SuperFlow® First Stage Regulator (P/N 305-161) Maintenance Manual

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1.1 General Information

1.1.1 Introduction

The Kirby Morgan® first stage regulator is known as the high vent first stage. This regulator is a balanced piston design and was originally designed as a saturation bail out regulator. This is due to its capability to deliver mixed gas at highflow with minimal first stage pressure drop, even to depths in excess of 850 FSW.

This maintenance manual is primarily intended to provide authorized Repair Technicians and properly trained professional divers with the technical information and guidance needed to perform normal service adjustments and corrective maintenance. It is strongly recommended that overhauls and repairs be completed by KMDSI authorized Technicians. Owners of the SuperFlow® who elect to work on their own regulators should have the proper tools, training and experience in regulator function and repair. All repair parts should be genuine Kirby Morgan parts and should only be obtained from authorized Kirby Morgan® dealers. Technical assistance can be obtained by contacting KMDSI (805) 928-7772 or by Email at kmdsi@kirbymorgan.com or Dive Lab Inc. (850) 235-2715 or at divelab@divelab.com

1.1.2 Safety Precautions

To ensure the best possible regulator performance and avoid equipment failure, use only KMDSI original factory replacement parts.

To avoid damage to regulator components, only the correct size and type of tools should be used. The use of adjustable wrenches should be avoided whenever possible to avoid damage to soft brass parts.

Should you encounter technical difficulties in servicing a Kirby Morgan® regulator, please contact Kirby Morgan® or Dive Lab directly for assistance. When you call, you should have the regulator and this manual on hand for reference.

1.1.3 Specifications

- First Stage Type: Balance Piston
- Maximum Supply Pressure: 3500 PSIG
- Intermediate Pressure: 135–145
- Intermediate adjustment: Shim
- Low Pressure Ports: 5

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- High Pressure Ports: 2
- Body Material: Chrome Plated Brass

1.2 Preventative Maintenance

1.2.1 Routine Maintenance

Routine maintenance is the best way to ensure long regulator life and optimum performance.

1) Whenever the regulator is removed from the scuba cylinder, the dust cap should be dried and installed over the first stage inlet port . It is very important to dry the dust cap to prevent water from the cap from entering the first stage. Screw the regulator set screw down until snug and the rubber dust cap is slightly compressed.

2) At a minimum, the regulator should be thoroughly rinsed with fresh clean water after every dive. Mild hand washing type liquid dish soap can be used to remove grime.

3) If possible, the entire regulator should be soaked in fresh warm water, between 80–120 ºF, for 15 minutes or longer. Soaking in warm water will remove salt and mineral deposits more effectively than a fresh water rinse alone.

4) Allow the regulator to dry completely before storage. Do not leave the regulator sitting in direct sunlight. Clean, oil-free, low-pressure (< 30 psig) (1.8 Bar) air can be directed into the first stage sensing holes to help displace water. This is helpful if the regulator is to be packed for travel.

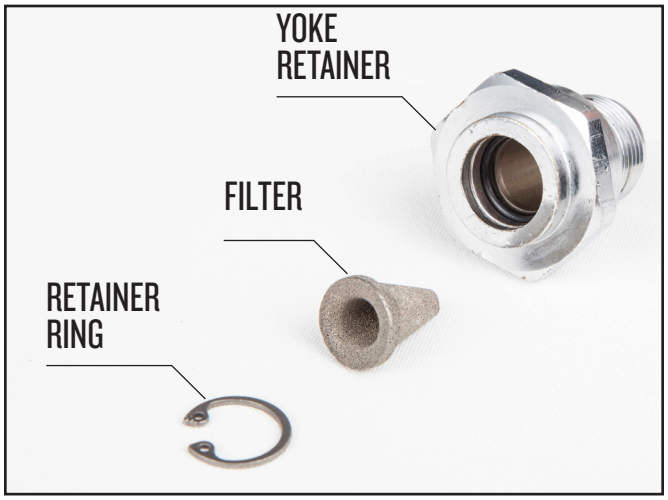
5) Ensure the regulator is completely dry before storing. Store only in a clean, cool dry place.

1.2.2 Scheduled Maintenance

Do not assume that a regulator is in good working order because of infrequent use. Prolonged or improper storage can still result in O-ring deterioration or internal corrosion that could result in poor performance.

1) The minimum maintenance suggested for all regulators is an annual inspection and service. However, regulators that are used frequently or under severe or harsh environmental conditions should be serviced more often. For example, a regulator used as a rental or for training purposes may require service every two to three months or more. Whenever a regulator has been inactive for longer than three months, it should be carefully inspected and surface checked prior to use.

