K SERIES PLUNGER PUMP

KP Pump Installation and Operating Instructions Manual

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1. Introduction to TKM K Series Metering Pumps

This instruction manual is to provide the end user with an extensive understanding of TKM Metering Pumps. The information provided in these instructions includes important guidelines for the safe and successful installation, operation, and maintenance of TKM K Series Plunger Metering Pumps.

The instructions and additional information outlined in this document must be integrated into the current rules and regulations in the location of installation. The instructions in this manual DO NOT replace any company or plant regulations or requirements which have been issued for safety purposes.

1.1 Description of Terms

To prevent ambiguity and possible misinterpretation of information, the following technical description of users and personnel have been defined and assigned a common term, which will be referred to hereafter. The following terms are only a few of the most common terms used in the entire manual.

- **Manufacturer** – Refers to TKM LLC
- **End User** – Refers to the company, whether through a distributor or directly, that purchases the TKM Metering Pump for their own private use
- **Distributor –** A third-party company acting between the Manufacturer and the End User that focuses exclusively on purchasing TKM Pumps for redistribution
- **Representative** – A third-party company acting on behalf of TKM LLC. These companies can repair, service, and offer advice to End Users
- **Qualified Personnel –** Pump operators, technicians, installers, or maintenance staff who have undergone the appropriate training necessary to handle TKM Metering Pumps

1.2 General Information

The following instruction manual covers the operation, maintenance, and storage of TKM Metering Pumps. Correctly following the guidelines presented in this manual will help to:

- Avoid dangers to company personnel, machinery, and the working environment.
- Ensure the longevity of the TKM Metering Pump and the performance of the system.
- Reduce the need for repairs due to mishandling the product.

TKM Metering Pumps are intended for operation in industrial areas and thus are not considered retail products. The End User must take corresponding accident prevention

measures to protect Qualified Personnel from danger while operating, repairing, and handling TKM products.

NOTICE **This document contains information intended for Qualified Personnel only. Carefully read the instructions in this manual before using TKM Metering Pumps. Please keep these instructions for future use.**

TKM LLC reserves the right to update or modify the design, features, and components of KP Pumps. The information contained in this instruction manual is thus subject to change without notice.

2. Safety Instructions and Guidelines

The following safety instructions will assist Qualified Personnel with handling the TKM Metering Pump in a safe manner.

2.1 Qualified Personnel and Training

The personnel for operation, maintenance, inspection, and installation must be qualified for their tasks. The End User must clearly define the responsibilities of personnel and organize their supervision.

The End User is solely responsible for the appropriate training of company personnel and for assuring that personnel are qualified for the needed work. It is never appropriate nor acceptable for untrained personnel to handle any TKM product.

In the case that the End User requires the appropriate training for company staff, the Manufacturer, Distributor, or Representative can provide the necessary training services.

2.2 Safety Precautions during Maintenance, Servicing, and Installation

It is the End User's responsibility to ensure that only Qualified Personnel who have read and understood the operating instructions for TKM Metering Pumps are allowed to service the TKM equipment.

Only TKM spare parts should be used to repair valves or other parts of the TKM Pump.

When servicing the connections on the TKM Pump, always confirm that the connections are not under any pressure. Servicing a TKM Pump under pressure may result in injury to staff and damage to equipment.

2.3 Neglecting the Safety Instructions

Neglecting the safety instructions may cause danger to company personnel, environmental hazards, and damage to the TKM Metering Pump or other TKM products.

Dangers resulting from safety negligence may include:

- Product failure
- Bodily harm from mechanical or chemical malfunctions
- Environmental hazards from chemical leaks and pipeline bursts

2.4 Importance of TKM Authorized Spare Parts

Modification of the TKM Pump is not permitted. Repair of the TKM Pump Liquid End is only permitted after authorization from TKM LLC. Only genuine spare parts approved by TKM may be used to service the pump. The use of non-TKM replacement parts will immediately terminate the warranty. See section **3. Manufacturer's Warranty** for more information.

TKM authorized parts are essential for the safe performance of the TKM Pump. Using any parts unauthorized by TKM LLC may result in serious injury to staff or damage to the TKM Pump.

2.5 Intended Use for the TKM Pump

The TKM Metering Pump or system is only to be used in accordance with the product description. The End User must honor the specified working conditions of the pump stated in section **6. Technical Data:**

- Liquid End material
- Working pressure of the pump
- Appropriate atmospheric temperature
- Appropriate motor voltage and power

If the TKM Pump is to be used for other applications not previously discussed with TKM LLC, the End User must consult with TKM before initiating the new process.

2.6 Personal Protection Equipment for Installation and Maintenance

The End User is solely responsible for providing their Qualified Personnel with the appropriate personal protection equipment (PPE) necessary for safely installing and servicing TKM Metering Pumps.

When servicing the TKM Pump, always adhere to the safety regulations needed for the pumped chemical.

3. Manufacturer's Warranty

TKM Metering Pumps, as well as other TKM products, are under a manufacturer's warranty for a period of two years (24 months) from the Manufacturer's shipping date. The warranty covers replacement, free of charge, of any defective components deemed unsuitable by the TKM technical office.

This warranty **is not valid** in the following cases:

- Components subject to normal wear, i.e.:
  - Valve assemblies
  - O-rings, seals, gaskets included in valve assemblies
  - Plunger packing
  - Bearings
- Using unauthorized replacement parts for the TKM Pump
- If the installation or use do not meet the technical conditions of the sale confirmation
- Improper installation of the TKM Pump or not following the installation instructions (refer to section **7. Installation** for full installation procedures)
- Disassembling the TKM Pump
- Tampering with the TKM Pump
- If the End User sells the pump to another party
- Faulty or careless handling i.e. dropping the TKM Pump

NOTICE

The TKM Pump should only be serviced for routine maintenance of the Liquid End and valve components. DO NOT attempt to repair a TKM Pump under warranty, and DO NOT attempt to disassemble a TKM Pump under warranty if the TKM Pump is malfunctioning from any component other than the Liquid End.

Disregarding this notice will result in immediate termination of the manufacturer's warranty.

TKM LLC reserves the full right to determine the warranty coverage of a defective TKM Metering Pump or TKM product. All obligations and liabilities under this warranty are limited to repairing the TKM Pump, replacing the TKM Pump, or refunding the original purchaser, who may be the End User or the Distributor, but not both, up to the full purchase price. TKM LLC shall not be held responsible for any removal or replacement cost, or any additional consequential damages.

4. General Description of TKM K Series Plunger Pump

The K Series Plunger Metering Pump is a mechanically actuated spring return pump, which falls into the category of controlled volume alternative displacement pumps.

The KP Pumps include three variations: standard, high pressure, and high viscosity. The technical data provided in this instruction manual is equally applicable (unless otherwise noted) for any KP model pump.

KP Pumps are characterized by a plunger Liquid End, which has been engineered to operate in constant low pressure or high pressure, and in low flow applications while maintaining a continuous discharge flow.

4.1 KP Plunger Pump Models

The TKM KP Plunger Metering Pump exists in four distinct models, which are described in the sections below. Each model is designed for a specific application depending on the requirements provided by the End User.

4.1.1 The Standard KP Pump

The Standard KP Pump is designed and manufactured for use with non-aggressive chemicals. This pump is built to withstand a maximum pressure of 600 PSI (40 BAR). Fitted with a SAF 2205 duplex steel plunger, and PTFE Chevron Packing, the KP Pump is easy to service and inexpensive to repair.

The Liquid End and the check valves are made entirely of 316L stainless steel.

4.1.2 The High-Pressure KP Pump

The High-Pressure KP Plunger Pump (KP HP) is designed for applications reaching a working pressure of 1500 PSI (100 BAR). Fitted with a SAF 2205 duplex steel plunger and braided ring packing composed of PTFE and Kevlar, the High-Pressure KP Pump is manufactured for the toughest applications where a constant high pressure has to be maintained.

4.1.3 The Low-Flow KP Pump

The Low-Flow KP Plunger Pump (KPL) is used for applications that require consistently low flows at high pressures. With flowrates ranging from .14 GPH (.5 LPH) to .41 GPH (1.6 LPH), the KPL is designed for extremely accurate dosing.

Being a KP HP variant, the KPL Pump is fitted with a SAF 2205 duplex steel plunger, and PTFE and Kevlar packing. The KPL can reach a maximum working pressure of 1500 PSI (100 BAR).

4.1.4 The High Viscosity KP Pump

The High Viscosity KP Plunger Pump (KP HV) is fitted with a Single Valve system and engineered for pumping fluids with a viscosity of up to 55,000 centipoises. The KP HV can reach a maximum working pressure of 600 PSI (40 BAR).

4.2 KP Plunger Pump Standard Features

Every KP Plunger Pump is shipped from TKM LLC with the following technical features:

- Anodized cast aluminum housing, yoke, and motor flange
- Powder coated aluminum castings in a deep red color (other colors available upon request)
- Stainless steel Liquid End
- Stainless steel check valves
- Stainless steel hardware

5. Receiving and Storing a TKM Pump

All TKM Metering Pumps and TKM products are shipped from TKM LLC in excellent condition after undergoing thorough testing. TKM LLC carefully assembles each pump to the specified needs of the End User. The pump should only be used for the application intended and agreed to with TKM LLC.

Every pump that is distributed from TKM LLC is properly packaged in order to withstand normal shipping and handling conditions. Please refer to the section **5.1 Receiving Inspection** for the proper course of action when receiving a TKM Pump.

