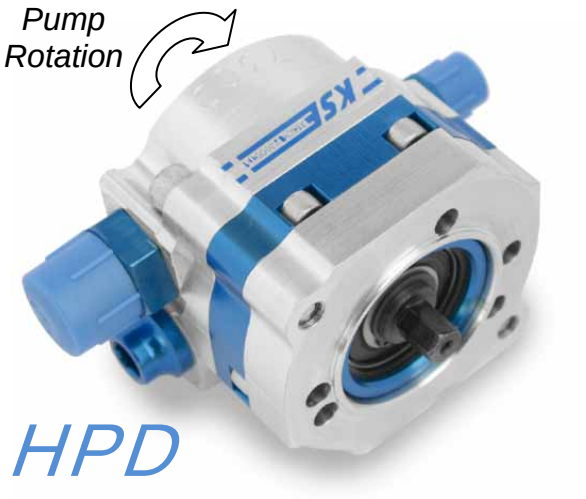
INSTALLATION & START-UP GUIDE
HPD Power Steering Pump



KSE's High Power Density Power Steering Pump is a gerotor-style positive displacement pump with a 3/8" Hex drive. This is a single direction pump and is designed to operate in a CCW rotation when viewed from the back of the pump. This pump contains an internal pressure relief which has been pre-set at the factory and is designed to protect the power steering gear and pump from over-pressurization. In order to avoid system damage, this relief setpoint should only be adjusted by the factory. This pump is shipped "ready-to-install" with a positive piloted mounting adaptor for a rear motorplate installation.

REAR MOTORPLATE INSTALLATION

NOTE: Methods of mounting pumps to motorplates vary based on chassis make, motorplate design, and/or personal preference.

IMPORTANT: Regardless of the method of mounting, the shaft engagement and alignment is critical to proper pump operation. The pump shaft should engage the drive spud a minimum of 3/8" and must not bottom-out on the spud. It is recommended that grease is applied between all mating drive components to minimize metal-to-metal contact. The pump should be within 0.005 TIR (Total Indicated Runout) alignment with the drive spud. Some motorplates and pump mounting adaptors do not have a positive piloting device for proper alignment. The most successful method of aligning this type is to fully plumb the pump and then mount the pump with the bolts snug. Start the motor and while running, fully tighten the mounting bolts.

