

# 1000/2000

## HOMOGENIZER

FORM NO.: J400100\$% REVISION: I ?!&B

READ AND UNDERSTAND THIS MANUAL PRIOR TO OPERATING OR SERVICING THIS PRODUCT.



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## EC DECLARATION OF CONFORMITY

**SPX Flow Technology, Stanisława Rolbieskiego 2, 85-862 Bydgoszcz, Poland**

herewith declares that **APV 1000/2000 Homogenisers / Laboratory Machines**

are in conformity with the following EU Directives:

- Machinery Directive (2006/42/EU)
- Low Voltage Directive (2014/35/EU)
- Electromagnetic Compatibility Directive (2014/30/EU)
- EC Mark of Conformity Directive (93/68/EU)

**SPX Flow Technology, Stanisława Rolbieskiego 2, 85-862 Bydgoszcz, Poland**

déclare que les **Homogénéisateurs / Machines de Laboratoires APV 1000/2000**

sont conformes aux Directives UE suivantes:

- Directive des Machines (2006/42/UE)
- Directive sur la Basse Tension (2014/35/UE)
- Directive CEM (2014/30/UE)
- Directive sur le Label CE (93/68/UE)

**SPX Flow Technology, Stanisława Rolbieskiego 2, 85-862 Bydgoszcz, Poland**

erklärt, dass **APV 1000/2000 Homogenisatoren / Labormaschinen**

den folgenden EU Richtlinien entsprechen:

- Maschinenrichtlinie (2006/42/EU)
- Niederspannungsrichtlinie (2014/35/EU)
- EMV-Richtlinie (2014/30/EU)
- CE-Kennzeichnungs-Richtlinie (93/68/EU)

**SPX Flow Technology, Stanisława Rolbieskiego 2, 85-862 Bydgoszcz, Poland**

verklaart hiermee dat **APV 1000/2000 homogenisator / laboratory machines**

in overeenstemming is met de volgende EU-directieven:

- Directief voor machines (2006/42/EU)
- Directief voor laagspanning (2014/35/EU)
- EMC-directief (2014/30/EU)
- CE-teken directief (93/68/EU)

Copenhagen, 20.03.2018

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## Preface

The operation and service manual contains important information on how to operate the machine safely, properly and most efficiently. It also includes information about homogenisation theory. Observing these instructions helps to increase safety, reduce repair costs, and increase the success of research and development projects.

The operation and service manual is to be supplemented by the respective national rules and regulations for accident prevention, chemical safety, and environmental protection.

The operation and service manual must always be available wherever the machine is in use. This operation and service manual must be read and applied by any person in charge of carrying out work with and on the machine, such as

- \* **Operation** including setting up, troubleshooting in the course of work, disposal of waste, care and disposal of fuels and consumables.
- \* **Maintenance** (servicing, inspection, repair)
- \* **Transport**

In addition to the operation and service manual and to the mandatory rules and regulations for accident prevention, chemical safety, and environmental protection in the country and place of use of the machine, the generally recognised technical rules for safe and proper working must also be observed.

In case you could not find a satisfactory answer to your questions in this operation manual, please contact:

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## Safety

### Introduction

This section states the safety instructions that must be followed when handling the homogeniser.



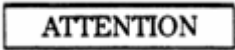
A homogeniser is a positive displacement pump and therefore potentially may cause a dangerous situation. The machine has been designed and produced according to current regulations and precautionary measures but may pose a risk when handled and operated incorrectly.

Generally you must be careful when you handle and operate the machine.

The machine shall only be operated within the limits stated in this "Operation and Service Manual" (Chapter 2 in the section with general information).

The safety and guarantee for the machine depends on original spares and recommended lubrication- and cleaning medias as described in this manual.

### Warning Symbols in the Manual

|   |  |
|---|--|
|  | <b>WARNING! Dangerous Voltage:</b> Warns of situations in which high voltage can cause physical injury and/or damage equipment. The text next to this symbol describes ways to avoid danger.             |
|  | <b>WARNING! General Warning:</b> Warns of situations that can cause physical injury and/or damage equipment by means other than electrical. The text next to this symbol describes ways to avoid danger. |
|  | Notification of the need for special attention for safe operation of the pump unit of the homogeniser and/or protection of the pump unit of the homogeniser.   |

## Warnings and Hazards



Before servicing, repair or manual cleaning always turn off the power supply.



Operators and service technicians must have a qualified background, including:

Having read and understood the user manual.

Training in safety precautions of high-pressure equipment.

Knowledge of the process equipment and the product enabling them to adjust process parameters according to the required product quality

To prevent hazards of crushing by moving machine-parts and/or spraying with hot pressurized product, the machine must not be used without having all guards mounted.

The homogeniser discharge line must not be blocked as this would result in a pressure increase with a subsequent hazard to damage to parts of the system.

It is the responsibility of the user to ensure that there is no build-up of high pressure in the discharge line of the homogeniser where it is not planned or expected.

Always wear the recommended personal protection equipment in the production facility; non-slippery footwear is mandatory and shoes with protective cap are required when handling heavy parts.

For applications for which product and machine parts reach high temperatures (>55°C), the final installation must include means to guard and/or warning against contact with hot surfaces.

Flush the Liquid End with clean, cold water and allow the machine to cool down before starting any disassembly.

Wear protective goggles during operation, cleaning, servicing and troubleshooting of the APV-1000 and APV-2000.

Protective goggles and gloves are required when handling oils, cleaning agents or other potentially harmful liquids.

When spilling oil, product, etc., this should be cleaned up as soon as possible to prevent any health and/or pollution risk and the danger of slipping. Prevent hazardous substances from coming into contact with the skin.

Special care should be taken for the homogenisation of classified products:

- Homogenising of aggressive/abrasive products can only be allowed to the extent that it is configured with appropriate materials

and parts must be replaced if they show significant sign of wear or corrosion.

- Aggressive products require the installation to include draining according to local legislation for preserving the environment, also from the base/floor in case of packing failure and spilling.
- The homogeniser must normally not be used for toxic, flammable, or contagious products. In cases where these types of products may be homogenised this requires a special risk-evaluation of the entire process-system in which the homogeniser is placed.
- Be aware of any occurrence of inflammable vapours as these may ignite and cause explosion or fire.

**Hygienic hazards relevant for APV-1000 and APV-2000 in aseptic applications:**

- Be aware that a limited amount of lubrication-liquid / barrier-liquid may migrate into the pumped product due to the oscillating of the plungers.
- The lubricant / barrier-liquid must be non toxic, sterile and compatible with the pumped product (for most products clean, sterile water is recommended).
- Misuse or processing beyond the limitations specified in the “Operation and Service Manual” including insufficient feed-pressure and dry running, may result in cavitations or progressive wear, which may cause contamination of the product (wear debris in the product).
- The level of micro-organisms remaining after CIP/SIP depends on the product and the CIP/SIP cleaning/sterilisation procedures. It is recommended to dismantle the valve housing and do manual cleaning and autoclaving of the separated parts of the APV-1000 and APV-2000.

**ATTENTION**

Always see that the machine is fed adequately.

During start-up the homogenising valves must be kept fully open so that the machine is not pressurized.

Pressure regulating should be performed slowly so that the pressure indication equipment may be given time to keep up with the actual pressure.

The machine must never be loaded with a pressure higher than the max. Pressure, which is max. 1000 BAR for APV-1000 and max. 2000 BAR for APV-2000.

Take steps to minimize/avoid air in the product because air may result in extreme pulsations and unintended pressure peaks, which may damage the homogeniser with subsequent potential hazard to exposed persons.

Adequate supply of cooling / lubrication media is necessary for safe and trouble free operation of the homogeniser.

## Prohibited misuse of the homogeniser



- Standing on the machine may result in damage to parts and hazard of falling and is therefore prohibited.
- Tampering with pressure-regulating parts may lead to excessive pressures and infringe the safety of the machine and is therefore prohibited. The homogeniser is dimensioned to withstand pressures as stated in the “Operation and Service Manual”: Max. 1000 BAR for APV-1000 and max. 2000 BAR for APV-2000.
- Under no circumstances should the emergency stop switch be short-circuited. Disabling the safety-system is therefore prohibited.
- The homogeniser must normally not be used for toxic, flammable, or contagious products and it is prohibited to homogenise explosive products.
- The machine is designed according to its designated use and should never be used beyond the limits.
- In case of new requirements beyond above limits, SPX can offer rebuilding and a range of options to expand the designated use. Please contact our local agent or the SPX sales department listed in the preface.
- Unauthorized modifications or use of non-original parts will result in loss of warranty and may infringe personal safety.

## Warning Labels on the Homogeniser

The following warning labels have been attached on the homogeniser using graphics to identify the most important hazards, prohibitions and mandatory actions.

For information about placement of labels please refer to the assembly drawing on page A37. The meaning of the graphic symbols is explained below:



Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.



Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.



Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury. It may also be used to alert against unsafe practices.

|   |   |
|---|---|
|    | <p>Prohibition !<br/>Do not exceed max pressure.</p>  |
|    | <p>Prohibition !<br/>Do not start machine unless all safety guards are mounted according to instructions.</p> |
|    | <p>Warning !<br/>High voltage !</p>   |
|    | <p>Warning !<br/>Hot surfaces !</p>   |
|   | <p>Mandatory !<br/>Read and understand manual before installation / use / servicing.</p>                      |
|  | <p>Mandatory !<br/>Wear eye protection when cleaning, servicing or trouble shooting.</p>                      |

## General Information

### *Theory of Homogenisation & Introduction to the APV-1000 and APV-2000 Homogenisers*

**H**omogenisation is used for processing a variety of products in the chemical, pharmaceutical, biotech, cosmetic, food, and dairy industries. These products are typically characterised as emulsions, dispersions, or cell slurries. In very simple terms, an emulsion is defined as a mixture of two immiscible liquids such as oil and water. A dispersion is a mixture of a non-soluble solid in a liquid, such as magnesium hydroxide in water. Of course, many products processed on a homogeniser can have characteristics of both an emulsion and dispersion. The last type of product that can be processed with a homogeniser is cell slurry, otherwise known as a cell disruption application.

SPX's line of homogenisers is positive displacement pumps equipped with a homogenising valve. The actual homogenisation takes place when material is pumped through the homogenising valve. Regardless of the homogenisation pressure, the flow rate remains relatively constant. If a product can be pumped, it can be processed with a homogeniser. Laboratory scale homogenisers are usually gravity fed using a feed hopper or feed funnel. If a material is extremely viscous or contains solid particles, sometimes it is necessary to use pressure to feed the homogeniser. An optional pressure-feeding device is available for the APV-1000 and APV-2000 homogenisers, or you may use a peristaltic pump to feed your homogeniser.

Homogenisation efficiency is directly related to the unique geometry of the SPX homogenising valve. Other factors also influence efficiency. Emulsions with viscosities higher than 500 cP can be processed, but the results are not usually as good as they are with lower viscosity products. This may be remedied by reducing the viscosity of the product. For example, when some oils are heated, the increase in temperature reduces the viscosity without detriment to the product. Thus the homogenisation efficiency is improved. With dispersions, the homogeniser is an excellent choice for de-agglomerating solids. However, the homogeniser is not a grinding device. Large, discrete particles will not be reduced in size very effectively by the homogeniser.

Finely milled products are almost impossible to thoroughly disperse with low energy mixers and colloid mills. The homogeniser can effectively disperse these solids to reduce settling, improve efficacy, or reduce defects in the final product.

**B**oth of SPX's laboratory homogenisers have been developed using the latest in machine and homogenising valve technology. They have been equipped with seals, packing's, and gaskets with a broad range of chemical compatibility.\* Wherever possible, the same parts have been used in multiple locations to reduce the number of unique spare parts and maintenance issues. The following table outlines the standard equipment characteristics for each machine. Alternate materials may be available for some parts. Please see the assembly drawings in Chapter 7 for more information.

| <b>STANDARD EQPT</b>       | <b>APV-1000</b>                | <b>APV-2000</b>                |
|----------------------------|--------------------------------|--------------------------------|
| Maximum Operating Pressure | 1000 bar                       | 2000 bar                       |
|                            | 14,500 psi                     | 29,000 psi                     |
|                            | 100 MPa                        | 200 MPa                        |
| Nominal Capacity           | 22 l/h                         | 11 l/h                         |
| Minimum Sample Size        | 150 ml                         | 100 ml                         |
| Approximate Hold-Up Volume | 13 ml                          | 13 ml                          |
| Noise Level                | 70 decibels                    | 70 decibels                    |
| Fluid End                  | Duplex Stainless Steel         | Duplex Stainless Steel         |
| Plunger                    | Ceramic - 14 mm                | Ceramic - 10 mm                |
|                            | 70 r.p.m.                      | 70 r.p.m.                      |
| Pump Valve Seats           | Tungsten Carbide               | Tungsten Carbide               |
| Homogenising Valve         | Unique Knife Edge Geometry     | Unique Knife Edge Geometry     |
| Homogenising Valve         | Ceramic                        | Ceramic                        |
| O-Rings *                  | EPDM                           | EPDM                           |
| Back-Up Rings *            | POM (acetal polymer)           | POM (acetal polymer)           |
| Plunger Packing *          | PVDF (polyvinylidene fluoride) | PVDF (polyvinylidene fluoride) |
|                            | with O-Ring                    | With O-Ring                    |

\* Alternate materials may be available upon request.



Laboratory use of homogenisation for research, development, and product reformulation has become extremely important. Because the SPX homogenisers are proven to be scaleable, the APV-1000 and APV-2000 are well worth the investment. However, when performing laboratory testing, it is important to consider the physical and chemical characteristics of your sample.

### **Temperature**

Temperature can have a great impact on the results of homogenisation. The maximum temperature at which the APV-1000 and APV-2000 can operate is 100°C. In practice, it is difficult to maintain a temperature above 80°C in the lab without insulating the machine's fluid end. SPX does not recommend using heating mantles or other devices on the APV-1000 or APV-2000.

Since the homogeniser is a high-energy device, a temperature rise of about 2.5°C per 100 bar of homogenisation pressure should be expected on water. Of course, this temperature rise will vary with the actual composition of the sample. If your product is sensitive to heat, samples should be cooled immediately after collection using an ice bath or small heat exchanger.

### **Flammability**

If the material to be processed is highly flammable, it is necessary to order the machine with explosion proof components, such as an explosion proof motor. In addition, all switches and controls in the vicinity of the homogeniser should be explosion proof. A standard APV-1000 or APV-2000 is not supplied with explosion proof components. SPX does not endorse processing flammable materials on the homogeniser unless it has been specifically designed for this type of use and the user is fully aware of the safety issues that may arise.

### **Viscosity**

Samples processed with the APV-1000 and APV-2000 are gravity fed. Although there is no absolute value at which the machine can no longer pump, the product should be pourable and flow readily. If the material cannot reach the plunger or ball valves, a pressure-feeding device must be used to properly feed the homogeniser. To check if the machine is pumping properly, measure the flow rate. If the flow rate is significantly less than the nominal capacity of the machine, homogenisation efficiency may be affected. This may be remedied by using a pressure-feeding device.

### **Solvents and pH**

The APV-1000 and APV-2000 are remarkably compatible with many harsh solvents and acidic or alkaline products. However, it is important to note that the O-rings, back-up rings, and packing's supplied with the machine are not indestructible. Please check a solvent compatibility chart to be sure that your product will not damage the standard supplied parts. If an incompatibility is found, alternate materials may be available.

### **Solids and Precipitates**

Products with large, gritty particles may cause pumping problems by lodging between the pump ball valve and the pump seat. In this situation, pumping will continue as long as no homogenisation pressure is applied. Once homogenisation pressure is applied, the machine will cease pumping. If the particles are too large, the solids must be milled to a smaller size. If particles are large but relatively soft, a pressure-feeding device might remedy pumping problems. Products that coat the ball valves may also cause pumping problems. A few examples include fibrous materials such as cellulose and raw latex. Pumping problems do not necessarily occur immediately since build up may take several minutes to form. When this happens, remove the homogenising valves and ball valves for inspection and cleaning.

### **Processing Capabilities**

Although the laboratory homogeniser has been designed using the latest technology, it is not intended for production scale use. Lengthy processing times at the maximum operating pressure will significantly reduce the life of the machine. If you require long processing runs, please consult your sales representative for information on pilot and production scale machines.

For more information on potential problems or processing issues, please see the troubleshooting section in Chapter 4.

# Installation & Maintenance

*Proper Installation & Maintenance is Necessary to Ensure the Life of Your New APV-1000 or APV-2000 Homogeniser*

Installation of the APV-1000 and APV-2000 is the same. The first part of Chapter 3 outlines the specific instructions necessary for proper installation of the machine. Following part names are position numbers in brackets. These numbers are included for easy reference to the assembly drawings. Occasionally, two numbers are listed. In these instances, the position number is unique to the machine model you have. Only one will apply to your machine. Questions should be directed to your SPX Sales or Service Representative.

### **Installation: Uncrating Your New Machine**

Please refer to Chapter 7 and drawing number 722668M (Transportation Equipment). When you receive your new machine, inspect the exterior of the crate [1] for any damage that may have occurred during shipment. If the condition is acceptable, begin uncrating the machine by first removing the top, then the sides of the crate. Remove the feed hopper [6] and box of tools. Some of the tools will arrive in their original packaging. Be sure to keep any packaging that contains specific usage instructions for the tool.

Using an adjustable wrench, remove four nuts [2] and bolts [3] from the crate. Next, remove the support bracket [5] from the underside of the homogeniser by removing four bolts [4]. Finally, install the unit on a suitable bench or cart capable of supporting 100 kg. Refer to Chapter 5 for more specific assembly instructions for the entire machine. You may wish to attach the feed hopper [6] at this time.

Occasionally, a machine is damaged during transit or unloading. Inspect the exterior of the crate and, if found damaged, open the crate and inspect the machine carefully. If any damage is evident, you must file a claim with the shipping carrier immediately. Also, you must notify your SPX Sales Representative of the damage and pending claim.

### **Installation: Delayed Start Up**

If start-up of the unit is delayed for a month or longer, it is suggested that the plunger packing and all O-rings, back-up rings and seals be removed and stored separately. This will prevent the seals from drying out. The unit should be covered and stored in a secure area, but no servicing is required for the drive end of the unit.

### **Installation: Machine Specifications**

The unit should be installed on a level surface that will properly support the weight of the machine. When properly installed, the top surface of the pump valve block will be level.

|        |        |
|--------|--------|
| Height | 62 cm  |
| Width  | 37 cm  |
| Depth  | 77 cm  |
| Weight | 100 kg |

### **Installation: Electrical Specifications**

The standard motor is 3 kW and either 50 or 60 Hz. The actual voltage varies. Each machine is wired according to specified voltage and Hertz at the time of original order. Ensure that the gear [135] has the proper direction of rotation as shown on the gearbox. Proper rotation is critical for bearing life.

The machine is supplied with a 2 metres long power cord with no plug attached. All wiring is done in accordance with the electrical requirements specified on the original machine order. An electrical schematic is located in Chapter 7. SPX strongly recommends that a licensed electrician perform wiring in accordance with local codes and other applicable regulations.

The machine is equipped with a pressure gauge that automatically stops the machine, if the homogenising pressure is higher than 110% of the pressure that the machine is designed for.

To reset the machine, refer to drawing 728138M in Chapter 7. Inside the control box, there is a reset button that must be pressed to reset the thermal relay. Adjusting of over-current control relay see page A26 in Chapter 7.

### **Installation: aseptic cooling/lubrication system CLS**

As indicated on drawing no. 723236M, the CLS connections are mounted on the back of the machine. A flow of roughly 6 litres an hour is sufficient to cool/lubricate piston and gasket.

A rustproof box for the connections is mounted on the outside. The internal pipe fittings are made of stainless steel which is compatible with steam, condensation from steam, sterile fluids and solvents – as required for special processes/products.

**Installation: Lubrication/oil**

Check oil is visible in the oil level glass on the gear. In case the oil is not visible in the level glass, please contact SPX Sales Representative in order to arrange returning the machine to the factory for repair.

There is no lubrication necessary during installation. Please see the Maintenance section of this chapter for more information.

**Installation: Tools**

Tools needed for servicing this unit are supplied. They are pictured in Chapter 5.

**M**aintenance of the APV-1000 and APV-2000 is a necessary part of machine ownership. Regular maintenance as described in this section will ensure maximum life and reliability. The following items should be regularly inspected as part of your internal maintenance program. For machine repairs or more information, you should contact your SPX Service Representative.

### **Maintenance: General Lubrication**

All threaded parts should be lubricated with an anti-galling grease. O-rings should be lubricated with a small amount of lubricant compatible with the O-ring material.

### **Maintenance: Motor/Gear Assembly & Crosshead Lubrication**

Oil: KlüberSynth GH6-680

The motor/gear assembly [135] is permanently lubricated and will provide an estimated 5.000 hours of use in typical laboratory service. This lifetime may vary depending on the specific operating conditions of the machine. Oil level can be checked on the oil level glass on the gear. In case the oil is not visible in the level glass. Please contact the SPX Sales Representative in order to arrange returning the machine to the factory. If the machine will be used for extended sample runs, please contact your SPX Sales Representative to discuss alternate materials for packing and seals.

Every 500 hours of operation it is necessary to grease the crosshead [129]. Please refer to drawing 722371M (Drive Assembly). To lubricate the crosshead [129], completely remove the fluid end parts including the cooling cylinder [72, 82]. To move the crosshead [129] towards the rear of the machine, turn the power on and off very quickly. Next, disconnect the power cord and carefully clean the inside of the eccentric assembly [127] with a soft cloth and apply a new coating of lithium thickened, multi-purpose grease, such as Mobiltemp SHC 460 Special. Reassemble the cooling cylinder and other fluid end parts as per Chapter 5.

### **Maintenance: Pressure Gauges**

The machine is supplied with a pressure gauge displaying the pressure in either bar, psi or Mpa, as required. All models are supplied with a pressure gauge displaying the total homogenising pressure. As an option for two-stage machines, a 2<sup>nd</sup> stage pressure gauge is available. The 2<sup>nd</sup> stage pressure gauge displays only the 2<sup>nd</sup> stage pressure.

The pressure gauge is equipped with an ON/OFF switch, on which the gauge is turned ON and OFF.

**Attention!**

The manometer may only be reset when there is no pressure on the machine.

### **Maintenance: Homogenising Valve, Valve Seat & Impact Ring**

These parts are ceramic, tungsten carbide, or hardened stainless steel. You can usually tell the difference by the colour. Hardened stainless steel is characterised by shiny metal. Tungsten carbide is also metallic, but is darker grey than steel. It is also very dense and feels heavy for its size. Ceramic is white, yellow, or very light grey. Ceramic and tungsten carbide must be handled with care since they are very brittle and can shatter easily.

All valve components will exhibit wear over a period of time. If badly worn, a poorly homogenised product will result. You should inspect these parts for wear regularly. If the homogenising valve [46] is worn, it may be sent to our factory for regrinding or resurfacing. If the homogenising valve seat [48] is worn, it may be reversed. When both sides are worn, it may be sent back to our factory for regrinding or resurfacing. Wear of the impact ring [47] is less critical than the homogenising valve and valve seat. Erosion of the inside diameter of the impact ring is acceptable up to 1.0 mm before it is necessary to replace the part. When the impact ring is eroded on one side, it may be reversed. The impact ring cannot be repaired.

The page entitled Wear Pattern Chart at the end of this chapter contains valuable information on how to identify homogenising valve wear patterns. Please contact your SPX Sales Representative for more information on repairing or replacing your homogenising valve assembly.

### **Maintenance: Plunger & Cooling Cylinder**

The ceramic plunger [76,85] should be inspected regularly for scoring and excessive wear. The plunger and the plunger packing are cooled and slightly lubricated by water circulating through the cooling cylinder [72,82]. However, the cooling cylinder does not cool the product being processed by the homogeniser.

Some discoloration of the plunger is normal, but cracks, deep scratches, and/or chips are an indication that replacement is necessary. A worn plunger will dramatically impact the life of the packing. To replace the plunger, you must first remove all the fluid end parts including the cooling cylinder. If the plunger is not worn excessively, it may be reversed rather than replaced. See Chapter 5 for more specific information on removing the plunger.

### **Maintenance: Plunger Packing**

The standard plunger packing [75,84] consists of solvent resistant polymer with an O-ring. Although SPX recommends changing both pieces at the same time, they may be changed individually. Part numbers are supplied on the corresponding assembly drawings in Chapter 7 for the two piece packing assembly and for the individual pieces. Contamination of the cooling water with product indicates that the packing is worn and should be replaced.

### **Maintenance: O-Rings & Back-Up Rings**

All O-rings and back-up rings have been made from highly chemical and solvent resistant materials. However, extreme care must be taken at assembly and disassembly to prevent damage to these parts.

difficult to gauge whether or not these parts are worn. However, as these parts wear, leakage may occur which indicates the need for replacement. You should visually inspect these parts for physical changes such as swelling, distortion, or fraying especially after they have been used for many sample runs or for several processing hours.

Wear will likely occur as a result of punctures and tears made during assembly and disassembly of the machine. Therefore, a special tool is supplied to facilitate safe installation and removal of O-rings and seals. Please see Chapter 5 for more information about the tools supplied with your machine.

### **Ordering Spare Parts**

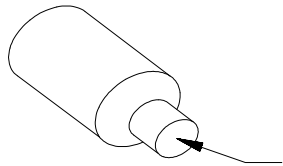
Contact your SPX Sales Representative or SPX Customer Support Centre, our 24-hour parts order hotline at +45 70 278 278. Please provide the model and serial number for your machine. This information is found on the name plate [100] on the back of your machine. Also, please provide the appropriate part numbers needed for your order. The assembly drawings included in Chapter 7 of this manual will help you easily find the parts you are looking for.

### **Returns**

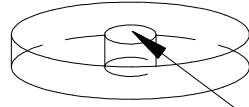
Materials and parts cannot be returned without first contacting your SPX Sales Representative. He or she can explain the return policy and also provide a Returned Materials Authorization (R.M.A.) number to use when shipping materials back to SPX. Materials accepted for credit may be subject to a service charge plus all shipping charges. Any specialty items built to order are not returnable.



