LAKOS FILTRATION SOLUTIONS

Installation and Operators Manual

Model: JPX & JPL Industrial Separators

FRESNO, CALIFORNIA, USA

LS-731C (Rev. 02/21)

Declaration of Conformity

Manufacturer:

LAKOS Filtration Solutions
1365 N. Clovis Avenue
Fresno, California 93727
USA

We hereby declare that all LAKOS JPX/JPL High Performance Liquid-Solid Separators, to which this declaration relates, are in conformity with the quality standards set forth by the LAKOS Corporation.

Lakos Corporation

Contents:

1. Limited warranty

LAKOS products are factory tested to meet the highest quality standards in the filtration industry.

Please refer to www.lakos.com/warranty for information about the warranty on this and all other LAKOS products.

2. Introduction

The JPX/JPL High Performance Liquid-Solid Separators are based on a centrifugal-action style of filtration pioneered by LAKOS. With patented Swirlex Slots™ and Vortube™ design, LAKOS JPX (accessible) and JPL (inaccessible) Separators are engineered to remove solids from liquids. Each model is manufactured to be used within a specific flow range for maximum efficiency and solids removal performance. JPX/JPL Separators are suitable for filtering suspended solids in water and other non-viscous liquids in industry, water treatment and other markets. Some notable features of the JPX/JPL Industrial Separator include:

- High performance
- Ease of maintenance
- Accessible upper chamber (JPX models)
- Compact size and small footprint
- Reliability and robustness
- Quiet operation
- No moving parts

For additional information about JPX/JPL Industrial Separators, or for information about other LAKOS products and services, visit our website at www.lakos.com.

3. Principle of Operation

LAKOS JPX/JPL High Performance Liquid-Solid Separators are specifically designed to remove solids from liquids.

Upon entry the liquids/solids pass through internal Swirlex Slots™ and are accelerated into the separation chamber where solids heavier than the carrying liquid are centrifugally separated and accumulated in the separator's collection chamber for eventual purging. The liquid (free of separable and settle-able solids) is then drawn to the vortex and up through the separator's outlet. See figure 1.

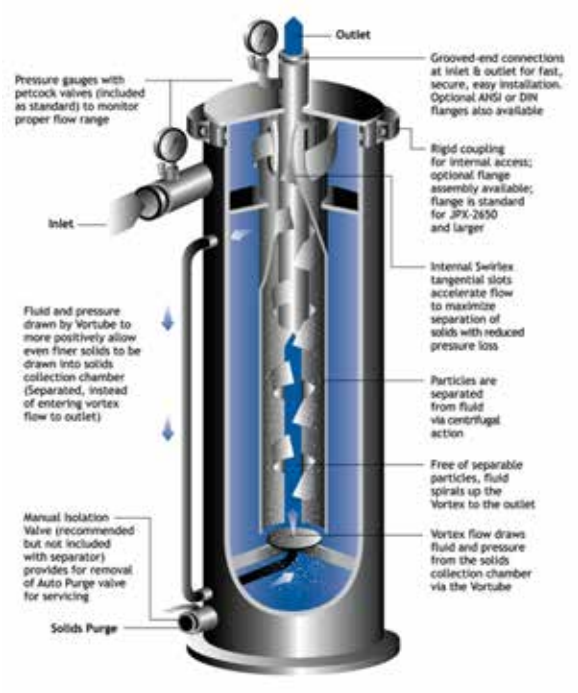


Fig. 1 Principle of operation.

3.1 Pressure Loss Overview

LAKOS separators convert a small amount of energy from the flow stream, (the product of flow rate, or velocity of liquid through the passageways, and the static pressure of the liquid-solids), into

- centrifugal action
- acceleration of the liquid-solids
- vortex creation
- friction

By this process through the separator, the separable solids are removed from the liquid.

Since the flow rate remains constant through the separator, the liquid-solids accelerate through the separator as the passageways change size, shape and direction. This energy consumption is observed as a reduction in static pressure, or pressure loss, across the separator. $\Delta P_{separator} = P_{inlet} - P_{outlet}$.

For LAKOS JPX/JPL High Performance Liquid-Solid Separators, the pressure loss across the separator ($\Delta P_{separator}$) will be between 3 and 12 psi (0.2 - 0.8 bar), depending on specific application.

3.2 Annular Transfer Ring

LAKOS JPX Industrial Separators are available in the optional Annular Transfer Ring (ATR) configuration. This technology, in lieu of slots, is advantageous in applications where fibrous, stringy or long-shaped larger materials need to be separated from water or other non-viscous liquids. See figure 2.

For additional information see LAKOS Annular Transfer Ring publication, literature number LS-634B, at www.lakos.com.

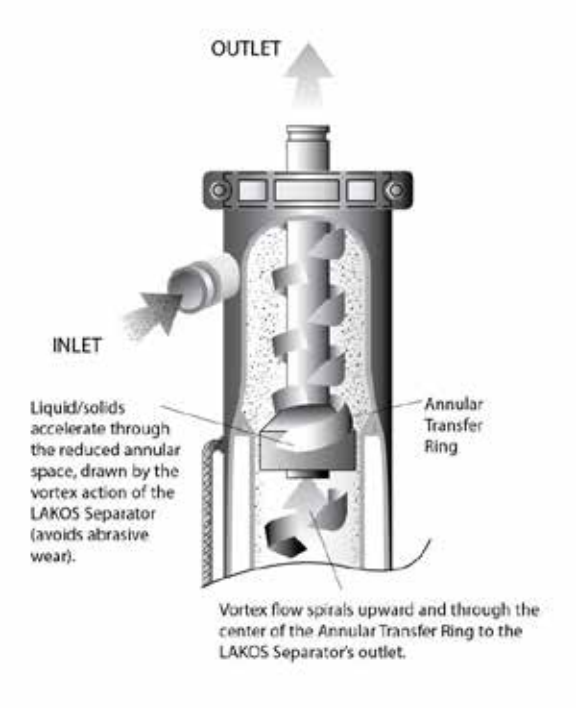


Fig. 2 JPX with Annular Transfer Ring.

Warning

Prior to installation, read these instructions. Installation and operation must comply with local regulations and accepted codes of good practice.

If these instructions are not observed, it may lead to personal injury.

Only qualified personnel should attempt installation, operation and maintenance of this equipment.

Important This manual contains important and useful information for the proper operation and maintenance of LAKOS separators. It also contains important instructions to prevent potential accidents and damage, and to ensure safe and fault-free operation.

Retain and store this manual near the separator for future reference.

4. Shipment inspection

Depending on size, LAKOS JPX/JPL High Performance Liquid-Solid Separators are delivered (as standard) in open wooden skids or crates, suitable for transport by forklift truck or similar vehicle.

a. Pressure gauges (2) and associated hardware are packaged separately.
b. Support legs (Low profile models) are detached for shipping.
c. Protective covers are fitted to the inlet, outlet and purge outlet connections.

Lifting lugs, located on the separator's side or upper chamber area are provided for lifting purposes. The separator must be transported using approved load bearing equipment.

Warning

Improper transport can lead to personal injury. The lifting point should always be above the center of gravity of the separator. See figure 3.

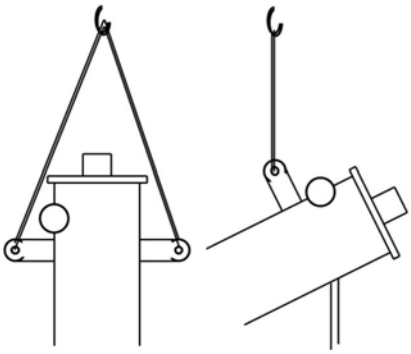


Fig. 3 Correct lifting.

The shipping container has been specifically designed to prevent damage during shipment. Examine the separator and other supplied parts for any damage that may have occurred during shipping. Care should be taken to ensure the separator is NOT dropped or mishandled. As a precaution, the separator should remain in the shipping container until ready to install.

5. Extended storage

In the event the separator is not installed upon receipt, and extended storage is needed, proceed as follows:

Important Damage to the separator may occur if suitable protection and appropriate care is not provided while in storage. Limited warranty coverage may be invalidated.

LAKOS standard packaging provides suitable protection to equipment against shipping and transit damage to delivery onsite, through to pre-commissioning. For extended storage after delivery, further consideration of the protective packaging, preservation and care is required (by others).

