

NITROGEN PRE-CHARGING INSTRUCTIONS FOR TOBUL ACCUMULATORS

READ ALL INSTRUCTIONS PRIOR TO PROCEEDING WITH PRE-CHARGING TO AVOID POSSIBLE INJURY

Warning:



Accumulators, gas bottles, and associated hydraulic systems are inherently dangerous to untrained personnel due to high pressure gasses and fluids. Do not attempt to install or operate these systems unless adequately trained, experienced with the items and systems, and can recognize the potential risks involved if mishandled. Failure to do so may result in severe injury or death to personnel.

General Information

- Hydraulic accumulators are pressure vessels and must be treated accordingly. Only trained and qualified individuals should perform installation and maintenance procedures on any accumulator. **Always wear personal protective equipment (ANSI Z87 or greater safety goggles , and chemical resistant protective gloves, if necessary)**
- All hydro-pneumatic accumulators function due to the differential pressure between the compressed nitrogen gas and the stored hydraulic fluid. It is extremely important to provide the proper amount of gas pre-charge, dependent on the accumulator application, and check the gas pre-charge level regularly. The correct pre-charge pressure is determined by maximum and minimum system pressure, and temperature, both ambient and operating temperature.
- Typical accumulator applications include:
 - Potential energy storage
 - Pulsation absorbing/dampening
 - Cushioning operating shocks
 - Supplementing pump flow
 - Maintaining system pressure
- Never allow hydraulic pressure into an accumulator/system which has not been nitrogen pre-charged—Significant damage to the accumulator may result!

Warning:



Always use dry inert gas (dry nitrogen – N²) for pre-charging – **NEVER use air or oxygen, due to the danger of combustion/explosion.**

Accumulators must be pre-charged with dry nitrogen for correct functioning. Pre-charging may be performed prior to or following installation. **Hydraulic pressure must not be introduced into accumulators prior to pre-charging, especially bladder-type accumulators.** Failure to correctly pre-charge may result in damage. Utilization of a nitrogen bottle pressure regulator (such as Tobul's **G2527F-RL** 3k gas regulator or **G2527F-RM** 6k gas regulator) is highly recommended.

Note: Only qualified and trained personnel should perform this procedure, which applies to both bladder-type and piston-type accumulators. Always wear personal protective equipment.

Do not use automotive-type valve cores in high pressure accumulator gas valves.

Caution:



In enclosed spaces, N² is an asphyxiant - always insure adequate ventilation when working with nitrogen gas. If there is any hissing sound that would indicate the release of gases from any vessel under service, extra caution should be taken. The escape of gases from the threads can mean there may be an inadequate amount of threads holding the force of the pressurized vessel and an ejection of the fitting may occur. Those who install any fittings should take their time and proceed slowly to prevent an accidental rapid discharge of energy. Insure all fittings are undamaged, and all hoses and ports are clean, free of foreign debris.

Note: Most standard Tobul accumulators (piston and bladder-types) utilize schrader-style .305-32 Gas valves. These various valves may have high pressure cores (similar to automotive-type tire valve) or may be a jam-nut style (also known as a strut-type or mil-style) valve — determine which style is present on the vessel.



3A-282 3k valve (contains high pressure valve core)
utilized on most bladder-type accumulators



3A-285H up to 7.5K valve (jam-nut style)
utilized on most 5k piston-type accumulators

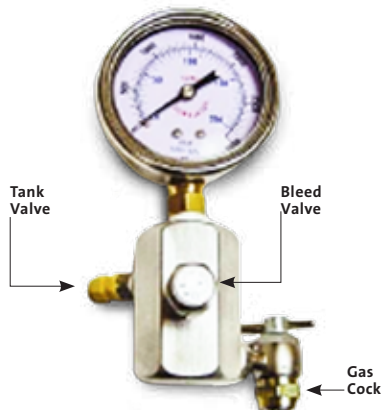
Note: Valve styles and types vary with the maximum operating pressure and application. If any doubt exists as to identification of the valve style or type, contact Tobul customer service / sales engineering for assistance — Tel: 803.245.2400 www.fst.com email: tobulsales@fst.com

Charging gauge and hose assemblies vary with the rated pressure

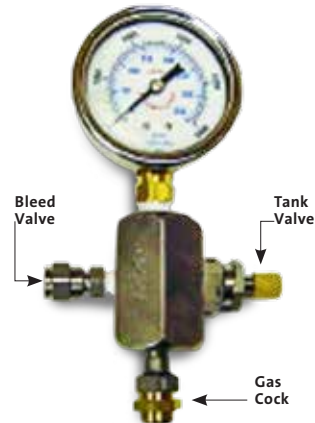
Warning:



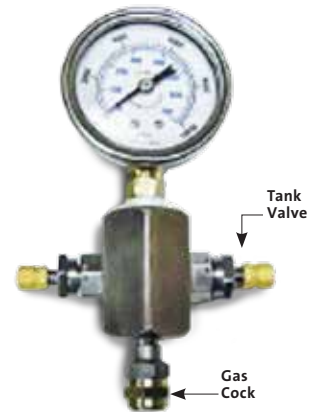
Do not exceed the recommended operating pressures for the vessel, gas valves or charging assembly!