## Wear Pattern chart. Homogenising valve, seat and impact ring

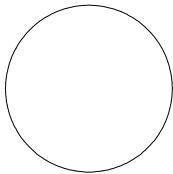


Homogenising  
valve face

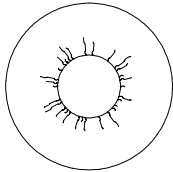


Impact ring  
inside Dia.

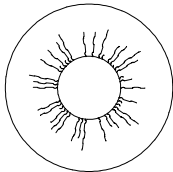
### Homogenising valve face



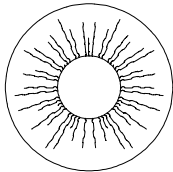
1. NEW VALVE – Smooth across entire face.



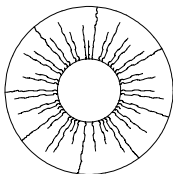
2. USED VALVE – No visually apparent wear except slight circular pattern in centre of valve face.



3. USED VALVE – Round erosion groove appears in centre and radial grooves begin to show. Still good but monitor more often now.



4. VALVE READY FOR REGRINDING – Deep, circular erosion groove in centre and radial grooves more evident.



5. EROSION GROOVES – Radial grooves due to erosion at any stage of wear. Valve must be reground for proper homogenisation, regardless of other face conditions.

*Similar erosion patterns will be evident on the face of the homogenising valve seat as well. When checking for wear, always check both the homogenising valve and the homogenising valve seat.*

*The impact ring may also exhibit wear on the inside diameter. The wear does not significantly impact homogenisation efficiency however, if the wear grooves appear deeper than 1mm (0.0400”) at one side it may be reversed.*

*When both sides have grooves, the impact ring should be replaced.*

# Operating Procedure

*SPX recommends using water the first time the APV-1000 or APV-2000 is operated.*

**T**he APV-1000 and APV-2000 will arrive nearly assembled and ready to use. After all installation instructions have been completed as outlined in Chapter 3, attach the feed hopper [6] using the hex socket bolts [8] provided. SPX recommends that the machine not be operated until the entire manual has been read.

### Standard Operating Procedure: APV-1000 & APV-2000

- 1 **DO NOT** operate machine without cover [111] securely in place.
- 2 Plug machine into power receptacle.
- 3 Turn on cooling water.
- 4 Turn on digital pressure gauge(s).
  - 4.1 Zero gauge if necessary.
- 5 Open homogenising valve(s) by turning hand wheel(s) [35] counter-clockwise.
  - 5.1 If the homogenising valve is closed when machine is started, large pressure spikes will damage the machine and could cause bodily harm.
- 6 Pour sample into feed hopper [6].
  - 6.1 To reduce sample loss, attach the J-shaped recirculation tube [9] to the discharge tube [34].
  - 6.2 Hook recirculation tube [9] onto feed hopper [6].
- 7 Press power button on front of machine to start motor.

- 8 Observe flow.
  - 8.1 Flow is normal when it pulses steadily with reciprocating plunger.
  - 8.2 If flow pulses erratically, allow the machine to continue pumping. This will allow all air to purge.
  
- 9 Engage Homogenising Valve.



Be sure to avoid actuating the pressure beyond the maximum safe operating pressure.

#### 9.1 SINGLE-STAGE MACHINE

- 9.1.1 Actuate pressure by turning hand wheel [35] clockwise until desired pressure is displayed on the pressure gauge.

\*NOTE: Set pressure at about 10% below desired final pressure. Pressure tends to drift upward during first few minutes of operation.

Be sure to turn the hand wheel [35] very slowly.

**Pressure increases very rapidly.**

#### 9.2 TWO-STAGE MACHINE

- 9.2.1 Actuate **second** stage hand wheel [35] by turning clockwise until about 10% of the total desired homogenisation pressure is displayed.

Be sure to turn the hand wheel [35] very slowly.

**Pressure increases very rapidly.**

- 9.2.1.1 The first stage pressure gauge [16] will initially display the second stage homogenisation pressure.
- 9.2.1.2 The optional second stage pressure gauge [19] may also be used to display the second stage homogenisation pressure.
- 9.2.2 Actuate **first** stage hand wheel [35] by turning clockwise until the total desired homogenisation pressure is displayed.
  - 9.2.2.1 The first stage pressure gauge [16] will display the total desired homogenisation pressure.
  - 9.2.2.2 The optional second stage pressure gauge [19] will continue to display only the second stage homogenisation pressure.

- 10 Observe flow and collect samples from end of discharge tube [34] or end of recirculation tube [9].
  - 10.1 You may choose to process samples either of two ways:
    - 10.1.1 Recirculation tube [9] may remain hooked over feed hopper [6] during pressure actuation so that outlet flow is recirculated until final pressure is reached and samples are collected.
    - 10.1.2 Recirculation tube [9] may be removed from feed hopper [6] before actuating pressure so that outlet flow is sent to waste until samples are collected.
  - 10.2 Do not allow feed hopper to empty during processing.
    - 10.2.1 If feed hopper is inadvertently allowed to run dry, disengage pressure before turning off power.
    - 10.2.2 To continue test, begin again at step 6.
  
- 11 After you have finished collecting samples, disengage homogenisation pressure by turning the hand wheel(s) [35] counter clockwise until the pressure gauge(s) read zero.
  
- 12 To drain remaining sample, allow machine to pump with no pressure actuated on the homogenising valve(s) until feed hopper [6] has drained and nothing flows from the discharge tube [34].
  
- 13 Turn off the motor by pressing the power switch.
  - 13.1 DO NOT turn off power until the homogenisation pressure is removed or damage to the machine may result.
  
- 14 Turn off the cooling water.

*END OF PROCEDURE*

## **Liquid Filled VS. Digital Pressure Gauges**

When using the APV-1000 or APV-2000 for the first time, you will probably notice that there is a fluctuation in the pressure readout. This is normal. A completely stable reading is not possible because of the design of the machine. As the plunger reciprocates, the actual pressure is constantly changing from zero to the actuated pressure. However, the gauge will register a fluctuation of about 10 bar (145 psi).

If you are concerned that the new digital pressure gauge is not as stable as a liquid filled pressure gauge, please consider the following. Liquid filled pressure gauges are not able to show fluctuations in pressure due to the dampening liquid used in the gauge. Digital pressure gauges are dampened electronically. It is possible to dampen a digital gauge to the same level as a liquid filled gauge, but that would result in a delay in the read out. SPX engineers have chosen to reduce the dampening effect slightly so the delay is nearly eliminated. If you have any questions about gauge dampening, please do not hesitate to contact your SPX Sales Representative or the SPX Service Department.

## **Single-Stage VS. Two-Stage Homogenisers**

Single-stage homogenisers are typically used for processing dispersions, cell slurries, and products processed at very high pressures (above 550 bar/8,000 psi). They are also used for formulations that incorporate both oils and solids, such as pharmaceutical creams. Two-stage homogenisers are typically used only for pure emulsions processed below 550 bar/8,000 psi. There are, of course, exceptions to these guidelines.

To better understand this, it is helpful to think of the second stage homogenising valve as a back pressure valve. No significant amount of homogenisation takes place in the second stage valve. In the case of pure emulsions processed at relatively low pressures, research has shown that the second stage valve helps produce a more uniform particle size and prevent newly formed oil droplets from re-agglomerating. At higher pressures (above 680 bar/10,000 psi), this benefit is not as great and usually does not justify the use of a second stage homogenisation valve. Typically, the optimum benefit from a second stage homogenising valve is achieved when the second stage pressure is set to 10% of the total pressure. Again, there are exceptions to this rule.

## **Multiple Discrete Passes VS. Continuous Recycling**

For some applications, it may be necessary to process a sample using two or more passes through the homogeniser. For instance, liposome and intravenous emulsions require an extremely narrow particle size distribution. To achieve this, the entire sample volume must be passed through the homogeniser once and then poured back into the feed hopper for the second pass. This process must be repeated for any necessary subsequent passes. This method ensures that each particle, globule, or cell within the entire sample is exposed to the same number of passes and amount of energy.

An alternate form of recycling, known as continuous recycling, mistaken for multiple discrete passing. Continuous recycling is an inefficient way to produce a similar result. The entire sample is

homogenised. Some particles, globules, or cells pass through the homogenising valve many times while others remain unhomogenised in the feed hopper. Statistically speaking, it can take up to 6 times as long to produce a similar result with this method of recycling. Usually continuous recycling results in a very unstable product.

**Attention!**

There can be a significant heat build up with any type of recycling. For water, a 2.5°C temperature rise for each 100 bar (1.7°C for 1000 psi) of processing pressure is normal. If a sample is recycled without cooling between passes, a very high temperature will result. You can counteract temperature rise by cooling the sample with a small heat exchanger or using an ice bath. The temperature of the sample should not be allowed to rise above 100°C or machine damage could result.

## Using the Pressure Feeder

When processing extremely viscous samples, you may wish to utilise the optional Pressure Feeder [155]. The following outlines the procedure for its use.

### Standard Operating Procedure: Optional Pressure Feeder

- 1 Attach pressure feeder [155] to machine using O-ring [7] and hex bolts [8].  
**NOTE:** Reference drawing number 21351M
- 2 Remove cap [159], gasket [157], and piston [156].
- 3 Pour sample into pressure feeder tank [155].  
Be sure to leave enough space for the piston [156] and cap [159].
- 4 Replace piston [156], gasket [157], and cap [159]. No o-rings required for the grooves in the piston.
- 5 Supply air (*Not Greater Than 100 psi*) to fitting [161].  
**NOTE:** Customer must supply appropriate 0.125" NPT fitting/adapter.
- 6 Operate machine as instructed above.
- 7 Release air pressure BEFORE opening the pressure feeder! We recommend installing a pressure gauge in your air supply line.

## Troubleshooting

| PROBLEM                              | EXPLANATION & SOLUTION  |
|--------------------------------------|---|
| No Power                             | Ensure machine is plugged in.<br>Ensure machine is properly wired.  |
| Machine Shuts Down During Processing | All machines are equipped with an over current shut down safety feature. If this feature engages, there may be a problem with the power supply, wiring, or pressure gauge(s) in your machine. A qualified electrician should review this manual and the wiring diagrams to troubleshoot the problem. You may reset the machine to continue processing, but you should only do so temporarily. The reset switch is found inside the cover near the bottom of the electrical box. You should examine the motor and motor wiring carefully before resetting the motor to check for damage.<br>Chapter 3 for more informati |

| PROBLEM   | EXPLANATION & SOLUTION  |
|---|---|
|   | <p>The machine may have been exposed to excess pressure and is therefore stopped by the excess pressure safety switch on the pressure gauge. In this case the machine can be restarted.</p> <p>A fuse or circuit breaker could have blown. If this is not the case, it is possible (though unlikely) that the motor has burned out.</p>   |
| No Pumping  | <p>Sample will not pump because it cannot reach pumping block or the ball valves are not seating properly. This typically happens when a sample is highly viscous or contains large particles. A pressure-feeding device should be used to force these products to the pumping block. However, large particulates or long fibres may continue to clog the small orifices and/or get caught under the ball valves, thus interfering with pumping.</p> <p>Another source of pumping problems is air. If a sample has a tendency to form air pockets, it can be degassed using a vacuum pump prior to processing on the homogeniser.</p> |
| Erratic Pumping                                     | <p>Small pockets of air are the most likely source of this problem. Allow sample to pump, continuously recirculating, without actuating pressure. After a few minutes, pumping should become normal.</p> <p>Particulates in a sample could cause erratic pumping. If particulates are large enough to interfere with proper seating of the ball valves, pumping problems will occur. Try using more finely ground solids in your sample.</p>  |
| Low Flow Rate                                       | <p>This could be an indication of a worn ball valve and seat or due to a highly viscous product. Check ball valves and seats for wear and repair or replace. If the sample is highly viscous or mucoid, use a pressure-feeding device.</p> <p>Low flow could also indicate an electrical supply problem. For example, if the motor is rated for 60 Hz but is being powered by 50 Hz, a 17% reduction in flow rate will result.</p>  |
| Not Able to Attain Pressure, but Pumping Seems Fine | <p>Worn homogenising valve and/or valve seat. Check wear pattern by comparing to chart located at the end of Chapter 3. If worn, replace or repair.</p>   |
| Pumping Stops When Pressure is Applied              | <p>See No Pumping, Erratic Pumping</p>  |

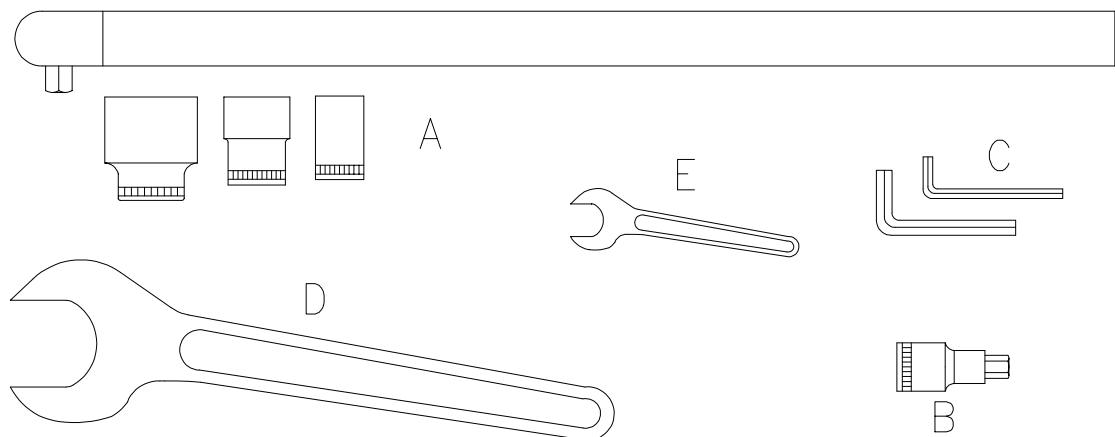


| PROBLEM                                  | EXPLANATION & SOLUTION  |
|--|---|
|  | This could be due to worn ball valves and seats. Inspect, and repair or replace if necessary. A pressure-feeding device may be used to force sample to the pump valves.   |
| Fluctuating Pressure Readout             | This is Normal. Please see the section entitled Liquid Filled vs. Digital Gauges in Chapter 4 for more information.   |
| No Pressure Readout                      | It must be ensured that the pressure gauge is turned ON..<br><br>No pressure is actuated on homogenising valve. The hand wheel must be turned clockwise until a slight resistance is felt to actuate pressure. The machine's sound will change once pressure is applied.  |
| Pressure Readout Does Not Return to Zero | After disengaging homogenising pressure by turning hand wheel counter-clockwise, sometimes the pressure readout does not display zero. This happens when heat has slightly distorted the pressure transducer or gauge. It will return to zero once the machine has cooled back to room temperature. If the pressure shown on the gauge is relatively small, you may disregard and continue processing. Or, you may re-zero the gauge.<br><br>DO NOT re-zero the gauge until you are certain that the homogenising pressure has been disengaged. |
| Pressure Readout Flashing                | The pressure has been actuated beyond the maximum pressure rating of the machine. Reduce pressure by turning the hand wheel(s) counter-clockwise until the gauge readout is steadily displayed.   |

## Assembly, Cleaning, & Disassembly

*SPX recommends using only supplied tools to assemble and disassemble the APV-1000 and APV-2000.*

The following two drawings show the various wrenches, key tops, and pullers supplied with the APV-1000 and APV-2000. Replacement tools may be purchased through your SPX Sales Representative.



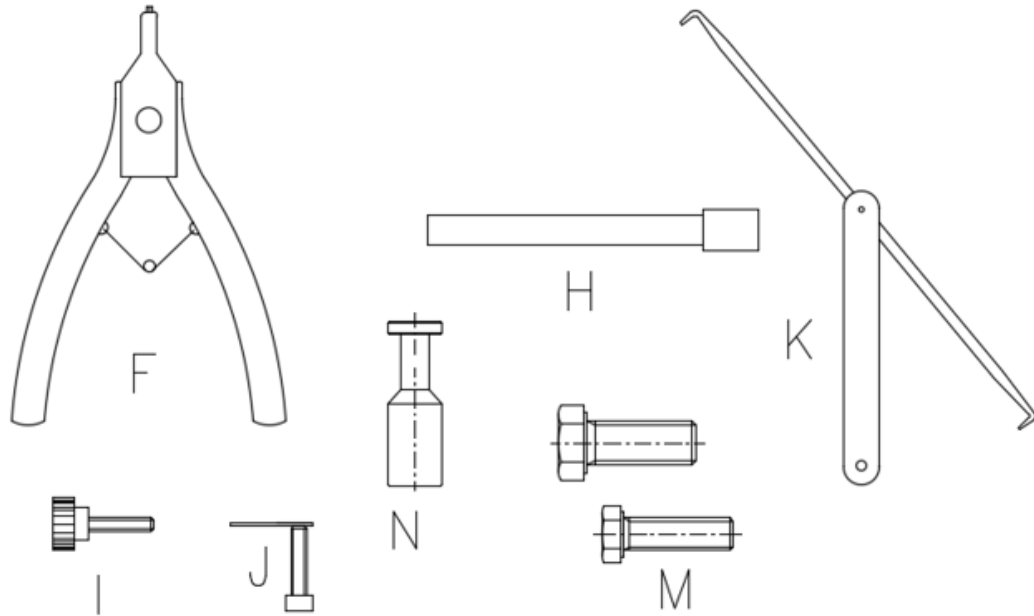
- A Torque Wrench**  
P/N K003131  
**Socket Heads**  
32 mm P/N 81210042  
22 mm P/N K003132  
16 mm P/N 81210041 (only for 1000)

- B Key top**  
P/N 81210128

- C Hex Wrenches**  
5 mm P/N K002254  
4 mm P/N K002253

- D Open End Wrench**  
32 mm P/N 81210021

- E Open End Wrench**  
11 mm P/N 81210020



**F Spring Ring Removal Tool**  
 P/N 81210029

**M Packing Ring Puller**  
 APV-1000 P/N K003291  
 APV-2000 P/N K003135

**H Packing Removal Tool**  
 P/N 81210050

**N Homogenising Valve Cartridge Puller**  
 P/N 81210017

**I Ball Valve Guide Puller**  
 P/N K002598

**J Plunger Removal Tool**  
 P/N 96610003

**K O-Ring Removal Tool**  
 P/N 81210046

\*\*\* **O-Ring & Back-Up Ring Chart**  
 APV-1000 P/N 81210081  
 APV-2000 P/N 81210082

\*\*\* **Stud Installation Tool**  
 P/N K117637

\*\*\* **Tool Pouch**  
 P/N K117532

\*\*\* **Tool Kit**  
 Contains all listed tools in tool pouch  
 APV-1000 P/N 96610002  
 APV-2000 P/N 96610001

\*\*\* **Cooling system, Aseptic**  
 Male Coupling P/N 84210022

\*\*\* Not Shown on Drawing

**A** ssembly and disassembly of the APV-1000 and APV-2000 may initially seem complex. But with experience, it is easy to efficiently assemble the machine in a matter of minutes.

### General Information

It is important that the various parts held on by nuts and bolt are installed by tightening all nuts uniformly. This ensures the faces of the various blocks remain parallel to prevent leakage, damage to parts, and the possibility of bodily harm.

**Attention!** Be sure to use a torque wrench to tighten to the specified torque values as shown on the drawings. If you are unsure how to use a torque wrench, please see the wrench's original packaging for instructions. Torque values are not listed for all hex socket bolts and other threaded parts. Use the following torque values on threaded parts unless otherwise specified by the drawings in Chapter 7:

| Size | Torque Value |
|------|--------------|
| 4 mm | 4 Nm         |
| 5 mm | 7 Nm         |
| 8 mm | 17 Nm        |

This section discusses only the typical assembly instructions for daily use. It assumes that the plunger remains installed along with the cooling cylinder. If you need any information not included in this manual, please call your SPX Sales or Service Representative.

## **DISASSEMBLY PROCEDURE**

### All Designs

BEFORE BEGINNING DISASSEMBLY, SHUT OFF THE POWER TO THE MACHINE AT THE POWER SOURCE OR STARTER BOX.

- Remove Cover [111] using Cover Lock [114] thumbscrew on top of machine.
- Remove Hand wheel [35].
- Remove Hand wheel Support [36] using wrench [A].
- Remove brass Disc Spring Retainer [42] from Hand wheel Support [36].
- It is not necessary to remove Disc Springs [37] from Disc Spring Retainer [42].
- Place Hand wheel [35] and brass Disc Spring Retainer [42] aside for manual cleaning if necessary.
- Repeat procedure for Two-Stage Design.
  
- Remove Homogenising Valve Cartridge(s) [38] using supplied puller tool [N].
- Remove Homogenising Valve [46], Valve Seat [48], Impact Ring [47], and Spring [44] from Cartridge [38].
- It is not necessary to remove Snap Ring [43] from Homogenising Valve [46].
- Remove O-ring [40] and Back-up Ring [39] from outside of Cartridge [38].
- Remove O-ring [45] from inside of Cartridge [38].
- Repeat procedure for Two-Stage Design.
  
- Remove Discharge Tube [34] by removing small Hex Head Bolt [33] with wrench [E].
- Pull Discharge Tube [34] out of block.
- Remove O-ring [31] from Discharge Tube [34].

### Two-Stage Design Only

- Remove Pressure Gauge(s) using appropriate wrench.
- Remove all O-rings and Back-up Rings from these parts.
- Remove Cap Nuts [25] from Second Stage Homogenising Valve Block [29] using torque wrench [A].
- Slide the block off studs [30].
- Remove Cap Nuts [25] from First Stage Homogenising Valve Block [27].
- Slide the block off studs [26].
- Remove any remaining O-rings and Back-up Rings from inside and outside of Homogenising Valve Blocks [27,29].

### Single-Stage Design Only

- Remove Pressure Gauge(s) using appropriate wrench.
- Remove large Hex Head Bolts [141] from Discharge Block [140] and remove block.
- Remove Cap Nuts [25] from Single-Stage Homogenising Valve Block [27] using torque wrench [A].
- Remove O-rings [22] and Back-up Ring [23] from inside and outside of Homogenising Valve Block [27] and Discharge Block [140].

### APV-1000

- Remove Feed Hopper [6] using appropriate hex wrench.
- DO NOT REMOVE Pump Valve Block assembly from machine yet.
- Remove Valve Caps [50] from Pump Valve Block [54,56] using adjustable wrench (not supplied).
- Remove Valve Guides [52,53] using supplied puller [I].
- Remove all O-rings and Back-up Rings from Valve Guides [52,53] on APV-1000.
- Remove Hex Socket Bolts [51].
- Slide Pump Valve Blocks off studs (gently pry from Cylinder if necessary).
- Separate two-piece Pump Valve Blocks [54,56].
- Remove Ball Valves [64].
- Remove Ball Valve Seats [55].
- Remove any remaining O-rings from inside or outside of the two Pump Valve Blocks [54,56].
- Remove O-Ring [78] from end of Cylinder [77].

### APV-2000

- Remove feed hopper [6] using appropriate hex wrench.
- DO NOT REMOVE Pump Valve Block assembly from machine yet.
- Slide Pump Valve Blocks off studs (gently pry from Cylinder if necessary).
- Remove the Ball Valve Guides [88,89] and Springs [87].
- Remove Ball Valves [64].
- Remove Ball Valve Seats [55].
- Remove any remaining O-rings and Back-up Rings from inside and outside of all three Pump Valve Blocks [58,60,61].

### All Designs

- Remove Cylinder [77,86] from Plunger [76,85].
- Remove Packing Ring [74,83] using supplied puller [M].
- Remove Packing [75,84] by pushing it out of the Cylinder with packing removal tool [H] and disassemble the pieces.
- Remove large O-ring [73] from front of Cooling Cylinder [72,82].

### Replacing the Plunger

- Remove the tubing from the water connections [147] from the Cooling Cylinder [72,82].

- Remove the Cooling Cylinder [72,82].
- Move the Crosshead [129] towards the front of the machine by turning the power on and off very quickly.
- Unscrew the Hex Sockets [68].
- Pull the Plunger [76,85] and Plunger Coupling [67,79] from the Crosshead [129].



- Using a hex wrench [C], remove the hex socket [66] from the Plunger Coupling [67,79].



- Using the Plunger Removal Tool [J], remove the screw from the tool and slide the plate in to the opening on the Plunger Coupling [67,79].
- Thread the tool screw into the Plunger Coupling until the Plunger loosens.



- Remove the Plunger from the Plunger Coupling.

**Attention!**

*Plunger placement is very important. If the plunger is not properly positioned, the plunger could shatter during machine operation. To ensure proper positioning of the plunger in the coupling, the following procedure must be followed:*



- Slide the new Plunger (or reverse the current plunger) into the Plunger Coupling.
- Make sure that you insert the Plunger so that the grooved side of the Plunger Coupling is positioned towards the Crosshead.
- Install the hex socket into the Plunger Coupling, but **DO NOT TIGHTEN**.
- Install the entire assembly into the Crosshead.
- Push the Plunger into the Plunger Coupling until it bottoms on the back of the Crosshead.
- Tighten the hex socket on the Plunger Coupling.
- Replace the two hex sockets which hold the plunger assembly in position in the Crosshead.
- Replace the Cooling Cylinder and attach the tubing to the water connections.

### **Assembly Procedure**

Perform the disassembly procedure in opposite order.

**Attention!**

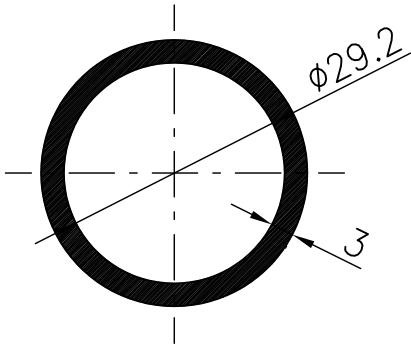
Be sure to tighten specified parts to required torque values as instructed by the assembly drawings.

The faces of the various blocks (pump valve block, homogeniser block, etc.) must remain parallel to prevent leakage, damage to parts, and the possibility of bodily harm.

