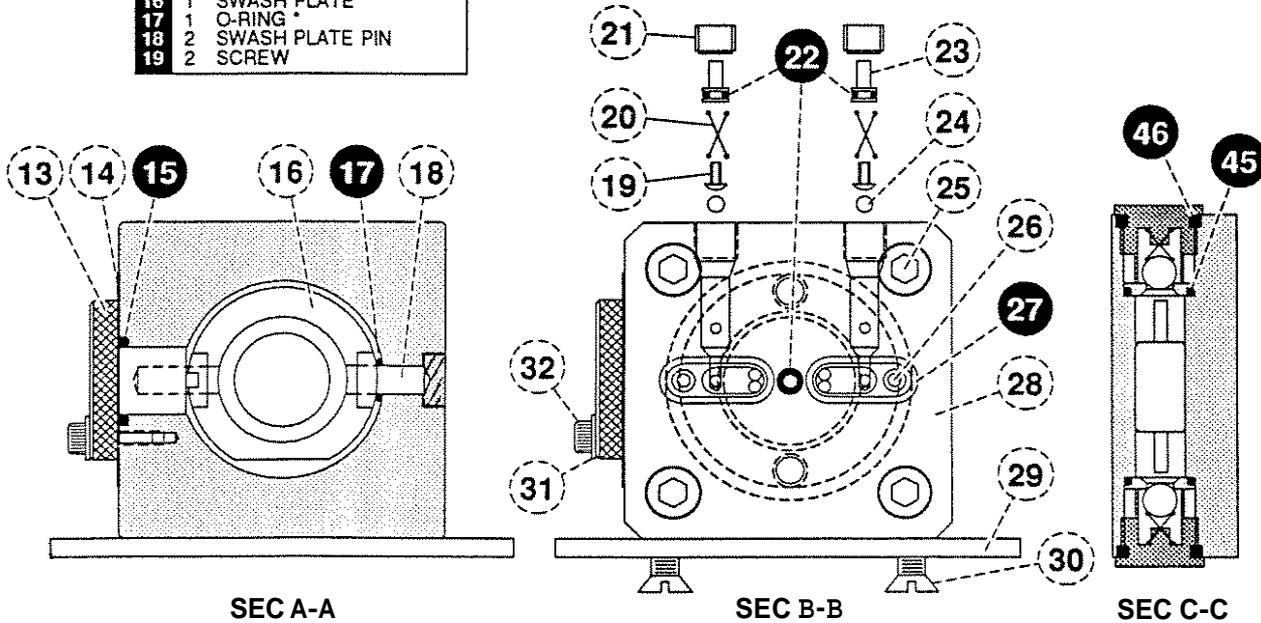


Fig. 17 - Cutaway of Wagner  
\*PV140PC Pumpset. Seal  
locations shown in black



Wagner A.H. Corp  
131 - 7080 River Road  
Richmond B.C., Canada V6X 1X5  
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Unit 3E, The Birches Industrial Estate  
Easr Grinstead, West Sussex  
RH19 1X2 England  
Telephone (0342) 313437  
Telefax (0342) 313438

## Trouble Shooting

SYMPTOM	CAUSE	REMEDY
Steering gear does not respond to electrical command.	Rudder speed knob may be at zero-flow position (refer to Pumpset Adjustment on page 10).	Turn rudder speed knob clockwise until rudder speed hard over time is 14 seconds $\pm$ 1 second.
	Not enough oil in pump	Loosen the reservoir port fitting (fig. 1 or fig. 10) to ensure that oil is flowing through it; eliminate any goosenecks in the top feed line.
	Relief balls are prevented from seating by contamination. (See fig. 1.)	Turn relief valve (3/16"-4.5mm) hex screw 4 turns counter clockwise.. Pressurize the steering gear in both hard-over positions, and hold momentarily to flush contaminants from the relief valve ball seats. Re-tighten hex screw to original setting, or 1/16" below surface (1 thread). This will reset the relief valve to approximately 500-600 psi.
	A helm pump (if installed) has a leaking lockvalve, indicated by its steering wheel turning when pumpset is operated.	Clean contaminated lockvalve. (Lockvalves are mounted to the rear of each helm pump.)
Electric motor will not operate.	Fuse 'F1' on motor control circuit board is open.	Replace fuse 'F1' (see fig. 4). P/N 420-007 2 amp "Pico"
Electric motor operates in one direction only or, continues to operate and won't turn off.	Circuit board is faulty.	Replace circuit board. (P/N 505-046B)
Steering gear goes in wrong direction in response to electrical command.	Motor is turning in the wrong direction.	Reverse the motor terminal connections at terminals 3 and 5 on TB-2. or the control signal connections 3 and 4 on TB-1 (See fig. 4).