2) The first stage filter, located in the pressure yoke assembly, should be visually inspected on a regular basis. If a visual inspection reveals discoloration or obvious signs of dirt or corrosion, the regulator should be thoroughly serviced. In addition, the scuba cylinders used must be internally inspected and cleaned, if necessary. filters that do not show signs of dirt corrosion or discoloration can be cleaned in an ultrasonic sink and dried with clean, oil-free, compressed air. In general, it is best to replace the filter anytime the first stage is disassembled for cleaning or overhaul.



1.3 First Stage Disassembly

1.3.1 General Information

This section provides information on the disassembly procedures for the Kirby Morgan SuperFlow® Regulator. The sequence should be followed exactly as presented and should be conducted in an area specifically designated for this task. The work area should have adequate lighting, be equipped with the proper tools, and have clean, breathing grade compressed air.

The parts from each regulator should be stored separately from the parts of other regulators, even if they are the same model regulator.

All of the replacement soft goods and parts should be available prior to the disassembly of the regulator. All of the correct tools should also be available. Use of improper tools may lead to damage of Regulator parts.

1.3.2 Tools Required

The following tools are required to properly service the Kirby Morgan SuperFlow® first stage regulator:

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- Spanner Wrench
- 1″ Box-End Wrench (Torque Wrench)
- Small Plastic or Ballpeen Hammer
- ⅜″ Diameter Dowel Rod (with ¼″ Diameter Hole Drilled in One End, ⅛″ Deep)
- 5⁄32″ Hex Key
- ¼″ Nut Driver or Socket Wrench and/ or KMDSI socket wrench P/N 525-612
- 5⁄16″ End Wrench
- 11⁄16″ Box-End Wrench
- Brass or Plastic O-ring Tool
- Circlip Pliers
- Breathing Quality Compressed Air Supply (Minimum Supply Pressure 1000 psi)
- Calibrated test Gauge, 0–200 psig (14 bar) with Bleed Valve.
- 5⁄16″ Wooden Dowel 4–6″ Long

1.3.3 Hose Removal

1) Separate the hoses from the first stage.

2) Remove all remaining port plugs from the first stage body.

3) Using a plastic or brass O-ring pick, remove the O-rings at each end of the second stage hoses.

NOTE

NOTE ON HOSES: All hose fittings should be carefully cleaned with mild dishwashing soap and fresh water, then carefully inspected for thread damage, signs of stress cracking and/ or deformity around the O-ring grooves and lands. The hose material should be carefully inspected for signs of bulging, fitting slippage and cracking. Replace the hose if any damage is found. All hose O-rings should be replaced at least annually. This includes accessory hoses (e.g.; power inflator, etc.).

4) Perform step 3) and remove the remaining high and low pressure plugs. Discard all of the O-rings when performing an overhaul..

1.3.4 First Stage Disassembly Procedure

1) Place the first stage body in a padded vise. Tighten the vise just enough to hold the regulator body.

2) Use the spanner wrench and loosen the end cap.

3) Remove the end cap from the regulator body. The piston/spring assembly will come away with

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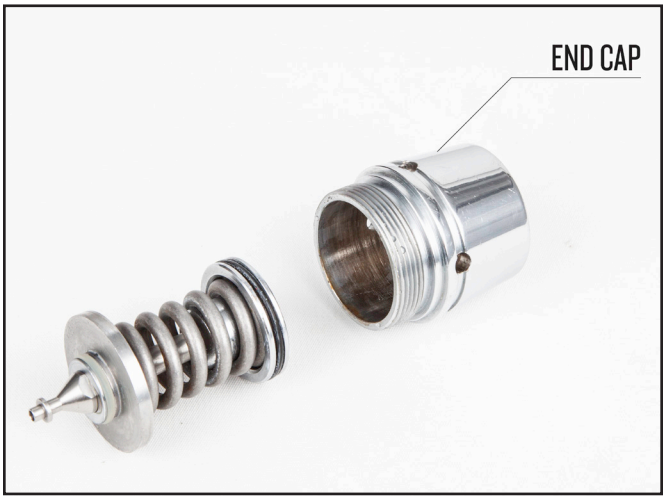
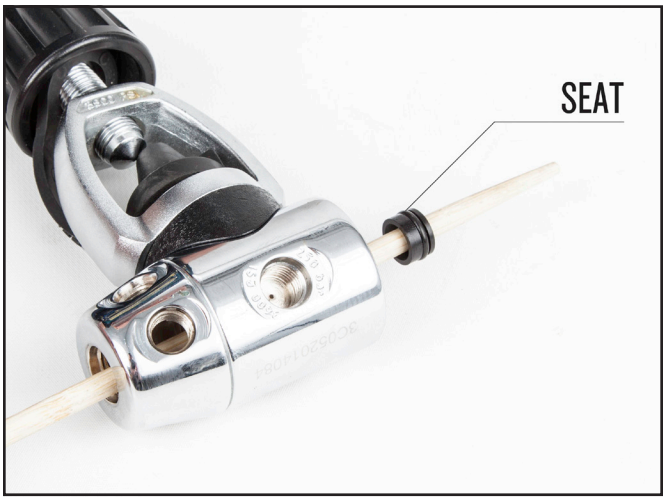
the end cap as you separate the cap from the regulator body. Set this aside.