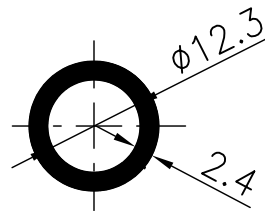
### **Selecting the Correct O-Rings & Back-Up Rings Using Charts**

The following pages will assist you in selecting the correct O-rings and back-up rings during machine assembly. These charts are drawn 1:1 scale and are intended for matching the actual O-rings and back-up rings directly with the drawings. It is helpful to write the total number of O-rings and back-up rings your particular machine uses on the respective charts. This will help you determine if you have misplaced any during cleaning or maintenance.

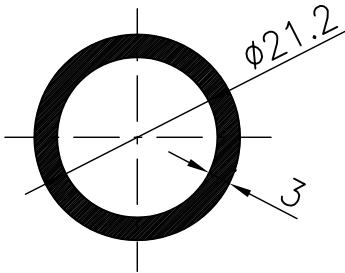
# O-RING CHART FOR APV-1000



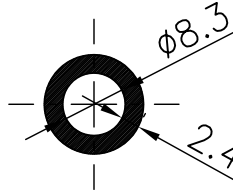
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| NBR   | K002196  |



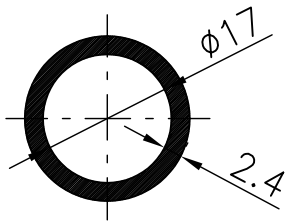
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| VITON   | 80110141 |
| CHEMRAZ | 80110123 |



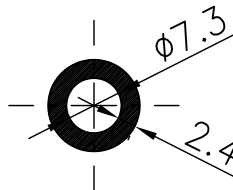
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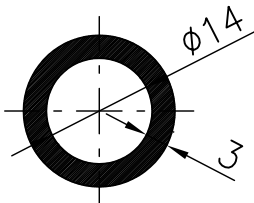
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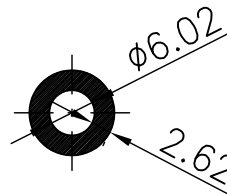
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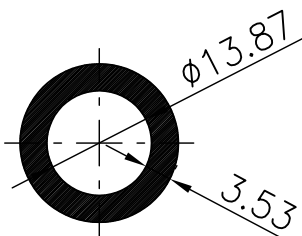
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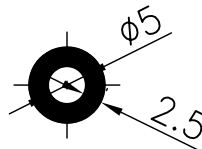
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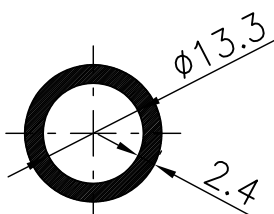
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| CHEMRAZ | 80110025 |



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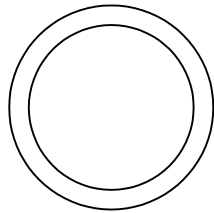


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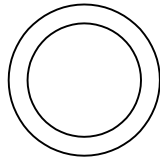


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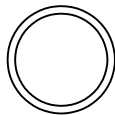
# BACK-UP RING CHART FOR APV-1000



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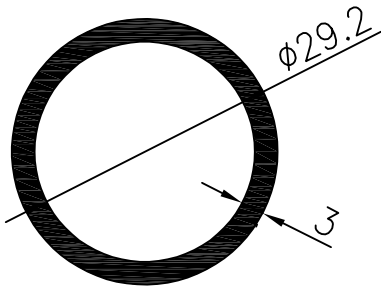


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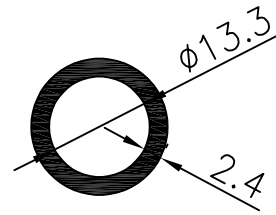


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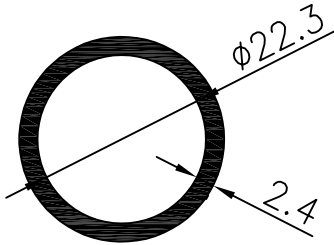
# O-RING CHART FOR APV-2000



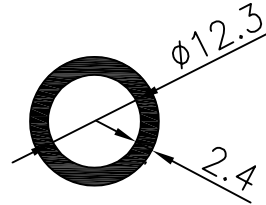
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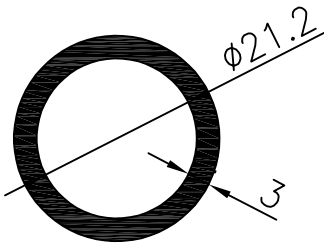
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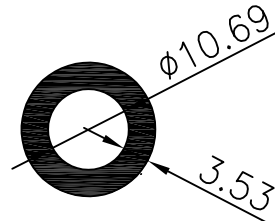
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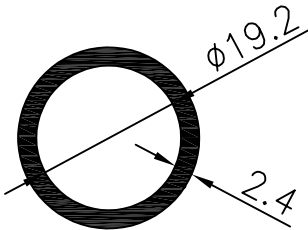
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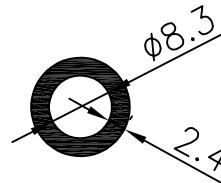
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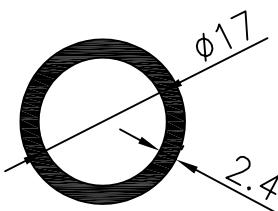
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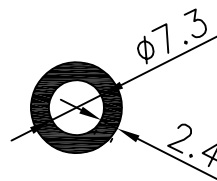
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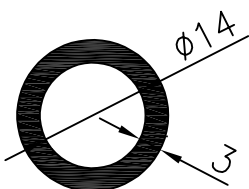
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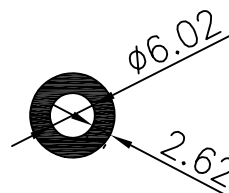
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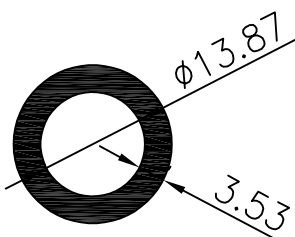
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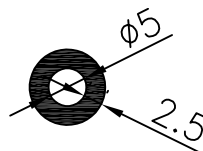
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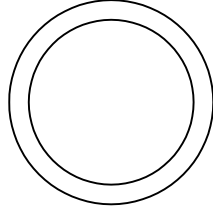


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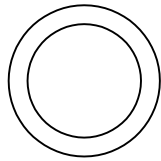


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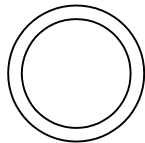
## BACK-UP RING CHART FOR APV-2000



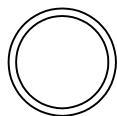
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| Matr. | Part no. |
|-------|----------|
| POM   | 80310006 |



| Matr. | Part no. |
|-------|----------|
| POM   | 80310000 |



| Matr. | Part no. |
|-------|----------|
| POM   | 80310004 |

## Recommended Cleaning Procedure

The only way to thoroughly clean the APV-1000 or APV-2000 is to completely disassemble the fluid end. This means removing all parts and completely disassembling them up to the cooling cylinder. The cooling cylinder and plunger may remain attached to the machine and simply wiped clean.

However, if complete cleanliness is not absolutely necessary, the machine may be flushed out first with hot water, then soapy water, and finally clean hot water until the water runs clear. For most samples, a cleaning solution containing a good laboratory soap is fine. However, it is important to note that flushing the machine will *not* thoroughly clean the product out of the fluid end parts. Cross-product contamination will occur if the machine is not completely disassembled between batches.

For manual cleaning, a variety of small brushes, cotton swabs, and pipe cleaners may be necessary. The following parts should only be cleaned manually when necessary:

### MANUALLY CLEANED PARTS

Hand Wheel(s)  
Brass Disc Spring Retainer(s)  
Cooling Cylinder  
Plunger  
Pressure Gauge(s)

The remaining parts can be cleaned manually or in an ultrasonic bath. A large ultrasonic bath that can hold the fluid end parts can be purchased from a laboratory supply catalogue. The ultrasonic action cleans each part thoroughly, especially within the small orifices and crevices that are difficult to reach using brushes and pipe cleaners. Be sure to remove all O-rings and back-up rings before submerging parts. Once the O-rings and back-up rings are removed, they can also be cleaned in the ultrasonic bath. Laboratory soap is acceptable for ultrasonic cleaning. If necessary, a dilute bleach solution may be used for a short duration to sanitise. Do not allow stainless steel parts to stay submerged in bleach solutions for very long. Pitting and staining may result. If bleach is necessary to sanitise your machine, be sure to rinse each part thoroughly before drying and reassembling.

Some products may require the use of solvents to clean the machine. Solvents may be used to clean any metal parts. However, certain solvents will attack the O-rings and back-up rings. It is recommended that O-rings, back-up rings, and packing's are replaced if the sample is solvent based and if solvents are used to clean these parts. If it is not practical to replace the O-rings and back-up rings each time the machine is re-assembled, use great care to inspect the parts before reassembling the machine. When using solvents for cleaning, do not allow O-rings and back-up rings to soak for long periods of time, as this may cause them to swell and weaken.

## Tips and Tricks

### O-Rings & Back-Up Rings

A general O-ring and back-up ring chart is located in this manual. A laminated chart specific to your machine design was also provided. Keep this laminated chart with the tool kit and use it each time you assemble and disassemble the machine. Quantities of each part are listed directly under the 1:1 scale drawing of the part. This will ensure that the appropriate O-rings and back-up rings are used in the correct quantities every time the machine is assembled.

Lubricate O-rings and back-up rings with a small amount of grease or lubricant. Be sure to use a product suitable for the O-ring and back-up ring material. This will make the parts easier to insert and remove.

Be sure to remove all O-rings and back-up rings when cleaning the machine. It is sometimes difficult to see the back-up rings located inside the homogenising valve blocks, so be sure to look closely. Use care when removing O-rings and back-up rings in order to prevent damage.

### Threads

Use a food-grade anti-galling grease on all metal to metal threads. This grease may contain additives such as PTFE to prevent seizing.

Never force threaded nuts, screws, or other parts. First, ensure that the parts are not cross-threaded or a seal has not dislodged during the assembly process. This is particularly important to consider when installing the hand wheel support. The face seal inside the block can easily be dislodged during installation of the homogenising valve cartridge without the user's knowledge (see tips on next page).

## Assembly & Disassembly Tips

To install the homogenising valve cartridge:

- Insert the homogenising valve, seat, and impact ring into the valve cartridges as per the drawings. It is helpful to thread the valve cartridge puller [N] on to the cartridge to assist installation.
- Slightly lubricate the O-ring [40] and back-up ring [39] around the outside of the cartridge.
- Insert the small O-ring [22] and back up ring [23] inside the homogenising valve block.
- Turn the valve block on its side so that the hole into which the valve cartridge is inserted is horizontal.
- Make sure that the O-ring and back-up ring inside the block are still in place.

*NOTE: You may use a small amount of O-ring lubricant to “glue” the O-ring in place so it doesn’t fall out when the valve block on turned its side.*

- Carefully insert the homogenising valve cartridge [38] containing the valve, seat, and impact ring.

*NOTE: The cartridge is inserted properly when the top surface of the cartridge is positioned below the surface of the block. If it protrudes above the block at all, it has not been properly positioned.*

*You will know if the valve cartridge was not properly inserted when you install the hand wheel support. If it is difficult to tighten or does not tighten all the way, do not force it. **Remove the homogenising valve cartridge**, make sure that the O-ring and back-up ring inside the homogenising valve block are in place, and try again.*



## Warranty

### **I. WHAT IS COVERED BY THIS WARRANTY.**

Subject to the exceptions below, SPX warrants to the original purchaser only that all machinery, equipment, parts and accessories manufactured by SPX:

- a. conform to SPX's published specifications; and,
- b. are free from defects in material or workmanship.

The duration of this warranty is one year from date of shipment.

Machinery, equipment, parts or accessories manufactured by others but purchased from SPX are warranted only to the extent of the original manufacturer's warranty to SPX. As purchaser's *sole and exclusive remedies* for any defective or non-conforming machinery, equipment, part or accessory covered by the SPX warranty, SPX will:

- a. repair or replace such non-conforming or defective machinery, equipment, part or accessory with new or used replacement parts, f.o.b., Factory; or,
- b. at SPX's option, return in full the original purchase price for such machinery, equipment, part or accessory in exchange for return of the machinery, equipment or part to SPX; in each case, provided that the defect or nonconformity is proved to SPX's satisfaction.

### **II. WHAT IS NOT COVERED BY THIS WARRANTY.**

SPX does not warrant damages:

- a. caused by operation of machinery, equipment, parts or accessories other than in conformance with the information and instructions contained in any operation manual supplied therewith;
- b. from unauthorized modifications or attachments;
- c. due to shipment;
- d. due to ordinary wear and tear;
- e. of parts of an expendable nature such as seals, gaskets and bearings;
- f. caused by deterioration, erosion or corrosion during periods of storage by purchaser prior to installation and operation;
- g. caused by failure to provide a suitable installation environment;
- h. any other abuse, misuse or improper application of the machinery, equipment, parts or accessories.

**III. PRE-CONDITIONS TO WARRANTY SERVICE.**

- A. Submit an Warranty Registration Data Sheet to SPX prior to placing the machinery or equipment in operation, and which is approved by SPX (applies only to production-size machinery).
- B. Upon discovery of any defects of nonconformity, promptly notify SPX in writing, reasonably specifying the breach. In no event shall such notification be received by SPX later than 13 months from date of shipment.
- C. Receive from SPX Group a written Return Authorization and shipping instructions.
- D. Return the machinery, equipment, part or accessory claimed to be defective or non-conforming to SPX, transportation prepaid, securely packed and crated.

**IV. DISCLAIMER OF WARRANTY.**

EXCEPT AS STATED ABOVE, SPX MAKES NO OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, BOTH OF WHICH ARE EXPRESSLY DISCLAIMED.

**V. LIMITATION OF REMEDIES**

In no case shall SPX be responsible for any indirect, special, incidental or consequential damages, whether based upon breach of warranty or contract, negligence, strict tort or any other legal theory or for any other claim arising out of the sale, delivery, installation or use of the machinery, equipment, parts or accessories beyond the remedies stated above. Excluded damages include but are not limited to loss of profits or revenues, loss of use of any associated equipment, costs of securing substitute equipment, claims of third parties and/or injury to property or persons.

## Assembly Drawings

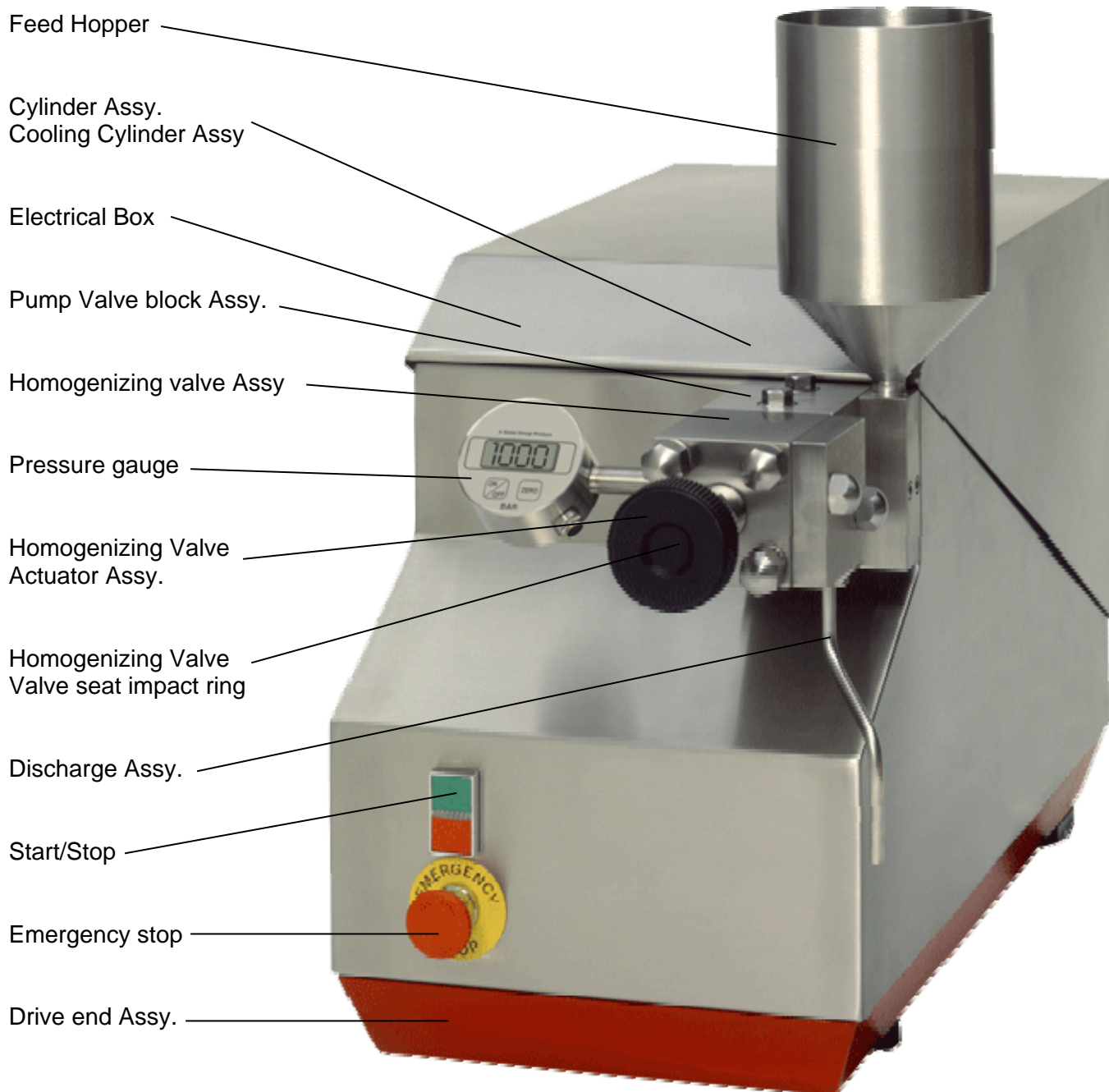
The following pages contain all the assembly drawings you will need for installation, maintenance, assembly, and disassembly of the APV-1000 and APV-2000.

Each drawing is uniquely titled and numbered for easy reference when contacting our office for technical support. Please use these drawings to identify spare parts and part numbers when necessary.

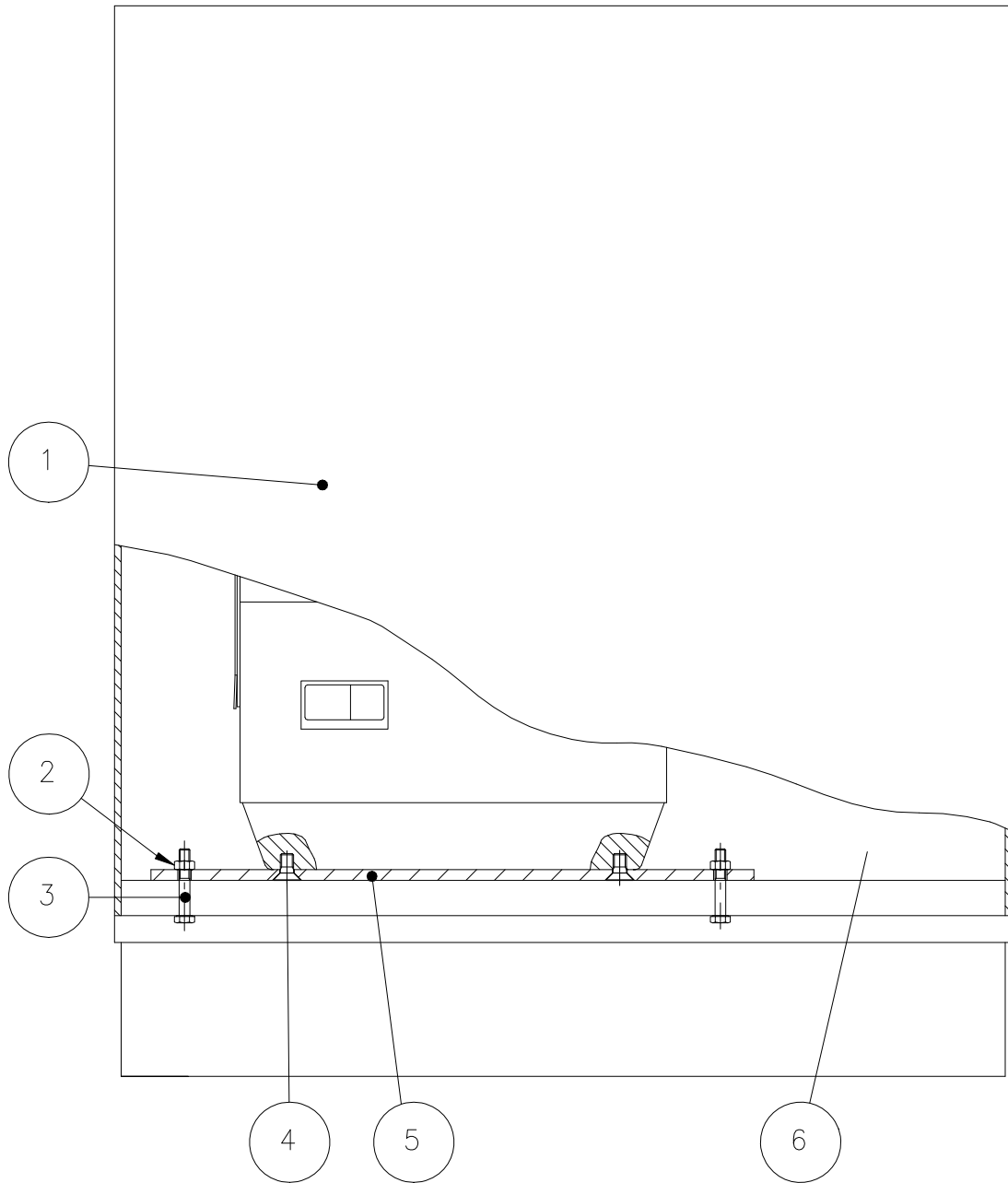
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| 21351M  | Pressure Feeder<br>(Optional)                                   | A3                      |
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| 722117M | Pressure Blank<br>Two-Stage Machine                             | A5                      |
| 722836M | Pressure indication, First and Second Stage                     | A6                      |
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| 722307M | Single-Stage Machine  | A10                     |
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| 727967M | Assembly kit  | A36                     |
|         |   |                         |
|         |   |                         |

## Assembly view



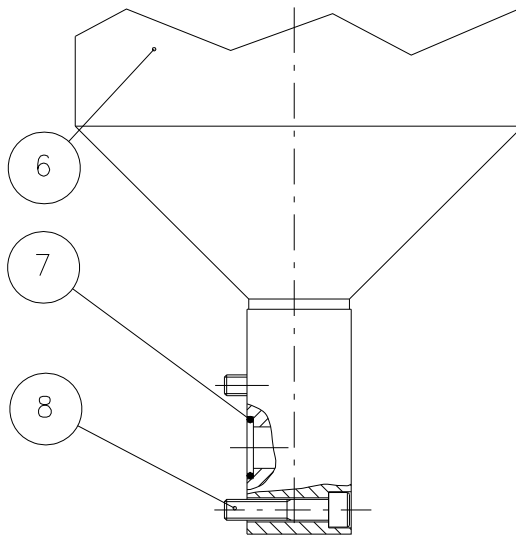
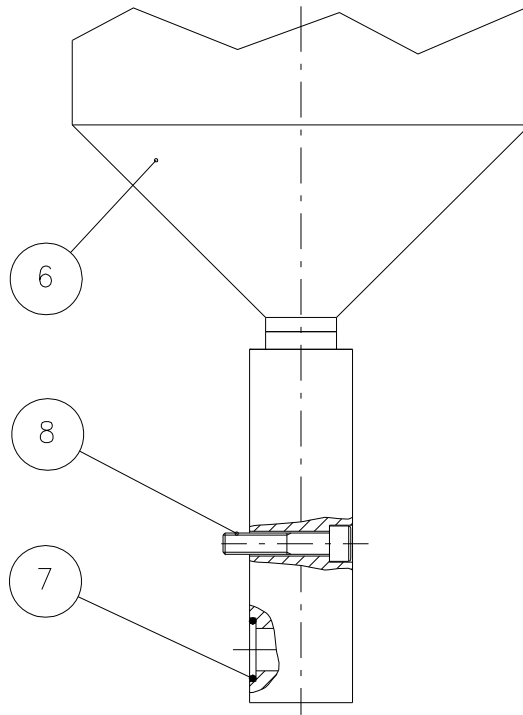
# TRANSPORTATION EQUIPMENT APV-1000 / APV-2000



| Item | Description                      |
|------|----------------------------------|
| 1    | Crate P/N 30110000               |
| 2    | Nut (4) P/N K002614              |
| 3    | Bolt (4) P/N 82010026            |
| 4    | Bolt (4) P/N K003318             |
| 5    | Support Bracket (2) P/N 30110001 |
| 6    | Feed Hopper & Tool Box           |

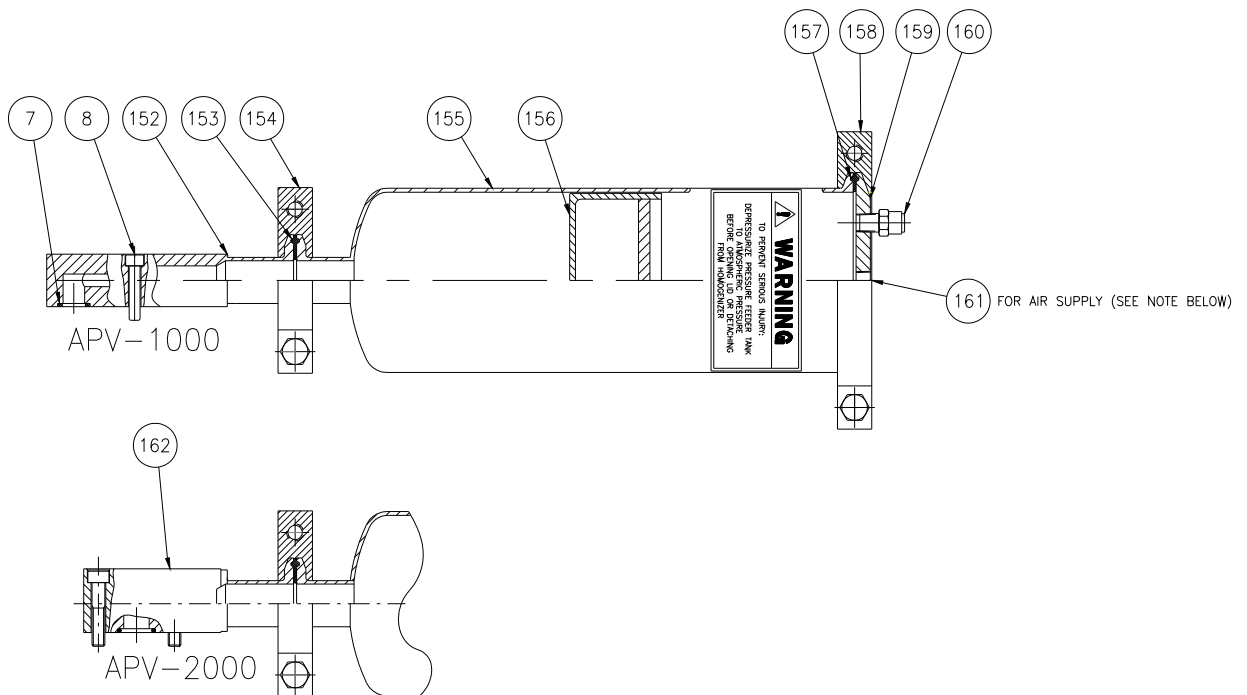
# FEED HOPPER

## APV-1000 / APV-2000



| Item | Description                     |
|------|---------------------------------|
| 6    | Feed Hopper                     |
|      | APV-1000 P/N 34210055           |
|      | APV-2000 P/N 34210034           |
| 7    | O-Ring P/N 80110040             |
| 8    | Hex Socket Bolt (2) P/N K001018 |

# OPTIONAL PRESSURE FEEDER APV-1000 / APV-2000

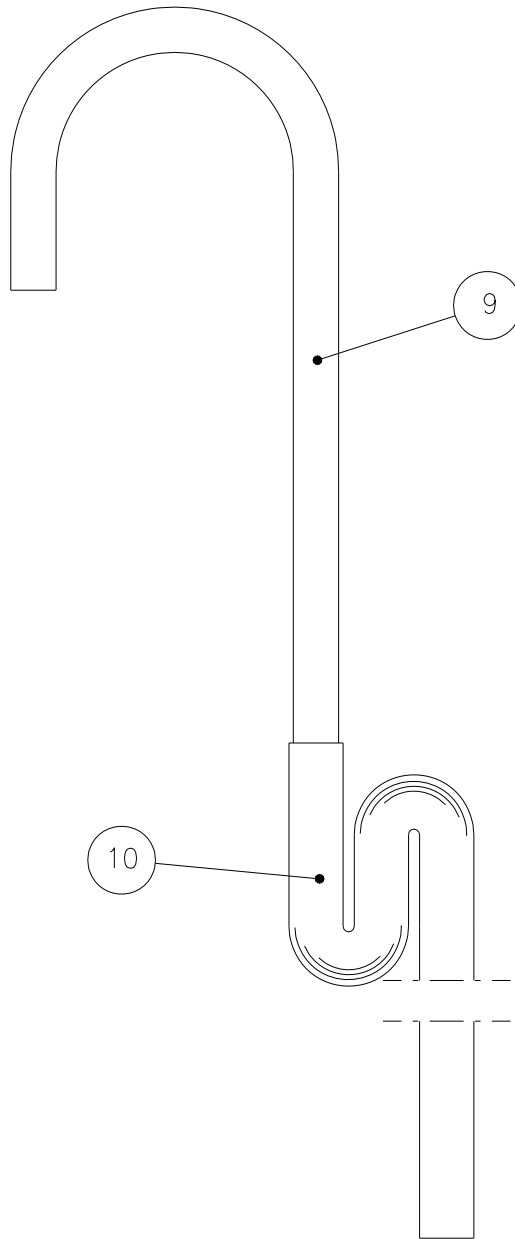


**NOTE:** Do not pressurise the tank above 7 bar (100psi). Most samples only require approximately 1 bar (15psi) to adequately feed the homogeniser.