A. Short term storage (up to 6 months)

- The separator must be stored on a flat, level surface in a dry, dust-free, indoor environment, away from weather conditions. All surfaces must be kept clear of the ground.
- Ambient temperatures must be between 40 - 120 F (4 - 49 C).
- Apply rust inhibitors to all exposed carbon steel and cast iron surfaces.
- Recoat painted surfaces that have been scratched or damaged.
- All openings must be covered or plugged and suitably protected.
- Ensure all nameplates and other identifying marks or tags are intact, protected and secure.

B. Long term storage (up to 12 months)

Follow short term storage requirements above, plus:

- The separator must be fully crated.
- Apply desiccants to keep contents dry.

Inspect the separator monthly to ensure against damage. Make repairs promptly.

6. Understanding nameplate data

Fig. 4 Nameplate information.

- Nameplate information: JPX/JPL High Performance Liquid-Solid Separators
  - Model Number — Product description and type
  - Inlet/Outlet — Connection size (inches)
  - Flow Range (US gpm) — Specific operating flow range (US gpm)
  - Flow Range (m^3/hr) — Specific operating flow range (m^3/hr)
  - Pressure Loss (psi) — Pressure differential range across separator (psi)
  - Pressure Loss (bar) — Pressure differential range across separator (bar)
  - Max Pressure — Maximum working pressure (psi/bar)
  - Serial Number — Production number

6.1 Model number type key

JPX – 0450 - V / ASME / HP / HT / S6 / ATR

JPX	Industrial Separator – Accessible
JPL	Industrial Separator - Inaccessible
JSK	Scotchkote™ (internal)
0450	Minimum flow rate (US GPM)
L	Low profile
V	Vertical
ASME	Complies with ASME code
HP	High pressure
HT	High temperature
S6	316 S.St.
S4	304 S.St.
ATR	Annular Transfer Ring

7. Type of separator

- Check that the model number given on the nameplate (fitted on sleeve) corresponds to the order. See figure 5.

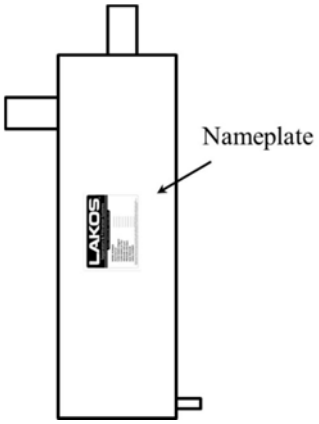
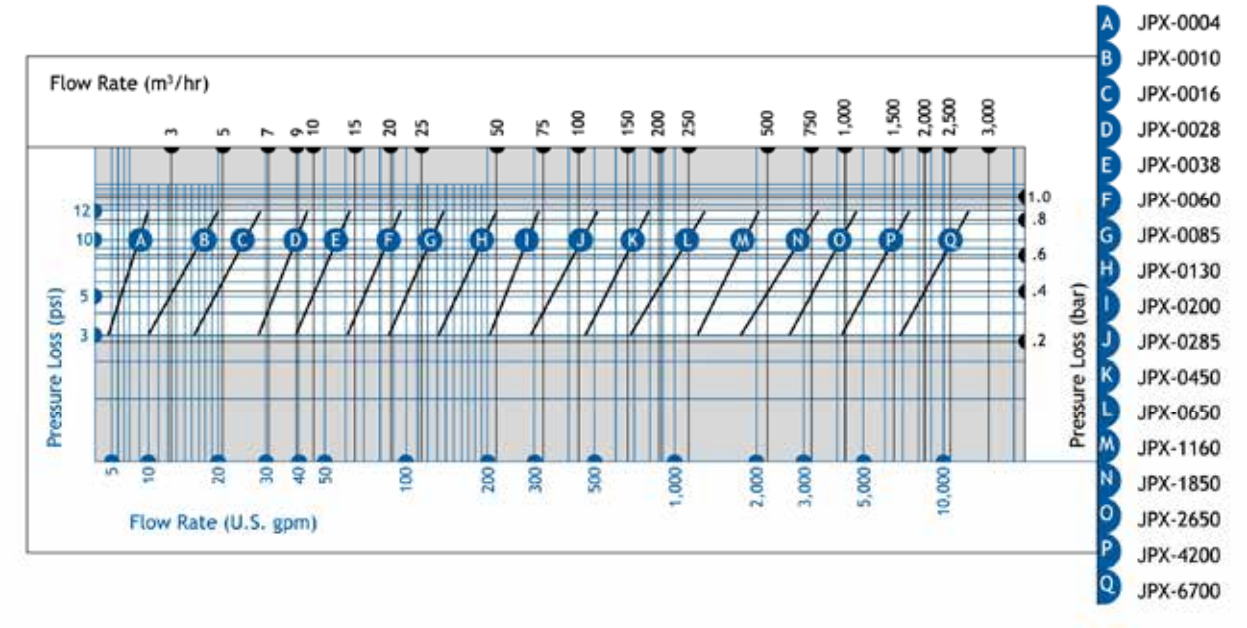


Fig. 5 Locating the nameplate.

8. Operating conditions

- Flow range — 4 – 12,750 US gpm (1 – 2,895 m^3/hr)
- Maximum liquid temperature — 180 F (82 C)
- Maximum working pressure — 150 psi (10.3 bar)
- Pressure loss range — 3 - 12 psi (0.2 – 0.8 bar)
- Maximum solids size — ø 1/4 inch (6.3 mm); models JPX/JPL 0004 - 0016
  ø 3/8 inch (9.5 mm); models JPX/JPL 0028 - 6700

JPX Separator Flow vs Pressure Loss (reference LAKOS literature LS-632L)



JPX Separator Model and Flow (reference LAKOS literature LS-632L)

Model*	Flow Range U.S. gpm	Flow Range m^3/hr	Inlet/Outlet Size**	Connections*** Inlet/Outlet	Connections*** Top Access	Purge Size Male N.P.T.	Collection Chamber Capacity gal	Collection Chamber Capacity liters	Weight Empty lbs.	Weight Empty kg	Weight with Water lbs.	Weight with Water kg
JPX-0004	4-10	1-2.5	1/2" NPT**	G	G	1"	0.09	0.3	23	10.4	37	16.8
JPX-0010	10-20	2.5-4.5	3/4" NPT**	G	G	1"	0.11	0.4	48	21.8	61	27.7
JPX-0016	16-30	4 -7	1"	G	G	1"	0.15	0.6	53	24.0	68	30.8
JPX-0028	28-45	7-10	1-1/4"	G	G	1-1/2"	0.27	1.0	84	38.1	101	45.8
JPX-0038	38-65	9-15	1-1/2"	G	G	1-1/2"	0.4	1.5	107	48.5	140	63.5
JPX-0060	60-100	14-23	2"	G	G	1-1/2"	0.8	3.0	188	85.3	259	117.5
JPX-0085	85-145	19-33	2-1/2"	G	G	1-1/2"	0.8	3.0	229	103.9	313	142.0
JPX-0130	130-225	30-51	3"	G	G	1-1/2"	0.8	3.0	241	109.3	329	149.2
JPX-0200-L JPX-0200-V	200-325	45-74	4"	G G	G G	1-1/2"	1.6 4.4	6.1 16.7	448 384	203.2 174.2	640 605	290.3 274.4
JPX-0285-L JPX-0285-V	285-525	65-120	4"	G G	G G	1-1/2"	2.1 5.4	7.9 20.5	579 488	262.6 221.4	898 781	407.3 354.3
JPX-0450-L JPX-0450-V	450-825	102-187	6"	G G	G G	1-1/2"	2.8 6.7	10.6 25.4	763 690	346.1 313.0	1203 1132	545.7 513.5
JPX-0650-L JPX-0650-V	650-1200	150-275	6"	G G	G G	1-1/2"	4.3 10.4	16.3 39.4	966 921	438.2 417.8	1664 1578	754.8 715.8
JPX-1160-L JPX-1160-V	1160-2150	265-490	8"	G G	G G	1-1/2"	8.6 20.5	32.6 77.6	1388 1378	629.6 622.3	2704 2627	1226.5 1191.6
JPX-1850-L JPX-1850-V	1850-3400	420-775	10"	G G	F F	2"	15.0 31.5	56.8 119.2	2141 2255	971.1 1022.9	4008 3977	1818.0 1803.9
JPX-2650-L JPX-2650-V	2650-4900	600-1115	12"	G G	F F	2"	23.5 51.1	89.0 193.4	3664 3186	1662.0 1445.1	7732 6532	3507.2 2962.9
JPX-4200-L JPX-4200-V	4200-7800	950-1775	16"	G G	F F	3"	52.2 99.3	197.6 375.9	6024 5761	2732.4 2613.1	13102 12867	5942.9 5836.3
JPX-6700-L JPX-6700-V	6700-12750	1520-2895	20"	G G	F F	3"	81.0 162.3	306.6 614.4	8476 8092	3844.6 3670.5	19612 19339	8895.8 8772.0