**TOBUL GG2525F CHG ASSM
3000 PSI MAWP**
Includes G2525F GAUGE ASSM
& G2527F HOSE ASSM
— for use with cored valves max 3k



**TOBUL GG2525F CHG ASSM
5000 PSI MAWP**
Includes G2525F-M GAUGE ASSM
& G2527F -M HOSE ASSM
— for use with jam-nut valves max 5k



**TOBUL GG2525F CHG ASSM
10,000 PSI MAWP**
Includes G2525F GAUGE ASSM
& G2527F HOSE ASSM
— for use with jam-nut valves max 10k

Determine the proper pre-charge pressure for the application— utilize one or more of the following:

- Tobul's accumulator sizing & selection software
- Tobul's fluid volume displacement charts— review the pressure/volume curves
- Industry standard pressure/volume calculations— page 173 "Lightning®" reference guide, 8th edition
- Tobul's customer service/sales engineering assistance
 - tobulsales@fst.com or 803.2452400 eastern us time

Important factors to be considered are: maximum pressure of system & accumulator; minimum pressure of system; ambient temperature; operating temperature; overall volume of accum & desired swept volume necessary (the amount of fluid flow under pressure necessary to perform desired work, etc.)

Pre-charge pressures will vary dependent on the application and operating conditions. Generally, if an accumulator is being utilized for energy storage, the pre-charge should be 90% of the minimum working pressure. If used for system shock absorption, 75% of the system working pressure. If used for pulsation damping, approx. 70% Of the system operating pressure. Note: every application is different and may vary!

Warning:



Accumulator pre-charging is a critical process in preparing an accumulator for installation, or checking an existing installed accumulator. Follow all procedures and all safety guidelines when performing this process! Insure all pressure & flow ratings of any equipment used to conduct these procedures are equal to or greater than the pressure & flow ratings of the system under test!

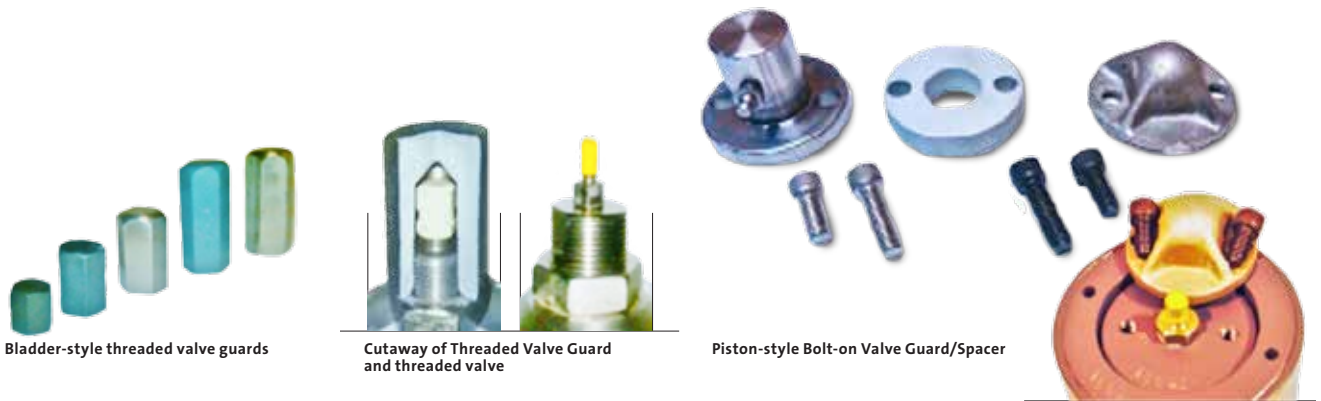
Step by Step Procedures:

1. Read all manufacturers' information regarding safety warnings prior to beginning any service
2. Have an individual trained & experienced in accumulator service present when performing any service procedures for the first time... safety first!
3. Check the system pressure gauge, or inspect the accumulator to insure any hydraulic pressure is relieved. Insure any system mounted units have no residual pressure trapped within system components
4. Gather all necessary equipment: charging hose & gauge assm; pressurized N² cylinder with regulator; all necessary hand tools; all personal protective equipment.
5. If accumulator is loose, secure in work area to prevent movement; if installed on system, insure brackets are adequately supporting the unit. Insure pressurized N² cylinder with regulator is secured near work area and adequately supported to prevent tipping, falling, etc.
6. Accumulator gas valves are protected from impact & damage by threaded or bolted valve guards. Determine type of valve guard and remove to gain access to charging valve.