TKM LLC sends every K Series Metering Pump in excellent condition. Every pump is shipped as follows:

- Ready for immediate installation for the application specified in the purchase order
- Thoroughly tested to meet the internal specifications of the pump
- Anodized and powder coated to ensure maximum protection against aggressive chemicals and harsh environments
- Filled with gear oil to the correct functioning level

5.1 Receiving Inspection

The End User should inspect the goods immediately upon receipt and ensure that:

- The products correspond to the purchase order
- Packaging and products have not been damaged or tampered with during transport
- The pump has been received in excellent condition
- All of the accessories or spare parts are present

NOTICE **In the event that the product has been damaged on delivery, immediately issue a complaint with the courier and inform TKM. If possible, photograph the damage for documentation purposes.**

5.2 Storing a TKM Pump

If the TKM Pump is not used immediately, the End User should store the pump in a dry, clean, and weatherproof environment. To prevent soil moisture, it is best to place the pump off of the ground on a shelf or on wooden pallets. Ensure that the temperature of the storage location is between 34°F (1°C) and 120°F (50°C).

To prevent serious injury and damage to the TKM Pump, **do not stack** multiple pumps together and **do not stack** anything on the individual pump packages. Ensure that the shelf or alternative location where the pumps are stored can support the weight of the pumps.

Before putting the pump into operation, make sure the pump is at the correct working temperature (see section **5.2 Temperature** for full details) before startup.

⚠CAUTION **Only Qualified Personnel should be responsible for the storage of the TKM Pumps. Always check the dimensions and weight of the TKM Pump before handling or lifting.**

6. Technical Data

The main housings for KP Pumps are constructed of cast aluminum. The aluminum castings are then fully anodized and powder coated for added chemical resistance. Liquid Ends are not coated but are instead specially selected from a variety of materials depending on chemical compatibility.

For the KP Pump, the most common Liquid End used is made from 316L stainless steel. The KP Pump is available in a standard model, as well as a High-Pressure model (KP…HP); a High Viscosity model (KP…HV); and a Low Flow model (KPL). Refer to section **4.1 KP Plunger Pump Models** for more detailed information regarding the various KP Pump models.

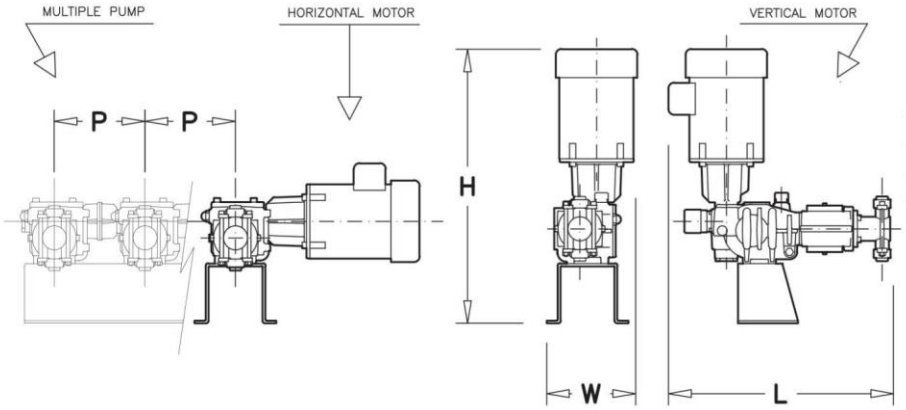
6.1 Specifications

The following details are the standard specifications for the KP Plunger Pump:

- Minimum Flow Capacity – KPL Model 0.14 GPH (0.5 LPH)
- Maximum Flow Capacity 112 GPH (416 LPH)
- Maximum Pressure – HP Model 1500 PSI (100 BAR)
- Accuracy +/- 2% between 10% and 100%
- Pump Weight 25 lb. to 50 lbs.
- Working Temperature 34° F (1°C) to 200°F (93°C)
- Noise 65 dB – 75 dB

6.2 KP Pump Dimensions

Please refer to the diagram below for the correct dimensions of the standard and high-pressure TKM KP Pumps. All dimensions are formatted in the following way: Inches (millimeters).



OVERALL DIMENSIONS

DIM	L	W	H	P
KP	19(483)	8(203)	24(610)	8(203)
HP	21(534)	8(203)	24(610)	8(203)

* H Value refers to NEMA Motor 0,5 HP frame 56 C

6.3 Temperature

The functioning temperature (TEMP) for all TKM Plunger Pumps is between 32°F (0°C) and 200°F (93°C).

32°F (1°C) ≤ TEMP ≤ 200°F (93°C)

The maximum working temperature should never exceed 200°F. Prolonged exposure to temperatures exceeding 200°F will severely reduce oil life and may damage Liquid End components.

6.4 Noise Levels

The average level of noise emitted by the K Series Metering Pumps varies depending on the material of the Liquid End, and the size of the Liquid End. The following table shows the average noise levels detected from four KP Pump prototypes at a distance of 3 feet (1 meter) from the pump:

KP Pump Model – Stainless Steel Liquid End	Noise Level in Decibels
KP16	< 65 dB
KP25	<68 dB
KP38	<71 dB
KP67	<75 dB

⚠CAUTION **The end user holds full responsibility of implementing the most effective measures to prevent the health risks resulting from daily noise exposure.**

6.5 Pump Name Plate Notation

KP	15	S	75		A	/3	F		HP
A	B	C	D	E	F	G	H	I	J

The following pump model is designated by the notation above (KP15S75/3 HP):

A. K series Plunger Pump, B. Plunger Diameter 15 mm, C. 316L Stainless Steel Liquid End, D. 75 Strokes per Minute (SPM), E. Standard Stainless Steel Valve Balls, F. Aflas Valve O-rings, G. Three Liquid Ends (Triplex), H. ANSI Flanged Connections, I. NEMA Motor Flange, J. High Pressure Model.

A. The two or three letters at the start of the model number determine the series of the pump. When paired together, the notation will determine the series and the type of pump i.e.
   KP – **K** Series **P**lunger; **KPL** – **K** Series **P**lunger **L**ow Flow
   - K – Series
   - P – Plunger
   - L – Low Flow
B. Plunger Diameter – This number determines the diameter of the plunger within the Liquid End in millimeters. This number is considered the size of the pump.
C. Liquid End Material – The material of construction for the Liquid End will differ depending on the pump application and model:
   - S – 316L SS
   - A – Alloy 20
D. Strokes Per Minute (SPM) – The SPM notation shows the maximum number of strokes the pump will complete in 60 seconds. SPM is determined by the gear ratio.
E. Valve Ball Material – The material of construction for the Valve Balls will differ depending on the pump application and model:
   - BLANK – Standard balls (Stainless steel in KP Pump)
   - A – Alloy 20 balls

F. Valve Seal Material – Depending on the application, the O-rings in the valves will change:
   - BLANK – FKM
   - E – EPDM
   - A – Aflas
   - P – PTFE Seals

G. Number of pump heads -- A forward slash and a number (i.e. /3) will equal the number of heads on the pump:
   - BLANK – One Liquid End (simplex)
   - /2 – Two Liquid Ends (duplex)
   - /3 – Three Liquid Ends (triplex)
   - /4 – Four Liquid Ends (quadraplex)

H. Liquid End valve connections – This section determines the fitting size of the valve connections:
   - BLANK – NPT
   - B – BPT
   - F – ANSI Flange

I. Motor Flange specification – The motor flange may change for international use:
   - BLANK – NEMA
   - Q – IEC

J. The final notation denotes a standard model, High Pressure model, or High Viscosity model:
   - BLANK – Standard model
   - HP – High Pressure model
   - HV – High Viscosity model

6.6 KP Standard Components

The following table contains all of the standard components for the KP Pump. If the model contains components that differ from the standard ones they will be specified on the pump nameplate with the appropriate notation.

Pump Model	S	A
Liquid End	316L SS	Alloy20
Diaphragm	PTFE	PTFE
Valve Housing	316LSS	Alloy20
Valve Balls	316LSS	Alloy20
Valve Seats	316LSS	Alloy20
Valve Guides	316LSS	Alloy20
Valve Seals	FKM	FKM

Connections	NPT	NPT
Motor Flange	NEMA	NEMA

6.7 KP Gear Oil

Every KP Pump uses Shell Omala Oil 320 for proper lubrication of the gearing and internal components. Each pump is filled with approximately 1 quart (0.95 liters) of Omala Oil 320.

The KP Pump's oil should be replaced once a year. TKM recommends replacing the gear oil with Shell Omala Oil 320. In the case that Shell Omala Oil 320 is unavailable, the following list provides acceptable alternatives:

- Chevron Meropa 320
- Mobilgear 600 XP 320
- Phillips 66 Extra Duty Gear Oil 320
- Sunoco Sunep 320 Gear Oil

NOTICE **Never use a different replacement gear oil for the KP Plunger Pump unless the replacement oil has been approved by TKM.**

For a full Material Safety Data Sheet for the Shell Omala Oil 320 please visit http://www.epc.shell.com/

7. Installation

Proper installation is critical for the efficient performance of the KP Pump. The pump should be correctly mounted for operation in an easily accessible area. Secure the pump base plate to an even, flat, sturdy surface. Do not attempt to mount the pump onto a sloped, uneven surface. Do not fasten the pump from any other threaded holes located on the pump.

7.1 Mounting a TKM Pump

The following guidelines will assure that the TKM Pump is installed in a location that is ideal for the efficient performance of the pump and convenient for routine maintenance and inspection.

