Series 111 Accumulator Product Information

Model 111.11 Model 111.12

011-553-304 D

be certain.

MTS software is developed using established quality practices in accordance with the requirements detailed in the ISO 9001 standards. Because MTS-authored software is delivered in binary format, it is not user accessible. This software will not change over time. Many releases are written to be backwards compatible, creating another form of verification. The status and validity of the MTS operating software is also checked during system verification and routine calibration of MTS hardware. These controlled calibration processes compare the final test results after statistical analysis against the predicted response of the calibration standards. With these established methods, MTS assures its customers that MTS products meet exacting quality standards when initially installed and will continue to perform as intended over time.

Contents

1.0 Technical Support

1.1.0 How to Get Technical Support

Start with your manuals

The manuals supplied by MTS provide most of the information you need to use and maintain your equipment. If your equipment includes software, look for online help and README files that contain additional product information.

Technical support methods

MTS provides a full range of support services after your system is installed. If you have any questions about a system or product, contact Technical Support in one of the following ways.

Web site	www.mts.com > Contact Us (upper-right corner) > In the Subject field, choose To escalate a problem; Problem Submittal Form
E-mail	Worldwide: tech.support@mts.com Europe: techsupport.europe@mts.com
Telephone	Worldwide: 1 800 328 2255 - toll free in U.S.; +1 952 937 4000 - outside U.S. Europe: +800 81002 222, International toll free in Europe

Outside the U.S.

For technical support outside the United States, contact your local sales and service office. For a list of worldwide sales and service locations and contact information, use the Global MTS link at the MTS web site:

www.mts.com > Global Presence > Choose a Region

1.2.0 Before You Contact MTS

MTS can help you more efficiently if you have the following information available when you contact us for support.

Know your site number and system number

The site number contains your company number and identifies your equipment type (such as material testing or simulation). The number is typically written on a label on your equipment before the system leaves MTS. If you do not know your MTS site number, contact your sales engineer.

Example site number: 571167

When you have more than one MTS system, the system job number identifies your system. You can find your job number in your order paperwork.

Example system number: US1.42460

Know information from prior technical assistance

If you have contacted MTS about this problem before, we can recall your file based on the:

- MTS notification number
- Name of the person who helped you

Identify the problem

Describe the problem and know the answers to the following questions:

- How long and how often has the problem occurred?
- Can you reproduce the problem?
- Were any hardware or software changes made to the system before the problem started?
- What are the equipment model numbers?
- What is the controller model (if applicable)?
- What is the system configuration?

Know relevant computer information

For a computer problem, have the following information available:

- Manufacturer's name and model number
- Operating software type and service patch information
- Amount of system memory
- Amount of free space on the hard drive where the application resides
- Current status of hard-drive fragmentation
- Connection status to a corporate network

Know relevant software information

For software application problems, have the following information available:

- The software application's name, version number, build number, and (if available) software patch number. This information can typically be found in the About selection in the Help menu.
- The names of other applications on your computer, such as:
  - Anti-virus software
  - Screen savers

- Keyboard enhancers
- Print spoolers
- Messaging applications

1.3.0 If You Contact MTS by Phone

A Call Center agent registers your call before connecting you with a technical support specialist. The agent asks you for your:

- Site number
- Name
- Company name
- Company address
- Phone number where you can be reached

If your issue has a notification number, please provide that number. A new issue will be assigned a unique notification number.

Identify system type

To enable the Call Center agent to connect you with the most qualified technical support specialist available, identify your system as one of the following types:

- Electrodynamic material test system
- Electromechanical material test system
- Hydromechanical material test system
- Vehicle test system
- Vehicle component test system
- Aero test system

Be prepared to troubleshoot

Prepare to perform troubleshooting while on the phone:

- Call from a telephone close to the system so that you can implement suggestions made over the phone.
- Have the original operating and application software media available.
- If you are not familiar with all aspects of the equipment operation, have an experienced user nearby to assist you.

Write down relevant information

In case Technical Support must call you:

- Verify the notification number.
- Record the name of the person who helped you.

- Write down any specific instructions.

After you call

MTS logs and tracks all calls to ensure that you receive assistance for your problem or request. If you have questions about the status of your problem or have additional information to report, please contact Technical Support again and provide your original notification number.

1.4.0 Problem Submittal Form in MTS Manuals

Use the Problem Submittal Form to communicate problems with your software, hardware, manuals, or service that are not resolved to your satisfaction through the technical support process. The form includes check boxes that allow you to indicate the urgency of your problem and your expectation of an acceptable response time. We guarantee a timely response—your feedback is important to us.

You can access the Problem Submittal Form at www.mts.com > Contact Us (upper-right corner) > In the **Subject** field, choose **To escalate a problem; Problem Submittal Form**

2.0 Preface

2.1.0 Before You Begin

Safety first!

Before you use your MTS product or system, read and understand the safety information provided with your system. Improper installation, operation, or maintenance can result in hazardous conditions that can cause severe personal injury or death, or damage to your equipment and specimen. Again, read and understand the safety information provided with your system before you continue. It is very important that you remain aware of hazards that apply to your system.