Caution:



Always inspect entire vessel, ends, valve guards, etc. For any possible damage which may have occurred during transit, prior to beginning service. If any damage is seen, please contact Tobul customer service for assistance immediately!



7. **Note:** the following step is not necessary for new units being pre-charged for the first time...

Remove yellow safety cap from valve stem. Keeping hands, face and body away from the valve, and using a suitable tool, either depress the valve core or, using two wrenches, loosen the jam nut on the valve slightly to check the unit for the presence of oil in the gas side or bladder bag. If oil is discharged from the valve, it is indicative the piston seals are worn/cut, or the bladder bag has been punctured or has ruptured, and the service has become a repair versus a check and N² recharge.

Note: in very limited circumstances w/piston accumulators used in pulpmill applications, a condition known as “carryover” occurs and oil is deposited in the gas end of the unit, but the seals are generally in working condition. Please contact Tobul customer service/sales engineering for assistance in this case.

8. Insure the proper pressure rated charging assembly has been chosen for the unit being serviced.
Note: occasionally the Tobul G2525F gauge assembly cannot be directly attached to valve due to a recessed location/smaller diameter of the vessel. Utilize Tobul’s 2522-EXT gas cock extension in order to connect the “T-handle” gas cock.

9. Attach the appropriate charging hose assembly to compressed nitrogen bottle, preferably with a gas pressure regulator. All Tobul connectors are compliant with CGA (compressed gases assn.) Standards, E. G., CGA 580 male right hand connector for max 3000 psi systems; CGA 677 female left hand connector for max 5000 psi systems; 10000 psi max hose is #4-1/4 JIC female swivels both ends.



10. Attach opposite end of charging hose to the tank valve/charging valve on the gauge assembly —see illustrations of gauge assm’s. on page two of these instructions. Do not overtighten.

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11. If unit being serviced has a valve core, select the G2527F (max 3000 psi) gauge assm and turn “T-handle” counterclockwise to retract valve core depressor. Connect to the top of the accumulator gas charging valve with swivel connector on bottom of gas cock after removing yellow safety cap. Do not overtighten— gas cock has a replaceable copper sealing washer. (G2522-A034)
12. If unit being serviced does not have a valve core, select the appropriate charging gauge assembly for the max pressure involved. Remove yellow safety cap from valve and attach gas cock on bottom of gauge assm to top of accumulator gas valve.
13. Revisit all gas connections and insure all are “gas-tight”, but not overtightened. Damage to connectors can occur if excessive torque is applied to the fittings. Hoses can pose a liquid & gas ejection hazard if failure occurs—fitting failure can result in flying debris & ensuing damage—remain clear of possible ejection area as much as possible by staying to either side of the ends/heads of the vessel.

Caution:



Pressurized nitrogen can be excessively cold and cause freeze burns on bare skin.

14. Always wear personal protective equipment (e.G., Safety goggles, gloves suitable for cold, etc.) And a wrench to open & close any valves connected to pressurized nitrogen safely.
15. Open bleed valve on charging assembly. Open nitrogen cylinder pressure regulator valve very slightly to allow flow of N² and bleed air out of charging hose and gauge assembly. Once sufficient N² has flowed through hose to eliminate air, close the bleed valve and the N² supply valve.
16. Nitrogen pre-charge pressure in accumulator can now be checked. In an installed unit, turn “T-handle” on gas chuck clockwise (down to depress valve core in gas valve) or by opening jam nut on strut style valve. Either action will allow any gas pre-charge pressure existing in vessel to register on gauge in charging assm. Determine if existing pre-charge is adequate to meet the needs of the system on which it is installed. If pre-charge needs adjustment to meet system requirements, proceed with following steps. If unit does not have existing pre-charge, proceed following steps to ready unit for service.

Accumulators must be pre-charged with inert gas prior to use in order to function as designed.