**WARNING:** Depressurize pressure feeder tank to atmospheric pressure before opening lid or detaching from homogenizers.  
Ignoring this warning may cause serious injury.

| Item | Description                                      |
|------|--|
| 7    | O-Ring P/N 80110040 (EPDM)                       |
| 8    | Hex Socket Bolt (2) P/N K001018                  |
| 152  | Inlet Connection P/N 34230020 1"                 |
| 153  | Tank Clamp Gasket P/N 80210032 1" (PTFE)         |
| 154  | Tank Clamp P/N P720525                           |
| 155  | Pressure Feeder Tank P/N 24730000                |
| 156  | Piston P/N 122010                                |
| 157  | Cap Gasket P/N 84130038 4" (EPDM)                |
| 158  | Cap Clamp P/N P716976 4"                         |
| 159  | Cap P/N 84130031                                 |
| 160  | Pressure Relief Valve P/N 905197                 |
| 161  | 1/8 NPT Provision For Male Quick Connect Fitting |
| 162  | Inlet Connection P/N 34230027                    |

# RECIRCULATING TUBE BYPASS APV-1000 / APV-2000

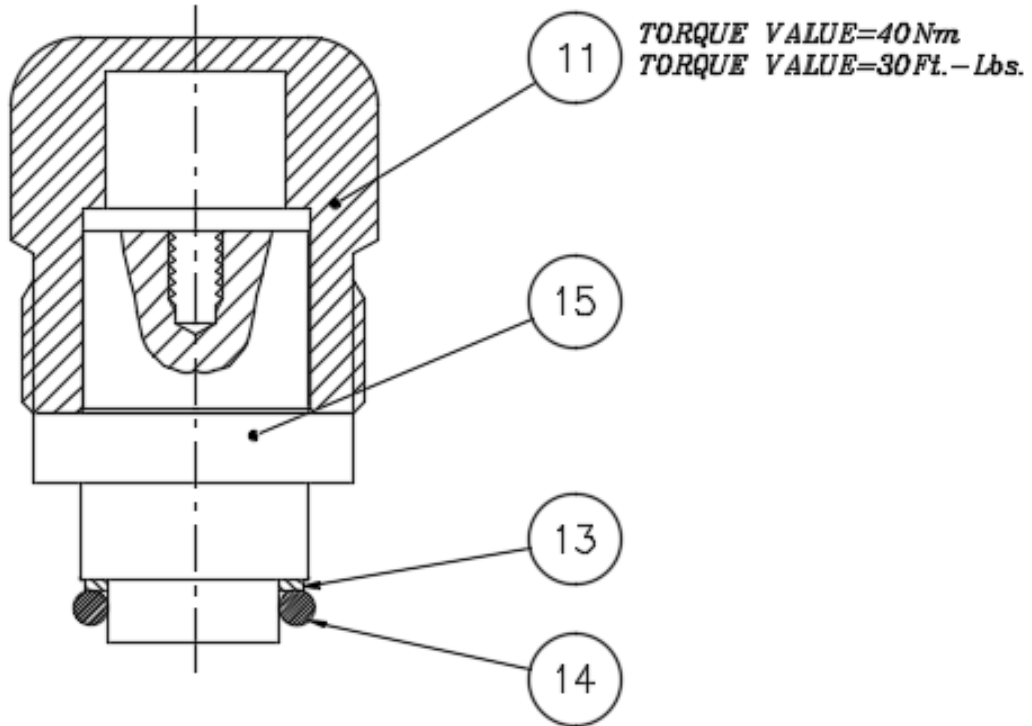


*NOTE: RECIRCULATION TUBE MAY BE USED WITH ANY 6mm I.D. (1/4") FLEXIBLE TUBING.*

| Item | Description                     |
|------|---------------------------------|
| 9    | Recirculation Tube P/N 34210042 |
| 10   | Flexible Tubing P/N 84110010    |



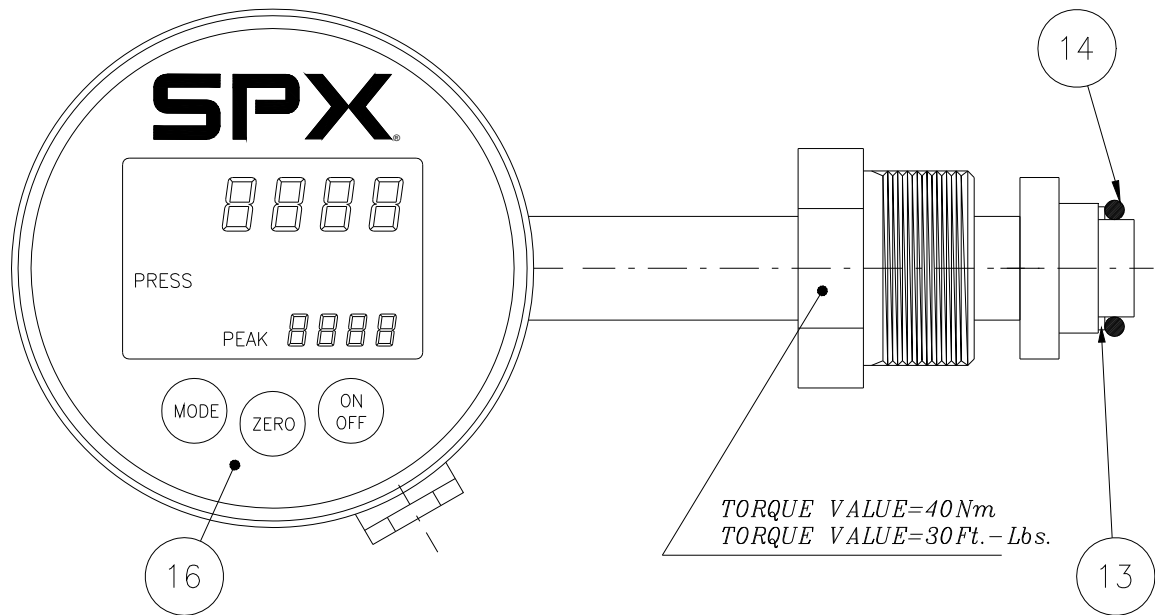
# PRESSURE BLANK TWO-STAGE MACHINE APV-1000 / APV-2000



| Item | Description                            |
|------|--|
| 11   | Blank Transducer Plug Nut P/N 04010000 |
| 13   | Back-Up Ring P/N 80310006              |
| 14   | O-Ring P/N 80110036 (EPDM)             |
| 15   | Transducer Blank P/N 82710000          |

DWG NO. 722117M

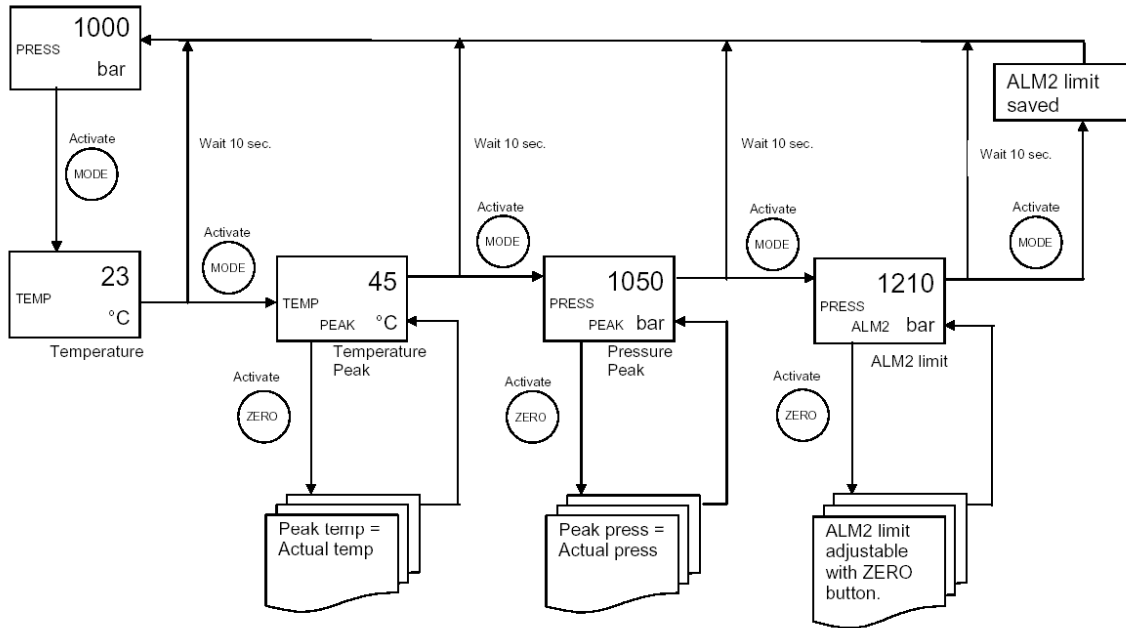
# PRESSURE INDICATION APV-1000/APV-2000



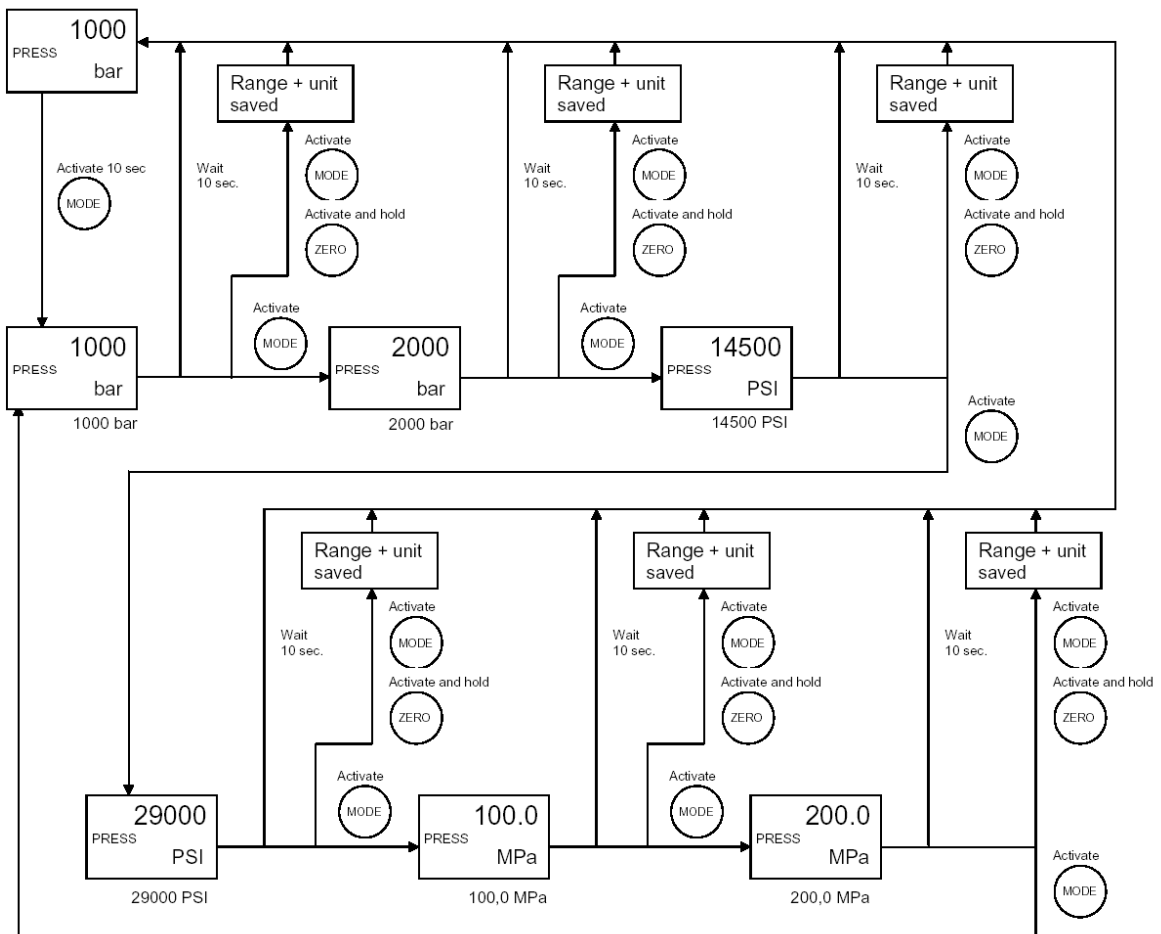
|                                  |   |
|----------------------------------|---|
| <b>Pressure ranges</b>           | 1000 bar, 2000 bar, 100.0 MPa, 200.0 MPa, 14500 PSI and 29000 PSI                     |
| <b>Dimensions</b>                | 160*ø80*45 mm   |
| <b>Peak response</b>             | 20 ms   |
| <b>Peak hold</b>                 | 1.5 s   |
| <b>Overpressure indication</b>   | Readout flashes above pressure range  |
| <b>Power supply</b>              | 16 to 30 Vdc with $R_L = 250 \text{ Ohm}$ . 21 to 30 Vdc with $R_L = 500 \text{ Ohm}$ |
| <b>Current consumption</b>       | < 30 mA   |
| <b>Output signal</b>             | 4-20 mA, 3-wire. $R_L \leq 500 \text{ Ohm}$   |
| <b>Max. pressure displayed</b>   | 2300 bar/230.0 MPa/33400 PSI  |
| <b>Tested overpressure</b>       | 2740 bar/274.0 MPa/40000 PSI  |
| <b>Temperature measurement</b>   | 0 -130 °C $\pm 3 \text{ }^\circ\text{C}$  |
| <b>Alarm1 limit</b>              | 110 % of nominal pressure range   |
| <b>Alarm2 limit</b>              | Adjustable. Default value: 110 % of nominal pressure range                            |
| <b>Alarm outputs</b>             | Open collector – 150 V, 1 A, 625 mW – normally closed                                 |
| <b>Display power up sequence</b> | "Supply voltage", 4-20, AL and "Pressure range"                                       |

| Item | Description                        |
|------|------------------------------------|
| 13   | Back-Up Ring P/N 80310006          |
| 14   | O-Ring P/N 80110036 (EPDM)         |
| 16   | Pressure Gauge 4-20mA P/N 04010078 |

**J04010078 Changing display readout and ALARM2 limit**



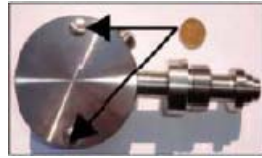
**J04010078 Setup mode**



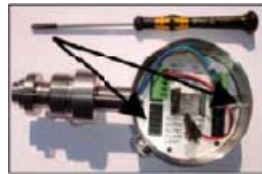
### Changing display orientation



Instrument shown with 3 o'clock orientation.



Remove back plate with coin.



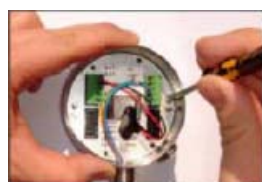
Loosen each screw one turn.



Make sure that all wires can move freely.



Turn display to the new orientation.

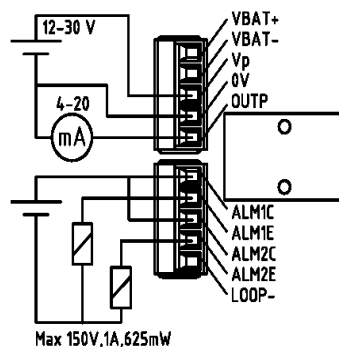


Fasten screws and replace back plate.



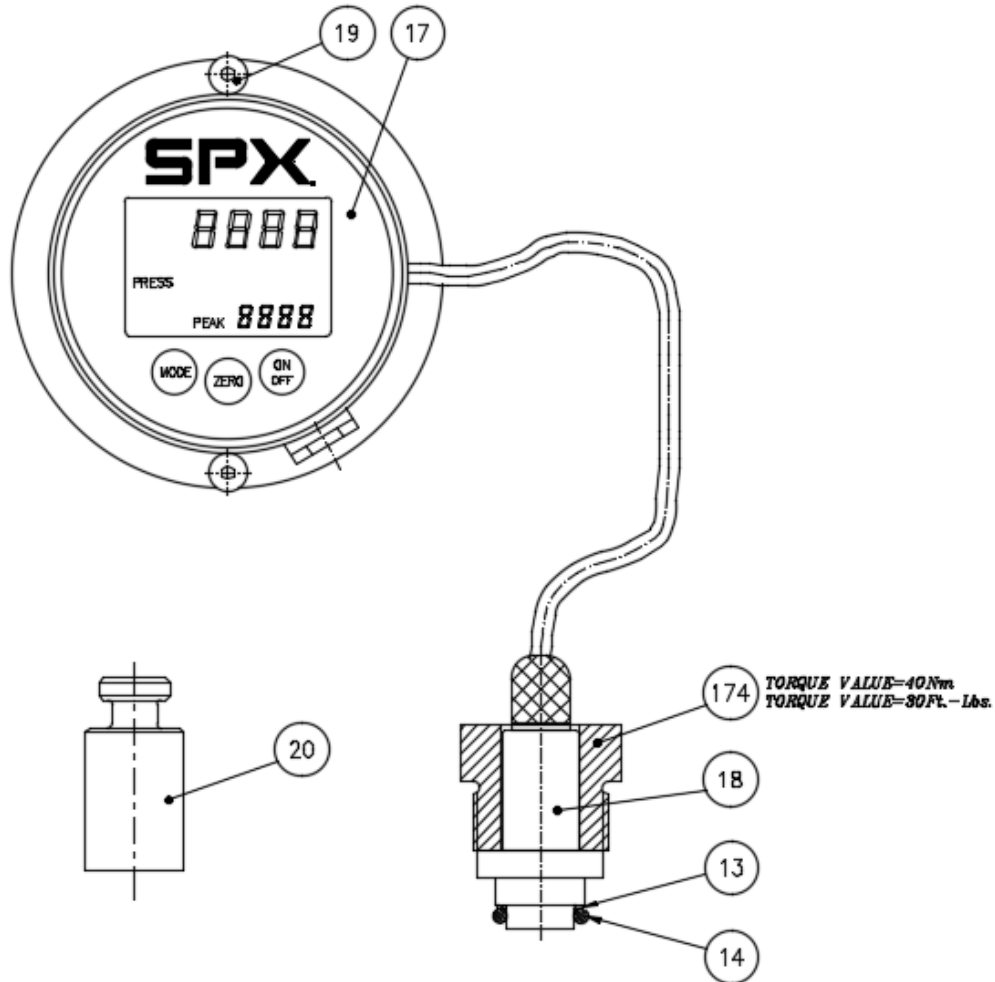
Instrument shown with new 6 o'clock orientation.

### J04010078 Connection diagram



Max 150V, 1A, 625mW

## PRESSURE INDICATION, SPECIAL APV-1000 / APV-2000



Replacing transducer system 91410317 (Old system 91410184)

If replacement of transducer or display in the pressure read out system is necessary, SPX recommend replacement of the total system.

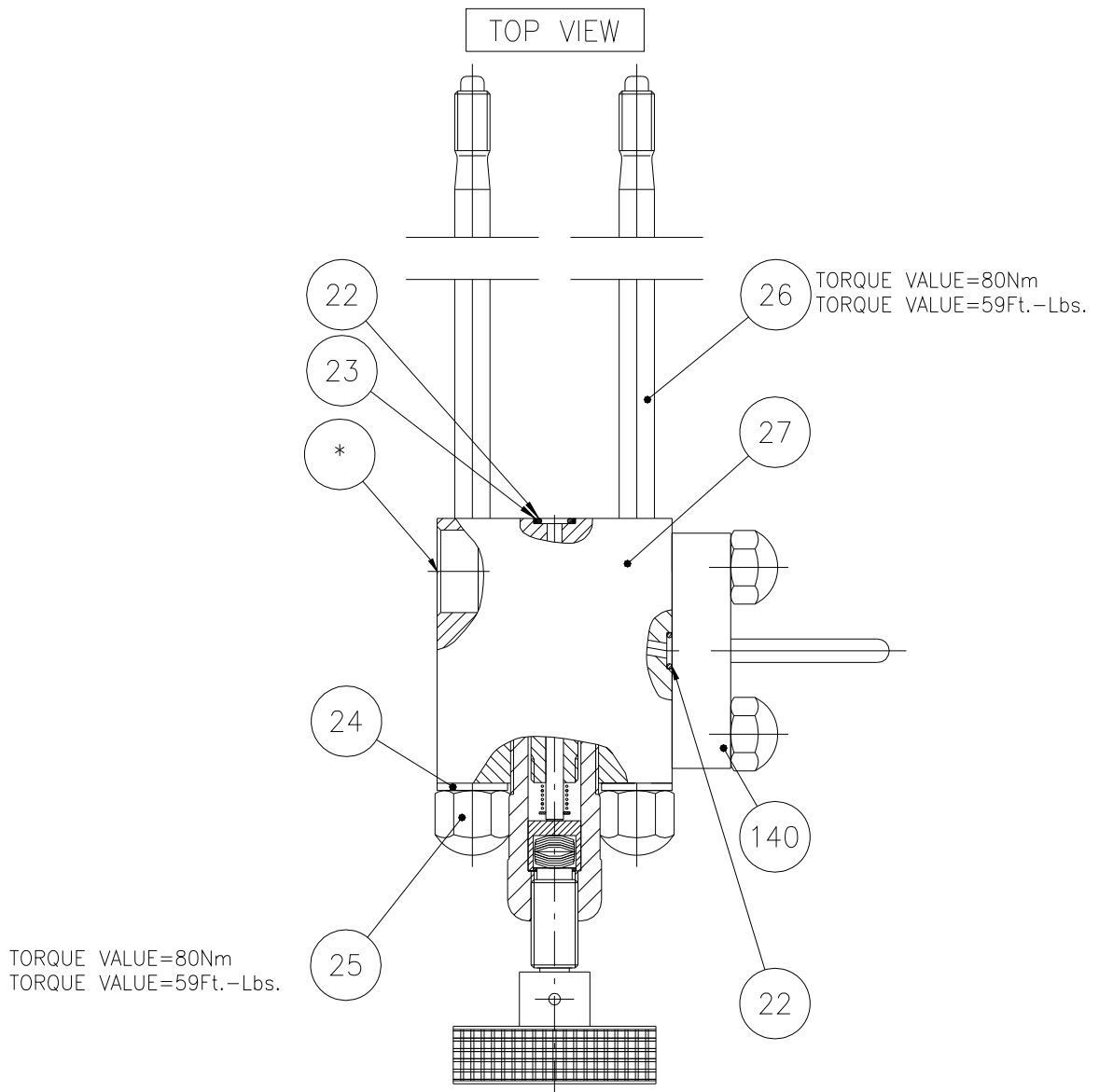
It is possible to change individual parts in the system, but then the system will be out of calibration and has to be re-calibrated.

