

DATA SHEET

PRESSURE-SENSITIVE REGULATING UNLOADER




Stainless Steel Model: 9970



SPECIFICATIONS	U.S. Measure	Metric Measure
Maximum Flow	15.9 gpm	60 lpm
Pressure Range	1160–11,600 psi	80–800 bar
Inlet Port	½" BSPP (F)	½" BSPP (F)
Discharge	½" BSPP (F)	½" BSPP (F)
Bypass Port	½" BSPP (F)	½" BSPP (F)
Operating Temperature	195° F	90° C
Weight	5.5 lbs	2.5 kg
Dimensions	7.13 x 4.57 x 1.85"	181 x 116 x 47 mm

Note: Use only at above specifications to ensure proper unloader life and performance.

 This Pressure-Sensitive Regulating Unloader can be converted to a Secondary Relief Valve. See page 4 for Relief Valve conversion.

FEATURES

- Provides system pressure setting and protection for single and multiple gun applications.
- Maintains full system pressure while running in bypass with minimal load on pump.
- Offers pump protection against pressure fluctuations and system changes.
- Minimum pressure fluctuations with alternating use of multiple guns.
- Easy external pressure adjustment with locking nut prevents over-pressurization.

Read all CAUTIONS and WARNINGS before commencing service or operation of any high-pressure system

SELECTION

This pressure-sensitive regulating unloader is designed for systems with single or multiple pumps, solenoid (gate) valves, nozzles and shut-off guns.

Note: For multiple-pump systems, it is best to use a pressure regulator, not a pressure-sensitive regulating unloader.

This unloader should meet both the desired system flow (combined nozzle flow rate requirement) and the desired system pressure.

NOTICE Operation below the minimum rated flow of the unloader causes the unloader to cycle. Operation above the maximum rated flow of the unloader causes cycling and premature wear, preventing achieving the desired system pressure.

INSTALLATION

This unloader operates properly when mounted in any direction. However, keeping the plumbing to a minimum and the pressure adjuster cap easily accessible is preferred. The ideal mounting location is directly onto the pump's discharge manifold.

The inlet connection is a 1/2" BSPP(F) port located on the backside. There is an arrow and the word IN marked on the body, indicating the direction of flow. Liquid from the discharge of the pump goes into this connection.

The discharge connection is a 1/2" BSPP(F) port located on the front side (hex end). There is an arrow and the word OUT marked on the body, indicating the direction of flow. Plumbing to the spray guns, solenoid (gate) valves or nozzles connect here.

The bypass connection is a 1/2" BSPP(F) port located on the bottom. There is an arrow and the word BY PASS marked on the body, indicating the direction of flow. Bypass liquid is directed out of this port and can be routed to a reservoir (preferred method), drain or pump inlet.

OPERATION

This unloader holds established system pressure in the discharge line when the trigger gun or solenoid (gate) valve is closed, or the nozzle is clogged, thus bypassing all unrequired flow. Squeezing the trigger gun or opening the solenoid (gate) valve will close the bypass and return to established system pressure.

PRESSURE ADJUSTMENT

Note: Pressure is not set at the factory.

1. Setting and adjusting the unloader pressure must be done while the system is running.
2. Start the system with unloader backed off to the lowest pressure setting (counterclockwise direction).
3. Increase the unloader pressure setting by turning the adjusting cap clockwise.
4. Squeeze the trigger and read the pressure on the gauge at the pump.

Note: Do not read the pressure at the gun or nozzle.

5. If more pressure is desired, release the trigger, turn pressure adjusting cap one quarter turn in clockwise direction.
6. Squeeze the trigger and read the pressure.
7. Repeat this process until desired system pressure is reached.
8. If desired system pressure cannot be reached, review TROUBLESHOOTING chart.

NOTICE A secondary pressure safety relief device (e.g. pop-off valve, relief valve) should be used along with this pressure-sensitive regulating unloader. Final adjustment for the secondary relief valve should be approximately 200 psi above the system operating pressure.