The proper guidelines for choosing a location for the TKM Pump are as follows:

- Mount the pump in clear accessible area that is high enough off of the ground to ensure correct plumbing for the suction piping. Ideally the bottom valve should be mounted no lower than 12 inches from the ground.
- Do not mount the pump directly onto a concrete foundation.
- The manual stroke adjustment should be facing an area with plenty of hand and arm access to facilitate adjusting the stroke position.
- When installing the pump outdoors in a warm climate, TKM recommends covering the pump to prevent direct sun exposure and overheating.
- When installing the pump in cool climate, TKM recommends installing the pump in an enclosure that is warmed and insulated to prevent the chemical from solidifying within the Liquid End and the valves.

7.2 Connecting the Suction Piping

To correctly connect the KP Pump to the available suction line, follow these guidelines:

- Qualified Personnel installing the TKM Pump must ensure that the valve axis is perfectly vertical. Failing to ensure a perfectly vertical valve axis will hinder the pump's performance.
- The pipe leading into the suction side (bottom of the pump) should always be equivalent in size to the pump's connection.
  - I.e. a pump with a 1/2-inch suction connection should attach to a 1/2-inch pipe

    NOTE: The suction piping should never be smaller than the pump's connection.

- The suction piping should always come from a flooded suction.
- The suction piping should be as short as possible.
- Piping should avoid bends if possible. This will prevent the likelihood of a vapor lock.
- Suction lines must be air tight to maximize the pump's efficiency.

Please refer to the following diagrams to ensure that the suction piping has been correctly installed:

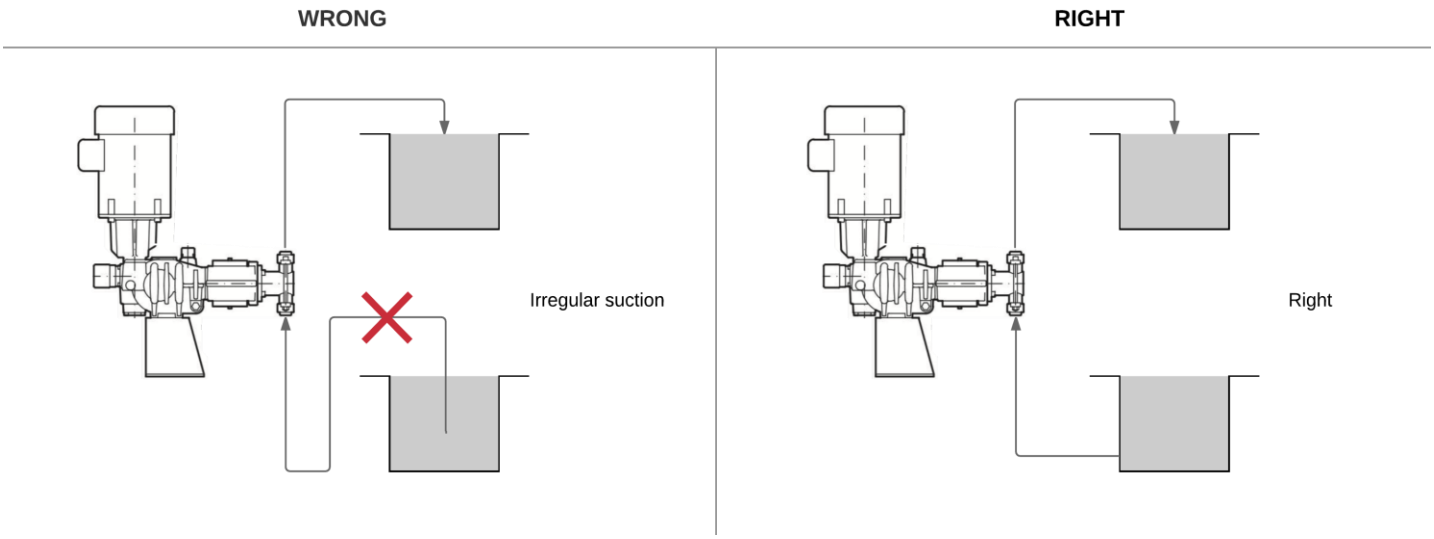


Figure 1 - Avoid irregular piping when connecting the suction line

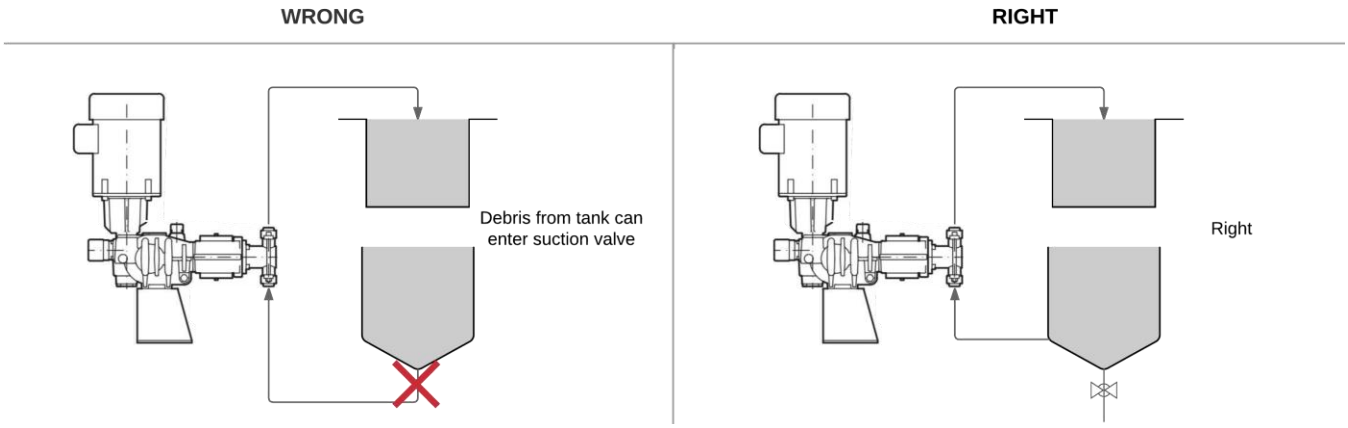


Figure 2 - Avoid debris from bottom of reservoir tank

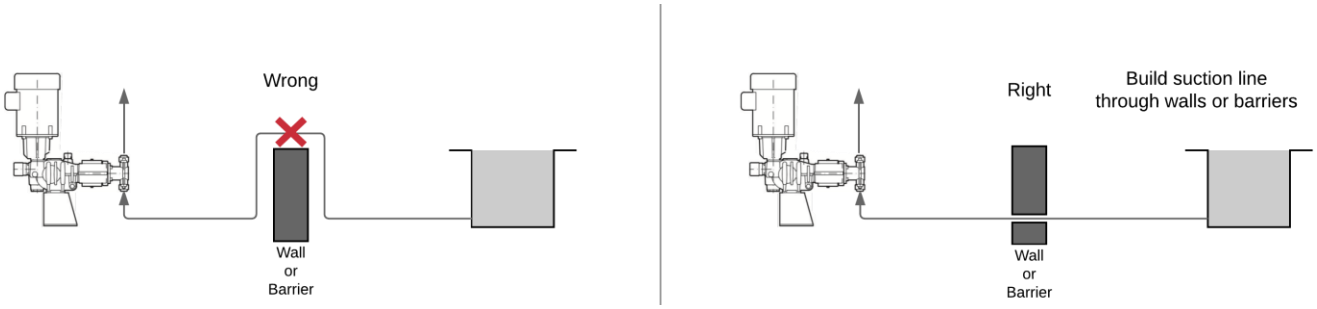


Figure 3 - Always run piping through walls or barriers

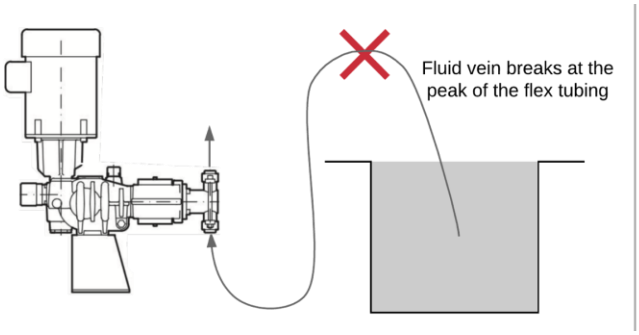


Figure 4 - Avoid rounded tubing in suction line to prevent air in suction line

7.2.1 Suction Line Filters

A filter in the form of a basket strainer or y-strainer on the suction piping is always recommended to prevent insoluble substances and debris from entering the pump's valves. Any debris entering the pump head may cause the valves to malfunction.