As only SPX can calibrate the system, the total system has to be returned to SPX. A handle and calibrating fee will be charged the customer.

| Item | Description                  |
|------|------------------------------|
| 174  | Union nut P/N 04010117       |
| 13   | Back-Up Ring P/N 80310006    |
| 14   | O-Ring P/N 80110036 (EPDM)   |
| 17   | Pressure Gauge P/N 04010072  |
| 18   | Pressure sensor P/N 08810155 |
| 19   | Screw P/N K002594            |
| 20   | Plug P/N 81410167            |

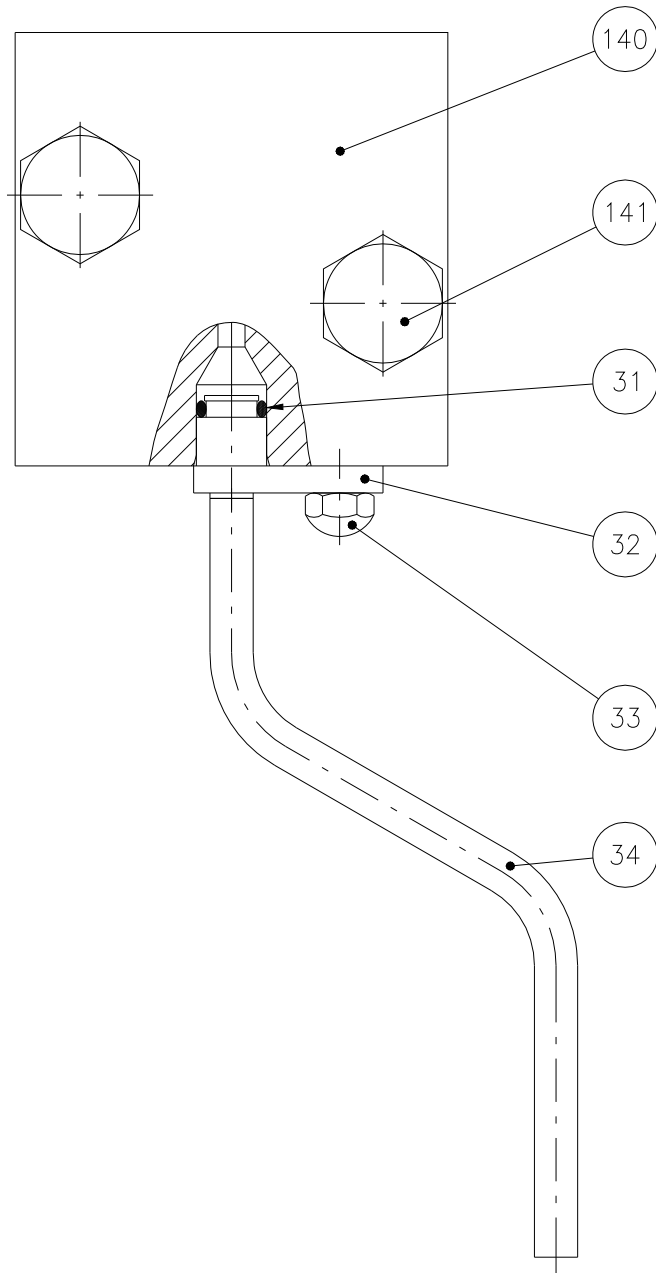
DWG NO. 727347M

# HOMOGENISING VALVE ASSEMBLY SINGLE-STAGE MACHINE APV-1000 / APV-2000



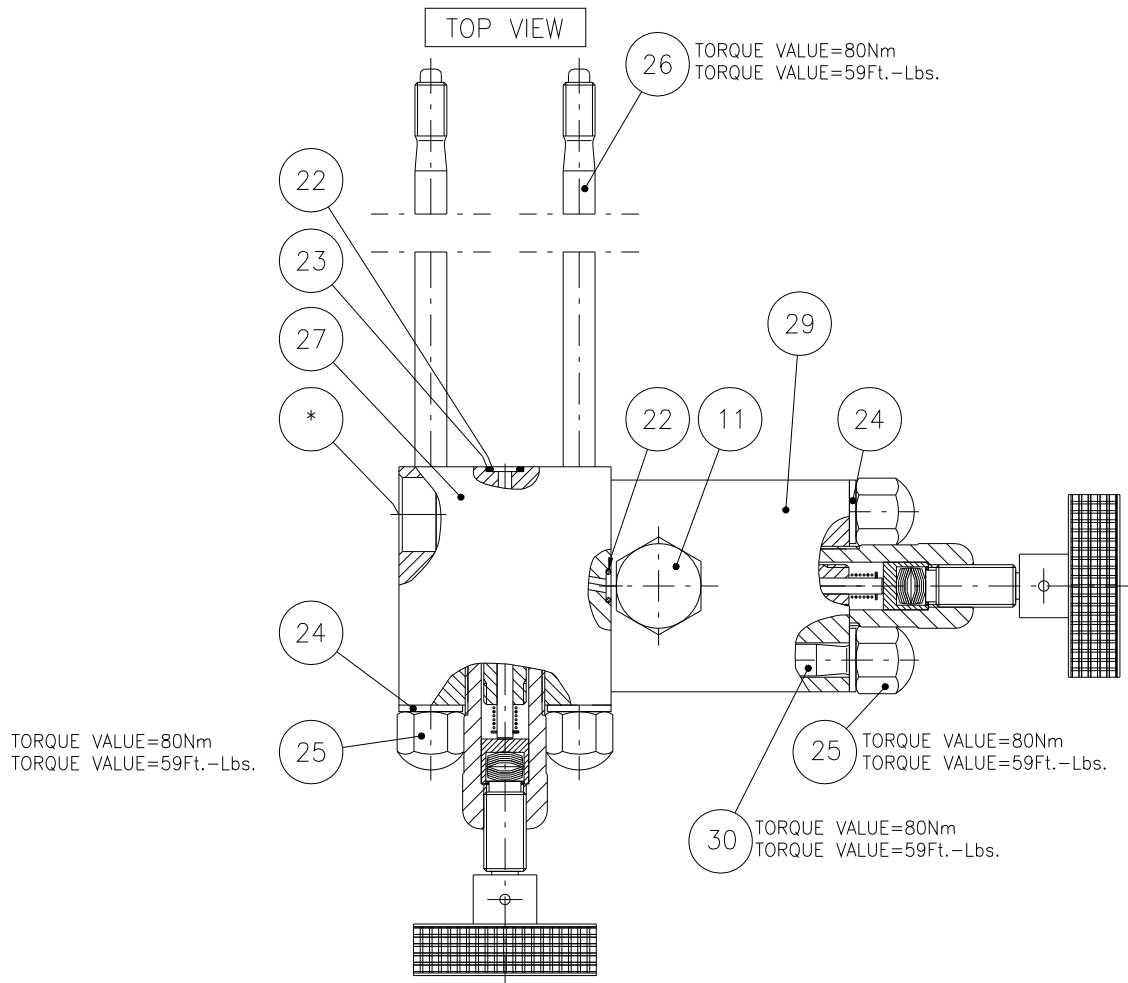
| Item | Description                           |
|------|---------------------------------------|
| 22   | O-Ring P/N K003213 (EPDM)             |
| 23   | Back-Up Ring P/N 80310004             |
| 24   | Washer (4) P/N K001560                |
| 25   | Cap Nut (4) P/N K107893               |
| 26   | Stud (4)                              |
|      | APV-1000 P/N 18910044                 |
|      | APV-2000 P/N 18910049                 |
| 27   | Homogenising Valve Block P/N 17810011 |
| 140  | Discharge Assembly See DWG. 722303M   |
| *    | Pressure Gauge Location               |

# DISCHARGE ASSEMBLY SINGLE- STAGE MACHINE APV-1000 / APV-2000



| Item | Description   |
|------|---|
| 31   | O-Ring P/N 80110033 (EPDM)                              |
| 32   | Flange P/N 82810014                                     |
| 33   | Hex Head Bolt P/N K103189-13                            |
| 34   | Discharge Tube P/N 34210032                             |
| 140  | Discharge Block P/N 70110016 (Single stage valve ass'y) |
| 141  | Hex Head Bolt (2) P/N K103189-2                         |

# HOMOGENISING VALVE ASSEMBLY TWO-STAGE MACHINE APV-1000 / APV-2000

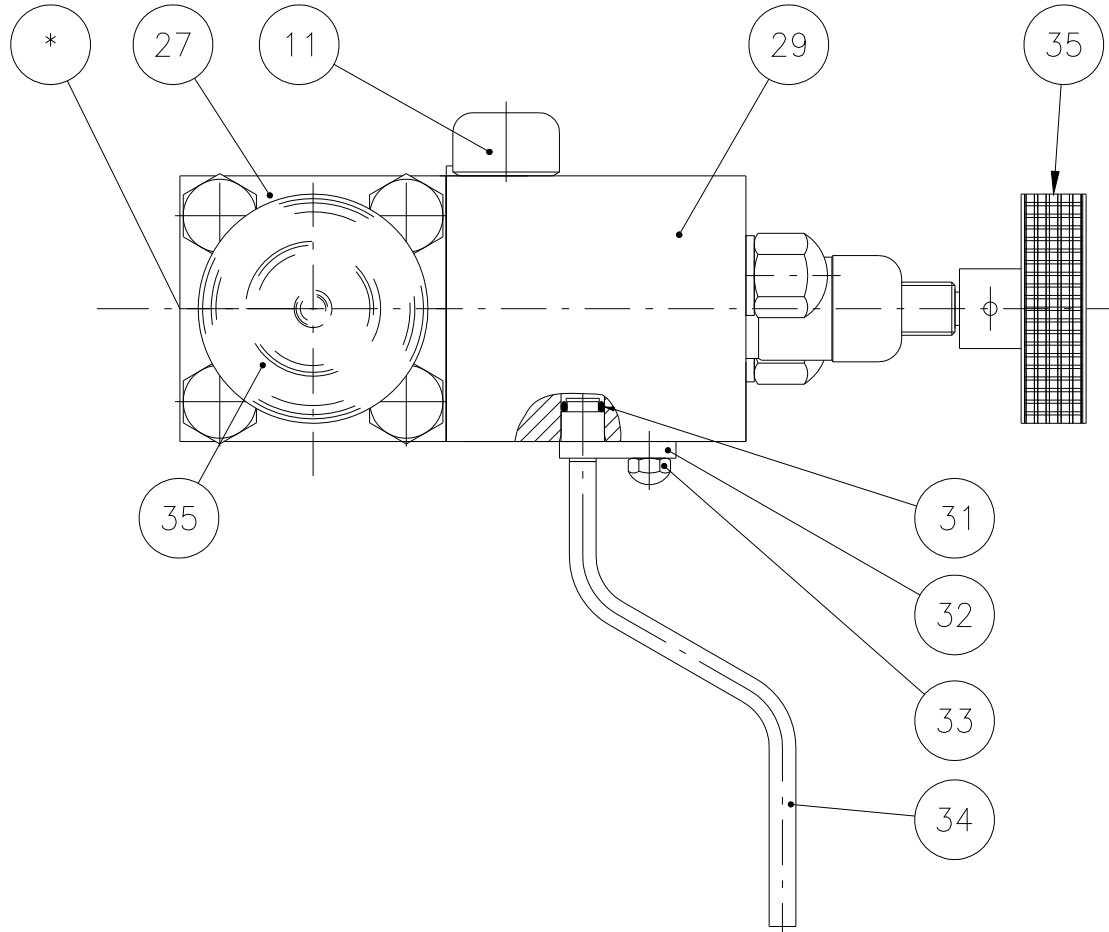


| Item | Description                           |
|------|---------------------------------------|
| 11   | Blank Transducer Plug See DWG. 72217M |
| 22   | O-Ring P/N K003213 (EPDM)             |
| 23   | Back-Up Ring P/N 80310004             |
| 24   | Washer (6) P/N K001560                |
| 25   | Cap Nut (6) P/N K107893               |
| 26   | Stud (4)                              |
|      | APV-1000 P/N 18910044                 |
|      | APV-2000 P/N 18910049                 |
| 27   | Homogenising Valve Block P/N 17810011 |
| 29   | Homogenising Valve Block P/N 17810013 |
| 30   | Stud (2) P/N 18910025                 |
| *    | Pressure Gauge Location               |



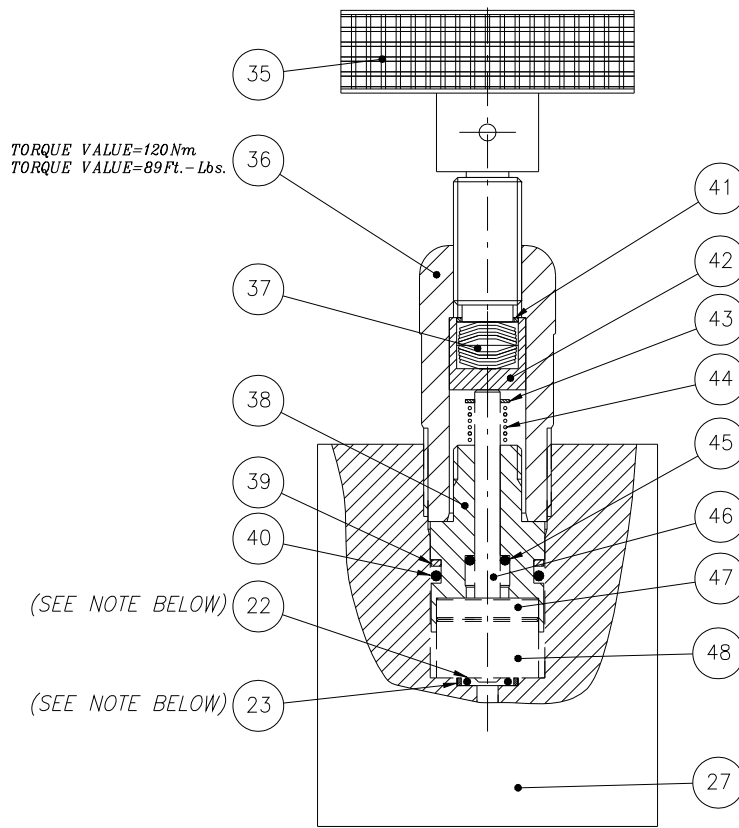
# HOMOGENISING VALVE ASSEMBLY TWO-STAGE MACHINE APV-1000 / APV-2000

FRONT VIEW



| Item | Description  |
|------|--|
| 11   | Pressure Blank (SEE DWG. 722117M)                    |
| 27   | Homogenising Valve Block P/N 17810011 (First Stage)  |
| 29   | Homogenising Valve Block P/N 17810013 (Second Stage) |
| 31   | O-Ring P/N 80110033 (EPDM)                           |
| 32   | Flange P/N 82810014                                  |
| 33   | Hex Head Bolt P/N K103189-13                         |
| 34   | Discharge Tube P/N 34210032                          |
| 35   | Hand wheel P/N 01010000 (First & Second Stage)       |

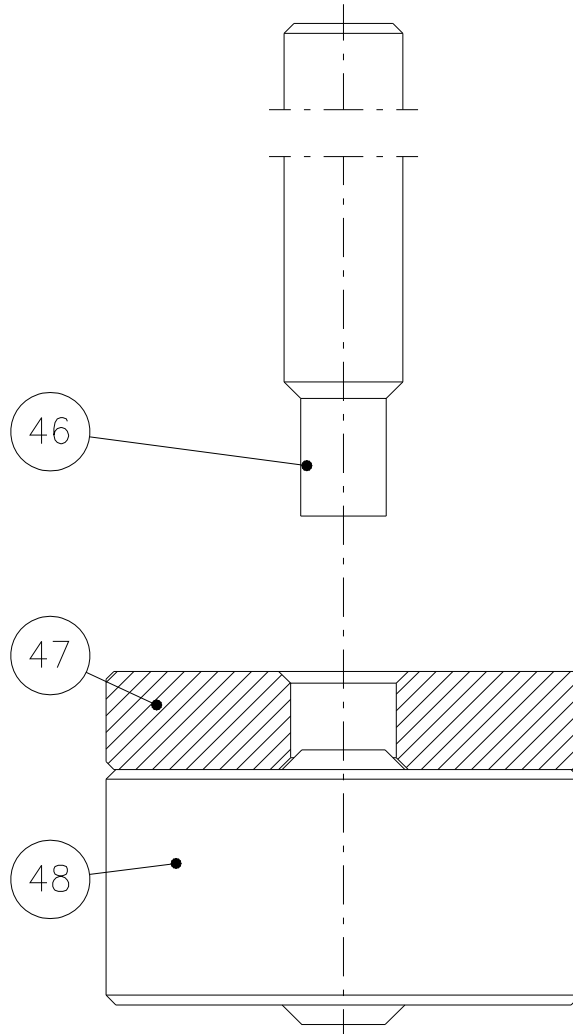
# HOMOGENISING VALVE ACTUATOR ASSEMBLY APV-1000 / APV-2000



**NOTE: O-RING AND BACK-UP RING ARE TO BE INSERTED INTO THE HOMOGENISING VALVE BLOCK.  
 THEY ARE NOT ATTACHED TO THE HOMOGENISING VALVE SEAT**

| Item | Description                               |
|------|---|
| 22   | O-Ring P/N K003213 (EPDM)                 |
| 23   | Back-Up Ring P/N 80310004                 |
| 27   | Homogenising Valve Block                  |
| 35   | Hand wheel P/N 01010000                   |
| 36   | Hand wheel Support P/N 17810003           |
| 37   | Disc Spring (10) P/N 68910010             |
| 38   | Homogenising Valve Cartridge P/N 17810012 |
| 39   | Back-Up Ring P/N 80310005                 |
| 40   | O-Ring P/N 80110034 (EPDM)                |
| 41   | Spring Ring P/N 81310000                  |
| 42   | Disc Spring Retainer P/N 17810002         |
| 43   | Snap Ring P/N 81310001                    |
| 44   | Spring P/N 68910012                       |
| 45   | O-Ring P/N 80110035 (EPDM)                |
| 46   | Homogenising Valve See DWG. 722480M       |
| 47   | Impact Ring See DWG. 722480M              |
| 48   | Homogenising Valve Seat See DWG. 722480M  |

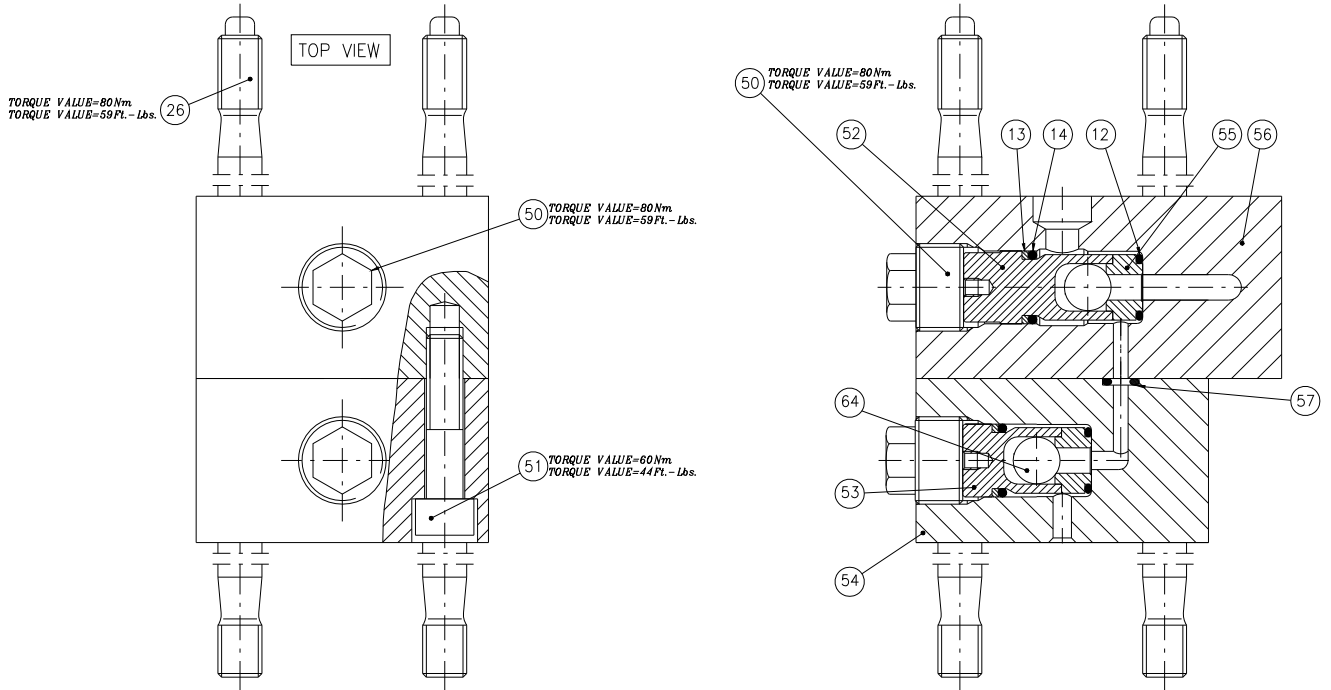
# HOMOGENISING VALVE, VALVE SEAT & IMPACT RING APV-1000 / APV-2000



| Item | Description                   |
|------|-------------------------------|
| 46   | Homogenising Valve            |
|      | CERAMIC P/N 12510006          |
|      | TUNGSTEN CARBIDE P/N 12510007 |
|      | STELLITE P/N 12510005         |
| 47   | Impact Ring                   |
|      | CERAMIC P/N 12610002          |
|      | TUNGSTEN CARBIDE P/N 12610003 |
|      | STELLITE P/N 12610001         |
| 48   | Homogenising Valve Seat       |
|      | CERAMIC P/N 12410006          |
|      | TUNGSTEN CARBIDE P/N 12410008 |
|      | STELLITE P/N 12410007         |

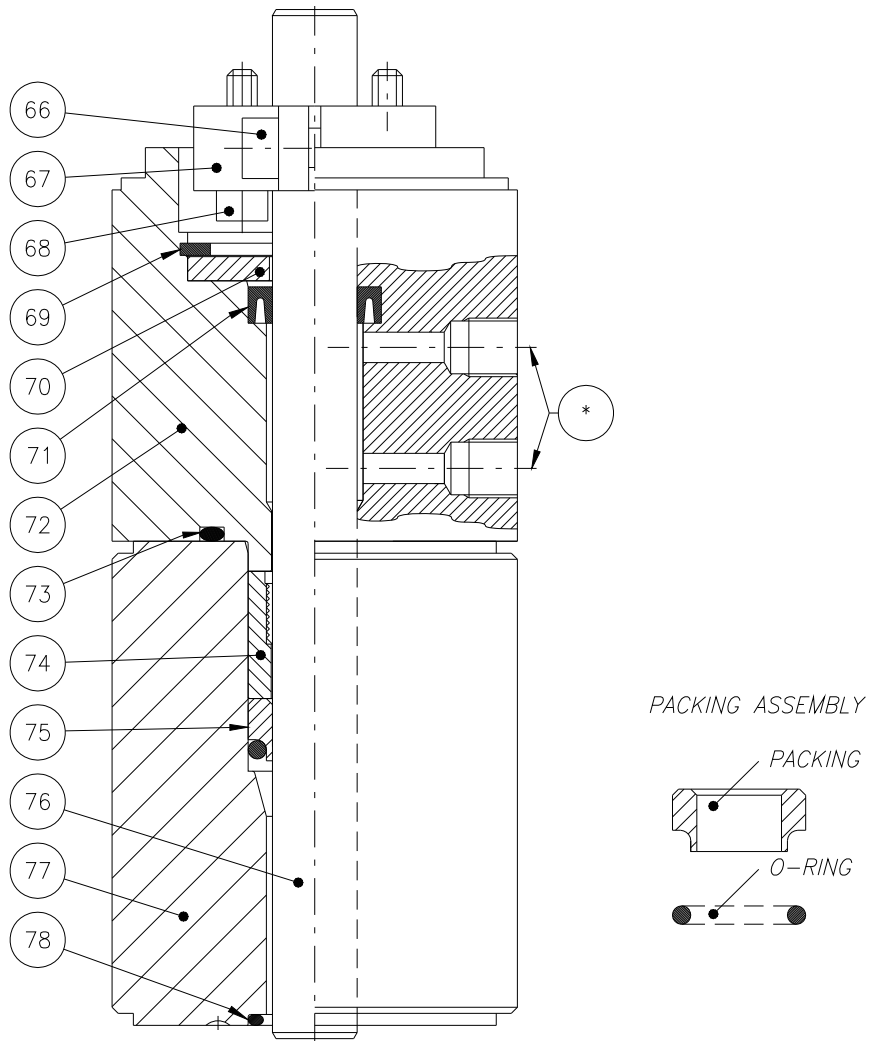


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**PUMP VALVE BLOCK**  
**APV-1000**