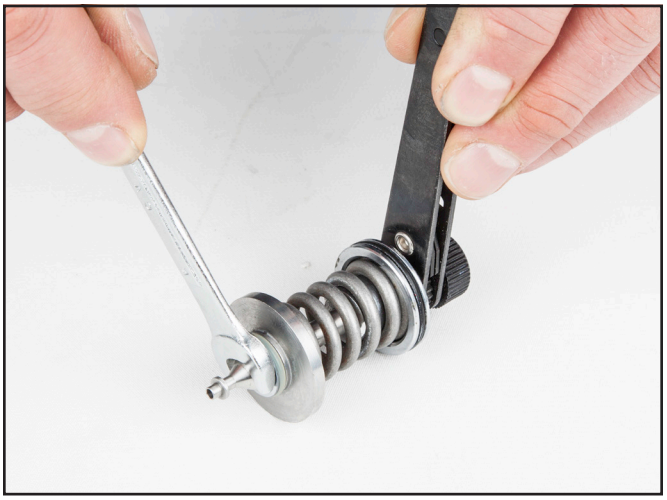


4) Insert a 5⁄16″ wooden dowel rod through the large low-pressure port opening in the end of the regulator body. Lightly tap the dowel rod with the hammer until the seat is dislodged from the regulator body.



5) Discard the seat and O-ring.

6) Carefully apply the 5⁄16″ end wrench to the wrench flats on the poppet to hold it securely.



7) Use the ¼″ nut driver to loosen and remove the nut from the opposite end of the poppet.

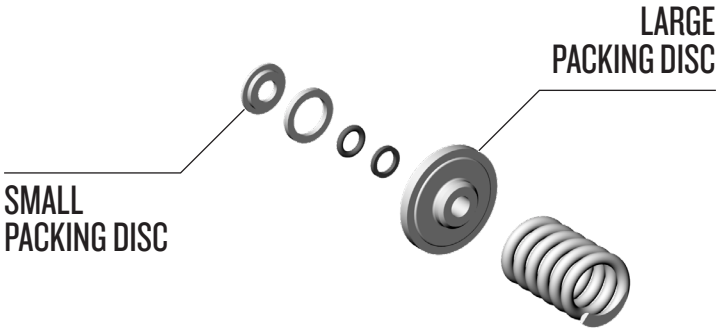
8) Remove the washer and the O-ring

9) Remove the piston head, both O-rings and any shims that are present. Some regulators may not require any shims.

NOTE

It will take slight force to remove the piston from the poppet. Generally the O-ring found under the washer will remain seated and require using a tool for removal.

10) Separate the spring, large packing disk, two O-rings, washer, and small packing disk from the poppet. All plastic parts and O-rings should be replaced prior to reassembly when performing an overhaul.



11) Inspect the poppet head carefully for nicks and gouges around the cone seating area. Inspect the poppet shaft for scoring, scratches and/or corrosion worm tracking. If damage is found, the poppet should be cleaned with metal polish, then inspected. If polishing does not remove corrosion marks,

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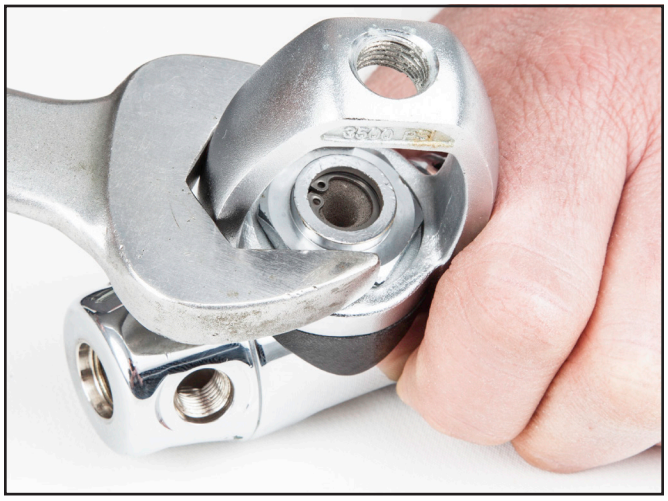
the poppet shaft must be replaced. Older poppets have a dull finish on the cone shaped sealing surface. Newer poppets have a bright, shiny finish.