# PVxx140TR Control Box Parts List

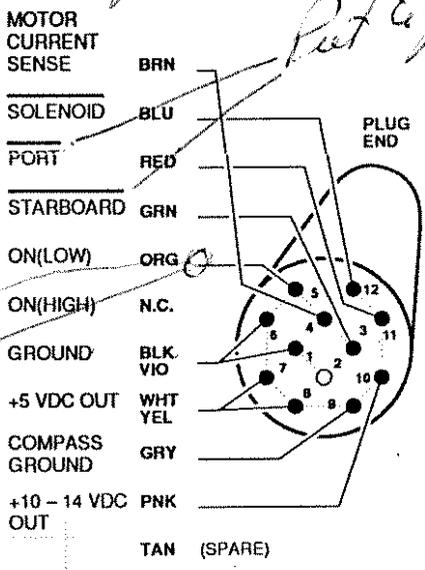
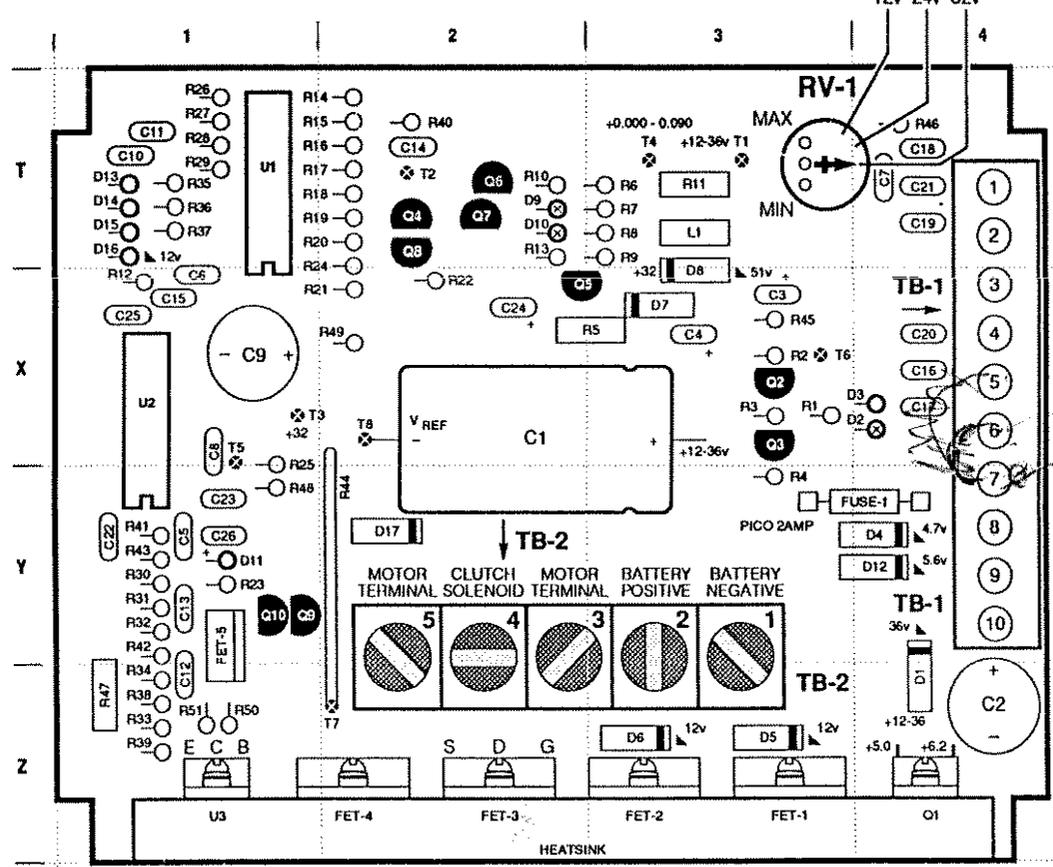
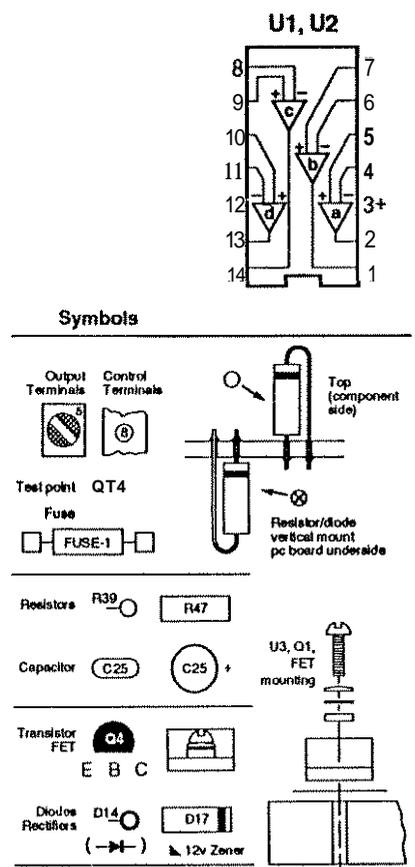
CAPACITORS			RECTIFIERS			RESISTORS			TERMINALS		
C1	X2	470µf 63V	D1	Z4	1N6287A 36V	R1	X3	1.2K	TB1	X4	CONTROL
C2	Z4	470µf 10V	D2	X4	1N914	R2	X3	10K	TB2	Y2	OUTPUT
C3	x3	4.7µf 50V	D3	X4	1N914	R3	X3	10K	TP1	T3	POST +12-36V
C4	x3	.1µf 50V	D4	Y4	1N5230B 5.6V	R4	Y3	100	TP2	TZ	POST
C5	Y1	470pf	D5	Z3	1N4742A	R5	X3	100K	TP3	X1	POST +32
C6	X1	.1µf 50V	D6	Z3	1N4742A 12V	R6	T3	15K	TP4	T3	POST +0 - 0.09
C7	T4	.1µf 50V	D7	X3	1N914 12V	R7	T3	15K	TP5	X1	POST
C8	X1	.001µf	D8	X3	1N4757A 32V	R8	T3	15K	TP6	X3	POST
C9	X1	470µf 10V	D9	T2	1N914	R9	T3	15K	TP7	Z2	POST
C10	T1	.1µf 50V	D10	T2	1N914	R10	T2	1K	TPB	X2	POST V-REF
C11	T1	.1µf 50V	D11	Y1	1N914	R11	T3	51			
C12	Z1	.1µf 50V	D12	Y1	1N5339 4.7V	R12	X1	10K			
C13	Y1	.1µf 50V	D13	T1	1N914						
C14	TZ	.1µf 50V	D14	T1	1N914						
C15	X1	.1µf 50V	D15	T1	1N914						
C16	X4	.1µf 50V	D16	T1	1N4742A 12V						
C17	x4	.1µf 50V	D17	Y2	1N5402						
C18	T4	.1µf 50V									
C19	T4	.1µf 50V									
C20	x4	.1µf 50V									
C21	T4	.1µf 50V									
C22	Y1	.1µf 50V									
C23	Y1	100pf									
C24	X2	4.7µf 50V									
C25	X1	.047µf									