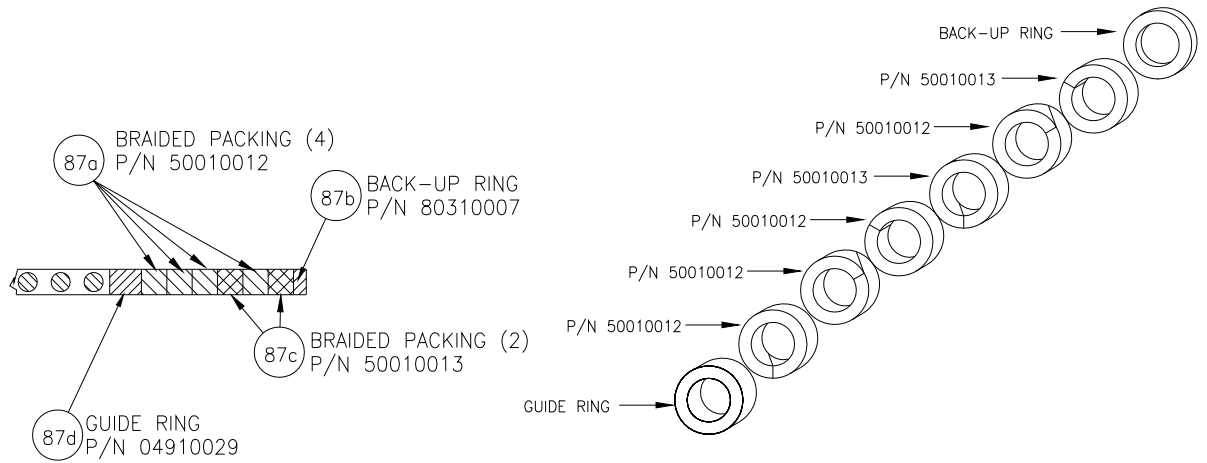
| Item | Description                    |
|------|--------------------------------|
| 12   | O-Ring (2) P/N 80110108 (EPDM) |
| 13   | Back-Up Ring (2) P/N 80310006  |
| 14   | O-Ring (2) P/N 80110036 (EPDM) |
| 26   | Stud (4) P/N 18910044          |
| 50   | Valve Cap P/N 82010021         |
| 51   | Hex Socket (2) P/N K001035     |
| 52   | Valve Guide P/N 03710012       |
| 53   | Valve Guide P/N 03710013       |
| 54   | Valve Block 1000A P/N 12710006 |
| 55   | Ball Valve Seat (2)            |
|      | STELLITE P/N 03610012          |
|      | TUNGSTEN CARBIDE P/N 03610046  |
| 56   | Valve Block 1000B P/N 12710005 |
| 57   | O-Ring P/N K002899 (EPDM)      |
| 64   | Ball Valve (2) P/N K001715     |

# CYLINDER ASSEMBLY APV-1000



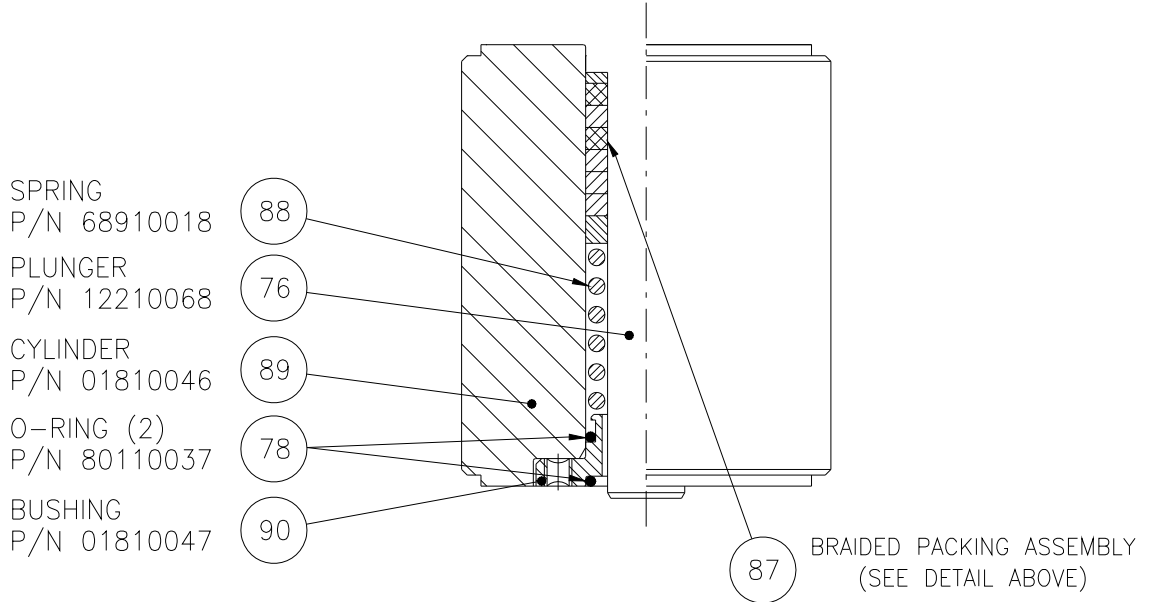
| Item | Description                                  |
|------|--|
| 66   | Hex Socket P/N K000168                       |
| 67   | Plunger Coupling P/N 17310019                |
| 68   | Hex Socket (2) P/N K001009                   |
| 69   | Snap Ring P/N 81310002                       |
| 70   | U-Packing Retainer P/N 02610007              |
| 71   | U-Packing P/N 80410017                       |
| 72   | Cooling Cylinder P/N 02510030                |
| 73   | O-Ring P/N K002196 (NBR)                     |
| 74   | Packing Ring P/N 01810036                    |
| 75   | Packing Assembly P/N 91310070                |
|      | P/N 80210010 (Packing)                       |
|      | P/N 80110038 (O-Ring)                        |
| 76   | Plunger P/N 12210068                         |
| 77   | Cylinder P/N 01810035                        |
| 78   | O-Ring P/N 80110037 (EPDM)                   |
| *    | Cooling Water Connections (See DWG. 723236M) |

# CYLINDER ASSEMBLY, BRAIDED PACKING SPECIAL OPTION APV-1000



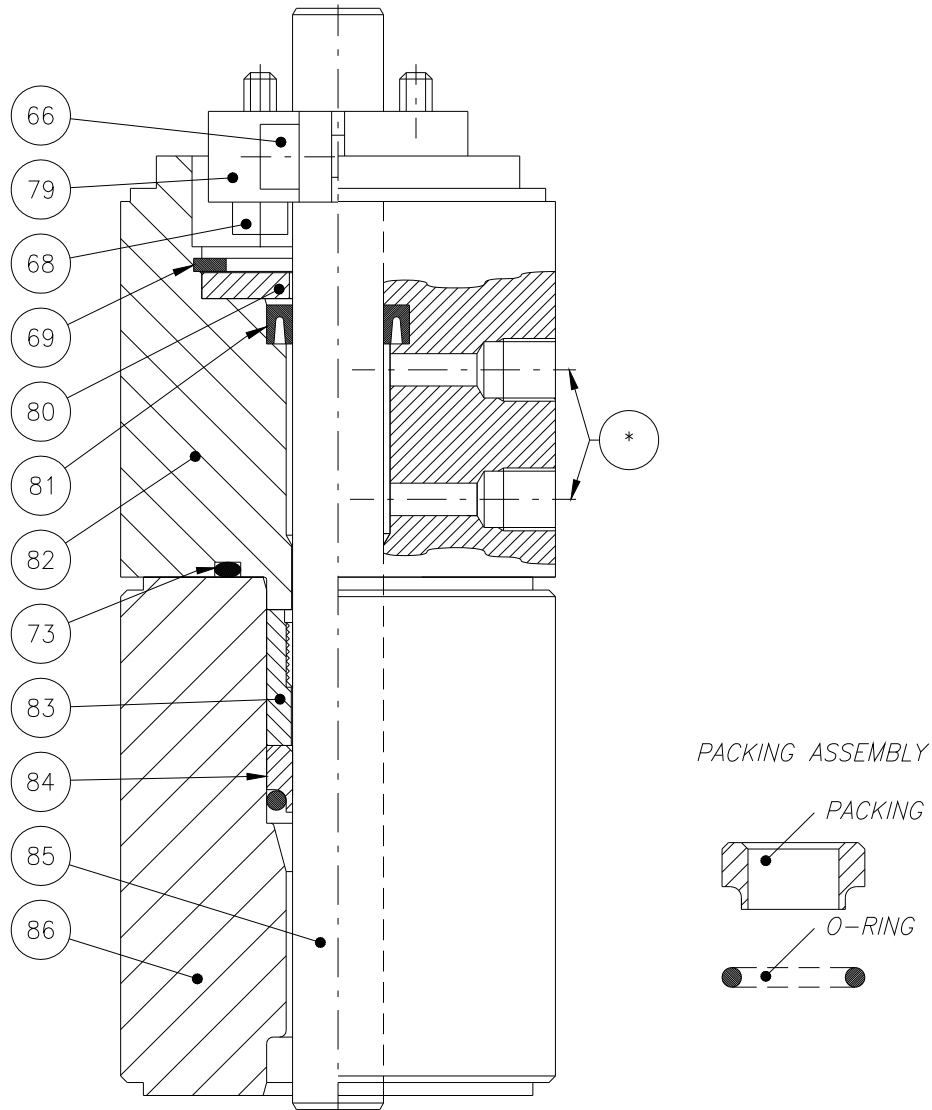
**NOTE:**

*BE SURE TO ARRANGE EACH PIECE OF PACKING SO THAT THE BREAKS ARE ORIENTED 60° FROM EACH OTHER. THIS ENSURES A MORE STABLE SEAL.*



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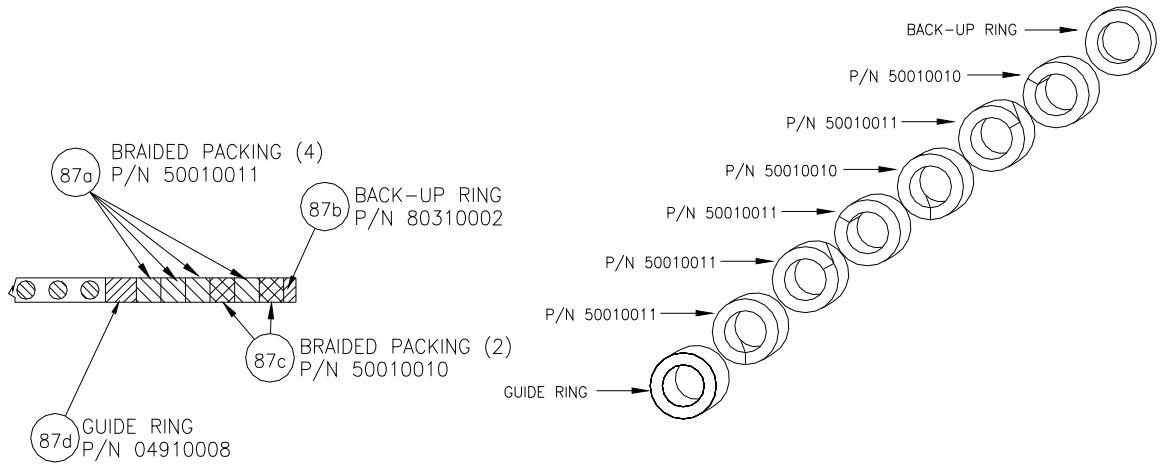
# CYLINDER ASSEMBLY APV-2000



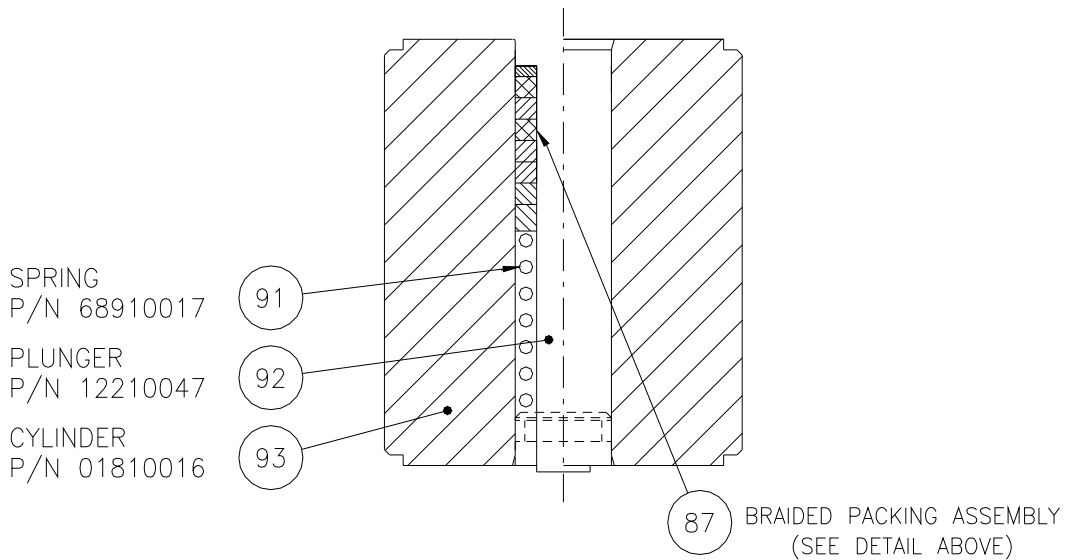
| Item | Description                                  |
|------|--|
| 66   | Hex Socket P/N K000168                       |
| 68   | Hex Socket (2) P/N K001009                   |
| 69   | Snap Ring P/N 81310002                       |
| 73   | O-Ring P/N K002196 (NBR)                     |
| 79   | Plunger Coupling P/N 17310007                |
| 80   | U-Packing Retainer P/N 02610005              |
| 81   | U-Packing P/N 80410010                       |
| 82   | Cooling Cylinder P/N 02510026                |
| 83   | Packing Ring P/N 01810027                    |
| 84   | Packing Assembly P/N 91310071                |
|      | P/N 80210009 (Packing)                       |
|      | P/N 80110039 (O-ring)                        |
| 85   | Plunger P/N 12210047                         |
| 86   | Cylinder P/N 01810017                        |
| *    | Cooling Water Connections (See DWG. 723236M) |



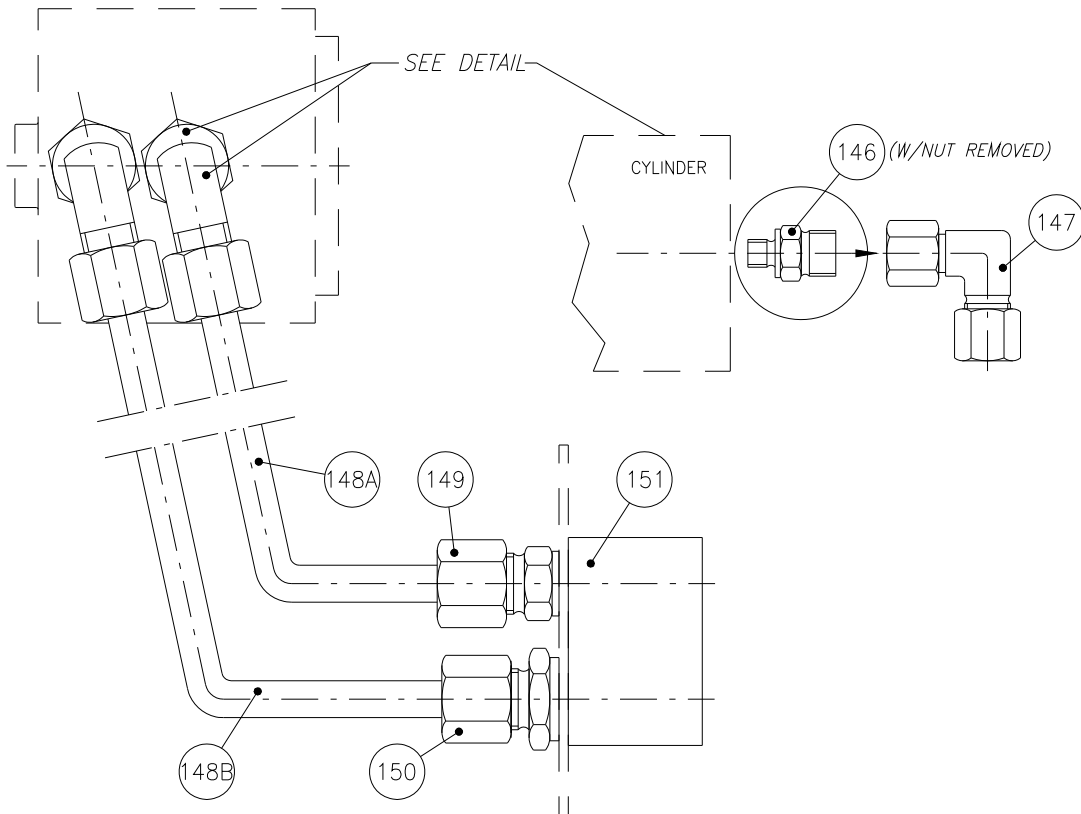
# CYLINDER ASSEMBLY, BRAIDED PACKING SPECIAL OPTION APV-2000



**NOTE:**  
*BE SURE TO ARRANGE EACH PIECE OF PACKING SO THAT  
THE BREAKS ARE ORIENTED 60° FROM EACH OTHER.  
THIS ENSURES A MORE STABLE SEAL.*

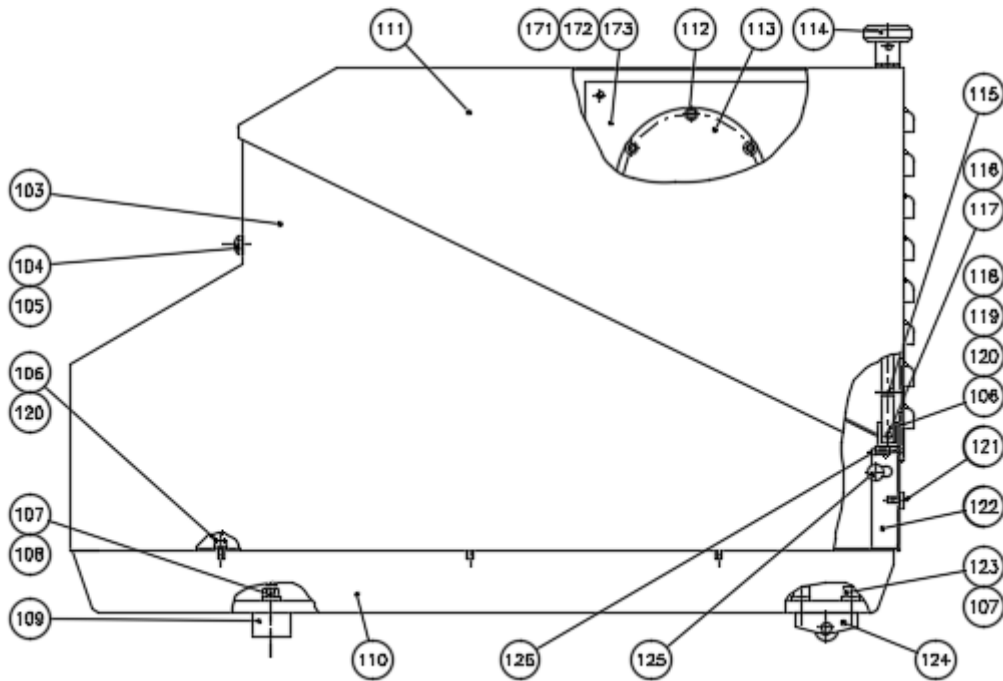
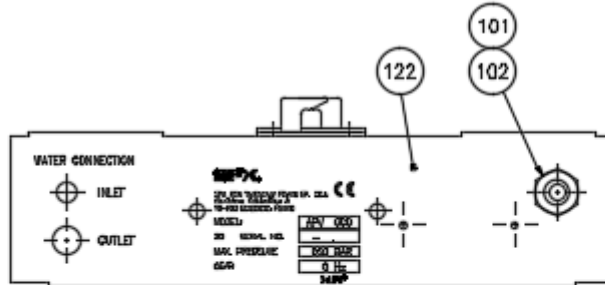


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**ASEPTIC CYLINDER PIPING**  
**APV-1000 / APV-2000**



| Item | Description  |
|------|--|
| 146  | Male Coupling (2) P/N 84210022                         |
| 147  | Elbow Fitting (2) P/N 84210021                         |
| 148a | Pipe P/N 84110055                                      |
| 148b | Pipe P/N 84110056                                      |
| 149  | Male Coupling (1) P/N 84210022                         |
| 150  | Male Coupling (1) P/N K003636                          |
| 151  | Hose Distribution Box P/N 84210063 2pcs. 1/8" BSP Fem. |

# CABINET, FRAME, AND NAME PLATE APV-1000 / APV-2000



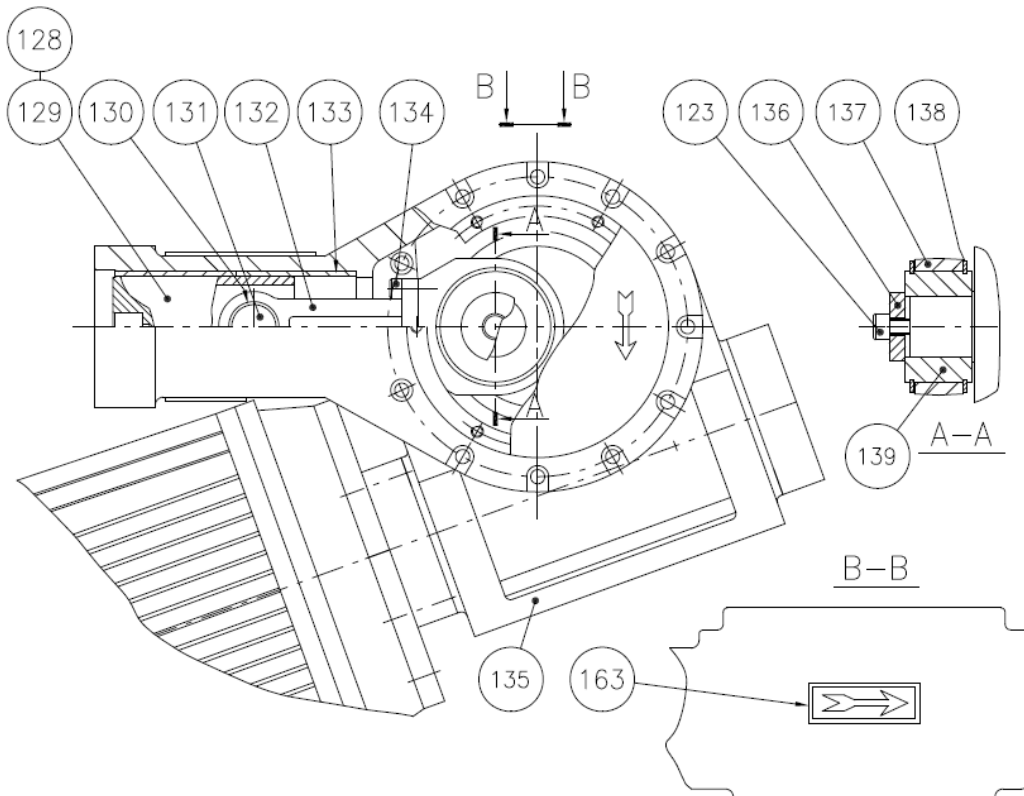
# CABINET, FRAME, AND NAME PLATE APV-1000 / APV-2000

| Item | Description                                       |
|------|---|
| 101  | Nut P/N 08910064                                  |
| 102  | Cable Gland P/N 08910063                          |
| 103  | Cabinet P/N 75410170                              |
| 104  | Nut P/N K003852                                   |
| 105  | Cable Gland P/N 08910088                          |
| 106  | Washer (10) P/N K001381                           |
| 107  | Lock Washer (6) P/N K000689                       |
| 108  | Nut (2) P/N K003392                               |
| 109  | Foot (2) P/N K002518                              |
| 110  | Sub-Base P/N 06810014                             |
| 111  | Cabinet Cover P/N 75410118                        |
| 112  | Hex Socket (6) P/N K001309                        |
| 113  | Cam Cover P/N 75010011                            |
| 114  | Cover Lock  |
|      | A) Knob P/N 81410049                              |
|      | B) Spring P/N 68910013                            |
|      | C) Washer P/N 82110010                            |
| 115  | Locking Ring P/N 81310004                         |
| 116  | Pin P/N 82210007                                  |
| 117  | Hex Screw P/N K000437                             |
| 118  | Lock Tab P/N 81410052                             |
| 119  | Lock Nut (2) P/N K003122                          |
| 120  | Hex Socket (10) P/N K000377                       |
| 121  | Bolt (2) P/N K004053                              |
| 122  | Back Plate Unna P/N 75410148, Poland P/N 75410638 |
| 123  | Hex Socket (4) P/N K001675                        |
| 124  | Wheel (2) P/N 81410046                            |
| 125  | Screw (2) P/N K000952                             |
| 126  | Rubber Plug (2) P/N 82710039                      |
| 171  | Mounting plate P/N 08910335                       |
| 172  | Cheese-head screw (2) P/N 82010022                |
| 173  | Cheese-head screw (4) P/N 82010110                |