NOTICE **The suction line filter needs to be cleaned often in order to prevent malfunction of the pump and system.**

Please refer to the following diagrams in order to correctly integrate a suction line strainer:

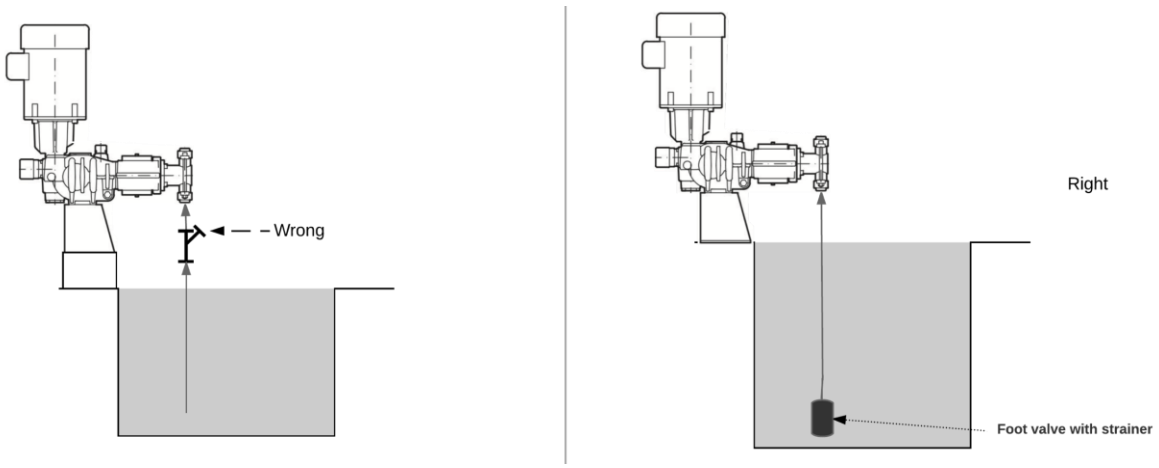


Figure 5 - Correctly integrating a Y-strainer on the suction line

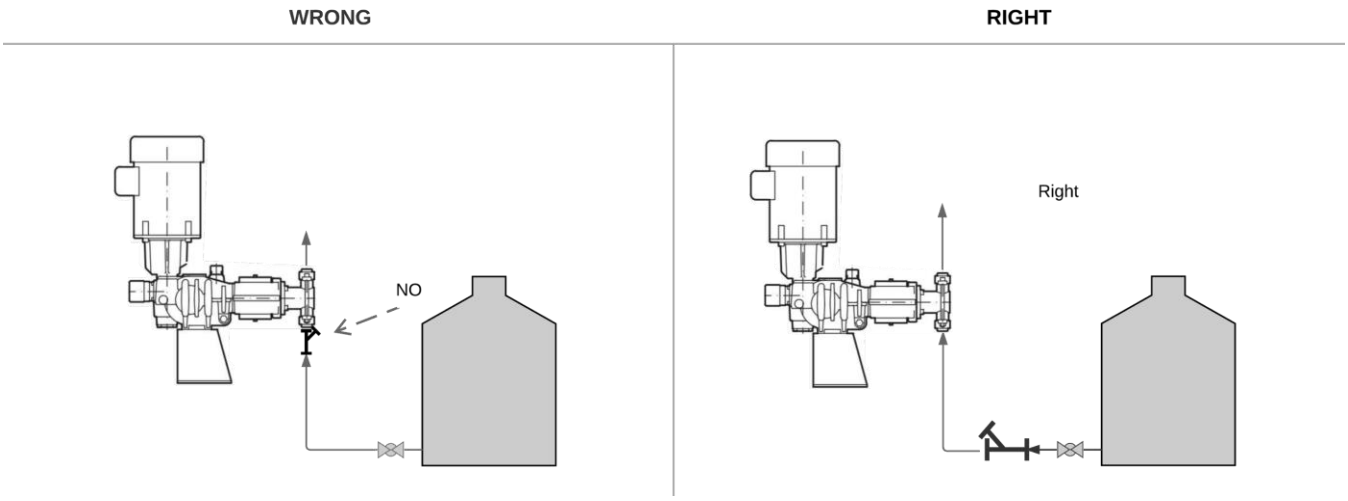


Figure 6 - Using a foot valve with a strainer when suction line runs into reservoir tank

7.3 Connecting the Discharge Piping

The discharge pipe should always be equal in size or larger than the pump suction connection. It should never be smaller than the connection.

- When sizing the pipe always remember to consider the pipe length, the chemical velocity, and the chemical viscosity.
- Generally, a more viscous liquid will perform better with a larger discharge pipe.

7.3.1 Pressure Relief Valve

A pressure relief valve should always be installed to protect the pump, the piping, and any accessories installed. A pressure relief valve protects the system in the case of unprecedented back pressure buildup.

When the pressure relief valve (PRV) is activated, the fluid will relieve from the bottom of the valve. TKM recommends installing a recycling line from the PRV back to the suction reservoir.

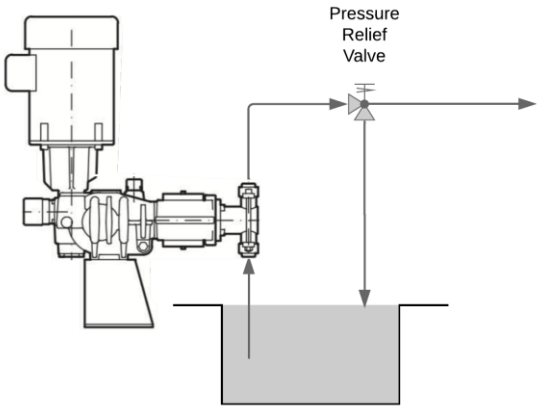


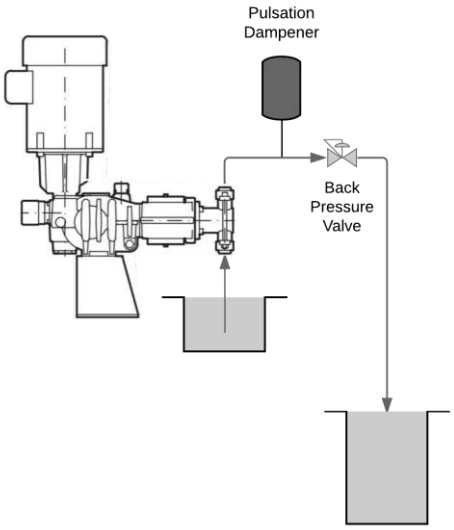
Figure 7 - PRV and recycling line

NOTICE **The pressure relief valve should always be installed before the back pressure valve. Always position the pressure relief valve as close to the pump as possible.**

⚠CAUTION **The pressure relief valve should be set no higher than the maximum working pressure shown on the pump's nameplate to prevent possible damage to the pump.**

7.3.2 Pulsation Dampener

Installing a pulsation dampener is highly recommended. Pulsation dampeners help to smooth the flow of the fluid. They provide surge protection when the valves open and close, which in turn extends the longevity of the valves.



Note: The pulsation dampener should be installed before the pressure relief valve and the back pressure valve. Always position the pulsation dampener as close to the pump as possible.

Figure 8 - Pulsation dampener and back pressure valve

⚠CAUTION **Neglecting to install a pulsation dampener may result in erratic flow rates, damage to the piping, or unprecedented pressure buildup. These effects may result in damage to equipment or injury to staff.**

7.3.3 Back Pressure Valve or Anti-Siphoning Mechanism

A back pressure valve should always be installed on the discharge piping. Back pressure valves ensure that no undesired siphoning occurs within the pumping system and prevent backflow. Refer to Figure 9.

Note: The back pressure valve should be located after the pressure relief valve and the pulsation dampener. Always position the back pressure valve as close to the pump as possible.

⚠CAUTION **The back pressure valve should be set no higher than the maximum working pressure shown on the pump's nameplate (minimum 15psi) to prevent unnecessary pressure buildup.**

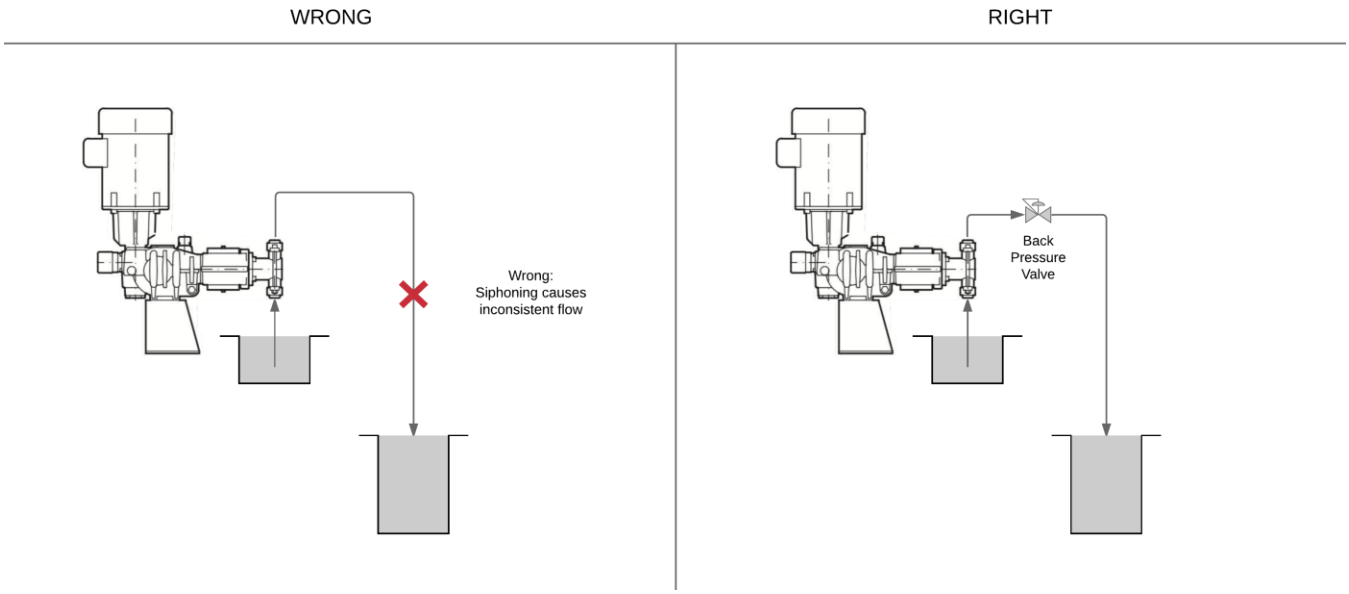


Figure 9 - Using a back pressure valve to avoid unwanted siphoning

7.4 Recommended Configuration for TKM KP Pump System

Figure 10 below is the recommended installation arrangement for TKM KP Pumps.