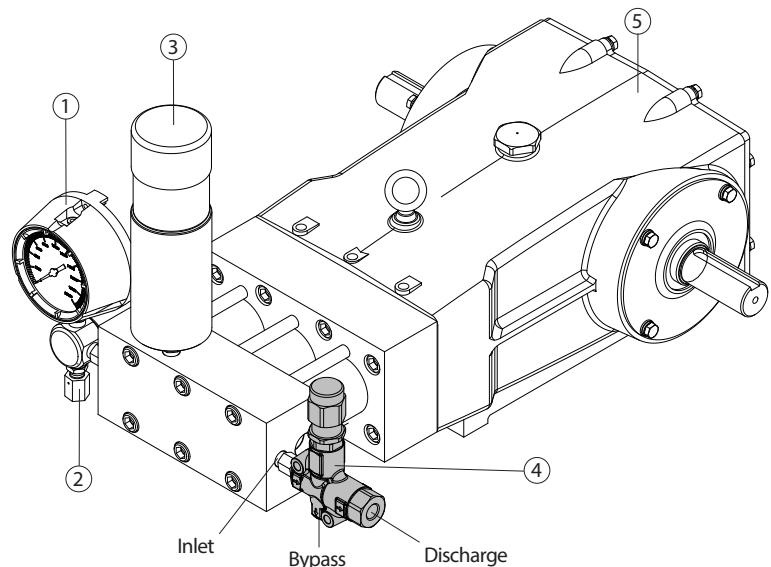
Note: A minimum of 5% of the flow through the unloader should bypass for proper regulator performance. If the entire unloader flow pumps through the nozzle (zero-bypass), the valve can easily be set for pressure higher than the desired pressure, causing a malfunction or premature wear

Note: By removing the check valve and spring, this unloader can function as a secondary relief valve.

🔧 See page 4 for Relief Valve conversion.

TYPICAL UNLOADER INSTALLATION

1. Pressure Gauge
2. Relief Valve
(Secondary Pressure Relief Device)
3. Pulsation Dampener
4. **Pressure-Sensitive Regulating Unloader**
(Primary Pressure Regulating Device)
5. Triplex Plunger Pump



SERVICING

Disassembly

1. Disconnect bypass, discharge and inlet plumbing from unloader.
2. Remove unloader from pump.
3. Secure body of unloader in a vise with adjusting cap facing up.
4. Remove discharge fitting with backup ring and O-ring, spring, check valve with O-ring, check valve seat with O-ring and backup ring.
5. Examine check valve seat, check valve, discharge fitting for wear, and spring for wear or fatigue. Examine O-rings and backup rings for cuts or wear. Replace as needed.

Note: While the discharge fitting is removed, inspect sealing area for grooves, pitting or wear. Where the check valve seat makes contact within the internal body of the unloader. If damage is found, stop the repair and replace with complete new unloader. If not, proceed with disassembly.

6. Remove adjusting cap by turning in a counterclockwise direction.
7. Remove spring, spring retainer and seat ball. Examine for scale build-up, fatigue or wear. Replace as needed.
8. Use an adjustable wrench to remove piston retainer. Examine for fatigue or wear. Replace as needed.
9. Use a needle nose pliers to remove the entire piston assembly from the body.
10. To disassemble the piston assembly, secure the piston stem end by inserting a 5 mm allen wrench into the piston stem and then grasp hex end of valve with a 16 mm open-end wrench to turn and separate piston stem from valve.
11. Examine upper spacer ring for scoring, fatigue or wear. Replace as needed.
12. Examine both the inner and outer upper spacer ring O-rings and backup rings for cuts or wear. Replace as needed.
13. Examine lower spacer ring for scoring, fatigue or wear. Replace as needed.
14. Examine the lower spacer ring o-ring and backup-ring for cuts or wear. Replace as needed.
15. Examine piston stem for scoring, fatigue or wear. Replace as needed.
16. Examine piston stem O-ring and backup ring for cuts or wear. Replace as needed.
17. Examine valve for scoring or wear. Replace as needed.
18. Remove unloader from vise and reposition so the bypass port is facing up.
19. Use a small socket or tool to drive out the seat with O-ring and backup ring.
20. Examine seat for scoring or wear. Replace as needed.
21. Examine O-ring and backup ring for cuts or wear. Replace as needed.

Reassembly

Note: Reposition unloader in vise so the bypass port is facing down.