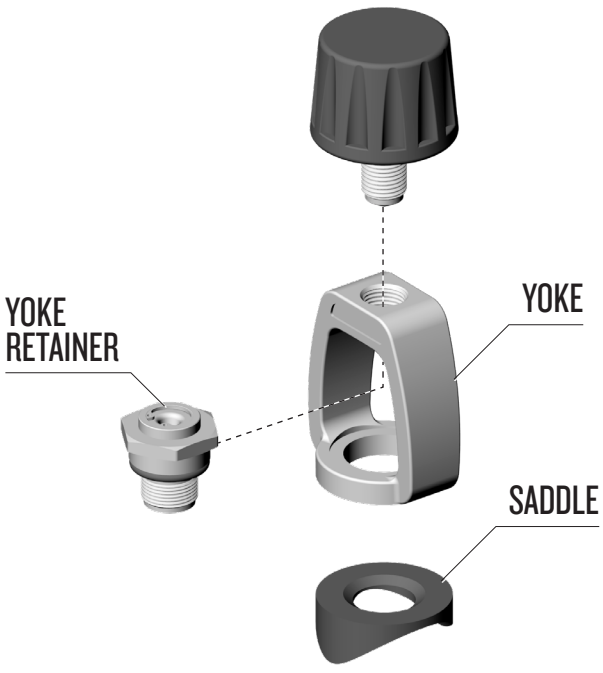
12) Apply the 1″ open-end wrench to the wench flats in the yoke retainer. Loosen the nut.



13) Unscrew the yoke assembly from the regulator body.

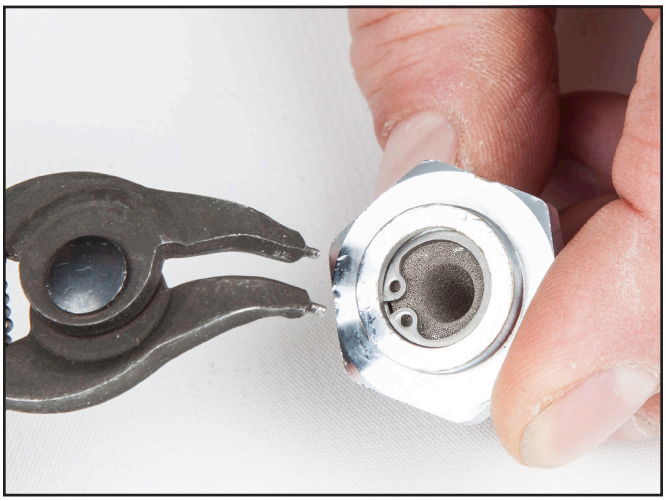
14) Remove the saddle from the regulator body.

15) Separate the yoke from the yoke retainer.



16) Remove two O-rings from the yoke retainer.

17) Remove the retainer ring using circlip pliers.



18) Remove and inspect the filter for oxidation and contamination. If the filter is corroded or shows visual signs of contamination it must be replaced. When in doubt, replace the filter.

1.3.5 Cleaning of First Stage Parts

1) All metal parts should be cleaned first with a solution of warm, soapy water. Use a mild liquid soap, such as Dawn® liquid dish soap or Simple Green® followed by a fresh water rinse.

2) An ultrasonic cleaning tank is the best method of cleaning metal regulator parts. These cleaning tanks are most effective when used in conjunction with a mild acidic cleaning agent. A 5% solution of white vinegar and fresh water works fine as a mild acidic cleaner.

3) A toothbrush may be used to help gently remove any encrustation or mineral deposits.

4) Rinse the parts thoroughly after washing.

5) If household vinegar is used as a cleaning agent, the dilution should be one-part vinegar to one-part

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fresh water. With this solution, a cleaning time of 10 to 15 minutes in an ultrasonic cleaner should be sufficient. If no ultrasonic cleaner is available, the parts may be submerged in a 5% solution of white vinegar and fresh water for up to two hours. A nylon toothbrush and/or tube brush can be used to help remove corrosion. After cleaning, rinse thoroughly with fresh water.

6) Parts should be dried using oil-free, compressed air no greater than 30 psig (2.07 Bar), or allowed to air dry.

1.3.6 Inspection of First Stage Parts

All soft good parts (i.e., O-rings, and seats) must be replaced during regulator service. All new parts should be carefully inspected prior to use to ensure there are no flaws.

All metal parts should be carefully inspected prior to re-use. Use a bright light and inspect with a magnifying glass for cracks, burrs, scoring, and corrosion. Plated surfaces must be inspected for blisters and peeling chrome. Parts showing evidence of wear that may affect performance, should be replaced.

Threaded parts must be inspected for thread deterioration, cross threading, and/or stripping. Replace any damaged parts.

Carefully inspect the poppet for nicks and scratches on both the conical seat end and the length of the shaft. Shallow scratches can be polished out using a mild abrasive metal polish like Brasso® brand. Deep scratches, worm track corrosion and/or pitting damage will make it necessary to replace the poppet.

Plastic parts must be closely inspected for distortion, cracking, deformities, and damage. Replace any parts that appear damaged.

1.4 Reassembly of the First Stage Regulator

1.4.1 General Information

When checking the intermediate pressure, it is imperative that the pressure gauge used is accurate. All test gauges should be calibrated, or at the very least, compared to a known standard.