Other MTS manuals

In addition to this manual, you may receive additional manuals in paper or electronic form.

You may also receive an MTS System Documentation CD. It contains an electronic copy of the manuals that pertain to your test system.

Controller and application software manuals are typically included on the software CD distribution disc(s).

2.2.0 Documentation Conventions

The following paragraphs describe some of the conventions that are used in your MTS manuals.

Hazard conventions

Hazard notices may be embedded in this manual. These notices contain safety information that is specific to the activity to be performed. Hazard notices immediately precede the step or procedure that may lead to an associated hazard. Read all hazard notices carefully and follow all directions and recommendations. Three different levels of hazard notices may appear in your manuals. Following are examples of all three levels. (for general safety information, see the safety information provided with your system.)

DANGER:

Danger notices indicate the presence of a hazard with a high level of risk which, if ignored, will result in death, severe personal injury, or substantial property damage.

WARNING:

Warning notices indicate the presence of a hazard with a medium level of risk which, if ignored, can result in death, severe personal injury, or substantial property damage.

CAUTION:

Caution notices indicate the presence of a hazard with a low level of risk which, if ignored, could cause moderate or minor personal injury or equipment damage, or could endanger test integrity.

Other special text conventions

Important:

Important notices provide information about your system that is essential to its proper function. While not safety-related, if the important information is ignored, test results may not be reliable, or your system may not operate properly.

Note:

Notes provide additional information about operating your system or highlight easily overlooked information.

Recommended:

Recommended notes provide a suggested way to accomplish a task based on what MTS has found to be most effective.

Tip:

Tips provide helpful information or a hint about how to most efficiently accomplish a task.

Access:

Access provides the route you should follow to a referenced item in the software.

Example:

Examples show specific scenarios relating to your product and appear with a shaded background.

Special terms

The first occurrence of special terms is shown in italics.

Illustrations

Illustrations appear in this manual to clarify text. They are examples only and do not necessarily represent your actual system configuration, test application, or software.

Electronic manual conventions

This manual is available as an electronic document in the Portable Document File (PDF) format. It can be viewed on any computer that has Adobe Acrobat Reader installed.

Hypertext links

The electronic document has many hypertext links displayed in a blue font. All blue words in the body text, along with all contents entries and index page numbers, are hypertext links. When you click a hypertext link, the application jumps to the corresponding topic.

3.0 Introduction

Topics:

3.1.0 Introduction

The MTS Series 111 Accumulators stabilize the hydraulic lines in your system. There are two models available:

- The Model 111.11B Accumulator is a boss port-mounted accumulator that requires a boss adapter fitting for mounting.
- The Model 111.12C Accumulator is bolt-mounted to a flange and typically has a larger nitrogen gas capacity than the Model 111.11B.

3.2.0 What you need to know

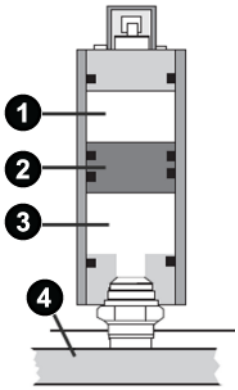
MTS Systems Corporation assumes that you know how to use your controller. See the appropriate manual for information about performing any controller-related step in this manual's procedures. You are expected to know how to perform the following procedure:

- Turn hydraulic pressure on and off
- Select a control mode
- Manually adjust the actuator position

3.3.0 Functional Description

Series 111 Accumulators can reduce fluctuations in hydraulic lines due to sudden changes in hydraulic flow rate. They also act as a short-term energy source for high-rate tests by providing additional hydraulic flow for short periods to meet irregular peak demands. Like a capacitor, accumulators filter out pulses in the hydraulic fluid to provide steady hydraulic pressure.

Accumulators are like a hydraulic version of a capacitor. They are hydro-pneumatic devices located at strategic points in a hydraulic system. They may be connected to the pressure line and to the return line.



Accumulator

Item	Description
1	Nitrogen Side
2	Piston
3	Fluid Side
4	Hydraulic Fluid

Accumulators are precharged with pressure. Precharge pressure is the pressure of the compressed gas (usually nitrogen) before hydraulic fluid is introduced.

Inserting accumulators into the hydraulic lines permits some fluid to be stored under pressure a short distance from the servovalve and actuator. This has the effect of keeping fluid in the lines in motion and reducing the inertia and line restriction considerations. When the servovalve opens and line pressure begins to drop, the accumulator in the hydraulic service manifold (HSM) immediately supplies part of the fluid volume and maintains the line pressure. Then, when the servovalve closes, the hydraulic power supply (HPS) recharges the accumulator, causing fluid in the lines to remain in motion.

The pattern and frequency of the signal that drives the servovalve will have considerable effect on the HSM accumulator efficiency. Square wave signals, for example, cause a greater demand than sine wave signals or ramp signals.