F = flanged connection
G = grooved connection

* Models ending with "L" are low profile; "V" for vertical profile

** Inlet/Outlet may also be specified with ANSI flanges or DIN flanges; JPX-0004 and JPX-0010 are standard male, N.P.T. (BSP or JIS threads available); other models also available with optional threading

*** For stainless steel specifications, including flanges and weights, consult the factory.

Maximum pressure rating: 150 psi (10.3 bar); consult factory for higher pressure requirements

Pressure loss range: 3 - 12 psi (.2-.8 bar). See chart below

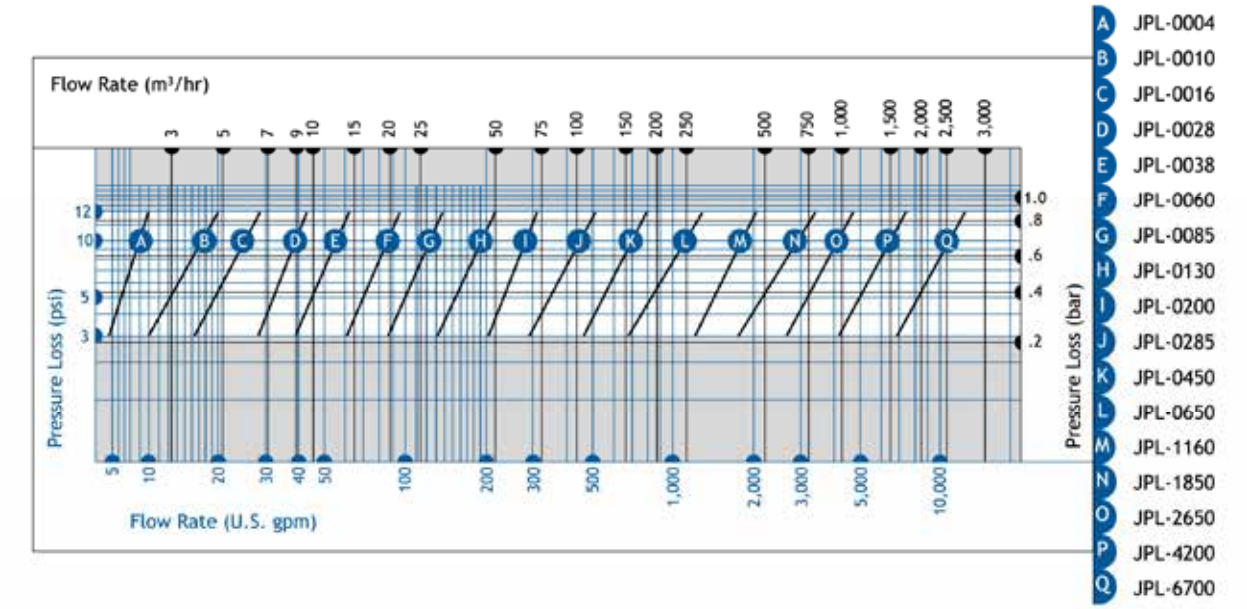
Maximum temperature rating: 180°F (82.2°C) Consult factory for higher temperatures

Maximum particle size: JPX-0016 and smaller - .25 inch (6 mm); all other models - .375 inch (9 mm)

Material (standard carbon steel): Domes - A-234/516 Gr 70.
Outer Barrels and Nozzles - A-53B/106B or equivalent
Flat heads - A-36/516 Gr 70

Paint coating: Acrylic urethane, spray-on royal blue

JPL Separator Flow vs Pressure Loss (reference LAKOS literature LS-631H)



JPL Separator Model and Flow (reference LAKOS literature LS-631H)

Model*	Flow Range U.S. gpm	Flow Range m^3/hr	Inlet/Outlet Grooved Coupling**	Purge Size Male N.P.T.	Collection Chamber Capacity gal	Collection Chamber Capacity liters	Weight Empty lbs.	Weight Empty kg	Weight with Water lbs	Weight with Water kg
JPL-0004	4-10	1-2.5	1/2" NPT**	1"	0.09	0.3	23	10.4	29	13.2
JPL-0010	10-20	2.5-4.5	3/4" NPT**	1"	0.11	0.4	37	16.8	47	21.3
JPL-0016	16-30	4 -7	1"	1"	0.15	0.6	43	19.5	53	24
JPL-0028	28-45	7-10	1-1/4"	1-1/2"	0.27	1.0	62	28.1	80	36.3
JPL-0038	38-65	9-15	1-1/2"	1-1/2"	0.4	1.5	86	39.0	115	52.2
JPL-0060	60-100	14-23	2"	1-1/2"	0.8	3.0	147	66.7	218	98.9
JPL-0085	85-145	19-33	2-1/2"	1-1/2"	0.8	3.0	189	85.7	272	123.4
JPL-0130	130-225	30-51	3"	1-1/2"	0.8	3.0	200	90.7	288	130.6
JPL-0200-L JPL-0200-V	200-325	45-74	4"	1-1/2"	1.6 4.4	6.1 16.7	425 368	192.8 166.9	617 582	279.9 264.0
JPL-0285-L JPL-0285-V	285-525	65-120	4"	1-1/2"	2.1 5.4	7.9 20.5	558 468	253.1 212.3	869 752	394.2 341.1
JPL-0450-L JPL-0450-V	450-825	102-190	6"	1-1/2"	2.8 6.7	10.6 25.4	720 645	326.6 292.6	1195 1090	542.0 494.4
JPL-0650-L JPL-0650-V	650-1200	150-275	6"	1-1/2"	4.3 10.4	16.3 39.4	924 880	419.1 399.2	1622 1536	735.7 696.7
JPL-1160-L JPL-1160-V	1160-2150	265-490	8"	1-1/2"	8.6 20.5	32.6 77.6	1309 1304	593.7 591.5	2634 2558	1194.8 1160.3
JPL-1850-L JPL-1850-V	1850-3400	420-775	10"	2"	15.0 31.5	56.8 119.2	1732 1829	785.6 829.6	3874 3843	1757.2 1743.1
JPL-2650-L JPL-2650-V	2650-4900	600-1115	12"	2"	23.5 51.1	89.0 193.4	2641 2331	1197.9 1057.3	7025 5821	3186.5 2640.3
JPL-4200-L JPL-4200-V	4200-7800	950-1775	16"	3"	52.2 99.3	197.6 375.9	5120 4675	2322.4 2120.5	12131 11886	5502.5 5391.4
JPL-6700-L JPL-6700-V	6700-12750	1520-2895	20"	3"	81.0 162.3	306.6 614.4	6983 6594	3167.4 2990.9	18332 18061	8315.2 8192.3

* Models ending with "L" are low profile, "V" for vertical profile. No suffix indicates low-flow vertical profile

** Inlet/Outlet may also be specified with ANSI, DIN or JIS flanges; other models also available with optional threading

Maximum pressure rating: 150 psi (10.3 bar); consult factory for higher pressure requirements

Maximum temperature rating: 180°F (82.2°C) Consult factory for higher temperatures

Pressure loss range: 3 - 12 psi (.2-.8 bar)

Maximum particle size: JPL-0016 and smaller - .25 inch (6 mm); all other models - .375 inch (9 mm)

Material (standard carbon steel): Domes - A-234/516 Gr 70.

Outer Barrels and Nozzles - A-53B/106B or equivalent

Flat heads - A-36/516 Gr 70

Paint coating: Acrylic urethane, spray-on royal blue

9. Foundation

Concrete or similar foundation material should be used to provide a secure and stable mounting base for the separator. The separator should be positioned on a flat, level and solid surface. The separator must be fastened to the floor or foundation using all mounting connection points provided. The use of anchor bolts is recommended.

Important When determining foundation requirements, be sure to consider the weight of the fully wetted separator. Reference the *JPX*

Separator Model and Flow chart and *JPL Separator Model and Flow* chart, respectively, provided in this manual for separator weights with water.

If the separator is wall or ceiling mounted, stabilizers may be needed. Do not allow the separator to hang in the piping.

Inlet and discharge pipes should be supported independently to minimize pipe strain to the separator.

