MTS FSE MODULAR TRAINING

358 and 359 Load Frames

September 25, 2015 Rev B

be certain.

Overview

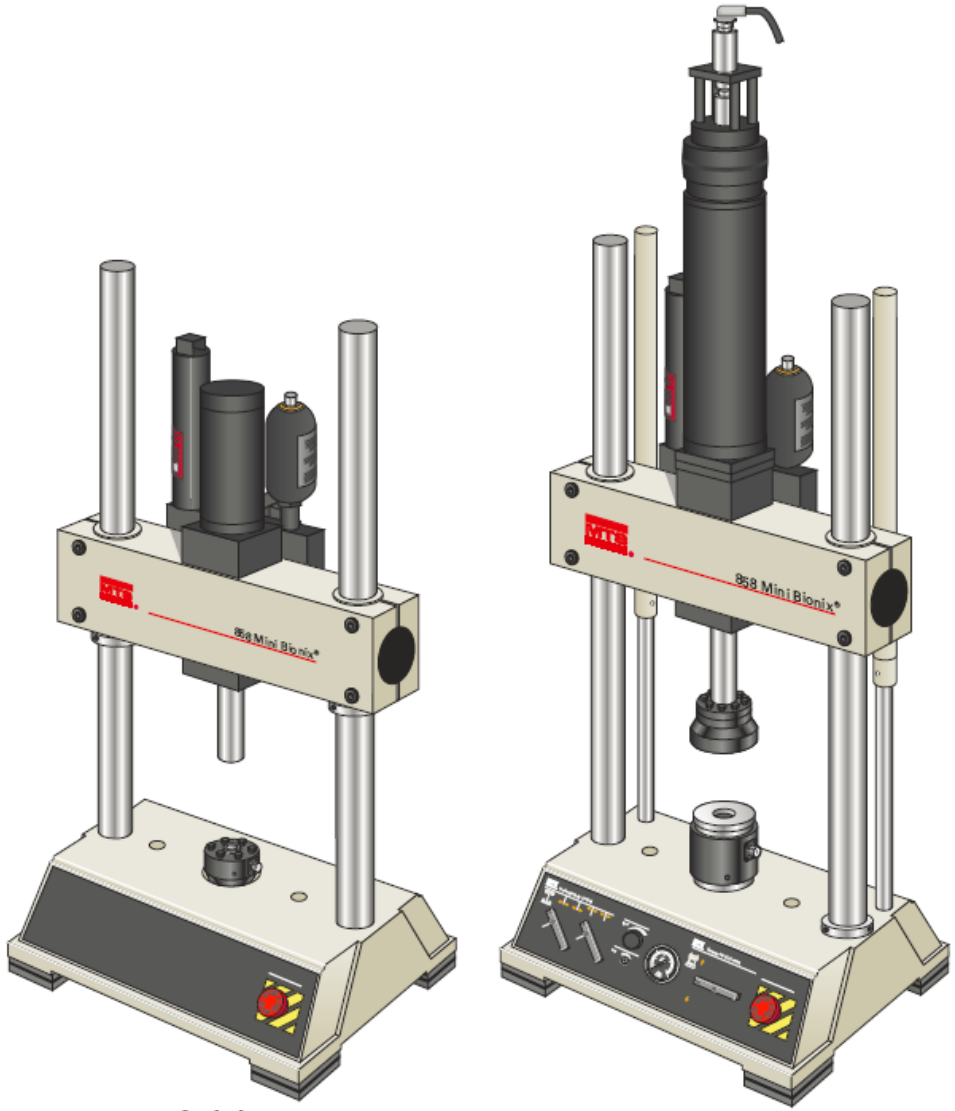
- The 358 and 359 series of load frames are available both as a floor standing and as a table top load frame.
- All 358 and 359 load frames have the linear actuator (and rotary if present) mounted on the crosshead.

358.10 Floor Standing

359.02 Table Top

Overview

- These are available in axial only or with both axial and torsional actuators.