1. Install backup ring and then O-ring into groove of outside diameter of seat. Ensure the o-ring is on top of backup ring with O-ring closest to small diameter hole of seat. Lubricate all parts.
2. Place seat with small diameter hole facing up into unloader body. Press into place.
3. Install O-ring and then backup ring onto piston stem. Lubricate both parts.
4. Lubricate and install O-ring and then backup ring into the upper spacer ring.
5. Lubricate and install backup ring and then O-ring over tapered end of upper spacer ring.
6. Slide upper spacer ring over piston stem so the tapered end is facing down.
7. Install O-ring and then backup ring into the grooved end of the lower spacer ring. Lubricate both parts.
8. Slide lower spacer ring over piston stem so the small diameter end is facing down.
9. Apply Loctite® 242® to the bottom threads of the piston stem.
10. Hand thread valve onto piston stem.
11. Secure piston end with a 5 mm allen wrench and tighten the valve with a 16 mm open-end wrench. Lubricate entire assembly.
12. Place piston assembly with valve facing down into unloader body. Press into place.
13. Hand thread piston retainer into unloader body. Tighten with an adjustable wrench.
14. Install ball seat into end of spring retainer. Install spring retainer/ball seat with ball seat facing down. Install spring onto spring retainer.
15. Hand thread adjusting cap.
16. Lubricate and install backup ring and then O-ring onto check valve seat. Place in discharge port with tapered end of check valve seat facing in.
17. Lubricate and install O-ring onto check valve. Place check valve with O-ring facing in.
18. Install check valve spring into check valve.
19. Lubricate and install backup ring and then O-ring onto discharge fitting.
20. Hand thread discharge fitting into unloader body.
21. Remove unloader from vise.
22. Re-install unloader onto pump.
23. Reconnect bypass, discharge and inlet plumbing to unloader.
24. Proceed to PRESSURE ADJUSTMENT.

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TROUBLESHOOTING

Unloader cycles	<ul style="list-style-type: none"> • Check valve O-ring is worn out • Fitting leaking downstream • Worn O-ring inside gun • Insufficient flow through unloader
Liquid leaking from bottom	<ul style="list-style-type: none"> • Seat or inlet fitting O-ring is cut or worn
Liquid leaking from middle	<ul style="list-style-type: none"> • Piston O-ring is worn or cut
Unloader will not come up to pressure	<ul style="list-style-type: none"> • Not properly sized for system pressure • Foreign material in unloader • Piston O-rings worn • Nozzle worn or too large • Pressure adjuster is not properly set
Extreme pressure spikes	<ul style="list-style-type: none"> • Adjusting handle turned completely into unloader • Restricted bypass or no bypass • System flow exceeds unloader rating

PARTS LIST

ITEM	PN	MATL	DESCRIPTION	QTY
402	—	BB	Cap, Adjusting	1
403	—	BB	Nut, Locking	1
404	33061	STZP	Screw, Set (M4 x 4)	1
408	—	STL	Spring	1
410	—	BB	Retainer, Spring	1
412	—	S	Stem, Piston	1
414	—	PTFE	Backup Ring, Piston Stem	1
415	—	NBR	O-Ring, Piston Stem-85D	1
417	—	S	Ball, Seat	1
422	—	PTFE	Backup Ring, Upper Spacer Ring	1
423	—	S	Ring, Upper Spacer	1
424	—	NBR	O-Ring, Upper Spacer Ring-85D	1
425	—	BB	Retainer, Piston	1
426	—	S	Ring, Lower Spacer	1
427	—	PTFE	Backup Ring, Lower Spacer Ring	1
429	—	NBR	O-Ring, Lower Spacer Ring-85D	1
430	—	NBR	O-Ring, Upper Spacer Ring (Inner)-85D	1
431	—	PTFE	Backup Ring, Upper Spacer Ring (Inner)	1
434	—	PTFE	Backup Ring, Seat	1
435	—	S	Valve	1
436	—	S	Seat	1
437	—	NBR	O-Ring, Seat-95D	1
438	—	S	Seat, Check Valve	1
439	—	NBR	O-Ring, Check Valve Seat-85D	1
440	—	S	Body	1
441	—	PTFE	Backup Ring, Check Valve Seat	1
442	—	NBR	O-Ring, Check Valve-85D	1
443	—	S	Valve, Check	1
444	—	S	Spring, Check Valve	1
446	—	NBR	O-Ring, Discharge Fitting-85D	1
447	—	PTFE	Backup Ring, Discharge Fitting	1
460	—	S	Fitting, Discharge (1/2" BSPP[F])	1
468	77050	NBR	Kit, Repair (Includes: 414, 415, 422, 424, 427, 429-431, 434-437, 439, 441, 442, 446, 447)	1
471	77051	NBR	Kit, Check Valve (Includes: 438, 439, 441-444, 446, 447)	1
—	994783	SS	Adapter, Fitting with Seal (1/2" NPT[M] x 1/2" BSPP[M])	1
—	994784	STL	Adapter, Fitting with Seal (1/2" NPT[M] x 1/2" BSPP[M])	1