To prevent the transmission of vibrations to building, it may be necessary to isolate the separator foundation from building parts by means of vibration dampers. Consult supplier of vibration dampers for proper type and sizing. When vibration dampers are used, expansion joints should always be fitted on the separator piping connections to minimize pipe strain.

9.1 Expansion joints

Expansion joints are installed for the following reasons, and are recommended:

1. To absorb expansions/contractions in the pipework from, e.g.: thermal expansion.
2. To reduce mechanical strains in connection with pressure surges in the pipework.
3. To isolate the mechanical structure-borne noise in the pipework.

Important Expansion joints must not be installed to compensate for inaccuracies in the pipework.

Isolation valves should be fitted on both sides of the separator to avoid draining the system during cleaning or maintenance.

10. Freeze Protection

Separators which are not being used during periods of frost should be drained to avoid damage. Follow the instructions below.

1. Switch off the main disconnect switch to take the system out of operation.
2. Close the isolation valves before and after the separator.
3. Drain the separator by opening the solids purge outlet connection.

 Warning

Lock the main disconnect switch with a padlock to ensure the power supply cannot be accidentally switched on.

Remember to open the isolation valves before the separator is put back into operation.

Important When operating in sub-freezing temperatures, be sure to protect the separator's collection chamber and all purge line piping from freezing.

Note Heat tracing and insulation may be used to keep liquid from freezing in the separator and purge outlet piping.

11. Installation

 Warning

Do not operate separator until properly installed.

LAKOS Separators & Systems must be installed downstream of the main System Pump. Do not install on the suction side of the main system pump. Flow must be pushed through the separator and not pulled. Consult LAKOS for questions.

Important JPX/JPL High Performance Liquid-Solid Separators are shipped with covered inlet, outlet and purge outlet connections. The covers must be removed before piping connections are made. Inspect the connections for damage and any foreign materials before fitting pipe.

Important Before installation, check the following:

1. That the separator model and configuration is as ordered.
2. That no visible parts have been damaged.
3. That no foreign materials are in the inlet/outlet or purge connections.

The separator can be installed vertically or at an incline (low profile), depending on the supplied model. See figure 6.

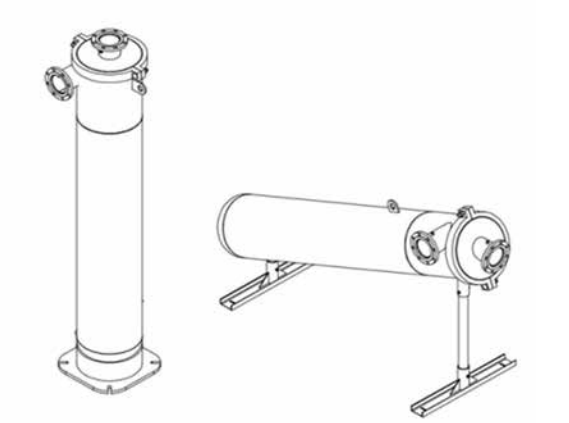


Fig. 6 Separator: Vertical and low profile models. (Shown with optional flanged connections).

Labels on the piping connections indicate the direction of flow of liquid through the separator. See figure 7.

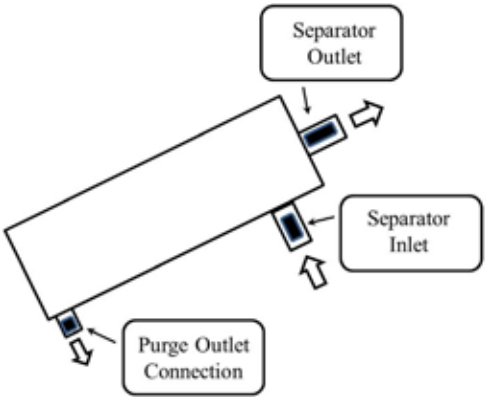


Fig. 7 Connection labels. Indicate the purpose and flow direction.

11.1 Inlet and discharge piping

The inlet and discharge piping should be adequately sized and run as straight and short as possible to minimize turbulence and to enhance separator performance, (minimum of four pipe diameters straight run before and after separator connections). Avoid using unnecessary fittings, valves or accessory items.

Pipe, valves and fittings should be at least the same diameter as the separator connections, or sized and installed in accordance with good piping practices to reduce excessive fluid velocities and pipe friction losses.

Note Pipe, valves and fittings must have a pressure rating equal to or greater than the maximum system pressure.

The piping should be adequately supported to reduce thermal and mechanical stresses on the separator.

Pressure gauges (provided) are required at the inlet and outlet connections to monitor system performance.

- Install with petcock and provided hardware.

Important A suitably sized strainer should be installed prior to the separator inlet to capture any organic materials or solids greater than 1/4" (6.3mm) diameter size (models JPX/JPL 0004 – 0016) or greater than 3/8" (9.5 mm) diameter size (models JPX/JPL 0028 – 6700).

A flow meter is recommended to monitor the flow rate through the separator. The flow meter must be installed prior to the separator and in accordance with manufacturer's recommendations for proper function.

Air vents should be fitted at the highest point in the discharge piping to expel and eliminate entrained air; therefore removing a source for excessive vibration in the system.

A throttling valve, (e.g.: butterfly or gate valve) must be installed in the discharge piping to:

a. ensure a minimum 5 psi (0.3 bar) back pressure.
b. provide a means to control the flow rate of the separator to optimize performance.
c. provide a means to isolate the separator for maintenance purposes.

Important Open, unrestricted discharge to a, e.g.: pit or sump, will result in unacceptable separator performance. See figure 8.

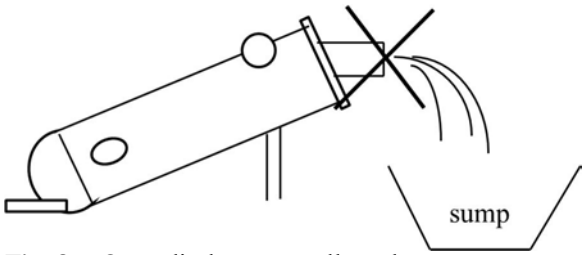


Fig. 8 Open discharge not allowed.

11.2 Piping orientation

To minimize and control vibration in the separator and associated piping, proper orientation of the separator's inlet and discharge piping is advised. See figure 9. Recommended acceptable configurations:

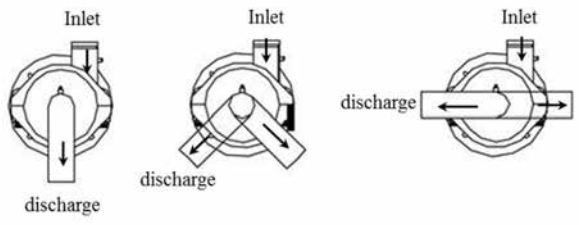
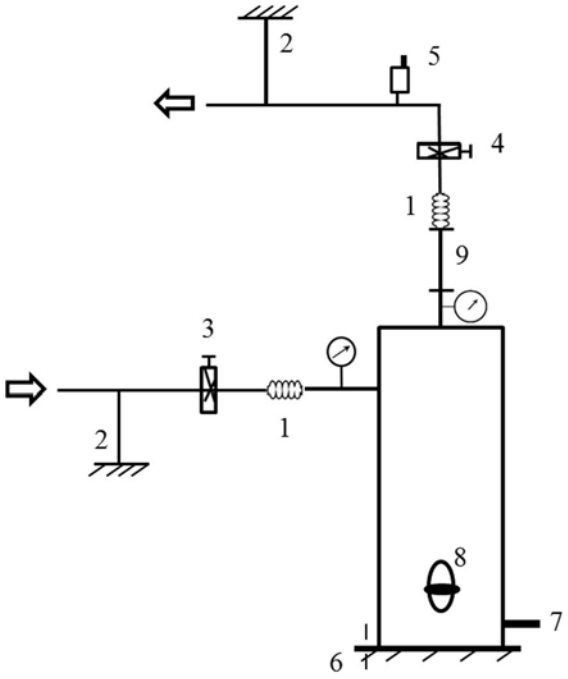


Fig. 9 Recommended piping orientation.

Note System piping, expansion joints, pipe supports, valves, anchor bolts and associated hardware supplied by others. See figure 10.

Note Connect purge hardware and/or solids-handling equipment to the purge outlet connection to flush separated solids from the separator. See **Purging the Separator**.



Pos.	Description
1	Expansion joint
2	Pipe support
3	Isolation valve
4	Throttle/isolation valve
5	Air vent
6	Anchor bolts
7	Purge outlet connection
8	Hand-hole clean out
9	Connecting spool (JPX models)

Fig. 10 Sketch showing the position of expansion joints, isolation valves and piping supports.