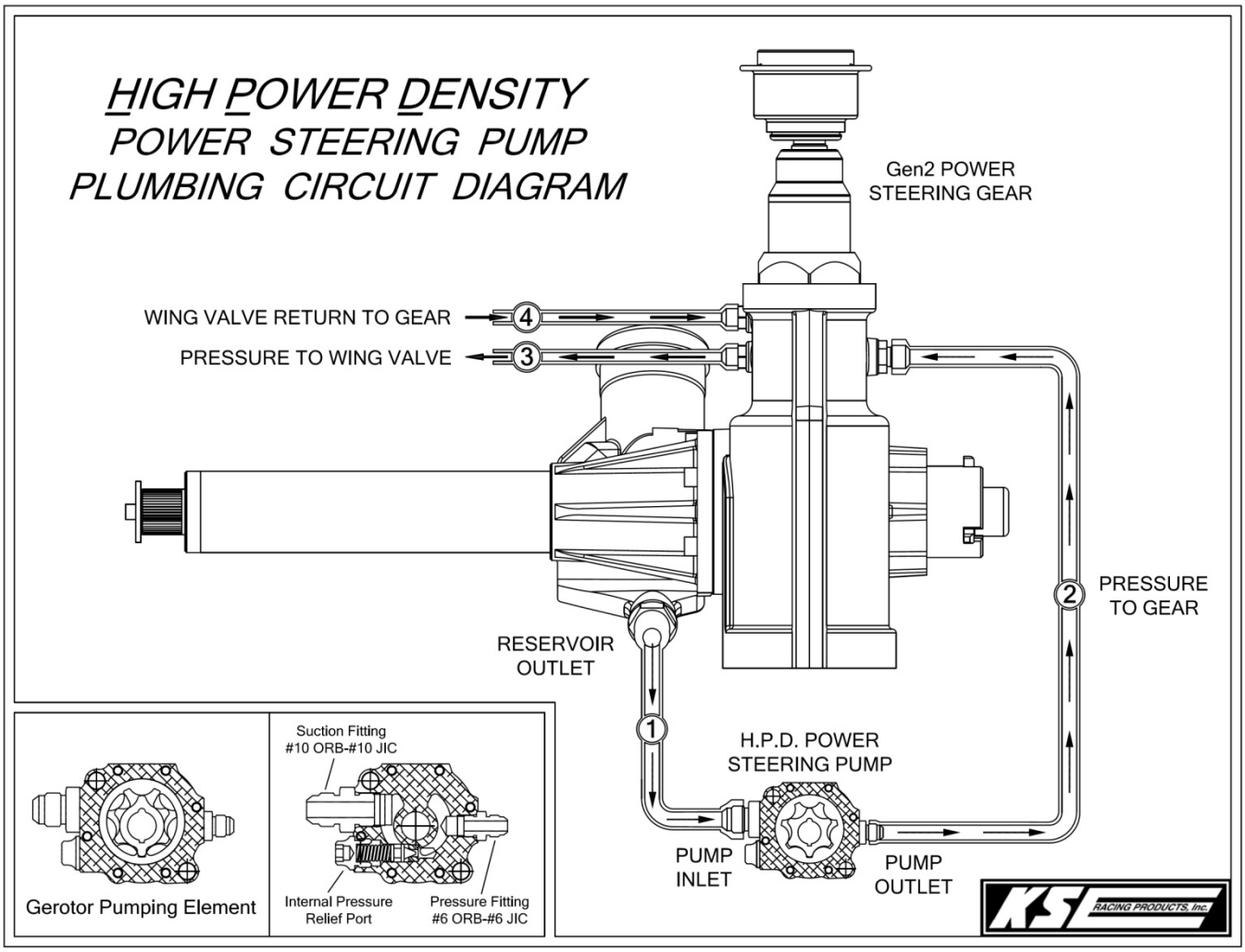
START-UP AND AIR PURGING

CAUTION: Running the P/S pump without fluid will cause damage to the pump.

RECOMMENDED AIR PURGING METHOD

After plumbing the pump (Plumbing Instructions on following page), unbolt P/S pump and pull it back far enough to disengage shaft from the drive spud. Fill vented P/S reservoir with KSE Elixer P/S fluid (P/N KSM1086). Loosen the pump inlet line at the inlet fitting until fluid is seen coming out around the fitting, then retighten. Using a suitable drill with a 3/8" hex socket, spin the P/S pump shaft from the back (i.e. fuel pump end) at a minimum of 500 RPM. *IMPORTANT:* Check for proper shaft rotation (CCW). Monitor fluid level and add as required. Disconnect drag link from pitman arm. With pump running turn steering wheel full left until it stops and full right until it stops, do this a minimum of three cycles. Stop pump and let stand 30 minutes. Check P/S fluid level and add as required. Start pump and repeat above procedure. *NOTE:* If the above procedure is not used, maximum P/S performance will not be achieved until 2 or 3 racing cycles.

POWER STEERING PUMP PLUMBING



IMPORTANT: All hoses and fittings must be clean and free of all contamination. It is highly recommended that these components be flushed with clean solvent or hot soap and water and blown dry before assembly. When installing hoses, take care to assure that they will not be exposed to being pinched, cut or rubbed that would cause hose damage or failure, which could cause poor power steering performance or failure. When using push-lock fittings on a suction line, utilize hose clamps to avoid potential air leaks which could cause pump cavitation.

STEP 1 Pump inlet line (Reservoir to Pump - Line #1) must be a minimum #10 (3/4" ID) line. This hose must be vacuum rated to 20 IN HG in order to avoid collapse. It is recommended that this line be as short as possible and that the reservoir is mounted above the pump.

STEP 2 Pressure line (Pump to Steering Gear Pressure Port - Line #2) should be a minimum #6 (3/8" ID) line. This hose should be rated 2000 PSI working pressure 6000 PSI burst rating. Push-lock style hose fittings are not acceptable on a high pressure line.

POWER STEERING SYSTEM OVERVIEW

KSE's Power Steering Pumps and Tandem Pumps (PS+Fuel) have been proven to give excellent power steering performance under racing conditions for various applications including sprint cars, modifieds, and late models. KSE's power steering pumps work well with stock power steering gears (i.e. Saginaw), power rack & pinions, and various aftermarket units. All of KSE's power steering pumps are specially designed positive displacement gerotor-style pumps which can be characterized by their high mechanical and volumetric efficiencies with smooth flow and low pulse ripple. It is important to note that a positive displacement pump (vane, gerotor, gear, etc.) creates flow, not pressure – pressure is only a signal of the resistance to flow!

