



## INSTALLATION & START-UP GUIDE Tandem Pump

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### PUMP OVERVIEW

**KSE's Tandem Pump** is a high performance power steering and fuel pump all-in-one. This pump is a gerotor-style positive displacement pump and is characterized by its high efficiency and smooth flow. The Tandem pump utilizes a single shaft for operation of both the power steering & fuel sections and is available in a belt drive and a direct drive (3/8" hex) version. The power steering section utilizes an internal high pressure relief to protect system damage (i.e. steering gear) from possible overpressurization. The fuel section contains an integral fuel by-pass system which utilizes a spring, poppet, and adjustable pill orifice to control low and high speed fuel pressures (flow). This pump is race proven is designed to work in both alcohol and gasoline racing applications. The Tandem pump additionally utilizes a phenolic insulator to mitigate heat transfer from one pumping element to another – the fuel pump has actually been proven to run cooler than many diaphragm and belt drive fuel pumps. It is always important to remember that a positive displacement pump (vane, gerotor, gear, etc.) creates flow, not pressure – pressure is only a signal of the resistance to flow!

### PUMP SPEED

**IMPORTANT:** The Tandem pump is designed to operate at half (50%) of engine RPM.

Front Drive Example: 20 tooth lower pulley on crank and 40 tooth upper pulley on pump.

Belt Drive Example: 22 tooth lower pulley and 44 tooth upper pulley on pump.

Pump speed percentages of more or less than recommended will affect the performance of the pump.

The pump and mounting brackets are not designed to be used with serpentine or v-belt drives due to the high side loads from belt tension. HTD style pulleys and belts are primarily recommended.

### 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.

### POWER STEERING SECTION

**Note:** Refer To Attached Plumbing Diagram For Additional Details. The suction line to the inlet of the pump (**Line #1: Reservoir to 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. It is recommended that this line be as short as possible, 24" or less. 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. **IMPORTANT:** The power steering fluid reservoir is a key part of the power steering system's overall performance.

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.



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The pressure line from the pump to the steering gear (**Line #2: Pump to 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 (**Line #3: Gear to 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.

### *FUEL SECTION - CARBURETION*

Verify that the hose material is compatible with the type of fuel being used. The suction line to the inlet of the pump (**Line #4: Fuel Tank / Filter to 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. The use of an inline filter is necessary for maximum performance and life of the pump. The filter should be rated for 6 GPM with zero pressure drop for suction application and a maximum of 62 micron.

The pressure line from the pump to the carburetor (**Line #5: Pump to Carburetor / Fuel Log**) is based on carburetor manufacturer recommendations. This pump's pressure port utilizes a #8 (1/2" ID) ORB fitting. A non-liquid filled fuel pressure gauge should be installed between the pump and the carburetor as a tuning tool for adjusting fuel delivery. It is important to remember when tuning a fuel system that the pump is only providing the fuel needed to fill the carburetor float bowls – the carburetor is what actually provides the engine with the correct air-fuel charge (not the fuel pressure). Fuel pressure is strictly a signal of fuel flow and line resistance.

The fuel bypass return line (**Line #6: Pump to Fuel Tank**) should be a #8 (1/2" ID) line. To minimize fuel pressure spikes, it is important that this line is as unrestricted as possible – no 90° fittings, pinching, or kinking of hoses. See *Fuel Pressure Regulating* section in this document for additional tuning details.

### **START-UP AND AIR PURGING**

**CAUTION:** Running the Tandem pump without fluid (PS+Fuel) will cause damage to the pump.

### *POWER STEERING*

Fill vented P/S fluid reservoir with a high performance P/S fluid (KSE Elixir – Part # KSM1086). Loosen the P/S inlet line at the pump inlet fitting until fluid is seen coming out around the fitting and then retighten fitting. **CAUTION:** Pressurizing the pump inlet more than 15 psi will cause pump seal damage.

### *FUEL*

Fill fuel tank with adequate amount of fuel for start-up and initial run. Loosen the Fuel inlet line at the pump inlet fitting until fuel is seen coming out around the fitting and then retighten. If the pump inlet port is above the fuel level of the tank, it will be necessary to take other steps to assure fuel is at the pump before start-up. **CAUTION:** Pressurizing the pump inlet more than 15 psi will cause pump seal damage.

### *ENGINE START*

If possible, crank engine for 15 seconds without starting. Start engine while watching fuel pressure gauge. Fuel pressure of 2 – 4 psi should be present within 15 seconds. If fuel pressure is not present, shutoff engine and repeat fuel priming steps. *Pump can be damaged in ran dry.* Check P/S fluid level in



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reservoir and add fluid as required. With pump running, turn the steering wheel full lock-to-lock several times to help purge air from the system. Let stand 30 for minutes 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.

### **FUEL PRESSURE REGULATING**

The fuel by-pass system utilizes a spring, poppet, and pill orifice design for regulating fuel pressure. The spring and poppet control idle pressure. The idle pressure should be 2 – 4 psi. Maximum high speed pressure is controlled by the pill orifice. The pump has a .160 pill orifice installed from the factory. This pill orifice is designed to get most alcohol applications in an 8 – 10 psi max pressure setpoint. A .140 & .180 pill orifice is additionally supplied with the pump. **IMPORTANT:** Maximum pressure (flow) must be checked with the engine under load. Free revving the engine will not give true maximum fuel pressure for correct tuning. To raise max fuel pressure – decrease pill orifice size. To lower max fuel pressure – increase pill orifice size. Adjusting the pill sizing by .020, equates to an approximate pressure adjustment of 1-2 psi respectively. Gasoline applications require less fuel and typically require a .220 pill orifice size for initial tuning. A maximum fuel pressure test is important for engine performance and at max power, fuel pressure (flow) should be steady. The following are typical engine fuel pressure requirements dependent upon fuel type - Alcohol: 8-10 psi & Gasoline: 6-9 psi.

**PERFORMANCE TIP:** To minimize carburetor flooding (resulting in engine stumble) and improve throttle response in a deceleration / “out-of-throttle” condition, set carburetor flow levels at max fuel pressure (flow) – not at idle pressure. This will put the float levels at a normally lower level and will allow them to react to any fuel pressure spikes.

### **POWER STEERING PRESSURE**

The power steering section's internal relief valve is preset at the factory for a minimum of 1100 psi (1300 psi for *TandemX* Pumps). This is more than adequate for most type of race power steering systems. The system pressure is relative to pump speed and steering load (flow resistance). In some applications, power assist may appear sluggish below 2000 engine RPM.

### **SERVICE**

Clean fuel and power steering fluid are important to pump performance and life. Avoid running either pump section dry. Fuel lube additives (upper cylinder lube) have shown improvements in pump life and mitigate fuel corrosion. Never use ATF in a power steering system – it can swell and damage pump and steering gear seals. For storage or extended periods of non-use, the fuel section and fuel by-pass should be cleaned and flushed with clean mineral spirits or kerosene and all ports sealed. The P/S section needs only to have the ports sealed.

Keep your equipment in top running condition. KSE offers complete general and repair services. Typical turnaround time during race season is 48-72 hours. When sending a pump to KSE for service, please include the following information: Name, Address, Phone Number, Email, and Additional Contact or Pertinent Product Information.

Please ship all general service or repair items to the following shipping address:

KSE Racing Products, Inc  
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