At some frequencies, fluid flow in the lines may stop completely, and overcoming the fluid inertia may become a more significant operational factor.

An accumulator in the return line damps the pulsing effect caused by “slugs” of fluid being injected into the line as the actuator moves. Movement of hoses or hammering of hard lines is also reduced.

3.4.0 Series 111 Accumulator Specifications

The following tables list the specifications for the Series 111 Accumulators.

Product Specifications

Parameter	Model 111.11B	Model 111.12C
Minimum burst pressure	83 MPa (12,000 psi)	138 MPa (20,000 psi)
Rated fatigue pressure	21 MPa (3000 psi)	22 MPa (3200 psi)
Operating temperature	–40°C to 93.3°C (–40°F to 200°F)	
Hydraulic fluid	Petroleum-based hydraulic fluid. Contact MTS for use with other fluids.	
Dry nitrogen	Dry nitrogen	

Note:

Specifications are subject to change without notice. Contact MTS Systems Corporation for verification of specifications critical to your needs.

Capacity, Dimension, and Weight

Model*	Nitrogen Gas Capacity	Length†	A†	B†	Hydraulic Fluid Port Connection	Maxp
		cm (in.)	cm (in.)	cm (in.)		kg (lbs)
111.11B-01	82 cm^3 (5 $in.^3$)	15.54 (6.12)	7.87 (3.1)	6.35 (2.5)	12 SAE (1-1/16-12 UNF-2B)	4.26 (9.4)

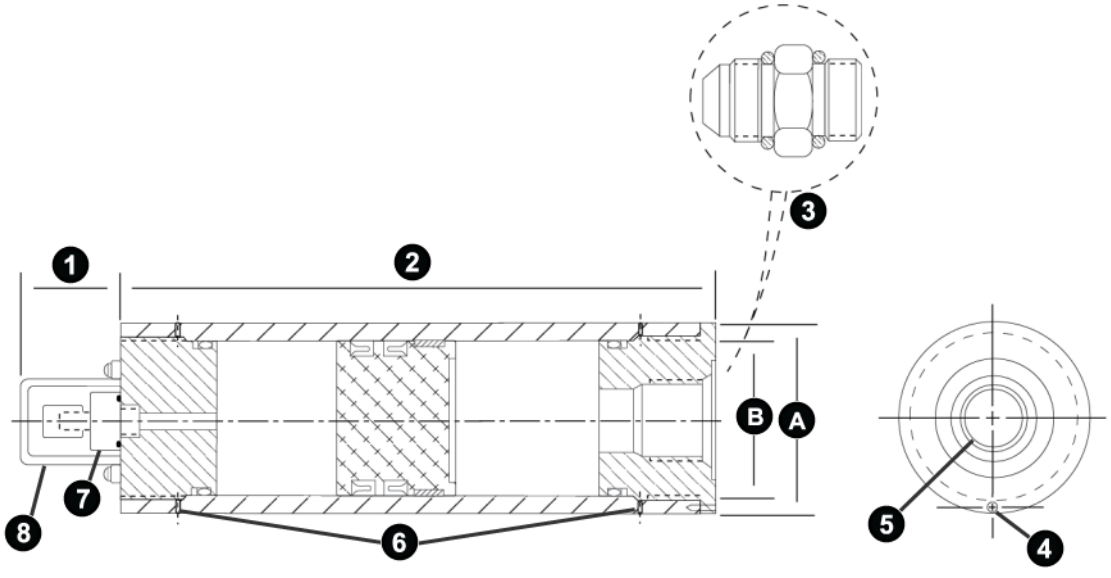
* The models listed in this table are considered standard models. Other models may be manufactured with different capacities, lengths, or hydraulic fluid port connections than listed here. Contact MTS Systems Corporation for information on nonstandard models.

† See the related cross-section figures.

‡ Standard pressure series (Code 61).