1.4.2 Determining the Proper Number of Shims to be Installed in the First Stage

Intermediate pressure is adjusted by installing or removing shims, P/N 350-215. In many cases, no shims are necessary, but may become necessary as the main spring wears in. The maximum number of shims that should be used in the first stage is two.

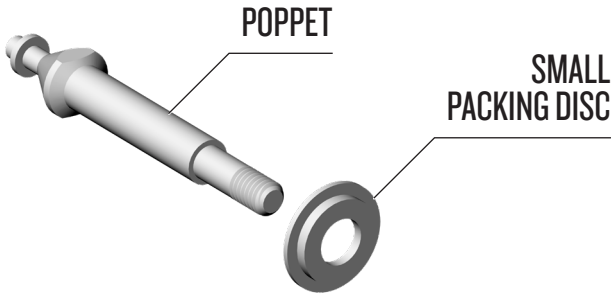
Each shim will increase the pressure in the first stage by 7–8 psi (0.5 Bar). The number of shims present in the regulator when it is disassembled is the number of shims that should be installed when the regulator is reassembled, provided the first stage is delivering between 135–145 psig (9.3–10 Bar). If the first stage pressure is below 135 psig (9.3–10 Bar), additional shims must be added for proper performance. If the pressure is above 145 psig (10 bar), shims should be removed until the pressure settles between 135–145 psig (9.3–10 Bar).

1.4.3 Procedure for Reassembly

1) Lubricate all O-rings with a light coating of Molykote® 111 silicone grease or equivalent. Christo-Lube® can also be used.

2) Install the large O-ring onto the Piston.

3) Lightly lubricate the poppet shaft and install the small packing disk on the poppet, flat side first. The extended lip that accepts the O-ring should be facing away from the cone shaped head of the poppet.



4) Install the urethane O-ring onto the small packing disk. This O-ring should sit on the lip of the small packing disk.

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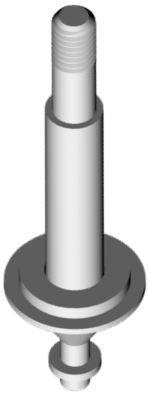
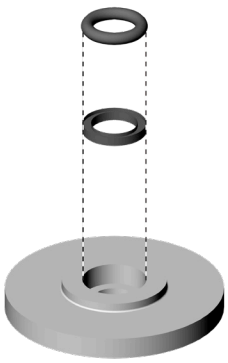
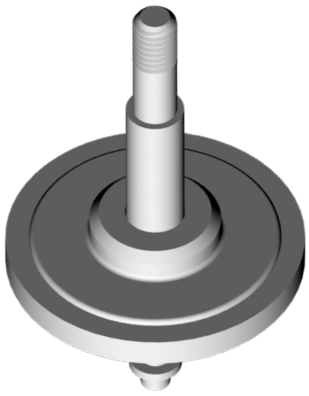


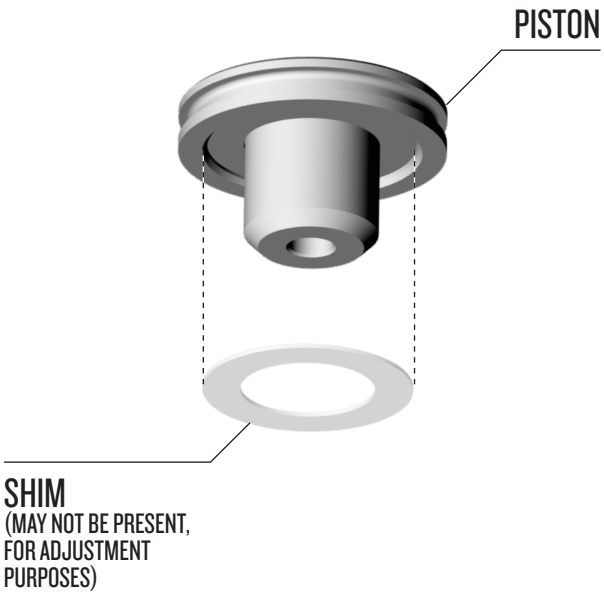
5) Insert the O-ring P/N 410-010 into the large packing disk. Note that one side of the back-up ring is concave. Place the flat side of the O-ring against the groove in the large packing disk. Insert the P/N 510-010 O-ring on top of the back-up ring and into remaining groove on the Packing Disk. Both O-rings will fit into the grove found on the Packing Disk.



6) Slide the large packing disk onto the poppet.



7) If shims were present in the regulator, install the shims in the recessed groove in the piston head.



8) Install the spring on the poppet so it rests against the large packing disk. There is no up or down to the spring.