Ensure a vacuum or negative pressure is not allowed in the piping. This can occur as a result of, (e.g.: the discharge piping sloping down and away from the separator or from a downstream booster pump). In such cases, install a throttling valve as vacuum breaker, (e.g.: gate or butterfly type) between the separator and negative pressure source. Throttle the valve until the pressure loss across the separator ($\Delta P_{separator}$) is within the acceptable operating range for proper separator function. Recommended pressure loss range: 3 - 12 psi (0.2 - 0.8 bar). ($\Delta P_{separator} = P_{inlet} - P_{outlet}$). See figures 11 – 12 – 13.

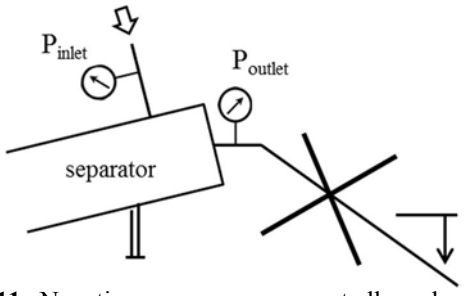


Fig. 11 Negative pressure source not allowed. (Shown: discharge piping downslope).

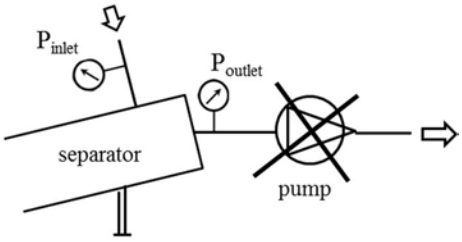


Fig. 12 Negative pressure source not allowed. (Shown: downstream pump).

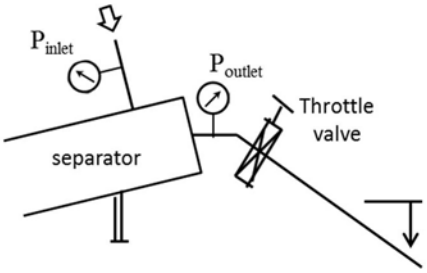


Fig. 13 Negative pressure source with throttle valve (Shown with vacuum breaker).

11.3 Connecting spool

JPX High Performance Liquid-Solid Separators are equipped with a removable/accessible upper chamber. To facilitate the removal of the upper chamber (2) for maintenance purposes, it is recommended a connecting spool (1), sold separately, be installed in the discharge piping immediately downstream of the separator. See figures 14 & 15.

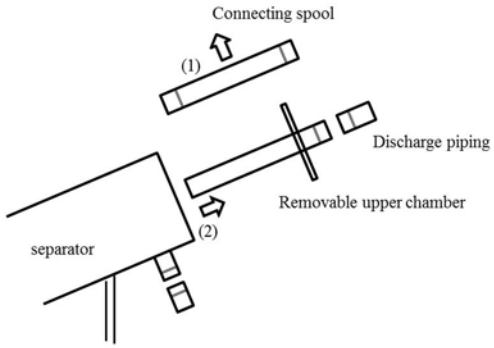
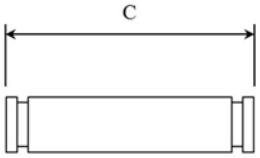


Fig. 14 JPX models. Removable/accessible upper chamber.



Model	Inlet/ Outlet in	Purge Outlet NPT (Male)	Connecting Spool Pipe Size in	Length C in	Length C mm
JPX-0004	1/2 NPT	1	1/2 NPT	6	152
JPX-0010	3/4 NPT	1	3/4 NPT	7	178
JPX-0016	1	1	1	7	178
JPX-0028	1-1/4	1-1/2	1-1/4	7	178
JPX-0038	1-1/2	1-1/2	1-1/2	8	203
JPX-0060	2	1-1/2	2	11	279
JPX-0085	2-1/2	1-1/2	2-1/2	15	381
JPX-0130	3	1-1/2	3	16	406
JPX-0200-V/L	4	1-1/2	4	21	533
JPX-0285-V/L	4	1-1/2	4	21	533
JPX-0450-V/L	6	1-1/2	6	24	610
JPX-0650-V/L	6	1-1/2	6	24	610
JPX-1160-V/L	8	1-1/2	8	30	762
JPX-1850-V/L	10	2	10	33	838
JPX-2650-V/L	12	2	12	38	965
JPX-4200-V/L	16	3	16	51	1295
JPX-6700-V/L	20	3	20	60	1524

Fig. 15 Connecting spool dimensions. JPX models.

12. Operation

Important Inlet-side isolation valve MUST be fully open when operating.

Important Each separator is designed to be used within a specific flow range for maximum efficiency and solids removal performance. Deviation

from this will adversely affect separator performance.

Important — The separator inlet pressure (P_{inlet}) must be greater than or equal to the pressure requirements needed downstream, plus 20 psi (1.4 bar). AND, the downstream load MUST be a minimum of 5 psi (0.3 bar). (See *Flow vs. Pressure Loss* chart provided in this manual).

- $P_{inlet} \geq P_{downstream\ load} + 20$ psi
- $P_{downstream\ load} \geq 5$ psi

The separator should be started against a partially closed discharge valve, providing sufficient back pressure to fill the separator completely with liquid and to facilitate the removal of air in the system.

Note — The separator's outlet-side pressure gauge connection may be used as an evacuation point for air removal. See figure 16. Prior to starting,

a. Open the petcock beneath the outlet-side pressure gauge.
b. Remove the pressure gauge.
c. Start the separator as above.
d. Air will liberate from the orifice.
e. Once the air is eliminated, and a steady stream of liquid is observed, close the petcock.
f. Reinstall the pressure gauge.
g. Open the petcock. Ensure the pressure gauge is functioning properly.

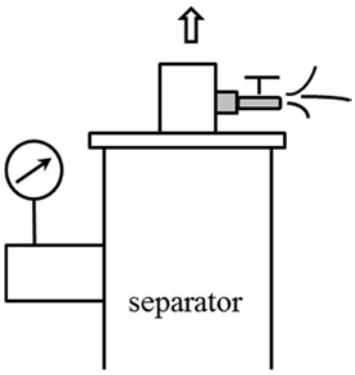


Fig. 16 Air evacuation. Outlet pressure gauge connection.

Once the air is eliminated, allowing sufficient time for the system to stabilize, throttle the discharge valve to achieve the desired pressure loss across the separator.

Note — The approximate flow rate through the separator may be obtained. (Reference the *Flow vs Pressure Loss* chart provided in this manual):

1. Measure the pressure differential/pressure loss across the separator ($\Delta P = P_{inlet} - P_{outlet}$).
2. Identify your particular separator model in the chart.
3. For a given pressure differential/loss, read across the chart to your separator model, then down to obtain the flow rate. See figure 17.

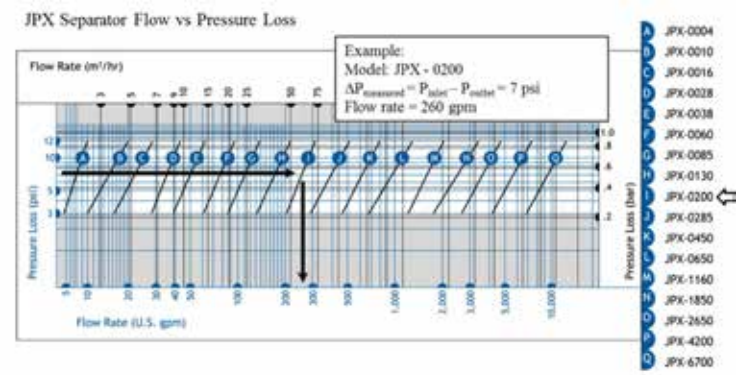


Fig. 17 Flow rate vs. Pressure Loss relationship.

13. Multiple separators

If multiple separators are connected to a common discharge manifold, and each are plumbed from independent pumps, balancing valves MUST be fitted on the discharge of each separator.

The balancing valves must be set to achieve a pressure loss across each separator as though each separator were operating independently. Ensure a pressure loss across each separator commensurate with the individual separator's performance range and corresponding with the flow rate of the individually connected pump. See figure 18.