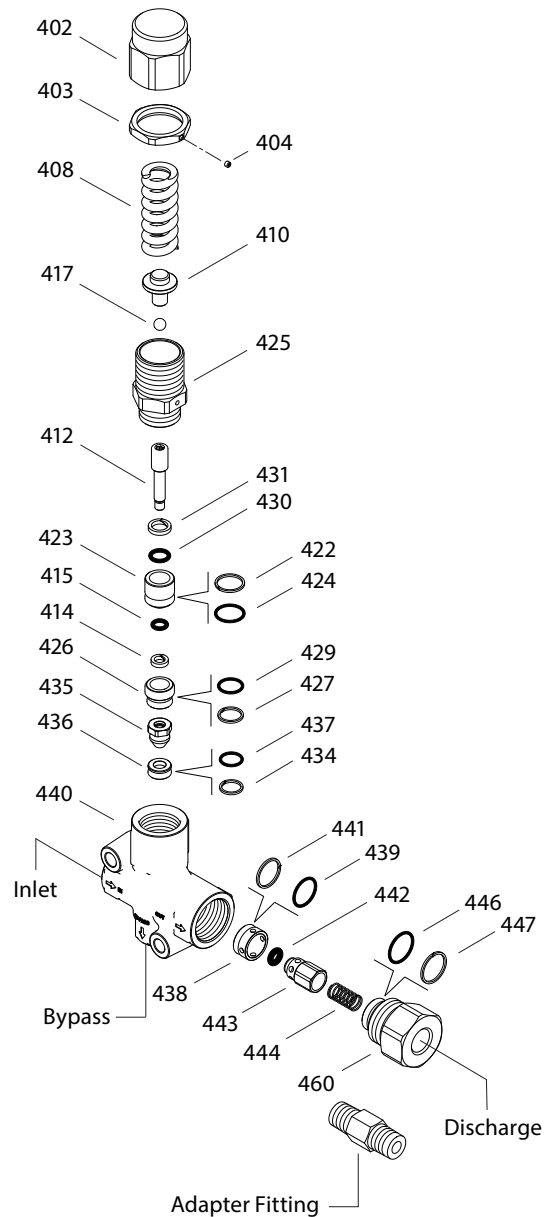
Italics are optional items.

Material Codes (Not Part of Part No.): BB=Brass

NBR=Medium Nitrile (Buna-N) PTFE=Pure Polytetrafluoroethylene

S=304SS SS=316SS STL=Steel STZP=Steel/Zinc Plated

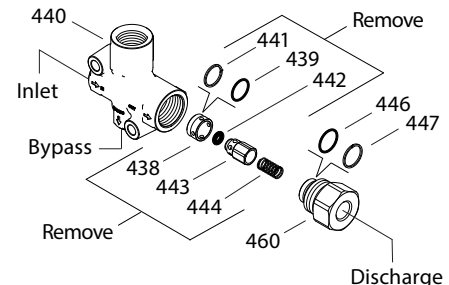
EXPLODED VIEW



REGULATING UNLOADER TO RELIEF VALVE CONVERSION

The 9970 Pressure-Sensitive Regulating Unloader is typically used as a primary pressure regulating device. It can be converted to a Relief Valve to be used as a secondary pressure relief device by removing the check valve with O-ring and backup ring, discharge check valve with O-ring and spring.

Unloader PN	Modifications	Converted Relief Valve PN
9970	Remove parts 438, 439, 441, 442, 443, 444	9970.100 (NBR Seals)



CAUTIONS AND WARNINGS

All high-pressure systems require a primary pressure regulating device (e.g. regulator, unloader) and a secondary pressure relief device (e.g. pop-off valve, relief valve). Failure to install such relief devices could result in personal injury or damage to pump or property. Cat Pumps does not assume any liability or responsibility for the operation of a customer's high-pressure system.

Read all CAUTIONS and WARNINGS before commencing service or operation of any high-pressure system. The CAUTIONS and WARNINGS are included in each Service Manual and with each Accessory Data sheet. CAUTIONS and WARNINGS can also be viewed online at www.catpumps.com/dynamic-literature/cautions-and-warnings or can be requested directly from Cat Pumps.

WARRANTY

View the Limited Warranty online at www.catpumps.com/literature/cat-pumps-limited-warranty