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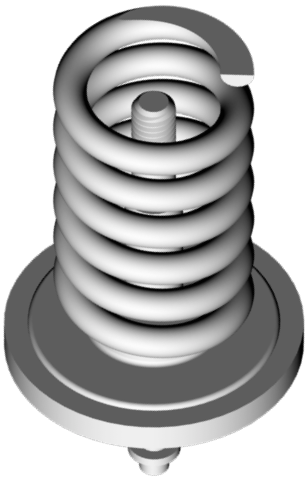
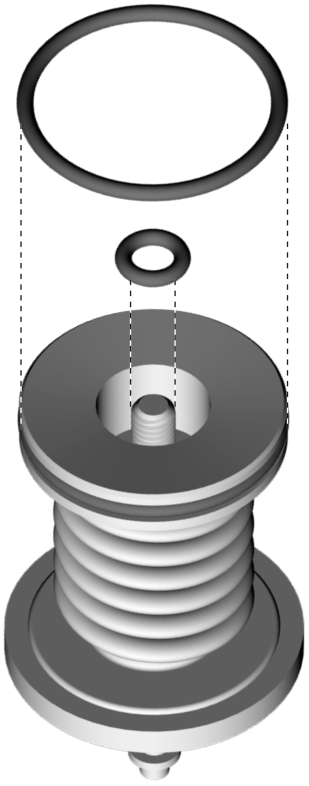


9) Install the piston on the poppet.

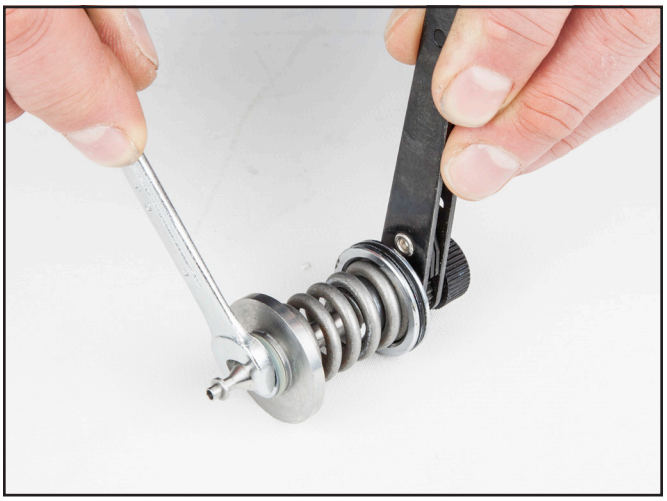
10) Insert the O-ring onto the poppet shaft threads and slide it down so it seats in the recess formed by the side of the piston. The O-ring will be tightly seated between the poppet shaft and the piston recess. Check to ensure the O-ring is not pinched.



11) Slide the washer onto the poppet shaft at the piston end. The sharp edge of the flat washer faces outwards, away from the piston head. If properly installed the flat washer should lay flat against the piston.

12) Screw the new lock nut onto the threaded end of the poppet, taking care not to dislodge the O-ring.

13) Place the 5⁄16″ end wrench to the flats on the cone shaped end of the poppet. Tighten the lock nut on the threaded end of the poppet with the nut driver. The nut should bottom out.



NOTE

When tightening, if the nut does not bottom out solid, the nut and washer should be removed and the O-ring should be checked to insure it is not being pinched between the poppet shaft and the piston.

14) When properly assembled, there should be enough play to allow the large packing disk and/or spring to slide approximately 1⁄16 of an inch on the poppet shaft. If there is no movement, the spring is too tight. Should this occur, remove a shim from the assembly and recheck correct that you are following the correct assembly procedures.

15) Install the black plastic seat with O-ring installed into the regulator body.

16) Insert the seat with the O-ring installed into the regulator body. Cone shaped end goes in first. The flat side of the seat should be facing you when looking into the large bore port.

17) Install the poppet/piston assembly down onto the main body, so that the assembly is flush to the main body. Engage the regulator end cap.

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18) Place the first stage body in a padded vise. Tighten the vise just enough to hold the regulator body.

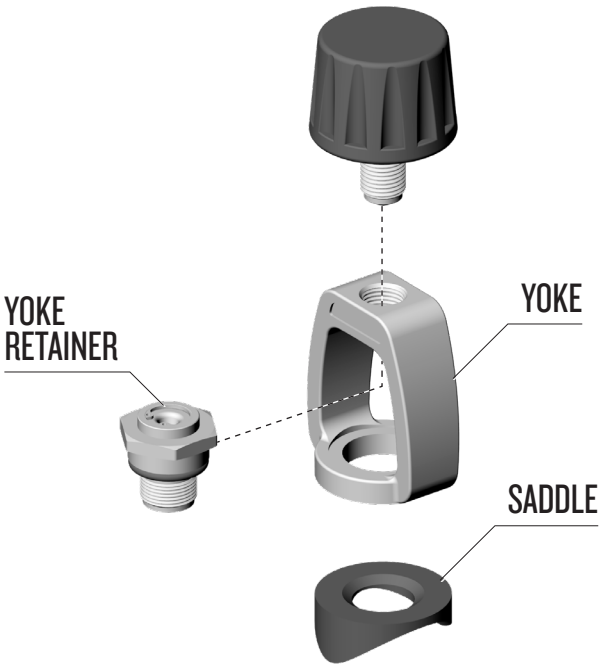
19) Screw the cap in, until the assembly is snug. Tighten with a spanner wrench.