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# DRIVE ASSEMBLY

## APV-1000 / APV-2000

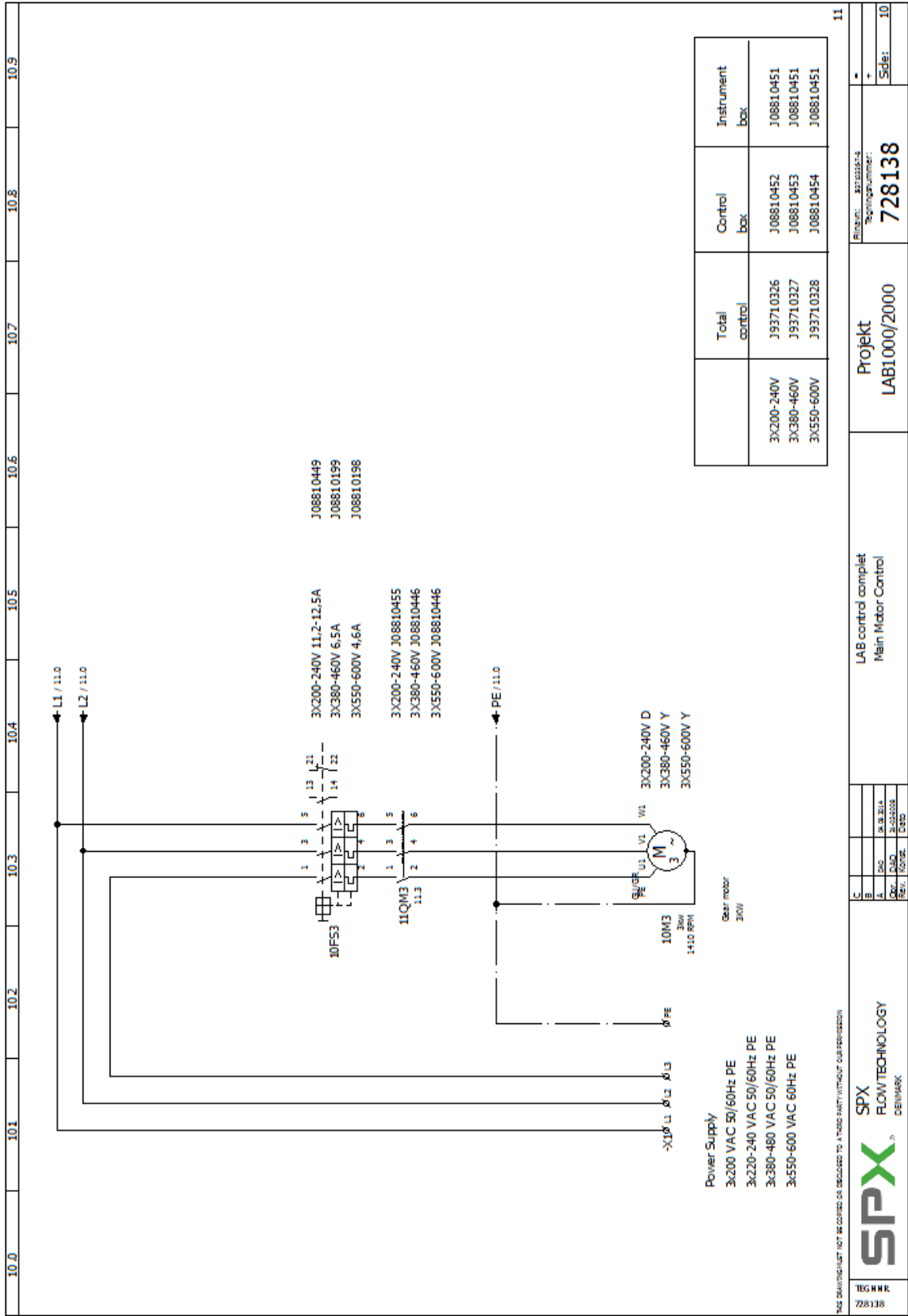


| Item | Description                   |
|------|-------------------------------|
| 123  | Hex Socket P/N K001675        |
| 128  | Set Screw P/N K001517         |
| 129  | Crosshead                     |
|      | APV-1000 P/N 00810002         |
|      | APV-2000 P/N 00810000         |
| 130  | Bushing P/N 83010005          |
| 131  | Crosshead Pin P/N 11610000    |
| 132  | Connecting Rod P/N 00610002   |
| 133  | Bushing (2) P/N 83010006      |
| 134  | Hex Socket (2) P/N K000168    |
| 135  | <i>Gear Assembly</i>          |
|      | 50Hz P/N 93810008             |
|      | 60Hz P/N 93810020             |
| 136  | Disc P/N 82110009             |
| 137  | Cap P/N 04910022              |
| 138  | Locking Ring (2) P/N 81310003 |
| 139  | Ball Bearing P/N 04910024     |
| 163  | Name plate P/N K003449        |

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# STANDARD ELECTRICAL DIAGRAM

## APV-1000 / APV-2000

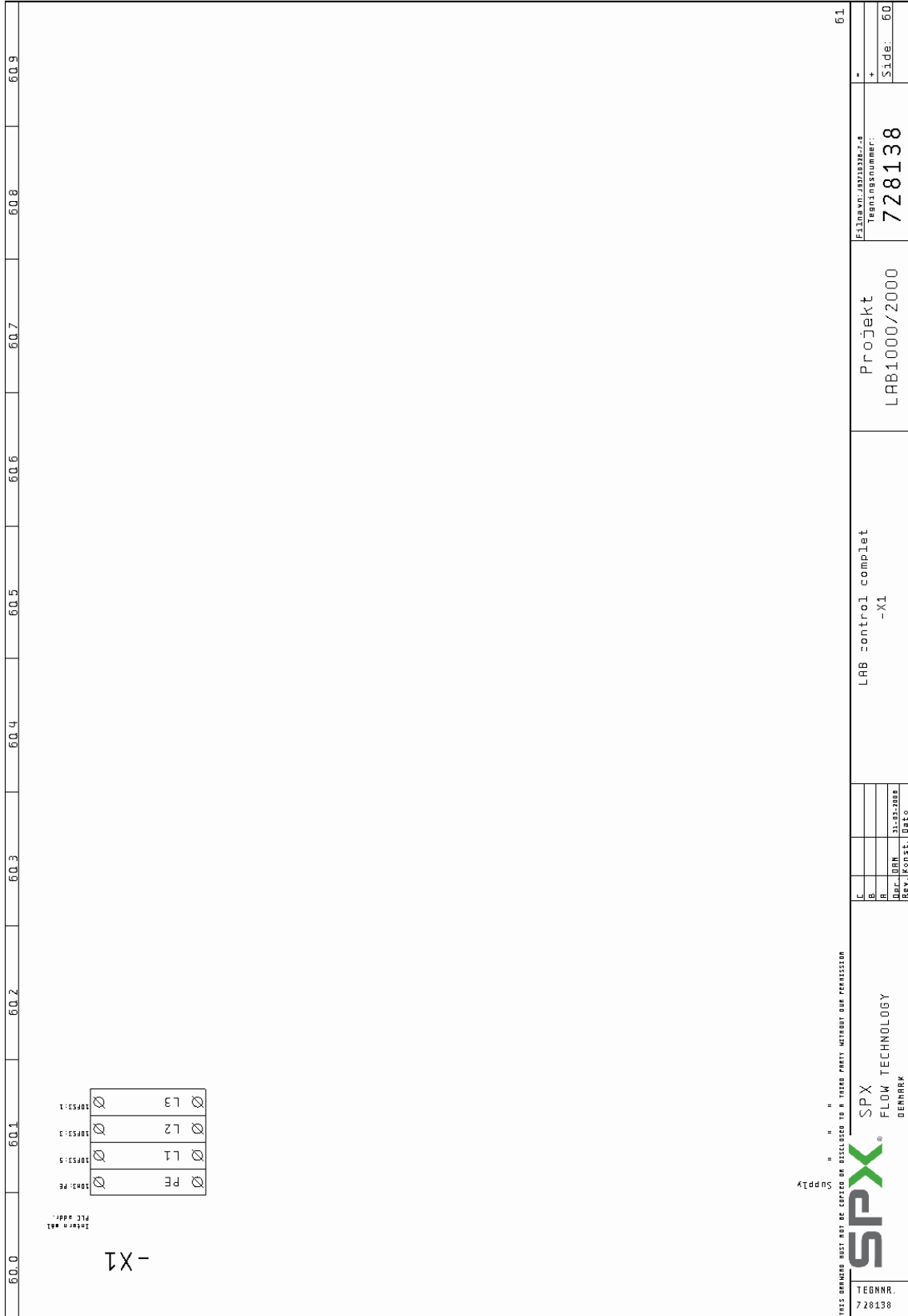




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# STANDARD ELECTRICAL DIAGRAM

## APV-1000 / APV-2000

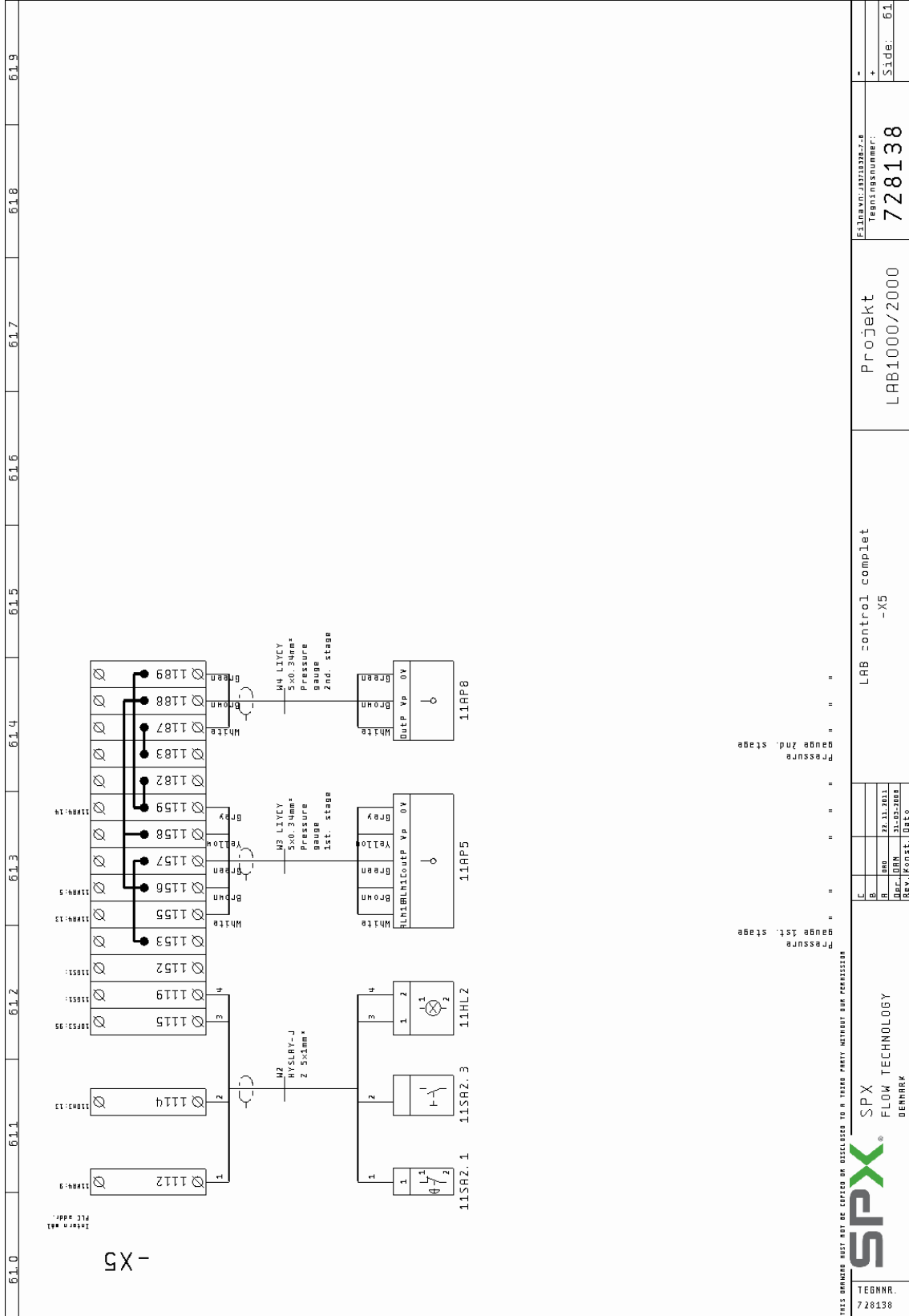




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# STANDARD ELECTRICAL DIAGRAM

## APV-1000 / APV-2000



## STANDARD ELECTRICAL DIAGRAM APV-1000 / APV-2000

### Control box

Type: 200-240V 08810452  
Type: 380-480V 08810453  
Type: 500-575V 08810454

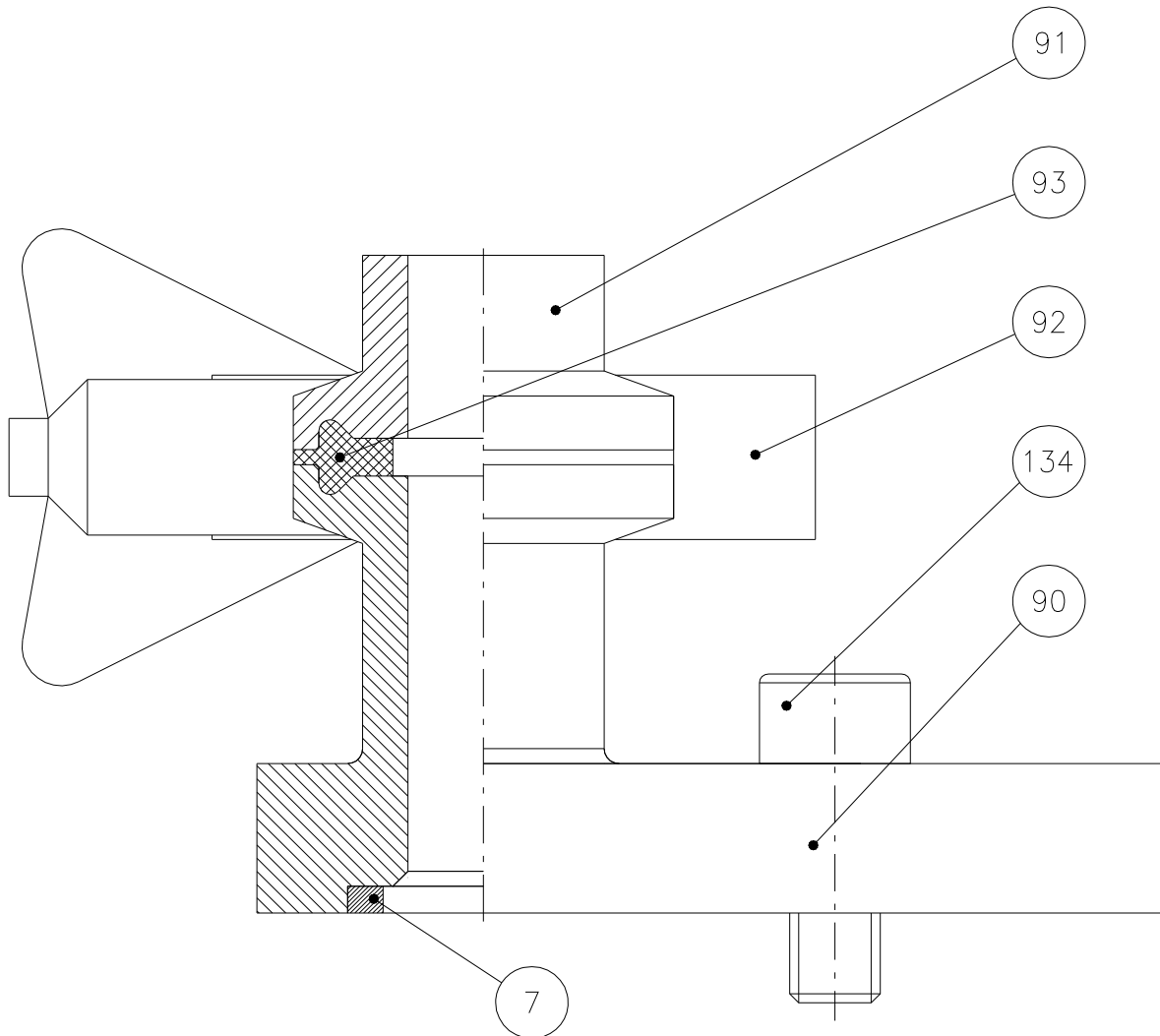
| Pos.  | Description   | Type              | SPX Part no. | Fabricate     |
|-------|---------------|-------------------|--------------|---------------|
|       | Box           | CT-861-UL         | 08810254     | Bernstein     |
|       | Box Cover     | 84-86M            | 08810255     | Bernstein     |
| 10FS3 | Thermal relay | LR2K0312 3,7-5.5A | 08810198     | Telemecanique |
| 10FS3 | Thermal relay | LR2K0314 5.5-8A   | 08810199     | Telemecanique |
| 10FS3 | Thermal relay | LRD 16            | 08810449     | Telemecanique |
| 11FU1 | Fuse terminal | UK 6,3-HESI       | 08910294     | Phønix        |
| 11FU1 | Fuse          | TDC11-150MA       | 08810502     | Busmann       |
| 11TC1 | Transformer   | AA72357-B         | 08810444     | Ulveco        |
| 11GS1 | Power supply  | S8VS-03024        | 08810445     | Omron         |
| 11QM3 | Contactora    | LP1K12 10BD       | 08810446     | Telemecanique |
| 11QM3 | Contactora    | LC1D18BD          | 08810455     | Telemecanique |
| 11KA4 | Relay base    | P2RF-05-E         | 08810447     | Omron         |
| 11KA4 | Relay         | G2R-1-SN(s) 24VDC | 08810448     | Omron         |
|       | Terminal      | 1640-3            |              | Enesto        |
|       | Terminal      | 1640ED            |              | Enesto        |
|       | Terminal PE   | 9700A6S35         |              | Wieland       |
|       | Terminal PE   | 9700A6SL2S35      |              | Wieland       |
|       | Terminal PE   | 9700-6            |              | Wieland       |
|       |               |                   |              |               |
|       |               |                   |              |               |
|       |               |                   |              |               |

### Instrument box

08810541

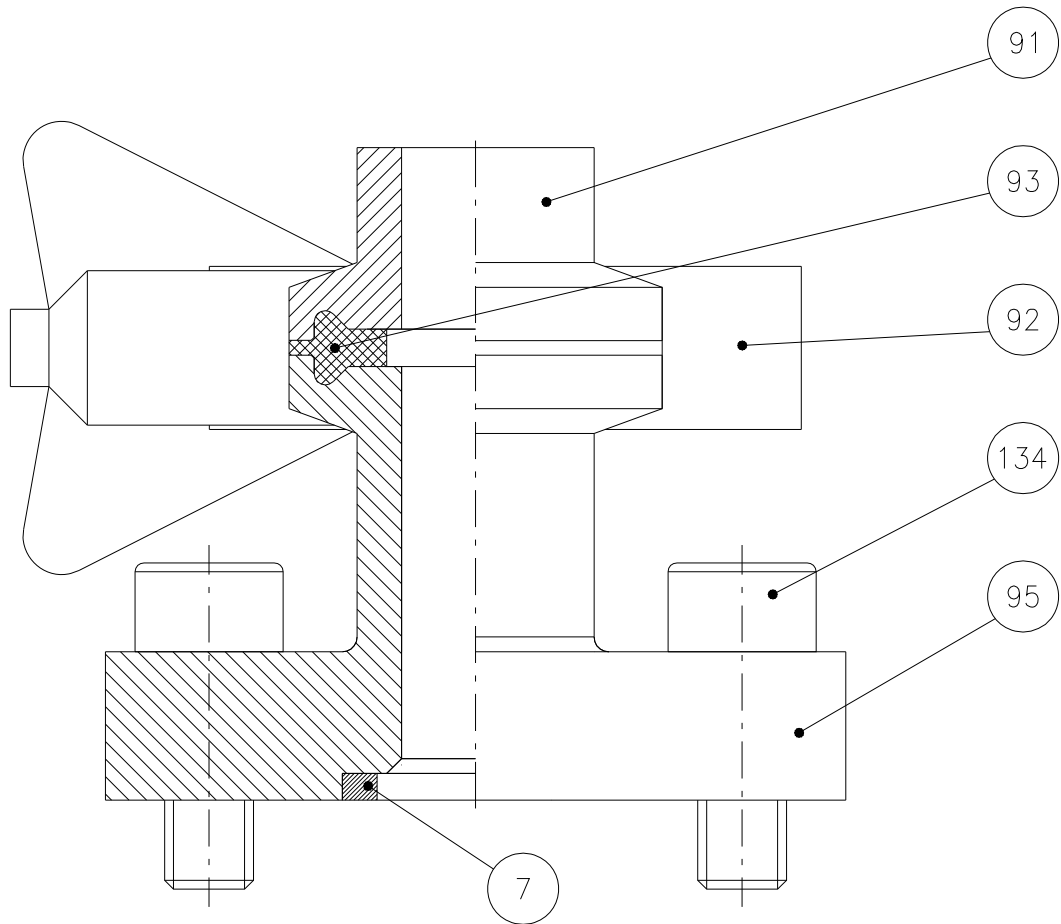
| Pos.                  | Description                              | Type                  | SPX Part no. | Fabricate     |
|-----------------------|--|-----------------------|--------------|---------------|
|                       | Box                                      |                       |              |               |
|                       | Box Cover                                | CT-581-UL             | 08810256     | Bernstein     |
| 11SA2.2/11SA2.3/11HL2 | Pushbutton body, start, stop, lamp       | ZB4-BW813743/ZBE101/2 | 08810072     | Telemecanique |
| 11SA2.2/11SA2.3/11HL2 | Pushbutton body, start, stop, green lamp | ZB4-BWOB35            | 08810076     | Telemecanique |
| 11SA2.1               | Emergency stop                           | XB4-BT42              | 08810077     | Telemecanique |
|                       | Emergency stop sign                      | ZBY-9330              | 08810450     | Telemecanique |
|                       |  |                       |              |               |

Triplex Sales  
 1-847-839-8442  
 www.triplexsales.com  
**PIPE CONNECTION**  
**APV-1000**



| Item | Description                       |
|------|-----------------------------------|
| 7    | O-Ring (1) P/N 80110040 (EPDM)    |
| 90   | Flanged Socket (1) P/N 34210141   |
| 91   | Welding Liner (1) P/N 84210095    |
| 92   | Clamp Ring (1) P/N 84210094       |
| 93   | Packing (1) P/N 80210046          |
| 134  | Cheese Head Screw (2) P/N K000168 |

Triplex Sales  
 1-847-839-8442  
 www.triplexsales.com  
**PIPE CONNECTION**  
**APV-2000**

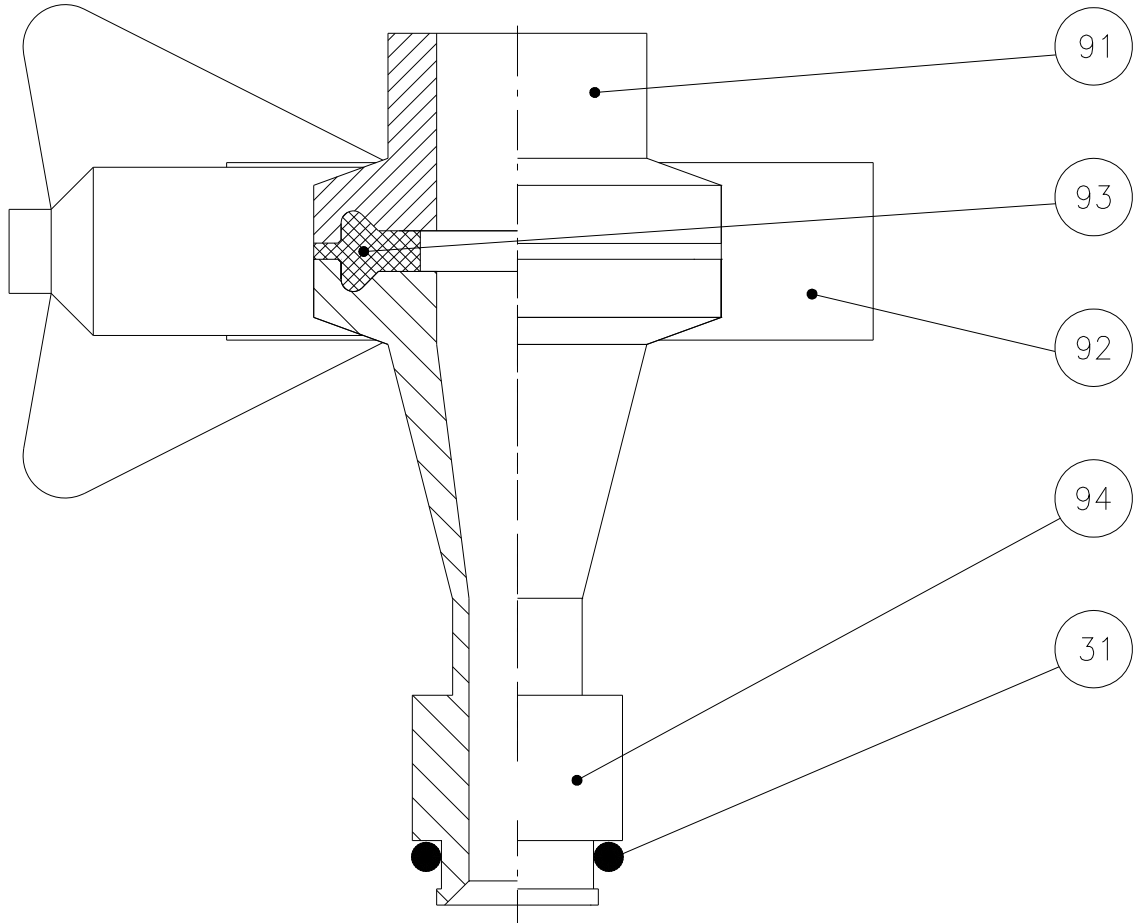


| Item | Description                       |
|------|-----------------------------------|
| 7    | O-Ring (1) P/N 80110040 (EPDM)    |
| 91   | Welding Liner (1) P/N 84210095    |
| 92   | Clamp Ring (1) P/N 84210094       |
| 93   | Packing (1) P/N 80210046          |
| 95   | Flanged Socket (1) P/N 34210143   |
| 134  | Cheese Head Screw (1) P/N K000168 |