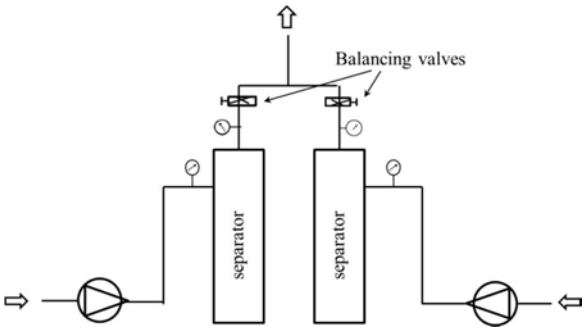


Fig. 18 Separators connected to common discharge manifold with independent pumps. Balancing valves required.

13.1 Separators in series

Separators arranged in a series configuration (in-line) are used for increased solids removal performance. The flow rate remains the same.
For a two separator system, the pressure loss across the system, (i.e.: both separators combined), is equal to the pressure loss across the first separator, plus the pressure loss across the second separator. ($\Delta P_{system} = \Delta P_{separator1} + \Delta P_{separator2}$). See figure 19.

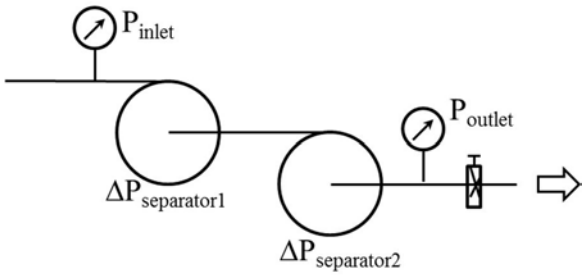


Fig. 19 Separators in series.
$\Delta P_{system} = \Delta P_{separator1} + \Delta P_{separator2} = P_{inlet} - P_{outlet}$.

13.2 Separators in parallel

Separators arranged in a parallel configuration (common manifold) are used to process greater flow rates. See figure 20.

Important — For similar model separators, the pressure loss MUST be balanced across each separator. ($\Delta P_{separator1} = \Delta P_{separator2}$).

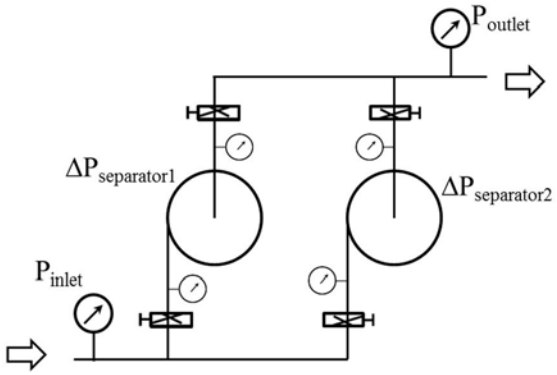


Fig. 20 Separators in parallel.
Balance pressure loss. For similar model separators: $\Delta P_{separator1} = \Delta P_{separator2}$.
Note: $\Delta P_{system} = P_{inlet} - P_{outlet}$.

14. Secondary filtration systems

The use of secondary filtration systems (finer/polishing) downstream of the separator is common practice.

Important — Care must be taken to ensure any equipment downstream of the separator does not impede the minimum required flow rate through the separator, adversely affecting separator performance.

15. Purging the separator

LAKOS separators must be purged regularly of separated solids. During normal operation, solids are separated from the liquid and accumulated in the collection chamber.

Important — To prevent over-fill, solids must be periodically evacuated. Failure to do so will adversely affect performance and cause significant damage to the separator.

The frequency and duration of the purge will depend on the particular application, type of solids separated and the rate of accumulation. For additional information regarding purging guidelines and recommendations, see LAKOS *Purging & Solids Handling* publication, literature number LS-608, at www.lakos.com.

To determine the necessary purging frequency, purge often at first being mindful to the actual volume of separated solids. Purge frequency should not exceed the time it takes to fill the collection chamber with solids. Solids should not be allowed to accumulate in the collection chamber for long periods of time. As a minimum, purging daily is recommended when the separator is in operation. Increase purging frequency if the solids tend to compact tightly/easily.

Purge duration should be long enough to evacuate all solids from the separator's collection chamber and deliver them through the purge piping to the desired disposal. It is recommended to program automatic valves, particularly motorized ball valves, to open/purge for 20-25 seconds, minimum, to allow sufficient time to flush the collection chamber.

The solids collection capacity (volume) is listed for each separator model in the *JPX Separator Model and Flow* chart and *JPL Separator Model and Flow* chart, respectively, provided in this manual.

The solids must combine with a sufficient amount of liquid (depending on compaction, accumulation rate and liquid type), in a slurry, to facilitate effective purging.

Note — Purging must be performed while the LAKOS separator is in operation. Pressure within the separator will flush the solids from the collection chamber out through the purge outlet connection.

Note — Pressure readings from gauges located on the separator's inlet and outlet connections are not indicative of solids accumulation and cannot be used to determine purge cycles.

Note — Continuous purging should not be allowed to exceed 10% of the separator's inlet flow rate. Separator performance will be adversely affected.

Important — Separators equipped with the optional Annular Transfer Ring (ATR) must be purged more frequently and thoroughly to reduce the risk of bridging and solids compaction in the separator's collection chamber. See section 3.2.

It is recommended a manual valve be fitted to the purge outlet connection to facilitate servicing any peripheral purge handling equipment. See figure 21.

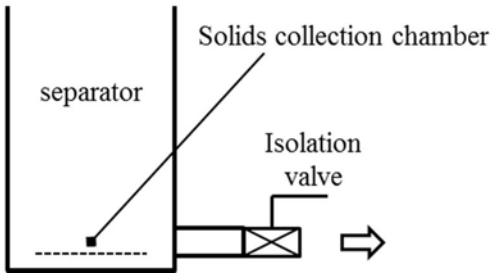


Fig. 21 Purge outlet connection with isolation valve.

Important — Do not purge uphill. To ensure against clogged piping or hindered solids removal.

Important — Separators connected together (series or parallel) MUST be purged separately. Do not join purge lines together. See figure 22.

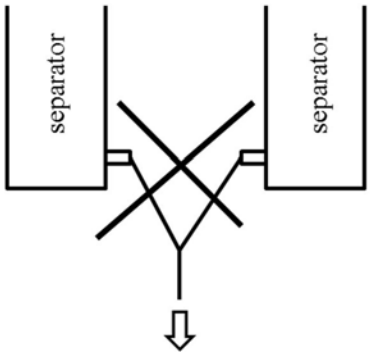


Fig. 22 Purge lines. Do not join together.

Note

1. All purge hardware and associated equipment should be installed prior to any elbows or turns in the purge piping.
2. Avoid multiple elbows and low points where solids can accumulate and cause blockages.
3. Do not reduce pipe size from the purge outlet connection size. Restrictions may cause blockages and prevent proper purging of separated solids.
4. Oversized purge line piping may allow solids to settle in the piping.
5. Purge piping should be as short as possible, not exceeding 10 feet (3 m).
6. Solids may be purged to a drain or secondary filter vessel.
7. Purge basins should be adequately sized to accommodate the volume (solids & liquids).
   a. Estimated purge volume per cycle (Note - depends on separator size, system pressure, flow rate, etc.):

- For 1" purge outlet:
  - 4-16 gallons (15-61 liters)
- For 1-1/2" purge outlet:
  - 10-45 gallons (38-171 liters)
- For 2" purge outlet:
  - 20-75 gallons (76-285 liters)
- For 3" purge outlet:
  - 45-130 gallons (171-494 liters)

15.1 Purging methods:

Manual — A manually operated, full port, straight through valve may be installed on the purge outlet connection to intermittently purge separated solids. See figure 23.

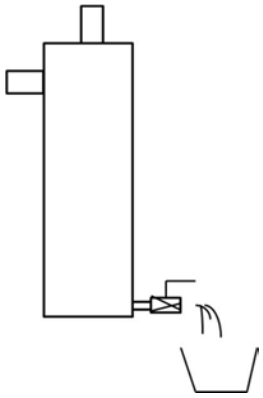


Fig. 23 Manual purge.

Semi-automatic — A LAKOS Purge Bag Vessel (PBV) may be used to capture separated solids and return clean liquid to the system. The PBV provides for continuous purging of the solids. Solids are deposited into a separate collection bag, with no interruption of system flow or filtration. When full, the bag is emptied manually. See figure 24. (For additional information about the LAKOS PBV system, reference LAKOS literature LS-687).

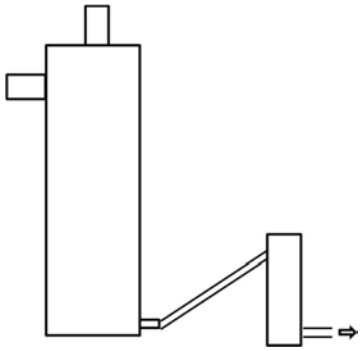


Fig. 24 Semi-automatic purge to Purge Bag Vessel.