20) Install a new filter in the yoke retainer.

21) Use the circlip pliers and place the retaining ring in its groove in the yoke retainer.

22) Install the two O-rings on the yoke retainer.

23) Place the yoke retainer in the opening in the yoke.



24) Install the saddle on the yoke retainer.

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25) Use a 1 inch box end wrench to tighten the yoke retainer. Tighten until snug.

26) Thread the Yoke retainer, saddle and yoke as an assembly into the regulator body.

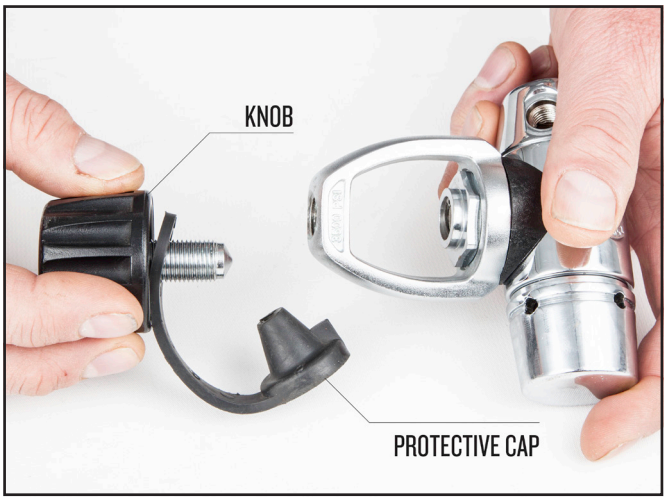
NOTE

Older SuperFlow® regulators require a different size yoke retainer.

27) Install the O-rings on all of the low and high pressure plugs.

28) Install the port plugs into the regulator body leaving two LP ports open.

29) Thread the knob with protective cap into the yoke.



1.4.4 Testing the First Stage

NOTE

The minimum-supply pressure for this test should be 1000 psig (69 bar).

1) Connect a second stage to the first stage and also connect an intermediate test gauge using an LP hose. With the intermediate pressure gauge face pointing away, slowly open the air supply valve a quarter of a turn, then view the gauge. After the pressure stabilizes, open the supply valve completely. The intermediate pressure on the test gauge should read between 135–145 psig (9.3–10 bar) static. Depress the second stage purge several times to ensure the first stage intermediate pressure locks up and stabilizes between 135–145 psig (9.3–10 bar).

2) If the pressure creeps more than 10 psig (0.7 bar) within 5 minutes, it is an indication that the poppet and seat are not sealing properly. Depressurize the system, then repressurize and check for intermediate pressure creep. If the regulator continues to creep, the poppet and/or seat may be

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damaged and should be re-inspected and/or replaced. Confirm the intermediate pressure is within the specified range of 135–145 psig (9.3–10 bar).

3) If the pressure is lower than 135 psig (9.3 bar), depressurize the system and remove the regulator from the air supply. Disassemble the regulator as explained previously and add a sufficient number of shims to achieve the correct pressure. Each shim will raise the pressure approximately 7–8 psig (0.5 Bar).

4) Ensure the second stage is connected to the first stage and the second stage regulator bias adjustment is turned in (clockwise) all the way. Plug all unused high and low pressure ports and ensure a high pressure submersible gauge is installed in one of the HP ports.

5) Attach the first stage to a high pressure supply whip and block test assembly. If no whip is available, the first stage may be attached directly to a scuba cylinder. The air supply pressure should not be higher than 3000 psig (207 bar).

NOTE

Install a second stage regulator to act as a relief valve in the event the first stage develops a leak.

Leak testing may be performed by submerging the regulator in a container of clear, clean water or by spraying the regulator with a solution of water and mild dishwashing liquid. If any leaks are observed, they should be corrected.

6) Turn off the air supply to the first stage and vent the pressure from the regulator using the second stage purge.