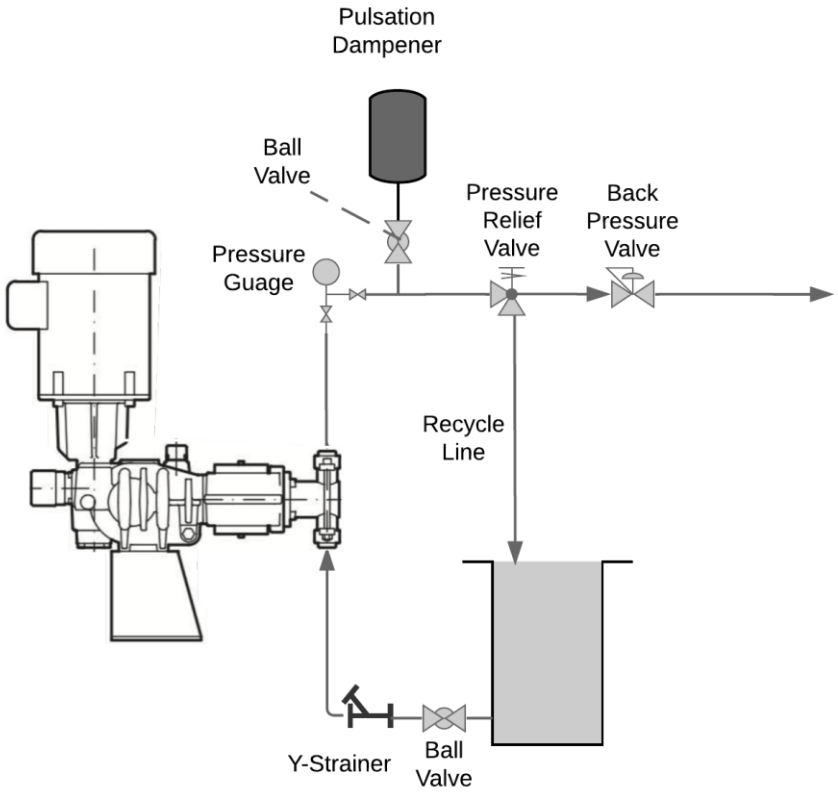


Figure 10 - Recommended configuration for TKM Pump system

7.5 Flushing the Liquid End

Always flush the valves whenever the TKM Pump has been turned off. This will prevent the chemical or other fluid from solidifying inside the valves. Flushing the valves will greatly improve their longevity and performance.

NOTICE **Do not allow the chemical inside the to freeze as this may result in damage to the valves or Liquid End.**

8. Pump Components

8.1 The Gear Box

The gear box contains the worm gear set and the stroke length adjustment. Plunger pumps are manufactured to have a maximum stroke length of approximately five-eighths (5/8) of an inch. The strokes per minute are determined by a worm screw and worm wheel gear set.

The ratio of the worm gear converts the revolutions of the motor into the revolutions per minute within the pump. The motor and worm gear actuate the eccentric shaft which creates an elliptical motion, powering the thrust shaft, which is connected to the plunger, in an outward and inward motion (in relation to the Liquid End). Please refer to section **8.3 The Liquid End** for a full description of the Liquid End function.

The stroke length is determined by the manual stroke adjustment knob, which can be adjusted from 100% to 0% stroke length depending on necessary flow rate.

8.2 Stroke Length Adjustment

The TKM Metering Pump is fitted with a stroke length adjustment knob, hereafter referred to as the knob or the adjustment knob. The adjustment knob allows the End User to determine the flow rate of the TKM Pump.

Turning the knob changes the length of the stroke and distance that the plunger travels within the Liquid End. The shorter the distance, the less liquid will flow through the valves.

The adjustment knob is fabricated as a 10:1 turn ratio, so that one complete turn of the knob, in either a clockwise or counterclockwise rotation, is equal to 10% of the stroke length. A clockwise rotation will decrease the flow, and a counterclockwise rotation will increase the flow.

Refer to the example below:

If the pump is running at 100% stroke length and the knob is turned clockwise one full rotation, the resulting stroke length is 90%. Starting at 100% and turning the knob five full rotations clockwise will result in a 50% stroke length.

Likewise, if the maximum flowrate is 10 gallons per hour when the adjustment knob is set to 100%, and the adjustment knob is turned down one full rotation, the resulting flow rate will be 90% of the maximum flow rate or 9 gallons per hour.

8.2.1 Adjusting the Stroke Position

To adjust the stroke length, turn the adjustment knob in a clockwise or counterclockwise direction. The stroke length decreases when turning the knob in a clockwise rotation. The stroke length increases when turning the knob in a counterclockwise rotation.

To read the stroke length, refer to the black and yellow scales adhered to the adjustment knob at the rear end of the pump.

The yellow scale measures the stroke length in 10% intervals, and the black scale measures the stroke length in .1% intervals. Used together, the scales will measure the stroke length of the TKM Pump down to .1% accuracy.

Refer to the example below:

If the yellow scale reads between 50% and 60% and the black scale reads 7%, then the final stroke adjustment is 57.0%. Similarly, if the yellow scale is set exactly to 50% and the black scale is set to 0%, then the resulting percentage is simply 50%.

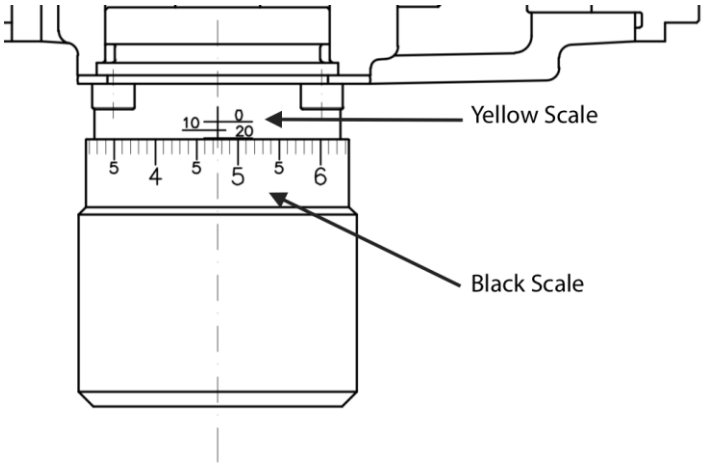


Figure 11- The adjustment knob

8.3 The Liquid End

The Liquid End consists of a plunger, packing, a pump head, and suction and discharge valve assemblies. The plunger, which acts as a piston within the Liquid End, is actuated through the particular gear ratio and the eccentric shaft.

As the plunger is pulled outward from the Liquid End, the valves develop suction and the valve balls are simultaneously pulled in towards the plunger. As a result, the discharge (top) valve closes and the suction (bottom) valve opens.

As the plunger is pushed inward towards the Liquid End, pressure develops causing the valve balls to push away from the plunger. During this motion, the discharge valve opens and the suction valve closes.

8.3.1 The Check Valves

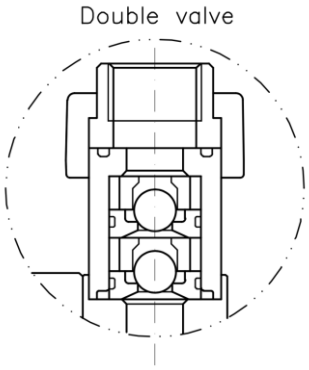
The stainless-steel Liquid End is fitted with two check valves: the suction valve on the bottom side and the discharge valve on the top side. The valves allow fluid to flow through the Liquid End in only one direction. The valves are engineered to improve accuracy and prevent backflow through the pumping system.

The TKM KP Plunger Pump's valves are composed of stainless steel (SS). There are four distinct pieces that make up each check valve: the ball, the guides, the seat, and the valve housing.

Most KP Pumps are fitted with Double Valves, meaning that each check valve contains two balls, two seats, and two guides. There are two check valves on every pump, resulting in a total of four balls, four seats, and four guides per pump.

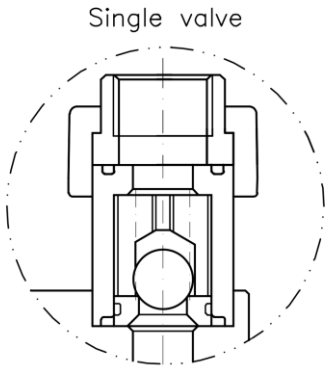
The full components of the Double Valves are as follows:

- 2 SS valve housings
- 4 SS guides
- 4 SS seats
- 4 SS balls
- 4 AS 015 Viton O-rings
- 2 AS 117 Viton O-rings
- 2 AS 210 Viton O-rings



When applications require higher flows or to pump overly viscous fluids, the KP Pump will contain Single Valves. In a Single Valve, each check valve contains one ball, one seat, and one guide. There are two valves on the pump, equaling a total of two balls, two seats, and two guides per pump Liquid End.

The full components of the Single Valves are as follows:



- 2 SS valve housings
- 2 SS guides
- 2 SS seats
- 2 SS balls
- 2 AS 015 Viton O-rings
- 2 AS 117 Viton O-rings
- 2 AS 210 Viton O-rings

8.3.2 The Plunger and Packing

The TKM KP Pump is designed with a SAF 2205 duplex steel plunger fitted for the Liquid End. The plunger acts as a piston within the Liquid End and is the main source of suction and discharge in the Liquid End. As the plunger moves in and out, the liquid flows through the check valves.

The plunger is surrounded by PTFE packing inside of the Liquid End. The packing ensures that the plunger will create a liquid proof seal in order to safely pump the fluid through the valves. The PTFE packing allows the KP Pump to reach a maximum pressure of 600 PSI (40 BAR).