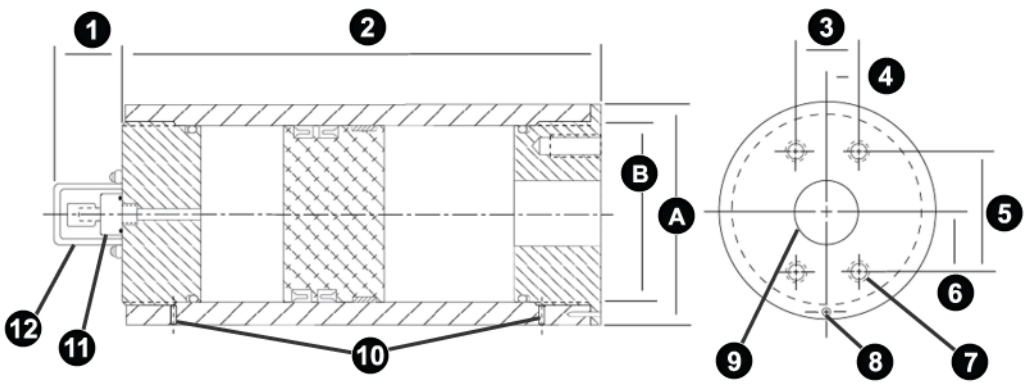
Model*	Nitrogen Gas Capacity	Length†	A†	B†	Hydraulic Fluid Port Connection	Maxp
		cm (in.)	cm (in.)	cm (in.)		kg (lbs)
111.11B-02	164 cm^3 (10 $in.^3$)	18.08 (7.12)	7.87 (3.1)	6.35 (2.5)	12 SAE (1-1/16-12 UNF-2B)	4.63 (10.2)
111.11B-03	475 cm^3 (1 pt)	27.94 (11.0)	7.87 (3.1)	6.35 (2.5)	16 SAE (1-5/16-12 UNF-2B)	5.94 (13.1)
111.11B-04	950 cm^3 (1 qt)	42.88 (16.9)	7.87 (3.1)	6.35 (2.5)	20 SAE (1-5/8-12 UNF-2B)	7.98 (17.6)
111.12C-02	950 cm^3 (1 qt)	29.51 (11.6)	12.7 (5.0)	10.16 (4.0)	1-1/2 SAE 4-bolt flange‡	18.45 (40.6)
111.12C-03	1.9 l (0.5 gal)	39.07 (15.4)	12.7 (5.0)	10.16 (4.0)	1-1/2 SAE 4-bolt flange‡	21.77 (48.0)
111.12C-04	3.8 l (1 gal)	61.93 (24.4)	12.7 (5.0)	10.16 (4.0)	1-1/2 SAE 4-bolt flange‡	29.87 65.8

The following cross-section figures illustrate the difference between the accumulator models.



Model 111.11B Accumulator Cross-Section

Item	Description
1	1.563 in. (39.7 mm)
2	Length
3	Typical Boss Adapter Fitting
4	Locking Pin
5	Hydraulic Fluid Port
6	Relief Vent
7	Accumulator Valve Assembly
8	Protective Cover



Model 111.12C Accumulator Cross-Section

Item	Description
1	1.563 in. (39.7 mm)
2	Length
3	1.406 in. (35.7 mm)
4	0.703 in. (17.8 mm)
5	2.750 in. (69.9 mm)
6	1.375 in. (34.9 mm)
7	1/2-13UNC 2B
8	Locking Pin

Item	Description
9	Hydraulic Fluid Port
10	Relief Vent
11	Accumulator Valve Assembly
12	Protective Cover

4.0 Safety

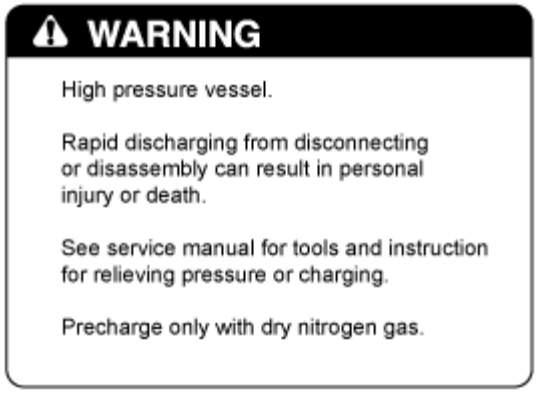
Topics:

4.1.0 Hazard Placard Placement

Hazard placards contain specific safety information and are affixed directly to the system so they are plainly visible.

Each placard describes a system-related hazard. When possible, international symbols (icons) are used to graphically indicate the type of hazard and the placard label indicates its severity. In some instances, the placard may contain text that describes the hazard, the potential result if the hazard is ignored, and general instructions about how to avoid the hazard.

The following labels are typically located on the accumulator.

Label	Description
	DANGER Nitrogen gas under pressure. Improper testing of precharge or disassembly without releasing nitrogen gas can cause severe injury or death. Release gas before disassembly. Read instructions before testing or servicing.
	WARNING High pressure vessel. Rapid discharging from disconnecting or disassembly can result in personal injury or death. See service manual for tools and instruction for relieving pressure or charging. Precharge only with dry nitrogen gas.

Label	Description
	Skin injection hazard; release of fluid pressure. High pressure fluid and penetrate skin. Do not tamper with fittings or hoses. Wear appropriate protection such as safety goggles and gloves. Maintain safe pressure levels.