When troubleshooting any power steering system, it is always important to remember that there are many components and/or factors which can affect the performance of the system, including:

- Power Steering Gear / Rack & Pinion
- Power Steering Pump
- Power Steering Fluid & Reservoir
- Plumbing – Hoses & Fittings
- Steering Geometry & Tire Scrub
- Steering Ratio - Linkage & Steering Quickener

Notably, the two most commonly overlooked items in this list (which account for a large majority of all power steering issues) are the power steering fluid reservoir and the power steering plumbing – namely the pump suction line. A well designed power steering fluid reservoir should have these features:

- The tank must be vented (i.e. vented cap). A non-vented tank will cause pump seal failure.
- Should be tall in shape and hold a minimum of 16 oz. of fluid.
- Should have baffling to defuse fluid turbulence.
- Returning fluid should enter below fluid level.
- Should be made of aluminum or good heat conductive material.
- A filtered system will increase the life of all system components.

The suction line to the inlet of the pump should be a minimum #10 (3/4" ID) line. This hose must be vacuum rated to 20 IN HG in order to minimize the potential for hose collapse. Proper care should be taken to assure that the hose is not cut, rubbing, or pinched which could cause hose failure. The fittings need to be inspected in order to verify that they are free of scratches, dents, or dings that could cause air to be pulled into the system. If push-lock hose ends are used, hose clamps are highly recommended.

The pressure line from the pump to the steering gear should be a minimum #6 (3/8" ID) line. This hose must have a minimum 2000 psi working pressure with a 6000 psi burst rating. The return line from the steering gear to the reservoir should be a minimum #6 (3/8" ID) line. This hose should have a minimum 100 psi working pressure with a 300 psi burst rating.

The pump's performance can be best determined by a flow-pressure test which requires specialized equipment for assuring proper flow capabilities. KSE's standard pump test specifications are as follows:

- Output Flow @ 3600 Pump RPM – 5 GPM (minimum at zero load)
- Output Pressure @ 1700 Pump RPM – 1100 psi (minimum relief setpoint)

WARNING: When testing the power steering section of a KSE Tandem Pump, clean oil or fuel must be pumped by the fuel section. Running a pump dry can result in severe pump damage.

STEERING HARD ALL THE TIME

CAUSE	SOLUTION
LOW FLUID LEVEL	ADD FLUID
PUMP SPEED TOO LOW	CORRECT TO 50% OF ENGINE RPM (CONFIRM PULLEY RATIO i.e. 40/20 TEETH)
RELIEF VALVE STUCK OR DAMAGED	REMOVE AND INSPECT
STEERING GEAR DEFECTIVE	REPAIR OR REPLACE STEERING GEAR
PUMP DEFECTIVE	REPAIR OR REPLACE PUMP

STEERING HARD AFTER WARMED UP

CAUSE	SOLUTION
AERATED FLUID (CAVITATION)	HOSE OR FITTING FROM RESERVOIR TO PUMP DEFECTIVE, AIR LEAK OR RESTRICTED
	RESERVOIR NOT VENTED
	INADEQUATE RESERVOIR DESIGN
	LOW FLUID LEVEL
	RESTRICTED FILTER, IF USED
STEERING SYSTEM OVERHEATED	INADEQUATE RESERVOIR DESIGN
POOR FLUID QUALITY	USE KSE ELIXIR, PART# KSM1086
PUMP DEFECTIVE	REPAIR OR REPLACE PUMP
STEERING GEAR DEFECTIVE	REPAIR OR REPLACE STEERING GEAR

STEERING HARD LOW SPEED
BELOW 2500 ENGINE RPM MAYBE NORMAL

CAUSE	SOLUTION
ENGINE STALLED (HARD BRAKING)	NONE
AERATED FLUID (CAVITATION)	HOSE OR FITTINGS FROM RESERVOIR TO PUMP DEFECTIVE AIR LEAK OR RESTRICTED
	RESTRICTED FILTER, IF USED
	RESERVOIR NOT VENTED
	LOW FLUID LEVEL
STEERING SYSTEM OVERHEATED	INADEQUATE RESERVOIR
POOR FLUID QUALITY	USE KSE ELIXIR, PART# KSM1086
STEERING GEAR DEFECTIVE	REPAIR OR REPLACE GEAR
STEERING LOADS TO HIGH	PITMAN ARM LENGTH (REDUCE LENGTH TO SLOW DOWN RATIO)
	HIGH CASTER ANGLE
	BIND UP IN STEERING LINKAGE
	EXCESSIVE TIRE SCRUB
STEERING COMPONENT BIND UP	KING PIN, DRAG LINK, TIE ROD, FRONT GEOMETRY
PUMP DEFECTIVE	REPAIR OR REPLACE PUMP

PUMP HAS REPEATED SEAL LEAK PROBLEMS

CAUSE	SOLUTION
NON VENTED RESERVOIR	VENT CAP OR RESERVOIR
FLUID INADEQUATE	USE KSE ELIXIR, PART# KSM1086
	REPAIR OR REPLACE PUMP