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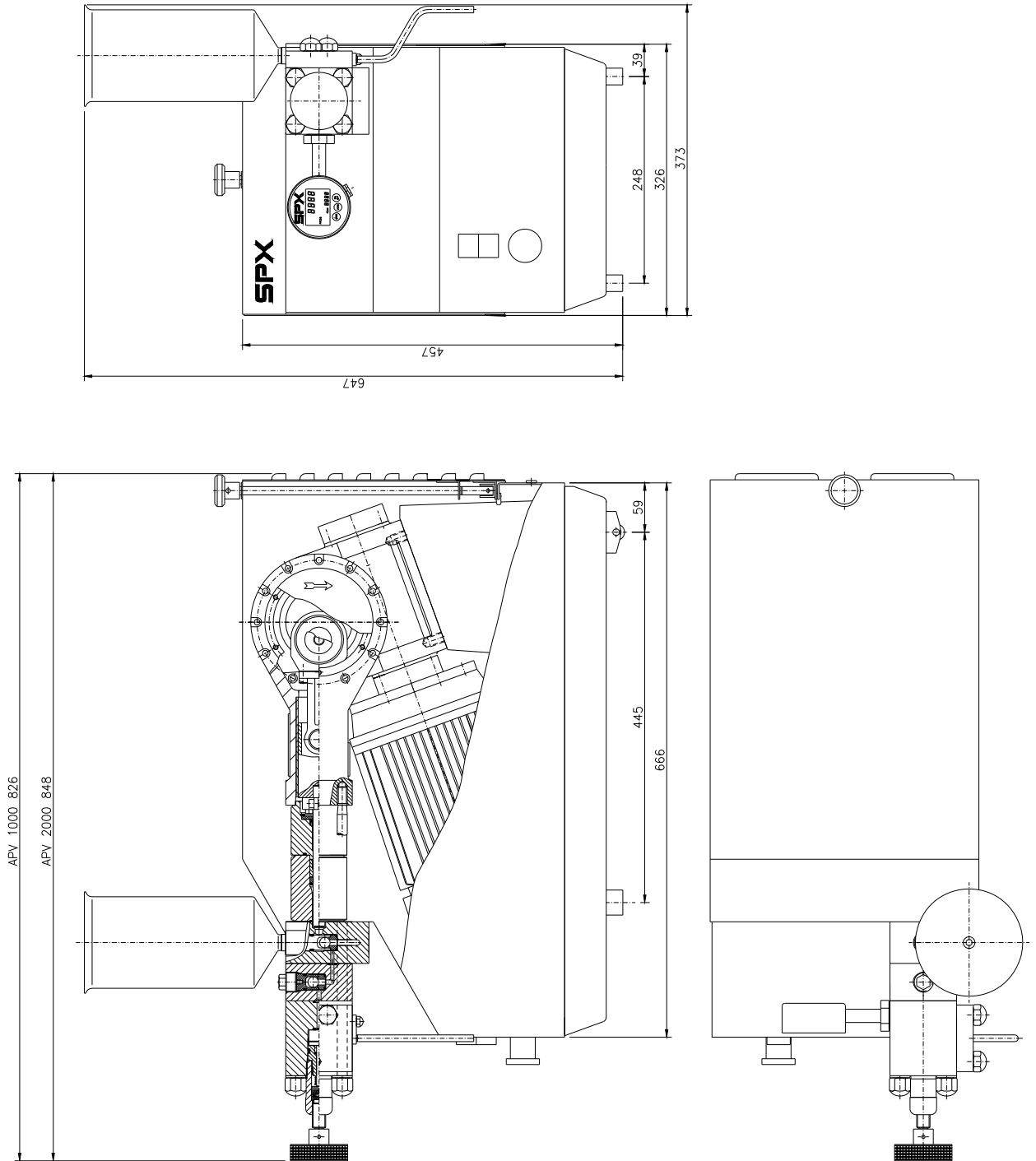
# PIPE CONNECTION

## APV-1000/APV-2000

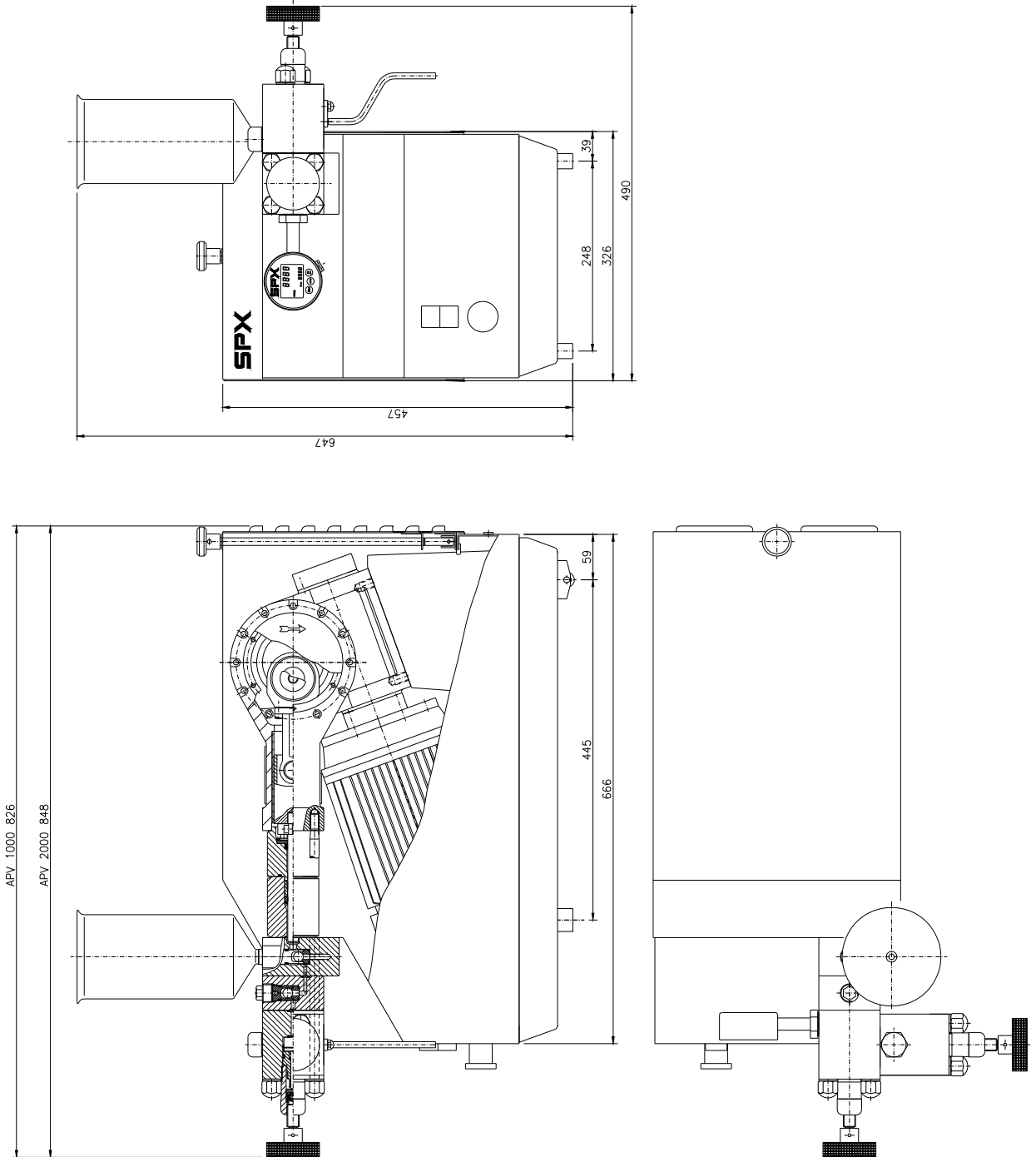


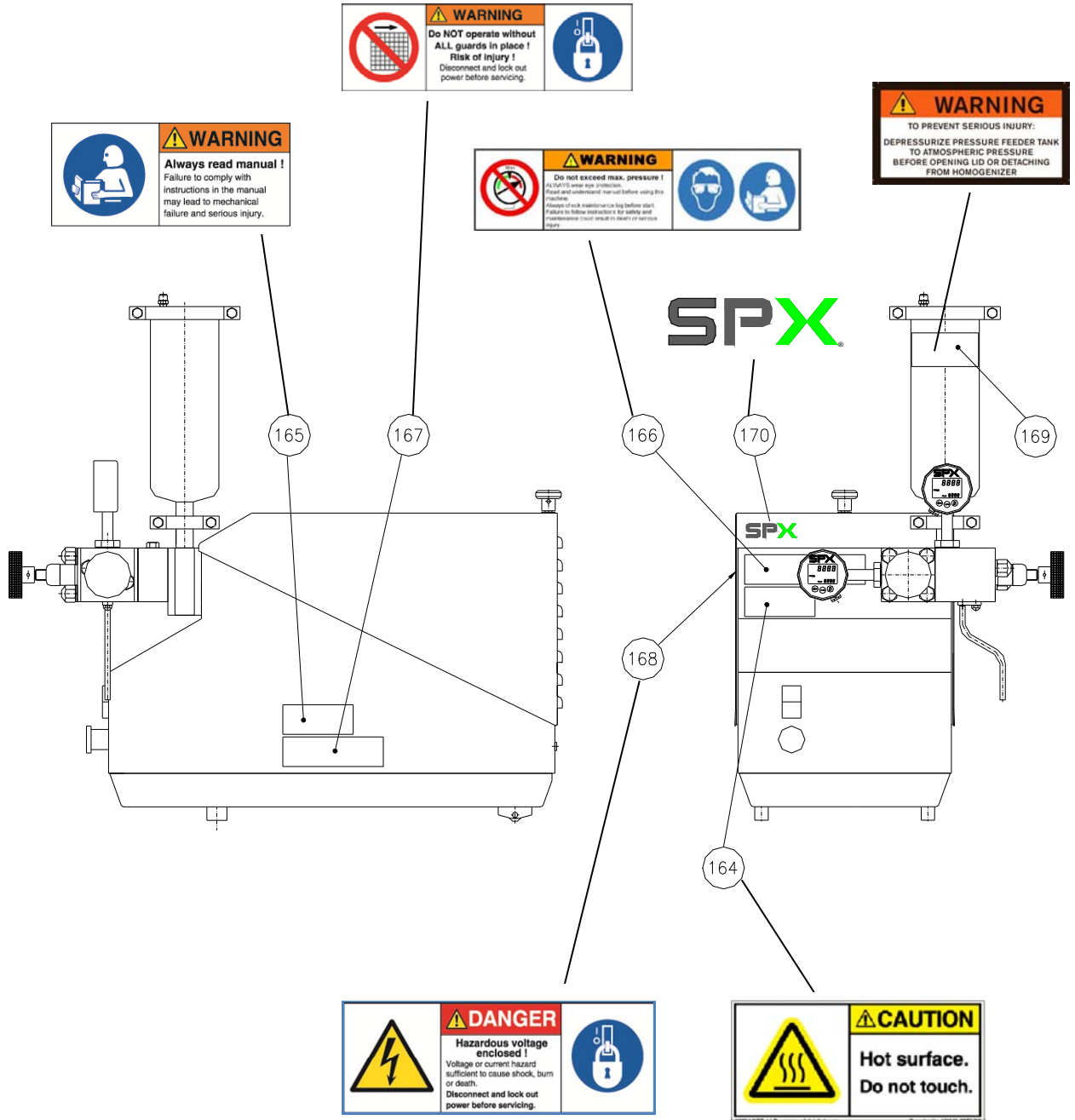
| Item | Description  |
|------|--|
| 31   | O-Ring (1) P/N 80110033 (EPDM)   |
| 91   | Welding Liner (1) P/N 84210095   |
| 92   | Clamp Ring (1) P/N 84210094  |
| 93   | Packing (1) P/N 80210046 Standard = EPDM "Special material on request" |
| 94   | Flanged Socket (1) P/N 34210142  |

# ASSEMBLY VIEW APV-1000/2000 – SINGLE STAGE



# ASSEMBLY VIEW APV-1000/2000 – TWO STAGE





| Item | Description                 |
|------|-----------------------------|
| 164  | Name plate (1) P/N 81410260 |
| 165  | Name plate (1) P/N 81410234 |
| 166  | Name plate (1) P/N 81410232 |
| 167  | Name plate (1) P/N 81410233 |
| 168  | Name plate (1) P/N 81410231 |
| 169  | Name plate (1) P/N 81410278 |
| 170  | Name plate (1) P/N H327468  |



# APV-1000 & APV-2000 MASTER PARTS LIST

(Effective 14.12.17)

| POSITION NO. | PART  | PART NUMBER |
|--------------|---|-------------|
|              | <b>TRANSPORTATION EQUIPMENT</b>                 |             |
| 1            | CRATE   | 30110000    |
| 2            | NUT   | K002614     |
| 3            | BOLT  | 82010026    |
| 4            | BOLT  | K003318     |
| 5            | SUPPORT BRACKET                                 | 30110001    |
|              |   |             |
|              | <b>FEED HOPPER</b>                              |             |
| 6            | APV-1000  | 34210055    |
| 6            | APV-2000  | 34210034    |
| 7            | O-RING  |             |
|              | EPDM  | 80110040    |
|              | NBR   | K000011     |
|              | VITON   | 80110140    |
|              | CHEMRAZ   | 80110024    |
| 8            | HEX SOCKET BOLT                                 | K001018     |
|              |   |             |
|              | <b>RECIRCULATING TUBE BYPASS</b>                |             |
| 9            | RECIRCULATION TUBE                              | 34210042    |
| 10           | FLEXIBLE TUBING                                 | 84110010    |
|              |   |             |
|              | <b>PRESSURE BLANK TWO-STAGE MACHINE</b>         |             |
| 11           | PRESSURE BLANK NUT                              | 04010000    |
| 12           | O-RING  |             |
|              | EPDM  | 80110108    |
|              | NBR   | K002916     |
|              | VITON   | 80110141    |
|              | CHEMRAZ   | 80110123    |
| 13           | BACK-UP RING                                    | 80310006    |
| 14           | O-RING  |             |
|              | EPDM  | 80110036    |
|              | NBR   | 80110028    |
|              | VITON   | 80110138    |
|              | CHEMRAZ   | 80110023    |
| 15           | SECOND STAGE PRESSURE BLANK                     | 82710000    |
|              |   |             |
|              | <b>PRESSURE INDICATION, FIRST/SECOND STAGE:</b> |             |
| 16           | MANOMETER, 4-20mA APV-1000/2000                 | 04010078    |
|              |   |             |
|              |   |             |

| POSITION NO. | PART  | PART NUMBER |
|--------------|---|-------------|
|              | <b>PRESSURE INDICATION, FIRST/SECOND STAGE:<br/>SPECIAL ( OPTION)</b> |             |
| 17           | MANOMETER APV-1000/2000   | 04010072    |
| 18           | PRESSURE INDICATION   | 08810155    |
| 19           | SCREW   | K002594     |
| 20           | PLUG  | 81410167    |
| 21           | <i>intentionally left blank</i>                                       |             |
| 22           | O-RING  |             |
|              | EPDM  | K003213     |
|              | NBR   | K000005     |
|              | VITON   | 80110143    |
|              | CHEMRAZ   | 80110020    |
| 23           | BACK-UP RING  | 80310004    |
| 24           | WASHER  | K001560     |
| 25           | CAP NUT   | K107893     |
|              | STUD  |             |
| 26           | APV-1000  | 18910044    |
| 26           | APV-2000  | 18910049    |
| 27           | HOMOGENISING VALVE BLOCK FIRST STAGE                                  | 17810011    |
| 28           | <i>intentionally left blank</i>                                       |             |
| 29           | HOMOGENISING VALVE BLOCK SECOND STAGE                                 | 17810013    |
| 30           | STUD  | 18910025    |
| 31           | O-RING  |             |
|              | EPDM  | 80110033    |
|              | NBR   | K000006     |
|              | VITON   | 80110142    |
|              | CHEMRAZ   | 80110021    |
| 32           | FLANGE  | 82810014    |
| 33           | HEX HEAD BOLT   | K103189-13  |
| 34           | DISCHARGE TUBE  | 34210032    |
| 35           | HAND WHEEL  | 01010000    |
| 36           | HAND WHEEL SUPPORT  | 17810003    |
| 37           | DISC SPRING   | 68910010    |
| 38           | HOMOGENISING VALVE CARTRIDGE  | 17810012    |
| 39           | BACK-UP RING  | 80310005    |
| 40           | O-RING  |             |
|              | EPDM  | 80110034    |
|              | NBR   | K000021     |
|              | VITON   | 80110136    |
|              | CHEMRAZ   | 80110022    |
| 41           | SPRING RING   | 81310000    |
| 42           | DISC SPRING RETAINER  | 17810002    |
| 43           | SNAP RING   | 81310001    |
| 44           | SPRING  | 68910012    |
|              |   |             |
|              |   |             |
|              |   |             |

| POSITION NO. | PART                                | PART NUMBER |
|--------------|-------------------------------------|-------------|
| 45           | O-RING                              |             |
|              | EPDM                                | 80110035    |
|              | NBR                                 | 80110029    |
|              | VITON                               | 80110144    |
|              | CHEMRAZ                             | 80110025    |
| 46           | <b>HOMOGENISING VALVE:</b>          |             |
| 46a          | CERAMIC                             | 12510006    |
| 46b          | TUNGSTEN CARBIDE                    | 12510007    |
| 46c          | STELLITE                            | 12510005    |
| 47           | <b>IMPACT RING:</b>                 |             |
| 47a          | CERAMIC                             | 12610002    |
| 47b          | TUNGSTEN CARBIDE                    | 12610003    |
| 47c          | STELLITE                            | 12610001    |
| 48           | <b>HOMOGENISING VALVE SEAT:</b>     |             |
| 48a          | CERAMIC                             | 12410006    |
| 48b          | TUNGSTEN CARBIDE                    | 12410008    |
| 48c          | STELLITE                            | 12410007    |
|              |                                     |             |
|              | <b>PUMP VALVE BLOCK (APV-1000):</b> |             |
| 49           | <i>intentionally left blank</i>     |             |
| 50           | VALVE CAP                           | 82010021    |
| 51           | HEX SOCKET                          | K001035     |
| 52           | VALVE GUIDE                         | 03710012    |
| 53           | VALVE GUIDE                         | 03710013    |
| 54           | VALVE BLOCK 1000A                   | 12710006    |
|              | BALL VALVE SEAT                     |             |
| 55           | STELLITE                            | 03610012    |
| 55           | TUNGSTEN CARBIDE                    | 03610046    |
| 56           | VALVE BLOCK 1000B                   | 12710005    |
| 57           | O-RING                              |             |
|              | EPDM                                | K002899     |
|              | NBR                                 | K002586     |
|              | VITON                               | 80110145    |
|              | CHEMRAZ                             | 80110124    |
|              |                                     |             |
|              | <b>PUMP VALVE BLOCK (APV-2000):</b> |             |
| 58           | HEX SOCKET (2)                      | K003614     |
| 59           | VALVE BLOCK 2000A                   | 12710009    |
| 60           | VALVE BLOCK 2000B                   | 12710008    |
| 61           | VALVE BLOCK 2000C                   | 12710007    |
| 62           | O-RING                              |             |
|              | EPDM                                | 80110047    |
|              | NBR                                 | 80110112    |
|              |                                     |             |
| 63           | BACK-UP RING                        | 80310000    |
| 64           | BALL VALVE (2)                      | K001715     |
|              |                                     |             |

| POSITION NO. | PART                                 | PART NUMBER |
|--------------|--------------------------------------|-------------|
| 65           | O-RING                               |             |
|              | EPDM                                 | 80110048    |
|              | NBR                                  | K001193     |
|              | VITON                                | 80110056    |
|              |                                      |             |
|              | <b>CYLINDER ASSEMBLY (APV-1000):</b> |             |
| 66           | HEX SOCKET                           | K000168     |
| 67           | PLUNGER COUPLING                     | 17310019    |
| 68           | HEX SOCKET                           | K001009     |
| 69           | SNAP RING                            | 81310002    |
| 70           | U-PACKING RETAINER                   | 02610007    |
| 71           | U-PACKING                            | 80410017    |
| 72           | COOLING CYLINDER                     | 02510030    |
| 73           | O-RING ( NBR ONLY )                  | K002196     |
| 74           | PACKING RING                         | 01810036    |
| 75           | PACKING ASSEMBLY APV-1000 includes:  |             |
|              | PACKING                              | 80210010    |
|              | O-RING                               |             |
|              | EPDM                                 | 80110038    |
|              | NBR                                  | 80110032    |
|              | VITON                                | 80110139    |
|              | CHEMRAZ                              | 80110026    |
| 76           | PLUNGER                              | 12210068    |
| 77           | CYLINDER                             | 01810035    |
| 78           | O-RING                               |             |
|              | EPDM                                 | 80110037    |
|              | NBR                                  | 80110030    |
|              | VITON                                | 80110137    |
|              | CHEMRAZ                              | 80110027    |
|              |                                      |             |
|              | <b>CYLINDER ASSEMBLY (APV-2000):</b> |             |
| 79           | PLUNGER COUPLING                     | 17310007    |
| 80           | U-PACKING RETAINER                   | 02610005    |
| 81           | U-PACKING                            | 80410010    |
| 82           | COOLING CYLINDER                     | 02510026    |
| 83           | PACKING RING                         | 01810027    |
| 84           | PACKING ASSEMBLY APV-2000 includes:  |             |
| 84a          | PACKING                              | 80210009    |
| 84b          | O-RING                               |             |
|              | EPDM                                 | 80110039    |
|              | NBR                                  | 80110031    |
|              |                                      |             |
| 85           | PLUNGER                              | 12210047    |
| 86           | CYLINDER                             | 01810017    |
| 87           | SPRING                               | K111371     |
| 88           | VALVE GUIDE                          | 03710018    |
| 89           | VALVE GUIDE                          | 03710019    |

| POSITION NO. | PART                            | PART NUMBER |
|--------------|---------------------------------|-------------|
|              | <b>PIPE CONNECTION:</b>         |             |
| 90           | FLANGED SOCKET                  | 34210141    |
| 91           | WELDING LINER                   | 84210095    |
| 92           | CLAMP RING                      | 84210094    |
| 93           | PACKING                         | 80210046    |
| 94           | PIPE BRANCH                     | 34210142    |
| 95           | PIPE BRANCH                     | 34210143    |
| 96           | <i>intentionally left blank</i> |             |
| 97           | <i>intentionally left blank</i> |             |
| 98           | <i>intentionally left blank</i> |             |
| 99           | <i>intentionally left blank</i> |             |
|              |                                 |             |
| 101          | NUT                             | 08910064    |
| 102          | CABLE GLAND                     | 08910063    |
|              |                                 |             |
|              | <b>CABINET:</b>                 |             |
| 103          | APV-1000/2000                   | 75410170    |
| 104          | NUT                             | K003852     |
| 105          | PLUG                            | 08910088    |
| 106          | WASHER                          | K001381     |
| 107          | LOCK WASHER                     | K000689     |
| 108          | NUT                             | K003392     |
| 109          | FOOT                            | K002518     |
|              |                                 |             |
|              | <b>SUB-BASE:</b>                |             |
| 110          | APV-1000/2000                   | 06810014    |
| 111          | CABINET COVER                   | 75410118    |
| 112          | HEX SOCKET                      | K001309     |
| 113          | CAM COVER                       | 75010011    |
|              |                                 |             |
| 114          | <b>COVER LOCK:</b>              |             |
| 114a         | KNOB                            | 81410049    |
| 114b         | SPRING                          | 68910013    |
| 114c         | WASHER                          | 82110010    |
| 115          | LOCKING RING                    | 81310004    |
| 116          | PIN                             | 82210007    |
| 117          | HEX SCREW                       | K000437     |
| 118          | LOCK TAB                        | 81410052    |
| 119          | LOCK NUT                        | K003122     |
| 120          | HEX SOCKET                      | K000377     |
| 121          | BOLT                            | K004053     |
| 122          | BACK PLATE UNNA                 | 75410148    |
| 122          | BACK PLATE POLAND               | 75410638    |
| 123          | HEX SOCKET                      | K001675     |
| 124          | WHEEL                           | 81410046    |
| 125          | SCREW                           | K000952     |
| 126          | RUBBER PLUG (2)                 | 82710039    |
|              |                                 |             |

| POSITION NO. | PART   | PART NUMBER |
|--------------|--|-------------|
|              | <b>CROSSHEAD:</b>  |             |
| 129          | APV-1000   | 00810002    |
| 129          | APV-2000   | 00810000    |
| 130          | BUSHING  | 83010005    |
| 131          | CROSSHEAD PIN  | 11610000    |
| 132          | CONNECTING ROD   | 00610002    |
| 133          | BUSHING  | 83010006    |
| 134          | HEX SOCKET   | K000168     |
|              | <b>MOTOR<br/>(CONSULT FACTORY FOR MORE INFORMATION):</b> |             |
| 135          | 50 Hz  | 93810008    |
| 135          | 60 Hz  | 93810020    |
| 136          | DISC   | 82110009    |
| 137          | CAP  | 04910022    |
| 138          | LOCKING RING   | 81310003    |
| 139          | BALL BEARING   | 04910024    |
| 140          | <b>DISCHARGE BLOCK<br/>SINGLE-STAGE VALVE ASSEMBLY</b>   | 70110016    |
| 141          | HEX HEAD BOLT  | K103189-2   |
| 142          | <i>intentionally left blank</i>                          |             |
| 143          | <i>intentionally left blank</i>                          |             |
| 144          | <i>intentionally left blank</i>                          |             |
| 145          | OVER-PRESSURE SHUT DOWN                                  | N/A         |
|              | <b>ASEPTIC CYLINDER PIPING</b>                           |             |
| 146          | MALE COUPLING  | 84210022    |
| 147          | ELBOW FITTING  | 84210021    |
| 148a         | Pipe   | 84110055    |
| 148b         | Pipe   | 84110056    |
| 149          | MALE COUPLING  | 84210022    |
| 150          | MALE COUPLING  | K003636     |
| 151          | HOSE DISTRIBUTION BOX                                    | 84210063    |
|              | <b>OPTIONAL PRESSURE FEEDER</b>                          |             |
| 152          | INLET CONNECTION (APV-1000)                              | 34230020    |
| 153          | TANK CLAMP GASKET 1"                                     |             |
|              | PTFE   | 80210032    |
| 154          | TANK CLAMP   | P720525     |
| 155          | PRESSURE FEEDER TANK                                     | 24730000    |
| 156          | PISTON   | 122010      |
| 157          | CAP GASKET 4"  |             |
|              | EPDM   | 84130038    |

| <b>POSITION NO.</b> | <b>PART</b>                 | <b>PART NUMBER</b> |
|---------------------|-----------------------------|--------------------|
| 158                 | CAP CLAMP                   | P716976            |
| 159                 | CAP                         | 84130031           |
| 160                 | PRESSURE RELIEF VALVE       | 905197             |
| 161                 | AIR CONNECTION              | N/A                |
| 162                 | INLET CONNECTION (APV-2000) | 34230027           |
| 163                 | NAME PLATE                  | K003449            |
| 164                 | NAME PLATE                  | 81410260           |
| 165                 | NAME PLATE                  | 81410234           |
| 166                 | NAME PLATE                  | 81410232           |
| 167                 | NAME PLATE                  | 81410233           |
| 168                 | NAME PLATE                  | 81410231           |
| 169                 | NAME PLATE                  | 81410278           |
| 170                 | NAME PLATE                  | H327468            |
| 171                 | MOUNTING PLATE              | 08910335           |
| 172                 | SCREW                       | 82010022           |
| 173                 | SCREW                       | 82010110           |
| 174                 | UNION NUT                   | 04010117           |

1000/2000

HOMOGENIZER

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SPX FLOW reserves the right to incorporate the latest design and material changes without notice or obligation.

Please contact your local sales representative for product availability in your region.

For more information visit [www.spxflow.com](http://www.spxflow.com).

ISSUED 11/2016 – Original manual

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