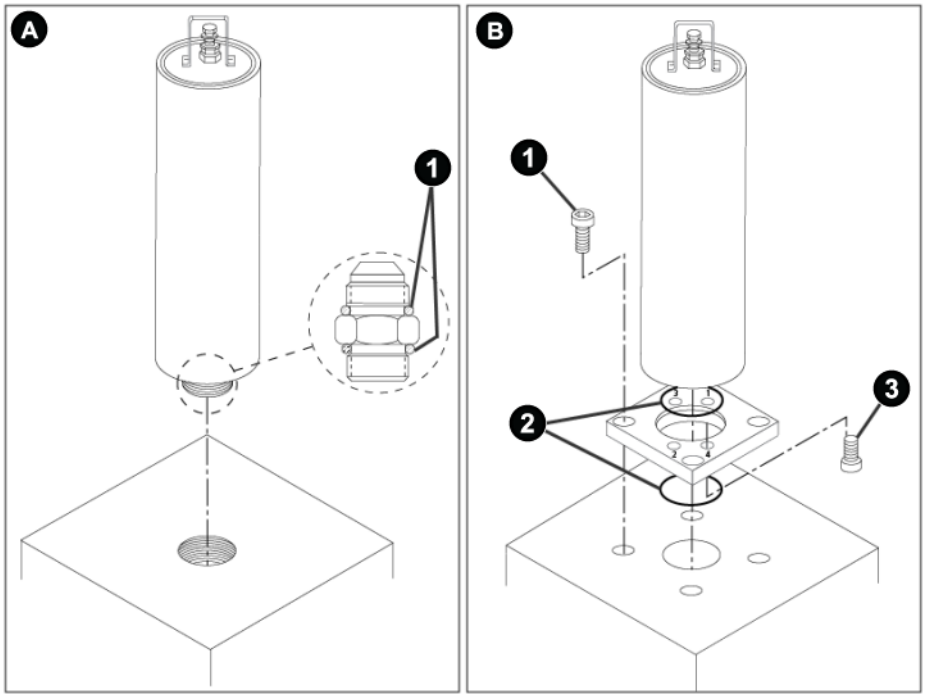
5.0 Installation

Topics:

5.1.0 About the Series 111 Accumulator Installation Procedure

There are two models of the Series 111 Accumulator. The following figure shows the typical mounting configuration for the Models 111.11B and 111.12C Accumulators.

- The Model 111.11B Accumulator is mounted with a boss adapter fitting and O-ring seals. When the accumulator is ordered as a component, the boss adapter and O-ring seals are not included with the accumulator, they must be purchased separately.
- The Model 111.12C Accumulator is flush mounted with four bolts and O-ring seal(s). When the accumulator is ordered as a component, the four bolts (grade-8) and O-ring seal(s) (maximum size 54.28 mm [2.137 in.] outside diameter, 47.22 mm [1.859 in.] inside diameter), are not included with the accumulator and must be purchased separately.



Mounting Configurations

Item	Description
A	Model 111.11 B
	1 Boss Adapter Mounting O-rings
B	Model 111.12C

Item	Description	
	1	Flange Mounting Bolt
	2	Flange Mounting O-rings
	3	Accumulator Mounting Bolts (4)

5.1.1.0 Series 111 Accumulator Installation Procedure

Required equipment

The following equipment is required for accumulator installation:

- Open-end wrench and strap wrench (for the Model 111.11B)
- Hex key set and torque wrench (for the Model 111.12C)

Note:

When installing a replacement accumulator into an existing system, the replacement accumulator should be precharged to the same pressure level as the accumulator being removed. Be sure that this precharge level is recorded on the label of the replacement accumulator.

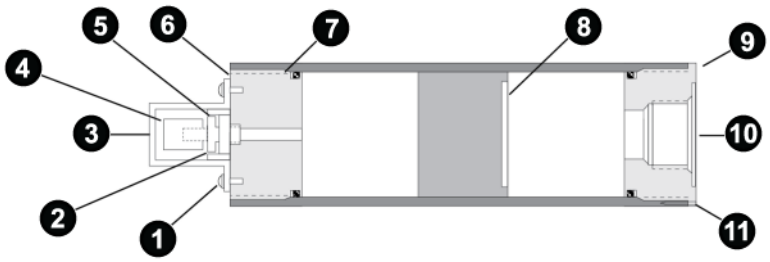
1. Mount the accumulator in the system after lubricating the mounting O-ring seal(s). Note the O-ring seal configuration.
   - **For the Model 111.11B Accumulator** Thread the unit onto the boss adapter fitting and securely tighten it with a strap wrench.
   - **For the Model 111.12C Accumulator** Lubricate and torque the four mounting bolts in increments (according to the pattern shown in the “Mounting Configurations” figure) to a final torque of 108 N·m (80 lbf-ft).
2. Check the accumulator precharge pressure as described in the related procedure.

6.0 Maintenance

Topics:

6.1.0 Series 111 Accumulator Maintenance Guidelines

Maintaining the proper pressure level for your accumulators is essential for optimum system performance and component life. Review the following figure to familiarize yourself with the accumulator components and their locations. Also review the following guidelines before performing any procedure.



Accumulator Components

Item	Description
1	Screws
2	Accumulator valve assembly
3	Accumulator valve protective cover
4	Valve stem cap
5	Locknut
6	End cap
7	Chamber
8	Piston
9	Hydraulic fluid end cap
10	Hydraulic fluid port
11	Locking pin

Use the following guidelines to determine when maintenance is required.

- Check the precharge pressure at periodic intervals. The length of time between checks depends on how the system is used. Some factors to consider when establishing this time interval are operating frequency,

displacement, and duration. Start with one month intervals until you determine that another interval is more appropriate.