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1.5 Torque Specifications for KMDSI First Stage Regulator

Loc. #	Part #	Description	Torque in Inch Pounds	Torque in Newton Meters
5	350-131	Yoke Retainer	70	7.9
8 14 17	350-060 550-095 350-092	Port Plugs	15	1.6
—	N/A	Hoses	40	4.5

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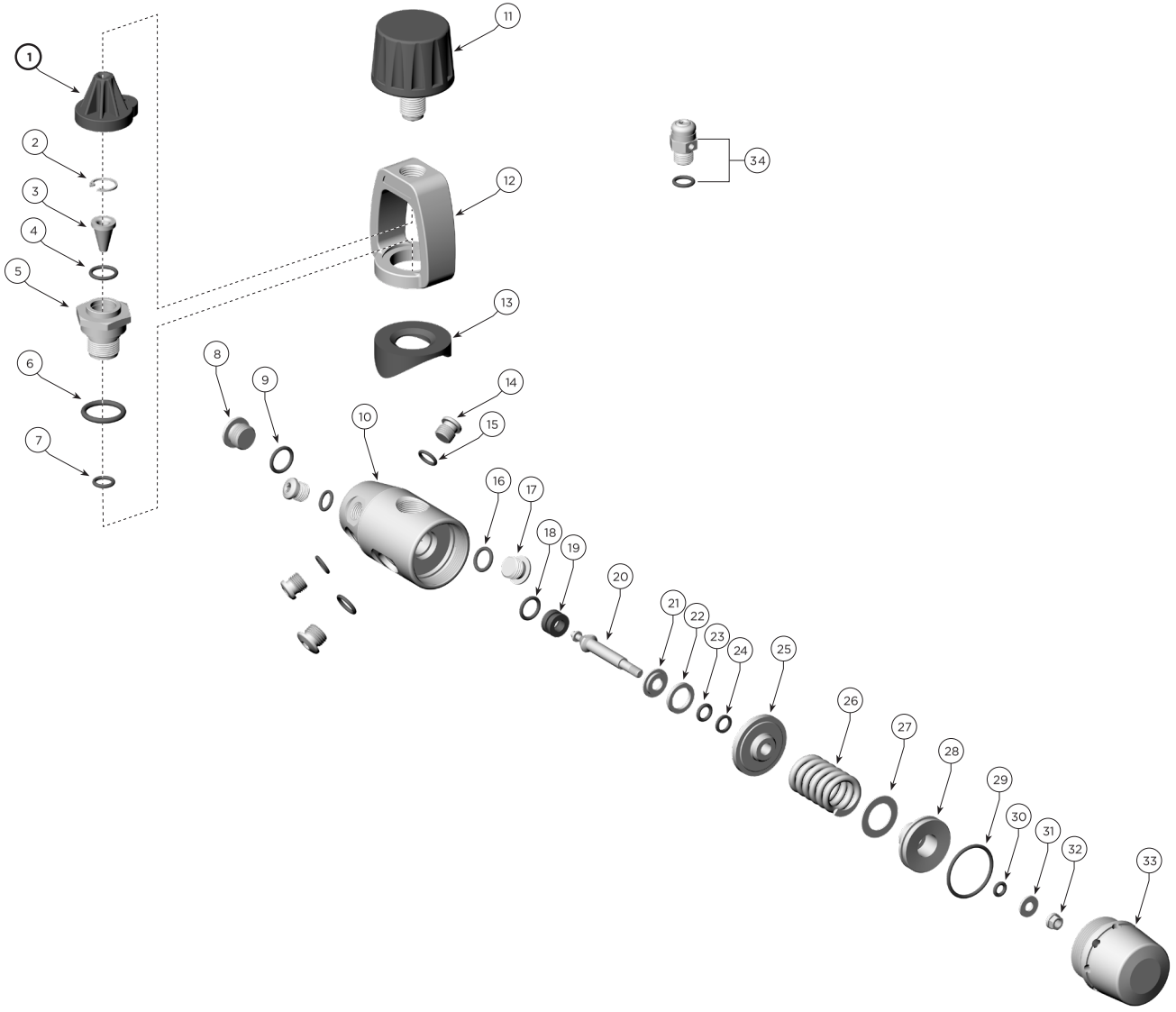
SuperFlow® First Stage Regulator P/N 305-161

Location #	Part #	Description
1	410-025	Protector Cap
2	430-060	Retainer Ring
3	355-035	Filter
4	510-013	O-ring
5	350-131	Yoke Retainer
6	310-115	O-ring
7	510-011	O-ring
8	350-060	Plug, L.P. High Flow, w/O-ring
9	510-013	O-ring
10	350-135	Regulator Body
11	330-050	Knob
12	350-110	Yoke
13	320-085	Saddle
14	550-095	Plug L.P. w/O-ring
15	310-003	O-ring
16	510-012	O-ring
17	350-092	Plug H.P.
18	510-012	O-ring
19	350-120	Seat
20	350-105	Poppet
21	350-137	Packing Disk, Small
22	310-023	O-ring
23	510-010	O-ring
24	410-010	Backup O-ring
25	350-133	Packing Disk, Large
26	335-010	Spring
27	350-215	Shim *(May or may not be present. For adjustment purposes)*
28	350-086	Piston
29	310-022	O-ring
30	510-008	O-ring
31	330-510	Washer
32	330-320	Lock Nut
33	250-020	1st Stage Regulator Cap
34	200-017	Over Pressure Relief Valve Hi-Flow *(sold separately)*



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