## PVxx140TR CONTROL BOX

PCB Layout & Parts List (PCB P/N 505-046B)

*Change to ground to 12V system in engine system. Part 2 of 2*



# PVxx140TR Control Box Parts List

CAPACITORS			RECTIFIERS			RESISTORS			TERMINALS		
C1	X2	470µf 63V	D1	Z4	1N6287A 36V	R1	X3	1.2K	TB1	X4	CONTROL
C2	Z4	470µf 10V	D2	X4	1N914	R2	X3	10K	TB2	Y2	OUTPUT
C3	X3	4.7µf 50V	D3	X4	1N914	R3	X3	10K	TP1	T3	POST +12-36V
C4	X3	.1µf 50V	D4	Y4	1N5230B 5.6V	R4	Y3	100	TP2	T2	POST
C5	Y1	470pf	D5	Z3	1N4742A	R5	X3	100K	TP3	X1	POST +32
C6	X1	.1µf 50V	D6	Z3	1N4742A 12V	R6	T3	15K	TP4	T3	POST +0 - 0.09
C7	T4	.1µf 50V	D7	X3	1N914 12V	R7	T3	15K	TP5	X1	POST
C8	X1	.001µf	D8	X3	1N4757A 32V	R8	T3	15K	TP6	X3	POST
C9	X1	470µf 10V	D9	T2	1N914	R9	T3	15K	TP7	Z2	POST
C10	T1	.1µf 50V	D10	T2	1N914	R10	T2	1K	TP8	X2	POST V-REF
C11	T1	.1µf 50V	D11	Y1	1N914	R11	T3	51			
C12	Z1	.1µf 50V	D12	Y4	1N5339 4.7V	R12	X1	10K			
C13	Y1	.1µf 50V	D13	T1	1N914						
C14	T2	.1µf 50V	D14	T1	1N914						
C15	X1	.1µf 50V	D15	T1	1N914						
C16	X4	.1µf 50V	D16	T1	1N4742A 12V						
C17	X4	.1µf 50V	D17	Y2	1N5402						
C18	T4	.1µf 50V									
C19	T4	.1µf 50V									
C20	X4	.1µf 50V									
C21	14	.1µf 50V									
C22	Y1	.1µf 50V									
C23	Y1	100pf									
C24	X2	4.7µf 50V									
C25	X1	.047µf									



## PVxx140TR CON PCB Layout & Parts List (PCB P/T)