- Maintain a log book on the condition of the precharge at each check. Use this data to determine if the time between checks should be increased or decreased and if maintenance is required.
- Because the precharge pressure level varies with a temperature change, the level should always be checked at the same temperature. If it is not, use one of the following formulas to determine if the precharge level is acceptable.

$$\underset{1}{\text{current pressure}} = \underset{2}{\text{original pressure}} \times \left(\frac{\underset{3}{273 + (\text{current temperature})}}{\underset{4}{273 + (\text{original temperature})}} \right)$$

Degrees Celsius

Item	Description
1	Current pressure
2	Original pressure
3	273 + (current temperature)
4	273 + (original temperature)

$$\underset{1}{\text{current pressure}} = \underset{2}{\text{original pressure}} \times \left(\frac{\underset{3}{460 + (\text{current temperature})}}{\underset{4}{460 + (\text{original temperature})}} \right)$$

Degrees Fahrenheit

Item	Description
1	Current pressure
2	Original pressure
3	460 + (current temperature)
4	460 + (original temperature)

- If a pressure line accumulator has a pressure level change of ±1.4 MPa (200 psi) between checks, the accumulator requires maintenance or the time interval between checks needs to be shortened.
- If a return line accumulator has a change of ±50% of the original pressure level between checks, the accumulator requires maintenance or the time interval between checks needs to be shortened.
- If the precharge pressure level increases at each check interval, this indicates that fluid is collecting on the gas side (a small amount of fluid leakage is normal). When the precharge pressure level cannot be

maintained within the limits, remove the fluid and charge the accumulator. If the levels are again exceeded at the first check interval, replace the piston seals after the initial fluid has been changed.

- If the precharge pressure level decreases at each check interval, this indicates gas leakage to the fluid side. When the precharge pressure level cannot be maintained within the limits stated in the previous guidelines, replace the accumulator piston seals.
- During normal operation, the accumulator piston should be near the center of the accumulator cylinder. To check the approximate piston location, note the warm-to-hot transition point on the accumulator cylinder wall during operation. If the piston is near the charging stem end, the accumulator may need charging. If the piston is at the other end, the accumulator may have an excess charge, or more likely an excessive amount of hydraulic fluid has collected in the gas chamber.

6.2.0 Check the Accumulator Precharge

The following equipment is required for any Series 111 Accumulator: Accumulator charging kit (MTS part number 376986-01).

1.

Warning:

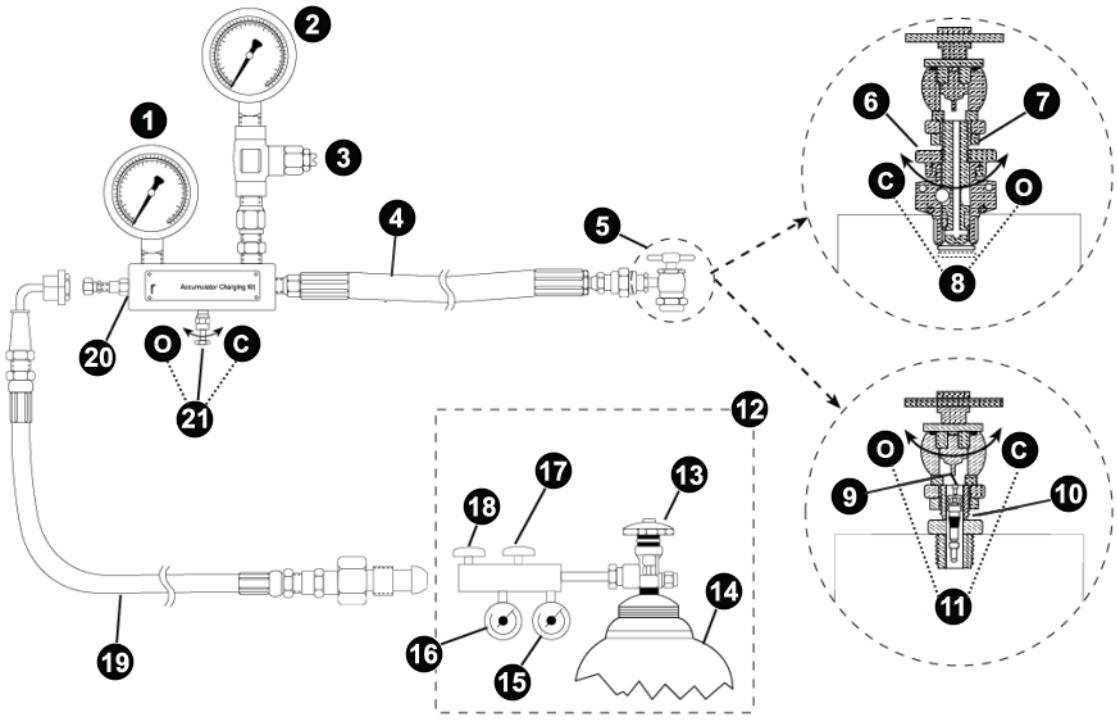
Accumulators are pressurized devices.