In the high-pressure KP Pump, the packing is composed of PTFE and Kevlar in a braided ring design. The braided strands of PTFE and Kevlar allow the high-pressure KP Pump to reach a maximum pressure of 1500 PSI (100 BAR).

8.3.3 Replacement Parts and Repair Kits

End Users can order replacement Liquid End parts for the KP Pump. Replacement parts include valve repair kits and replacement packing. Please refer to the following table when ordering repair kits or packing:

Pump Model	Valve Repair Kit #	Packing K#
KP10 Standard Model All gear sets	GPVR05S	K-103 Chevron Packing PTFE
KP16 Standard Model All gear sets	GPVR05S	K-104 Chevron Packing PTFE
KP25 Standard Model Gearing 20spm – 76spm	GPVR05S	K-105 Chevron Packing PTFE
KP25 Standard Model Gearing 92spm – 138spm	GPVR08S	K-105 Chevron Packing PTFE

KP38 Standard Model Gearing 20spm – 46spm	GPVR05S	K-106 Chevron Packing PTFE
KP38 Standard Model Gearing 60spm – 92spm	GPVR08S	K-106 Chevron Packing PTFE
KP38 Standard Model Gearing 106spm – 138spm	GPVR10S	K-106 Chevron Packing PTFE
KP67 Standard Model Gearing 20spm – 46spm	GPVR11S	K-107 Chevron Packing PTFE
KP67 Standard Model Gearing 60spm – 92spm	GPVR13S	K-107 Chevron Packing PTFE
KP67 Standard Model Gearing 106spm – 138spm	GPVR18S	K-107 Chevron Packing PTFE
KP10HP High Pressure Model All gear sets	GPVR05S	K-108 Braided Rings Packing PTFE & Kevlar
KP15HP High Pressure Model All gear sets	GPVR05S	K-109 Braided Rings Packing PTFE & Kevlar

8.3.4 Repair Kit Contents

Each pump requires a specific repair kit. The following sections list the contents of each repair kit. Please contact TKM to order repair kits.

8.3.4.1 Valve Repair Kit – GPVR05S V5 Stainless Steel

Part #	Description	Quantity
K-126	Seat V5 SS	4
K-129	Guide V5 SS	4
S09S025	Ball 1/4" SS V5	4
S02V015	AS 015 Viton 70	4
S02V117	AS 117 Viton 70	4

8.3.4.2 Valve Repair Kit – GPVR08S V8 Stainless Steel

Part #	Description	Quantity
K-132	Seat V8 SS	4
K-135	Guide V8 SS	4
S09S037	Ball 3/8" SS V8	4
S02V015	AS 015 Viton 70	4
S02V117	AS 117 Viton 70	4

8.3.4.3 Valve Repair Kit – GPVR10S V10 Stainless Steel

Part #	Description	Quantity
K-139	Seat V10 SS	2
K-142	Guide V10 SS	2
S09S050	Ball 1/2" SS V10	2
S02V015	AS 015 Viton 70	2
S02V117	AS 117 Viton 70	4

8.3.4.4 Valve Repair Kit – GPVR11S V11 Stainless Steel

Part #	Description	Quantity
K-155	Seat V11 SS	4
K-158	Guide V11 SS	4
S09S050	Ball 1/2" SS V11	4
S02V120	AS 120 Viton 70	4
S02V220	AS 220 Viton 70	4

8.3.4.5 Valve Repair Kit – GPVR13S V13 Stainless Steel

Part #	Description	Quantity
K-162	Seat V13 SS	4
K-165	Guide V13 SS	4
S09S062	Ball 5/8" SS V13	4
S02V120	AS 120 Viton 70	4
S02V220	AS 220 Viton 70	4

8.3.4.6 Valve Repair Kit – GPVR18S V18 Stainless Steel

Part #	Description	Quantity
K-169	Seat V18 SS	2
K-172	Guide V18 SS	2
S09S087	Ball 7/8" SS V18	2
S02V120	AS 120 Viton 70	2
S02V220	AS 220 Viton 70	4

8.4 The Electric Motor

Every TKM Metering Pump requires an electric motor to function. The correct motor specifications depend on the pump model and type. TKM assigns a motor to every pump model manufactured for distribution; however, it is the sole responsibility of the End User to purchase the electric motor separately from the pump. TKM can provide the correct motor for the End User, or the End User can source the motor independently.

The motor controls the initial speed of the worm shaft. TKM pumps are all rated at 1750 RPM and require motors that range from 1/2 horsepower – 1 horsepower.

8.4.1 Configuring the Electric Motor

Every TKM Metering Pump requires an electric motor to function properly. The End User is responsible for configuring the motor to the correct specifications for the TKM Pump.

Exercise extreme caution when working on an electric motor as electric shock may occur. Only Qualified Personnel should service the pump and the electric motor.

The End User is always responsible for providing Qualified Personnel with the appropriate tools and personal protection equipment necessary to safely service TKM Pumps.

To correctly configure the electric motor, please follow the guidelines below:

1. Ensure that the motor's specifications match those needed to correctly operate the TKM Pump.
2. Remove the motor from its packaging and place it on a safe and secure workstation.
3. Locate the motor's instruction manual before wiring the motor.
4. Follow the directions in the motor's instruction manual to correctly configure the motor's wiring.

   NOTE: The motor should always turn in a clockwise rotation.

5. Using the shaft key that comes with the motor, connect the motor coupling included with the TKM Pump onto the motor shaft.
6. Once in position on the motor shaft, tighten the set screw on the side of the motor coupling with a 2mm hex key.

7. Mount the motor onto the TKM Pump's motor flange ensuring that the motor coupling on the motor and the motor coupling on the TKM Pump align directly with one another when mounting.

   NOTE: Always ensure that the plastic spider included with the TKM Pump is correctly in position on the TKM Pump before mounting the electric motor.

8. Secure the motor onto the TKM Pump with the appropriate bolts (included with the TKM Pump).

9. Startup

This section will describe the process for safely and successfully starting a TKM Pump. Please ensure that the pump has been connected correctly to the suction and discharge piping before continuing with the startup process.

Before continuing with the following sections, please ensure that the electric motor has been correctly configured. More information about configuring the electric motor can be found in section **8.4.1 Configuring the Electric Motor**.

9.1 Starting a TKM Pump

To safely and successfully start a TKM Pump, follow steps one to eight below:

1. Verify the pump's oil level using the oil level sight glass located on the side of the pump. The oil level should be approximately to the halfway point on the sight glass when the pump is secured on a level and even surface. If the pump is not filled to capacity then fill the pump slowly until oil level reaches the center of the sight glass.

2. Verify that all ball valves on the suction and discharge lines are open**.**

3. Set the pump to 0% stroke length by turning the manual stroke adjustment on the pump in a clockwise direction. This will ensure that no fluid unexpectedly passes through the Liquid End.

4. Set the back pressure on the back pressure valve, which is connected to the discharge piping, as low as possible to facilitate the pump's calibration.

5. Power on the pump if and only if the motor has been correctly configured and mounted securely onto the TKM Pump. Refer to section **8.4.1 Configuring the Electric Motor** for details on correctly configuring the motor for installation.

6. After the pump has been correctly powered on, check that the motor is spinning in a clockwise rotation. The direction of the rotation can be verified by looking at the cooling fan through the air vent on the top side of the electric motor. The fan will be spinning in either a clockwise or counterclockwise direction.

   NOTE: If the motor is spinning in a counterclockwise direction, refer to the instructions included with the electric motor to reverse the rotation. The motor should spin in a clockwise direction.

⚠WARNING **Exercise extreme caution when servicing an electric motor as electric shock may occur. Only Qualified Personnel should service the pump and the electric motor.**

NOTICE **The End User is always responsible for providing Qualified Personnel with the appropriate tools and personal protection equipment necessary to safely service TKM Pumps.**

7. Once the motor is spinning in the correct direction, turn the manual stroke adjustment in a counterclockwise direction until the desired percentage is achieved. For more information regarding the stroke position refer to section **8.2.1 Adjusting the Stroke Position**

8. Slowly increase the back pressure on the back pressure valve until the required pressure is reached.

⚠WARNING **Do not set back pressure above the maximum working pressure specified on the pump's nameplate.**

10. Servicing a TKM KP Pump

The TKM KP Pump is manufactured for maximum durability in the field. However, after running for an extended period, the KP Pump will require routine maintenance and service including rebuilding the valves and replacing the packing.

Replacing the valves and the packing once a year or when necessary will ensure that the KP Pump continues to perform as expected.

10.1 Rebuilding the Check Valves

The KP Pump will require a valve rebuild 12 to 18 months after installation. This process replaces all the components within the valve housings of the pump.

10.1.1 Removing the Guides and Seats

1. Start by ensuring that the pump is completely turned off and that all back pressure has been relieved from the Liquid End.
2. Close any ball valves leading to the pump or away from the pump.
3. Using a 1/4-inch hex key and a 1/2-inch wrench, loosen the bolts and hex nuts keeping the flanges in place on the Liquid End.
4. As the flanges loosen, be sure not to let the valve housing fall from the Liquid End.
5. Once the flanges have been completely loosened, the check valves can be easily removed from the Liquid End.
6. Using a blunt tool, push into the bottom side or top side of the Check Valve (valve housing) in order to dislodge the seats and guides within the valve housing.
7. Carefully push until all of the pieces have been removed from within the valve housing.

10.1.2 Replacing the Guides and Seats

1. Place one guide, with the flat side facing down, into one of the empty valve housings.
2. Next place a ball into the same valve housing. The ball should fall correctly into the guide.
3. Next, with the flat side facing down, place the seat into the valve housing.