Automatic — A LAKOS AutoPurge system may be used for automatic purging of solids. LAKOS AutoPurge systems are available as ball valves or pinch valves; and electrically actuated or pneumatically actuated. The valve assembly with timer control allows for purge frequency and duration adjustment to suit specific requirements.

Contact a LAKOS representative for further information and recommendations about specific applications.

16. Maintenance

At regular intervals, depending on conditions and time of operation, the following checks should be made to ensure optimum separator performance.

External visual inspections of the separator should be performed monthly.

- ✓ Check for leaks
- ✓ Inspect for blockages
- ✓ Ensure proper operation

⚠ Warning

Prior to performing any maintenance, lock the main disconnect switch with a padlock to ensure the power supply cannot be accidentally switched.

Check flange and coupling gaskets for leaks and replace as necessary. Gaskets should be replaced whenever the separator is disassembled (JPX models).

Check purge system for proper operation.

a. Check programming (if configured) to be sure it is adequately removing separated solids. Adjust programming as necessary.
b. Inspect for leaks. Valve seats and diaphragms should be changed as necessary.
c. Inspect valves for blockages from separated solids. Clean or replace as necessary.

Remove and clean all strainers or filters in the system.

Check the operation of all controls, instrumentation and monitoring equipment.

Pressure gauges installed on the inlet and outlet connections of the separator are provided to monitor separator performance. Damaged or broken pressure gauges will indicate false readings. Check pressure gauges to ensure proper function. Replace gauges as necessary.

Note

1. When the separator is on-line and in stand-by mode (not operating), the indicated pressure readings should be the same ($P_{inlet} = P_{outlet}$). Ensure petcock valves are open.
2. When the separator is off-line and not pressurized, the indicated pressure readings should be 0 psi. (This can also be simulated by closing the petcock (provided) at each gauge and observing the gauge pressure reading).
3. During normal operation of the separator, the pressure differential/pressure loss ($\Delta P_{separator} = P_{inlet} - P_{outlet}$) should be between 3 - 12 psi (0.2 – 0.8 bar) and remain steady, indicating proper operation of the separator. Fluctuations in pressure gauge readings may indicate:

   A. pressure gauge blockage. Close the petcock at the gauge. Remove gauge and inspect for blockage. Clean or replace gauge(s) as necessary.
   B. a change in pump performance. Inspect pump for proper operation. Inspect downstream piping and equipment for blockages or other conditions which could impede system flow.
   C. an obstruction in the separator. Inspect internal slots for wear and foreign debris, (e.g.: large rocks and organic materials). Remove and clean as necessary. (JPX models only).
      - Disconnect discharge system piping.
      - Remove grooved coupling at top of separator.
      - Remove upper chamber from separator barrel to access the internal slots.

16.1 Grooved coupling

⚠ Warning

Always depressurize and drain the piping system before attempting disassembly, adjustment or removal of any piping component.

Keep hands away from coupling openings during tightening.

Failure to follow these instructions could cause joint failure, serious personal injury and property damage.

Warning

Always use factory supplied bolts and nuts for assembly of grooved couplings. For proper assembly, the nuts must be tightened alternately and evenly until metal-to-metal contact occurs at the bolt pads to prevent gasket pinching. Tighten nuts by another one quarter to one half turn to make sure the bolts are snug and secure. See figure 25.

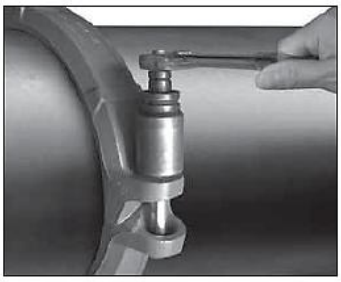


Fig. 25 Grooved coupling.

16.2 Hand-hole clean-out

The hand-hole should be accessed periodically to inspect the collection chamber for debris. Prior to opening, fully purge the separator. Open the hand-hole clean-out and inspect for solids accumulation. (Loosen the nut on the hand-hole assembly, then turn and push the hand-hole cover inward using the handle to access the collection chamber). See figure 26.

Carefully remove any debris by hand. Replace gasket and refit cover. (Pull the hand-hole cover toward the outer barrel of the separator using the handle. Align the gasket and cover evenly over the hand-hole). Tighten nut snugly. DO NOT OVER TIGHTEN.

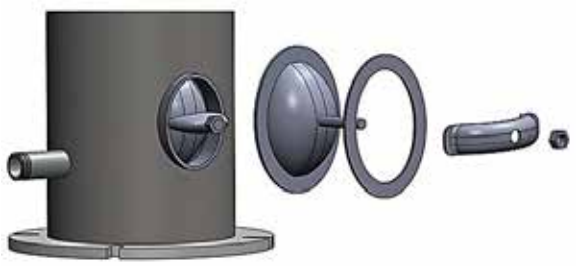


Fig. 26 Hand-hole assembly.

17. Spare Parts

It is recommended to have spare parts on hand for future maintenance. Spare parts are available separately. For these or other spares, contact a LAKOS representative.

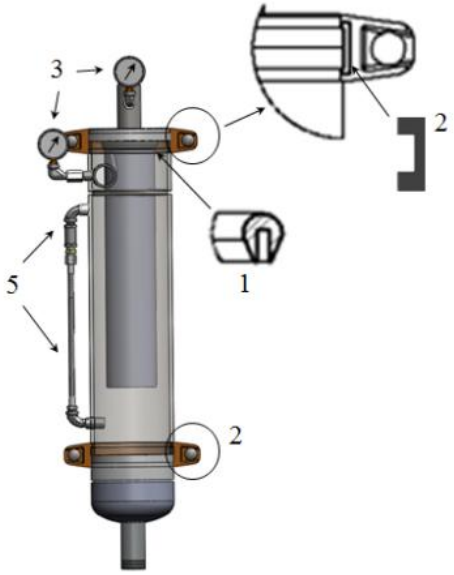


Fig. 27 Spare parts diagram. (models: JPX 0004 – 0130)

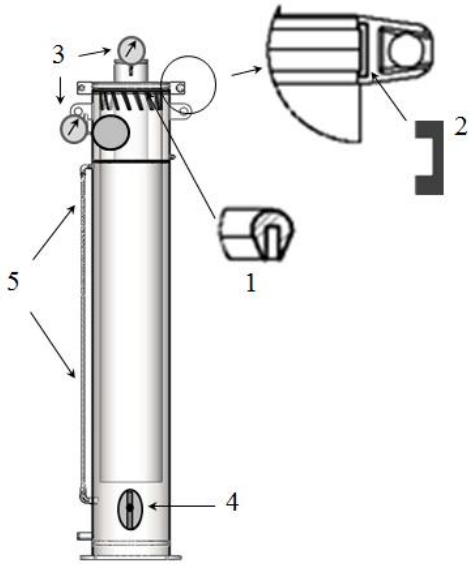


Fig. 28 Spare parts diagram. (models: JPX 0200 – 1160)

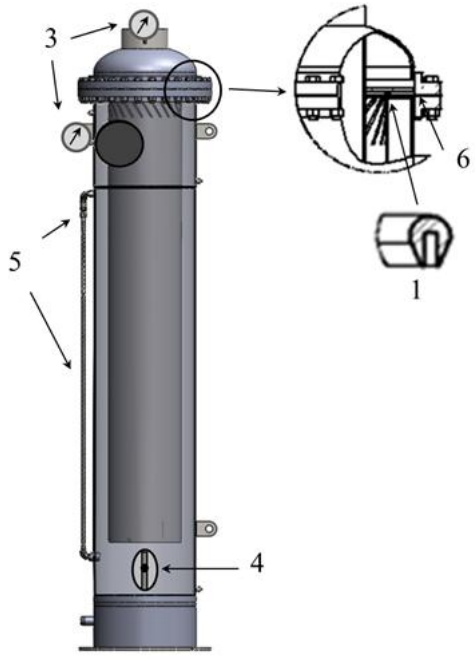


Fig. 29 Spare parts diagram. (models: JPX 1850 – 6700)

17. Spare Parts, continued.

Models: JPX 0004 – 0130. See figure 27.