Pressurized accumulators and their parts can become lethal projectiles if disassembled and can cause death to persons and/or damage to equipment.

Do not remove an accumulator that is pressurized. Completely remove hydraulic pressure and discharge the accumulator before any parts, except the protective cover and valve stem cap, are removed.

Ensure that system hydraulic pressure has been reduced to zero before proceeding. To do this, turn off the hydraulic power unit and exercise the actuator until it stops moving.

2. Close the bleed valve on the accumulator charging kit. Remove the protective cover and valve stem cap from the accumulator (see “Accumulator Components” and the figure below).
3. Check the precharge depending on the kind of accumulator on your system.
   a) For an MTS Series 111 Accumulator, see "Check the Series 111 Accumulator Precharge".
   b) For a non-MTS accumulator, see "Check a Non-MTS Accumulator Precharge".



Accumulator Precharge

Item	Description	
1	High Pressure Gage 0–21 MPa (0–3000 psi)	
2	Low Pressure Gage 0–2.1 MPa (0–300 psi)	
3	Gage Protector (factory set to limit pressure to the gage to approximately 1.4 MPa (200 psi)	
4	Extension Hose	
5	Check Valve: This valve will be either a poppet-type valve or a core-type valve.	
6	Locknut	
7	Valve Stem	
8	Poppet-Type Valve: To Open and Close Use Chuck Valve	
	C	Close
	O	Open
9	Valve Core	
10	Valve Stem	
11	Core-Type Valve: To Open and Close Use Chuck Valve	
	O	Open

Item	Description	
	C	Close
12	Customer supplied items	
13	Nitrogen Bottle Valve	
14	Nitrogen Bottle	
15	Nitrogen Bottle Pressure Gage	
16	Regulator Output Pressure Gage	
17	Regulator Output Pressure Valve	
18	Regulator Shut-Off Valve	
19	Nitrogen Supply Hose	
20	Input Check Valve	
21	Bleed Valve	
	O	Open
	C	Close

6.2.1.0 Check the Series 111 Accumulator Precharge

This procedure is a continuation of "Check the Accumulator Precharge." Steps 1-3 of that procedure should be preformed before completing this procedure.

The Series 111 Accumulators use the poppet-type valve.

1. Connect the charging kit chuck valve to the accumulator valve stem.
2. With an open-end wrench, turn the locknut counterclockwise on the accumulator valve assembly to open the valve. Read the pressure on either the high or low accumulator charging kit pressure gage.
   - If the pressure reading is other than the required pressure level recorded on the accumulator, go to the procedure “Change the Precharge Pressure.”
   - If the pressure level corresponds to the level recorded on the accumulator label, turn the locknut clockwise to close the valve and continue this procedure.
3. Open the bleed valve on the accumulator charging kit and remove the chuck valve from the accumulator.
4. Replace the valve stem cap and protective cover on the accumulator.

6.2.2.0 Check a Non-MTS Accumulator Precharge

This procedure is a continuation of "Check the Accumulator Precharge." Steps 1-3 of that procedure should be preformed before completing this procedure.

Non-MTS accumulators typically use either a poppet–type valve or a core–type valve.

1. Determine which type of gas pressure valve is present on the accumulator and connect the charging kit chuck valve to the accumulator valve stem.
2. Open the locknut (poppet-type) or chuck valve (core-type).

   Note:

   The poppet-type valve opens by turning the locknut counterclockwise and closes by turning the locknut clockwise. To open a core–type valve, attach a chuck valve to the valve stem and turn the chuck valve handle clockwise to depress the valve core. Close the valve by turning the handle counterclockwise.

3. Read the pressure on either the high or low accumulator charging kit pressure gage.

   The low pressure gage is limited to approximately 1.4 MPa (200 psi) by the gage protector.

   - If the pressure reading is other than the required pressure level recorded on the accumulator, go to the procedure “Change the Precharge Pressure.”
   - If the pressure level corresponds to the level recorded on the accumulator label, close the locknut (poppet-type) or close the chuck valve (core-type). Continue to Step 4.

4. Open the bleed valve on the accumulator charging kit and remove the chuck valve from the accumulator.
5. Replace the valve stem cap and protective cover on the accumulator.

6.3.0 About Changing the Precharge Pressure

The precharge of an accumulator mounted on a hydraulic supply line often is increased to enhance system performance and reduce the transient HPS flow demands. Accumulators may be precharged to 10 MPa (1500 psi) or more, although amounts above 14 MPa (2200 psi) will have less and less performance effect in most situations. Be sure that you read the following warning before you charge your accumulator.

Warning:

Accumulators have specific pressure ratings.

If the precharge pressure is too high, the accumulator can bottom out causing the release of metal particles into the hydraulic fluid. Charging accumulators above their rated level can damage system equipment.

Do not charge accumulators to pressures above their rated level. Charge accumulators below their rated fatigue pressure of 21 MPa (3000 psi) for the Model 111.11B and 22 MPa (3200 psi) for the Model 111.12C. Use a suitable regulator and gage set to an accumulator’s charges.