> **NOTE:** The seats should have the appropriate O-rings fastened around the outside perimeter

4. Repeat steps 1 – 3 until one check valve is completely assembled.
5. For the next check valve, start with the flat side of the seat facing up. Push the seat to the bottom of the valve housing.
6. Next drop a ball into the valve housing. Ensure that the ball is sitting in the middle of the seat.
7. Continue by placing a guide, with the flat side facing up, into the valve housing until it reaches the bottom of the valve housing.
8. Repeat steps 5 – 7 until the second check valve is completely assembled.

9. Place the check valves back into the correct positions and secure into place using the flanges

> **NOTE:** The quantity of guides, seats, and balls needed varies between pump models. Please consult with TKM before purchasing replacement valve components.

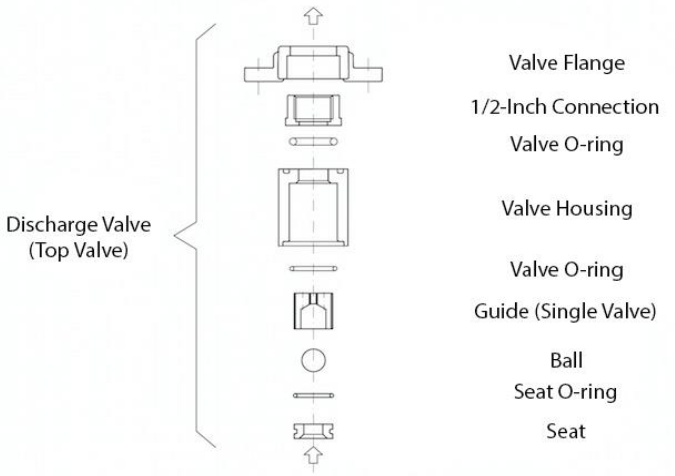


Figure 12 - Correct orientation for discharge valve

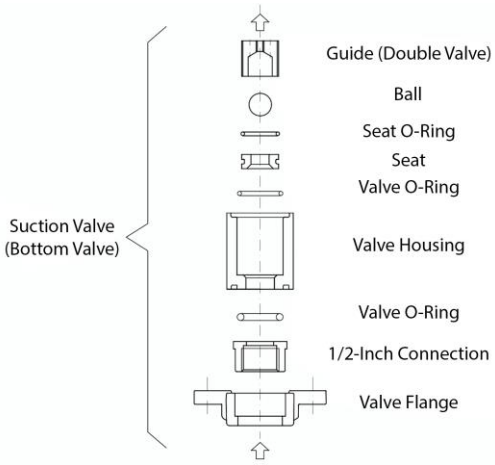


Figure 13 - Correct orientation for suction valve

10.2 Replacing the Standard KP Plunger Packing

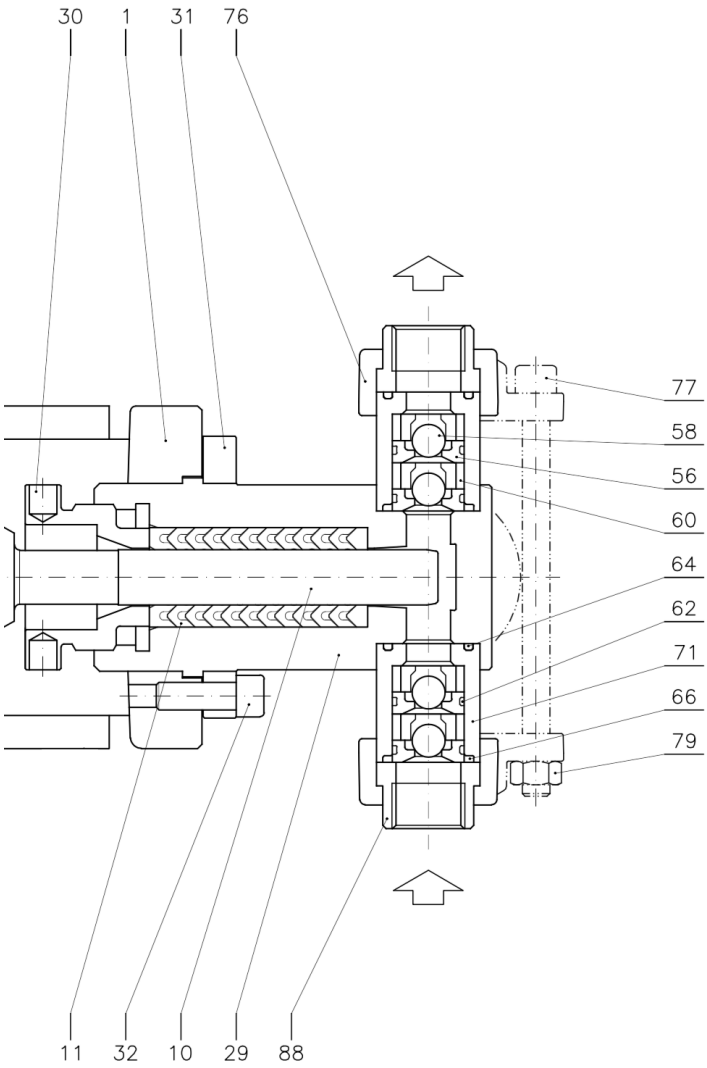
Similar to the check valves, the packing requires replacement every 12 – 18 months. TKM recommends replacing the packing at the same time as the valves.

Please refer to the following procedures to successfully replace the KP Pump packing:

1. Start by ensuring that the pump is completely turned off and that all back pressure has been relieved from the liquid end.
2. Disconnect the check valves from the piping to loosen the pump from the system
3. Once the pump has been separated from the system, remove the plastic safety covers from the yoke.
4. Loosen the gland nut.
5. Loosen the four screws on Locking Ring on the front of the yoke using a 1/4-inch hex key.
6. Once the Locking Ring has been removed, pull the Liquid End off the pump body.
7. With the Liquid End removed, fully unscrew the gland nut to reveal the packing inside of the Liquid End.

8. Using a hook tool, pull the packing from the inside of the Liquid End taking into account the orientation of the packing.
9. There will be 10 total pieces of packing to remove and replace.
10. Replace with the new packing, ensuring that the new packing is in the same orientation as the old packing.
11. Replace the gland nut.
12. Place the Liquid End back onto the yoke.
13. Secure the four bolts and the Locking Ring into place
14. Tighten the gland nut fully.
15. Replace the plastic safety covers.
16. Reconnect the pump to the system.

Please refer to the following sectional drawing when replacing the chevron plunger packing:



1	YOKE
4	SET SCREW LOCKING PLUNGER
10	PLUNGER
11	PLUNGER PACKING
29	PUMP HEAD BODY
30	GLAND NUT
31	LOCKING FLANGE
32	SCREW
38	SAFETY COVER
39	SCREW
56	SEAT VALVE
58	BALL VALVE
60	VALVE GUIDE
62	O-RING SEAT
64	O-RING VALVE HOUSING
66	O-RING VALVE HOUSING
71	VALVE HOUSING
76	VALVE LOCKING NECK
77	SCREW LOCKING VALVE
79	NUT
80	SUCTION FLANGE
81	DELIVERY FLANGE
88	THREADED CONNECTION
90	DRIVE BOLT NUT

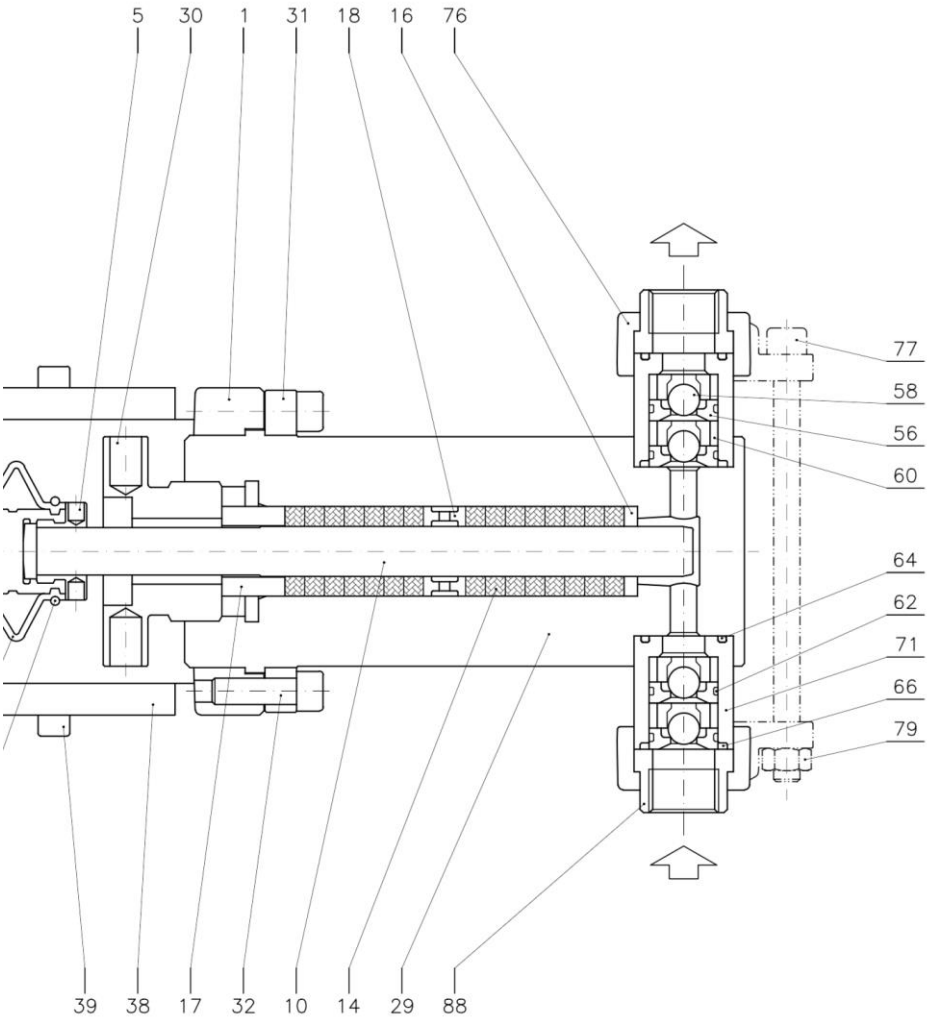
Figure 14 - KP Standard Pump Liquid

10.3 Replacing the High-Pressure Plunger Packing

1. Start by ensuring that the pump is completely turned off and that all back pressure has been relieved from the Liquid End.
2. Disconnect the check valves from the piping to loosen the pump from the system.
3. Once the pump has been separated from the system, remove the plastic safety covers from the yoke using a 5/32-inch hex key.
4. Loosen the gland nut and the nut locking the plunger.
5. Loosen the four screws on Locking Ring on the front of the yoke using a 1/4-inch hex key.
6. Once the Locking Ring has been removed, pull the Liquid End off the pump body.