Attaching gas cock to gas valve



Attaching hose/gas chuck to gas valve; remove yellow safety cap; thread gas chuck to .305-32 Valve stem — DO NOT OVERTIGHTEN



Gauge assembly affixed to gas valve—ready to bleed air from hose

17. Insure the proper pre-charge pressure level has been determined...

For energy storage — pre-charge of $\approx 90\%$ of system minimum operating pressure

For shock absorption — pre-charge of $\approx 75\%$ of system minimum operating pressure

For pulsation damping — pre-charge of $\approx 70\%$ of system minimum operating pressure

General recommendation for piston-type, pre-charge of ≈ 100 psi less than minimum operating pressure

General recommendation for bladder-type, pre-charge of ≈ 175 psi less than minimum operating pressure

Note: above pre-charge recommendations are starting points only; all hydraulic systems vary due to components and system cycle demands. Always follow guidelines on page two of these instructions for more accurate calculated pre-charge levels; always check & adjust pre-charge after initial usage.

18. When utilizing N² gas regulator on compressed gas cylinder, adjust regulator pressure limit to no more than 100 psi higher than previously determined pre-charge pressure. This insures no components are subject to overpressurization, even if a higher pressure (6000 psi) cylinder is utilized.

Always insure all connections are gas tight, all fittings & hoses are designed for use with system pressure, and personal protective equipment, including ANSI Z87 rated splash-proof goggles, are worn when working with compressed gases and hydraulics fluids.

19. Open nitrogen cylinder valve slowly and allow nitrogen to slowly enter accumulator.

Caution:



Compressed nitrogen will become extremely cold when it expands, and excess flow may result in damage to gas valve and other components, especially elastomeric bladder bags. Pressurized nitrogen will freeze when it expands rapidly and can cause the bag to become frozen, brittle, and possibly rupture.

20. Close the N² cylinder valve when the pre-charge pressure indicated on the charging assm gauge is approx. 100 psi greater than the recommended/desired pre-charge pressure. Allow time (10-15 minutes or longer, dependent on the volume of gas introduced into the vessel) for the newly introduced nitrogen pre-charge to equalize and the temperature to stabilize... check the pressure gauge on the charging assembly periodically.
21. When temperature and pressure have equalized/stabilized, open the bleed valve on the charging gauge assm very slightly and allow any extra nitrogen pre-charge pressure to bleed slowly down to the desired/recommended pressure. Close bleed valve carefully.
22. Turn "T-handle" of gas cock counterclockwise, withdrawing core depressor from gas valve, and closing the valve core or in case of jam nut style, rotate jam nut clockwise to close the gas valve. This will prevent nitrogen from escaping from the accumulator valve when the gauge assm is removed.

23. After insuring nitrogen cylinder valve is securely closed, open bleed valve on gauge assm to release residual pressure in the charging hose and gauge assm. When complete, close bleed valve and carefully remove charging assm from accumulator gas valve. Take care to prevent damage to valve threads. Check for leaks on and around gas valve with a soapy water solution—a leak is indicated by bubbles occurring at leak point. Reinstall yellow safety cap on valve; reinstall protective valve guard on accumulator. Accumulator is ready to use.

Note: accumulator performance and operating life is highly dependent on proper pre-charging and regular checking of pre-charge levels. A regular schedule and recording of pre-charge levels will provide an extremely important history of use and maintenance. N² pre-charge should be checked at least once during first week of operation following installation. If there is no loss of pre-charge pressure at that time, N² pressure should be re-checked in 90 to 120 days and annually thereafter. If pressure loss is evident, adjust pre-charge to recommended level and monitor on a bi-weekly or monthly basis. If pressure loss reoccurs, cease vessel use and investigate possible reasons for N² loss. Service, repair or replace as necessary.

In piston type:

Excessive pre-charge pressure will cause the piston to contact the bottom cap when system fluid pressures are low; repeated impact can cause internal damage.

Low pre-charge pressure will cause the piston to impact the top cap which can cause damage, beside causing the unit to be non-functional.

In bladder type:

Excessive pre-charge pressure can force the bladder into and around the poppet valve assembly. This can result in fatigue failure of the spring and poppet valve; it can also result in damage to the bladder bag if it is under the valve as it is forced down.

Low pre-charge pressure will cause the bladder to be crushed into the top of the shell causing cracking, and possible forcing of bag into the pre-charge valve access hole, resulting in a bag puncture, called “picking.” A single low or no pre-charge cycle is sufficient to cause a bag rupture or “pick.”

For additional information or questions, contact Tobul customer service/sales engineering at 803.245.2400 or email—tobulsales@fst.com. Literature available for viewing or download at www.Tobul.com