6.3.1.0 Decrease the Precharge Pressure

See “Check the Accumulator Precharge” to determine if you need to change the precharge pressure.

1. Slowly open the bleed valve on the accumulator charging kit until gas begins to escape. When the pressure reading on the appropriate pressure gage drops to the level required, close the bleed valve.
2. Close the locknut (or close the chuck valve if you have a core-type valve). Open the bleed valve on the accumulator charging kit and remove the chuck valve from the accumulator.
3. Install the valve stem cap and protective cover.

6.3.2.0 Increase the Precharge Pressure

See “Check the Accumulator Precharge” to determine if you need to change the precharge pressure.

1. Close the locknut on the accumulator (or close the chuck valve for a coretype valve).
2. Open the bleed valve two turns.
3. 

   Warning:

   Mixing gases can produce unpredictable results.

   Do not use another gas to precharge an accumulator.

   Use only dry nitrogen gas to precharge accumulators.

   Connect the nitrogen supply hose from the supply bottle pressure regulator output to the input check valve on the charging kit.
4. Open the nitrogen bottle valve. Check the nitrogen bottle pressure gage on the regulator. (The bottle must contain sufficient pressure to provide an adequate gas volume.)
5. Monitor the regulator output pressure gage and adjust the regulator output pressure valve to the required level.
6. 

   Caution:

   Rapid flow rates with pressure differentials of more than 2.1 MPa (300 psi) across the input check valve can damage the valve seal(s).

   Avoid rapid and extreme pressure transitions.

   Do not allow rapid flow rates. Open the regulator shut-off valve only far enough to permit a gradual transfer of gas.

   Slowly open the regulator shut-off valve until gas is heard escaping from the accumulator charging kit bleed valve. Allow gas to slowly escape for approximately ten seconds, and then close the bleed valve. Immediately close the regulator shut-off valve before the pressure reading on either the high or low charging kit pressure gage exceeds the pressure level of the accumulator.
7. Open the locknut (or open the chuck valve for a core-type valve). Slowly open the regulator shut-off valve until the pressure indicator on either the high or low charging kit pressure gage begins to rise. When the pressure is at the required pressure level (recorded on the accumulator), close the regulator shut-off valve.
8. Close the locknut (or close the chuck valve for a core type valve).
9. Open the bleed valve on the accumulator charging kit and remove the chuck valve from the accumulator.
10. Install the valve stem cap and protective cover. Close the valve on the nitrogen bottle.

6.4.0 Purge Fluid from the Gas Chamber

Piston-type accumulators may collect hydraulic fluid in the gas chamber, which then reduces the gas volume of the accumulator. The fluid should be purged from the gas side if a pressure check procedure shows one or more of the following:

- A consistent trend of pressure being higher than expected.
- Precharging requires smaller volumes of gas than expected to obtain a desired pressure level.
- Fluid is expelled from a gas valve during gas venting.

Caution:

Venting pressurized gasses can generate loud noises and freezing temperatures.

Transferring gasses from high to low pressure containers creates freezing temperatures.

Do not work with pressurized gasses without wearing protective clothing. Wear heavy gloves, safety glasses, and ear plugs when working with pressurized gases.

1. If the valve stem of the accumulator is facing down, go directly to Step 2. If the valve stem of the accumulator is facing up or the accumulator is on its side, remove the accumulator as described in “Remove the Accumulator” and turn it so that the valve stem is facing down.
2. Remove the accumulator valve protective cover and the valve stem cap. Securely position the accumulator with the gas valve down.
3. Place a suitable container under the valve stem to capture any expelled fluid. Use an open-end wrench and open the locknut on the accumulator valve assembly two or three full turns. Allow gas pressure to reduce to zero and any hydraulic fluid to be expelled.
4. Replace the accumulator as described in the Installation chapter. Then precharge the accumulator as described in “Change the Precharge Pressure.”

6.5.0 Remove the Accumulator

Warning:

Accumulators are pressurized devices.

Pressurized accumulators and their parts can become lethal projectiles if disassembled and can cause death to persons and/or damage to equipment.

Do not remove an accumulator that is pressurized. Completely remove hydraulic pressure and discharge the accumulator before any parts, except the protective cover and valve stem cap, are removed.

1. Ensure system hydraulic pressure has been reduced to zero before proceeding. To do this, turn off the HPS and turn on low pressure at the controller. Exercise the actuator until it stops moving. Then turn off the electrical power.
2. Place a drain pan under the accumulator to be removed.
3. To prevent contamination of the hydraulic fluid, cover any ports that are exposed.
4. If you have the Model 111.12C Accumulator, use a hex key to remove the flange and accumulator mounting bolts (see “Actuator Components”). If you have the Model 111.11B Accumulator, use an open-end and strap wrench to loosen the accumulator from the boss adapter fitting.
5. Perform any required maintenance (see the other procedures in this section).
6. To reinstall the accumulator, see “Series 111 Accumulator Installation Procedure”.

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