7. With the Liquid End removed, fully unscrew the gland nut to reveal the braided ring packing inside of the Liquid End.
8. Remove the pressing ring and set aside in a clean area.
9. Using a hook tool, pull the braided rings from the inside of the liquid end considering the pattern of the packing.
10. After removing 6 braided rings, there will be a lubricating ring inside. Remove and set aside in a clean area.
11. Continue removing the remaining 8 braided rings.
12. Replace with the new packing, ensuring that the new packing is in the same pattern as the old packing. (8 rings, lubricating ring, 6 rings, topped with pressing ring)
13. Replace and tighten the gland nut.
14. Place the liquid end back onto the yoke.
15. Secure the plunger using the locking nut.
16. Secure the four bolts and the locking ring into place
17. Tighten the gland nut fully.
18. Replace the plastic safety covers.

Please refer to the following sectional drawing when replacing the braided ring packing:



1	YOKE
5	NUT LOCKING PLUNGER
10	PLUNGER
14	PLUNGER PACKING
16	BACK–UP RING
17	PRESSING RING
18	LUBRICATING RING
29	PUMP HEAD BODY
30	GLAND NUT
31	LOCKING FLANGE
32	SCREW
38	SAFETY COVER
39	SCREW
56	SEAT VALVE
58	BALL VALVE
60	VALVE GUIDE
62	O–RING SEAT
64	O–RING VALVE HOUSING
66	O–RING VALVE HOUSING
71	VALVE HOUSING
76	VALVE LOCKING NECK
77	SCREW LOCKING VALVE
79	NUT
80	SUCTION FLANGE
81	DELIVERY FLANGE
88	THREADED CONNECTION
90	DRIVE BOLT NUT

Figure 15 - KP High-Pressure Pump Liquid

10.4 Changing the Gear Oil

TKM recommends changing the gear oil one time every 12 months. Changing the gear oil will ensure that the internal components of the pump stay lubricated. Keeping the internal components lubricated will greatly increase the longevity of the TKM Pump.

To change the gear oil please refer to the following directions:

1. Turn off the pump and disconnect it from all power sources.
2. Locate the oil drain plug on the side of the pump near the Liquid End.

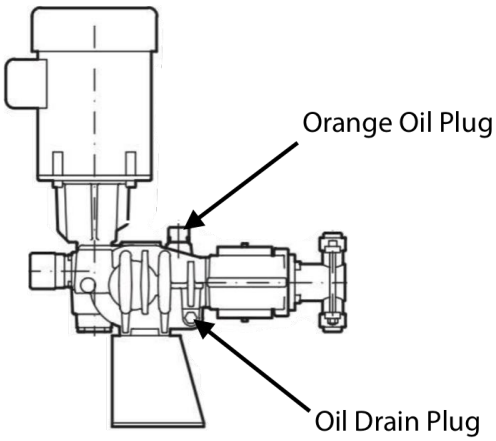


Figure 16 - Oil plug locations

3. Place an oil pan or other receptacle under the pump to collect the oil.
4. Unscrew the oil drain plug.
5. Let the oil drain completely from the pump.
6. Clean any residual oil from the drain hole.
7. Replace the oil drain plug. Do not overtighten.
8. Remove the orange oil plug on the top of the pump.
9. Refill the oil to the halfway point of the oil sight glass.
10. Replace the orange oil plug.

Do not overtighten the oil drain plug as this may cause damage to the plug, resulting in oil leaking during pump operation. A pump should never run without the appropriate level of gear oil.

10.5 Troubleshooting the TKM KP Pump

If a TKM Pump begins to malfunction, please follow the troubleshooting guide in order to successfully diagnose the problem. If an issue arises which cannot be diagnosed by Authorized Personnel, the TKM Pump will have to be returned to TKM LLC for repairs.

Please use the following table as a troubleshooting guide:

Problem	Solution
Pump performing with zero flow:	1. Motor a. Verify motor is on b. Motor should be rotating clockwise c. Secure the motor coupling tightly 2. Valving and piping a. Suction and discharge valving is open b. Make sure liquid is reaching the suction valve c. Check for line blockages d. Inspect suction and discharge valves for damage or wear

Pump performing with low flow:	1. Suction and Discharge Valves* a. Check the Liquid End valves for damage or debris in the guides and seats b. Assure orientation of the seats and guides is correct c. Verify that all O-rings are correctly positioned on the seats and guides and valve connections. d. Confirm that the suction and discharge valves are correctly positioned on the Liquid End. 2. Piping a. Assure there are no leaks in piping b. Check for worn or broken piping 3. Chemical a. Chemical is too viscous – increase the piping size b. Tank level is low – suction line is not flooded * Please reference section **10.1 Rebuilding the Check Valves** for instructions on removing and rebuilding the valves. Valve orientation can be found in section **10.1**.
Pump performing with minimal to zero flow: **Line blockages or vapor locking**	1. Ensure the back pressure valve is correctly installed for the direction of the flow. a. Back pressure must be 25 PSI greater than suction pressure 2. Pressure Relief Valve (PRV) a. Is the PRV set to the correct pressure b. Does PRV contain the correct pressure spring for the necessary working pressure

Continued	3. Pulsation dampener a. Is the dampener installed in the correct position on the piping b. Inflate to the appropriate working pressure 4. Ensure there are no line blockages in the system. 5. Piping should run as straight as possible and should avoid unnecessary bends. 6. Verify the piping has no vapor locking areas. Refer to section **7. Installation** for detailed descriptions and diagrams on how to correctly install a TKM Pump.
Plunger seizing in Liquid End (HP Models Only)	1. Liquid End a. Pump should be started with stroke knob at 100% to begin plunger motion b. Make sure the Liquid End is not under extreme pressure c. Loosen Gland Nut until the plunger starts moving* d. Tighten the Gland Nut slightly to prevent chemical leaks * Please see **Figure 14** and **Figure 15** to correctly locate the Gland Nut. **DO NOT** loosen the Gland Nut completely as it will result in fluid leaking from behind the Liquid End.
Chemical leaking from back of Liquid End	1. Verify packing Gland Nut is tight 2. Tighten Gland Nut 1/8th of a turn until leaking stops 3. Check packing – replace if needed

10.6 Returning the TKM Pump for Repairs

In the situation that the End User cannot safely or effectively service the TKM Pump, TKM recommends returning the pump to TKM for service. Always consult with TKM before returning a pump, as a solution to the problem may be possible without the need for a return.

An End User can choose to return the pump to TKM if they believe that servicing the pump themselves may void the Manufacturer's Warranty.

Please refer to the following situations, which may require TKM specialized service:

- Pump is grinding while running
- Oil is leaking from the pump
- Valves are clogged
- No flow
- Fluid leaking from plunger side of Liquid End
- Adjustment knob is stiff
- O-Ring replacements (not on valves)
- Bellows replacement

If a problem arises that the End User cannot diagnose, consult TKM before attempting to repair the pump.

10.6.1 Preparing the TKM Pump for Returns

Before an End User returns a TKM Pump for servicing, they must ensure that:

- Pump has been thoroughly cleaned
- Pump head and valves have been flushed of any chemicals and debris
- The black Blind Shipping Plug has been placed onto the pump
    - Please keep the Blind Shipping Plug as it is necessary to prevent the pump from losing oil during shipping
- All the pump components are included with the pump
    - i.e. motor coupling, valves, valve flanges, O-rings, etc.
- Remove the valves from the Liquid End and include them separately from the pump

NOTICE

The TKM Pump will not be serviced if the End User fails to thoroughly clean the pump before returning it to TKM. Many carriers will not accept packages covered in oil or chemicals. TKM are unable to handle pumps containing residual chemicals that may be harmful to our staff.

Always include a detailed description of the problem and what steps, if any, the Qualified Personnel attempted when diagnosing the problem. If possible, include photos of the malfunctions.

10.6.2 RMA for TKM Pump Return

Contact TKM for an RMA form before shipping the pump. Once an RMA has been completed, include a copy with the packing list for the pump return.

An RMA is required to initiate any return to TKM whether the pump is under warranty or not. Please wait until a return request has been accepted before shipping the pump to TKM.

11. Contacting TKM LLC

For any inquiries please contact TKM LLC via email: sales@tkmindustries.com.

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CE