			Model: JPX -							
Pos. No.	Part Number	Description	0004	0010	0016	0028	0038	0060	0085	0130
1	120761-0004	Gasket, Barrel/EPDM (2-1/8"OD x 15/16"ID x 1/4")	X							
1	120761-0010	Gasket, Barrel/EPDM (2-1/2"OD x 1-1/8"ID x 1/4")		X						
1	120761-0016	Gasket, Barrel/EPDM (3"OD x 1-3/8"ID x 1/4")			X					
1	120761-0028	Gasket, Barrel/EPDM (3-5/8"OD x 1-3/4"ID x 1/4")				X				
1	118504-0038	Gasket, Barrel/EPDM (15/16"W x 11-7/8"L x 1/4")					X			
1	118504-0060	Gasket, Barrel/EPDM (15/16"W x 16-11/16"L x 1/4")						X		
1	118504-0085	Gasket, Barrel/EPDM (15/16"W x 19-15/16"L x 1/4")							X	
1	118504-0130	Gasket, Barrel/EPDM (15/16"W x 20"L x 1/4")								X
2	106140	Gasket, Coupling/EPDM 3 TYPE E Groove	X							
2	106141	Gasket, Coupling/EPDM 4 TYPE E Groove		X	X					
2	116443	Gasket, Coupling/EPDM 5 TYPE E Groove				X				
2	106142	Gasket, Coupling/EPDM 6 TYPE E Groove					X			
2	106147	Gasket, Coupling/EPDM 8 TYPE E Groove						X	X	X
5	116811	Vortube kit: 1/2" JPX	X							
5	116227	Vortube kit: 3/4" JPX		X						
5	115840	Vortube kit: 1" JPX/HTX			X					
5	115841	Vortube kit: 1-1/4" JPX/HTX				X				
5	115842	Vortube kit: 1-1/2" JPX/HTX					X			
5	115843	Vortube kit: 2" JPX/HTX						X		
5	115845	Vortube kit: 2-1/2" & 3" JPX/HTX							X	X
3	118512 *	Pressure Gauge kit: 0-160 psi (2 Sets)	X	X	X	X	X	X	X	X

* Note: JPL Spare Part

17. Spare parts, continued

Models: JPX 0200 - 6700. See figures 28 and 29.

			Model: JPX -								
Pos. No.	Part Number	Description	0200	0285	0450	0650	1160	1850	2650	4200	6700
1	118504-0200	Gasket, Barrel/EPDM (15/16"W x 26-5/16"L x 1/4")	X								
1	118504-0285	Gasket, Barrel/EPDM (15/16"W x 27-1/16"L x 1/4")		X							
1	118504-0450	Gasket, Barrel/EPDM (15/16"W x 33"L x 1/4")			X						
1	118504-0650	Gasket, Barrel/EPDM (15/16"W x 39-1/4"L x 1/4")				X					
1	118504-1160	Gasket, Barrel/EPDM (15/16"W x 49-1/2"L x 1/4")					X				
1	118504-1850	Gasket, Barrel/EPDM (15/16"W x 55-3/4"L x 1/4")						X			
1	118504-2650	Gasket, Barrel/EPDM (15/16"W x 62-1/16"L x 1/4")							X		
1	124916	Gasket, Barrel/EPDM (16" JPX/JPL)								X	
1	124914	Gasket, Barrel/EPDM (20" JPX/JPL)									X
2	106149	Gasket, Coupling/EPDM 10 TYPE E Groove	X								
2	106150	Gasket, Coupling/EPDM 12 TYPE E Groove		X							
2	116634	Gasket, Coupling/EPDM 14 TYPE E Groove			X						
2	117152	Gasket, Coupling/EPDM 16 TYPE E Groove				X					
2	119488	Gasket, Coupling/EPDM 20 TYPE E Groove					X				
6	106188	Gasket, Flange/EPDM 24" - 150 Lb. FF						X			
6	120353	Gasket, Flange/EPDM 28" - 150 Lb. FF							X		
6	106194	Gasket, Flange/EPDM 36" - 150 Lb. FF								X	
6	106197	Gasket, Flange/EPDM 42" - 150 Lb. FF									X
4	119340 *	Gasket, Hand-Hole/EPDM (3" x 4")	X								
4	127244 *	Gasket, Hand-Hole/EPDM (4" x 6")		X	X	X	X	X	X		
4	128551 *	Gasket, Hand-Hole/EPDM (6" x 8")								X	X
5	119348	Vortube kit: 3-1/2" JPX/HTX-L/V	X								
5	115810	Vortube kit: 4" JPX/HTX		X							
5	115839	Vortube kit: 5" JPX; 5" & 6" HTX			X						
5	116871	Vortube kit: 6" JPX				X					
5	117016	Vortube kit: 8" JPX					X				
5	115848	Vortube kit: 10" JPX; 12" HTX						X			
5	117312	Vortube kit: 12" JPX							X		
5	117315	Vortube kit: 16" JPX								X	
5	115850	Vortube kit: 20" JPX/HTX									X
3	118512 *	Pressure Gauge kit: 0-160 psi (2 Sets)	X	X	X	X	X	X	X	X	X

* Note: JPL Spare Part

 Warning

Before starting fault finding, switch off the power supply. Make sure that it cannot be accidentally switched on.

18. Troubleshooting

Fault	Possible cause	Remedy
Excessive vibration.	Air in the system.	Install air vents. Section 11.
	Flow rate exceeds separator operating range.	Throttle discharge within acceptable operating flow range.
	Improper piping arrangement.	Follow installation instructions. Section 11.2.
	Other source.	Install vibration dampers. (Mild vibration is normal).
Pressure gauges read incorrectly; e.g.: stuck, sprung, not moving, reading zero…	Petcock valve(s) closed.	Open petcock valve(s).
	Debris in gauge piping.	Check for blockage in gauge piping.
	Pressure gauge(s) faulty.	Check and replace pressure gauge(s).
Solids not separating.	Isolation valves closed.	Fully open suction-side isolation valve.
	Insufficient flow rate.	Verify flow rate through separator. Check downstream piping for restrictions.
	Blocked strainers or filters upstream of separator.	Clean strainers and filters.
	Insufficient separator inlet pressure.	Ensure minimum inlet pressure requirement: 20 psi (1.4 bar) + downstream pressure load.
	Incorrect pressure loss across separator.	Adjust pressure loss across separator between 3 - 12 psi (0.2 - 0.8 bar).
	Outlet discharging to atmosphere.	Throttle discharge. Ensure 5 psi (min.) back pressure at separator outlet.
	Collection chamber full.	Purge collection chamber. Clean via hand-hole.
	Change in solids concentration and size.	Check specific gravity and size of solids.
	Upper chamber/Swirlex Slots™ blocked with foreign materials.	Access removable upper chamber and clean out foreign materials and debris. (JPX models only).

18. Troubleshooting, continued

Fault	Possible cause	Remedy
Solids are not purging. Purge system not collecting solids.	Low solids content in liquid.	It may take a period of time before solids reach the purge outlet. (Vertical separators: the purge outlet connection is not flush with the bottom of the collection chamber).
	Separator is not in operation.	Operate separator during during purge cycle.
	Purge system piping blocked.	Clear purge piping blockage. Ensure piping arrangement is correct.
	No flow. The purge configuration is incorrect.	Check purge frequency & duration. Check purge piping layout.
	Purge valve not opening.	Confirm valve actuation and timer settings.
	Collection chamber impacted.	Clean out solids by hand via hand-hole.
Separator corrosion occurring.	Chemical incompatibility. Liquid/solids are chemically attacking separator materials.	Check materials of construction.
	Incompatible materials.	Check system piping materials used. Install appropriate dialectric materials. Ensure separator is properly grounded.
Separator erosion occurring.	Percentage of solids exceeds 1% by volume limit.	Check condition & concentration of liquid/solids.
	Separator purge is blocked.	Check purge system. Access hand-hole and clean out solids by hand.
Pressure loss across separator is different than expected.	Pressure gauge(s) faulty.	Check and replace pressure gauge(s).
	Incorrect flow rate.	Verify flow rate through separator. Check downstream piping for restrictions.
	Pump on downstream side of separator, (ΔP too great).	Move pump to inlet side of separator.
	Upper chamber/Swirlex Slots™ blocked with foreign materials.	Access removable upper chamber and clean out foreign materials and debris. (JPX models only).
	Separator incorrectly connected to system piping, (ΔP below minimum).	Confirm proper flow direction through separator. Check piping.

Notes

Separator Model: _____

Sales Order Number: _____

Purchase Date: _____

Distributor: _____

_____

_____

System Flow Rate: _____

Separator Pressure Loss: _____

_____

_____

_____

_____

_____

_____

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