Axial

Axial-Torsional

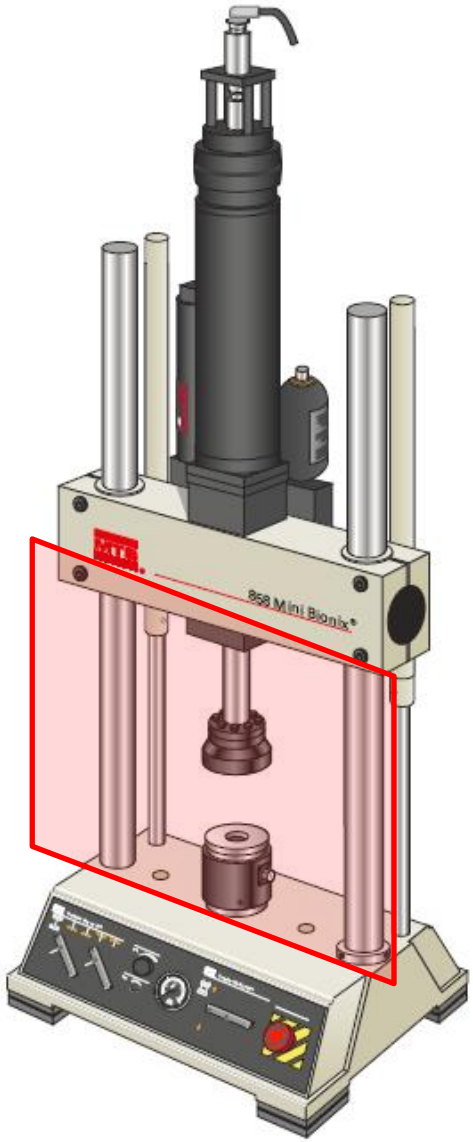
Specifications

- The load frame is rated
  - 25 kN (5.5 kip) axial.
  - 200 N•m (2000 in-lb) torsional.

- The axial actuator size may be smaller than load frame capacity.
  - The 2 standard size axial actuators are
  - 25 kN (5.5 kip)
  - 15 kN (3.3 kip)

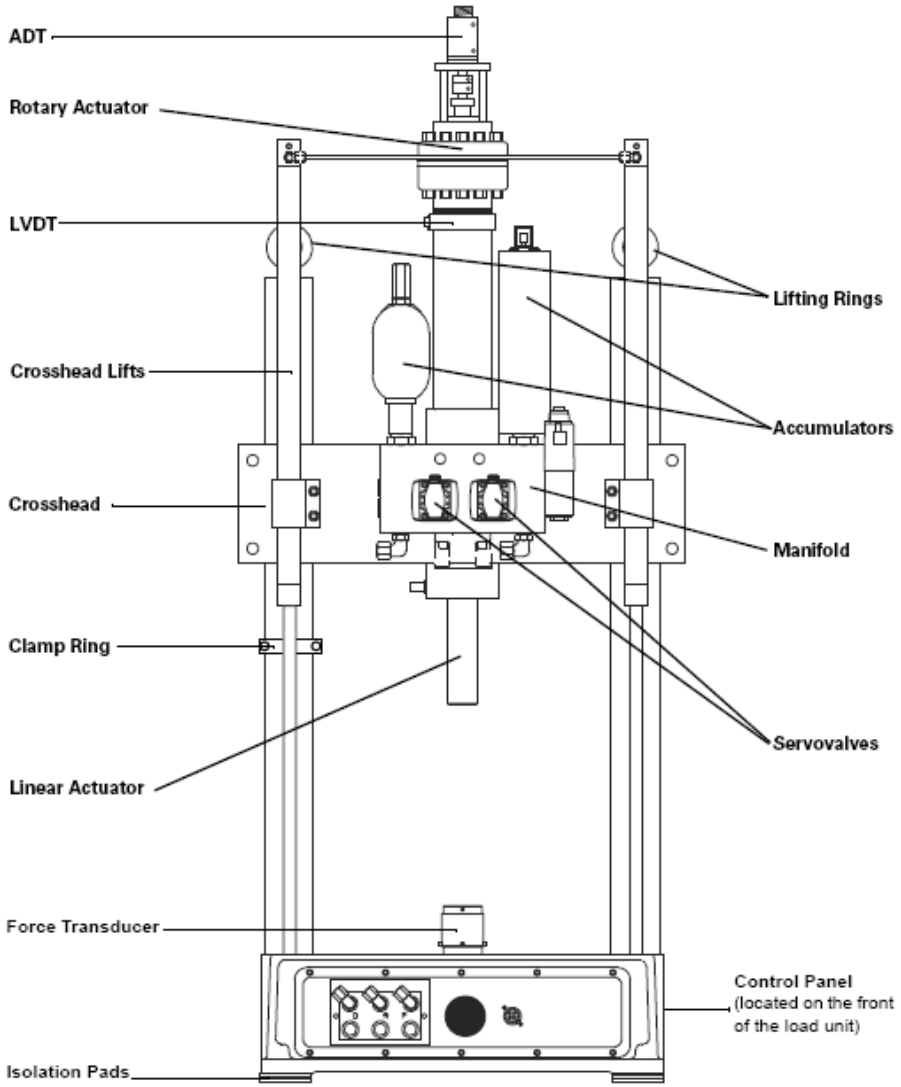
Safety

- Be aware of the crush zones on this load frame. Keep clear of the crush zones.
- There is a crush zone in the test space area between the platen and the crosshead.



Component Locations

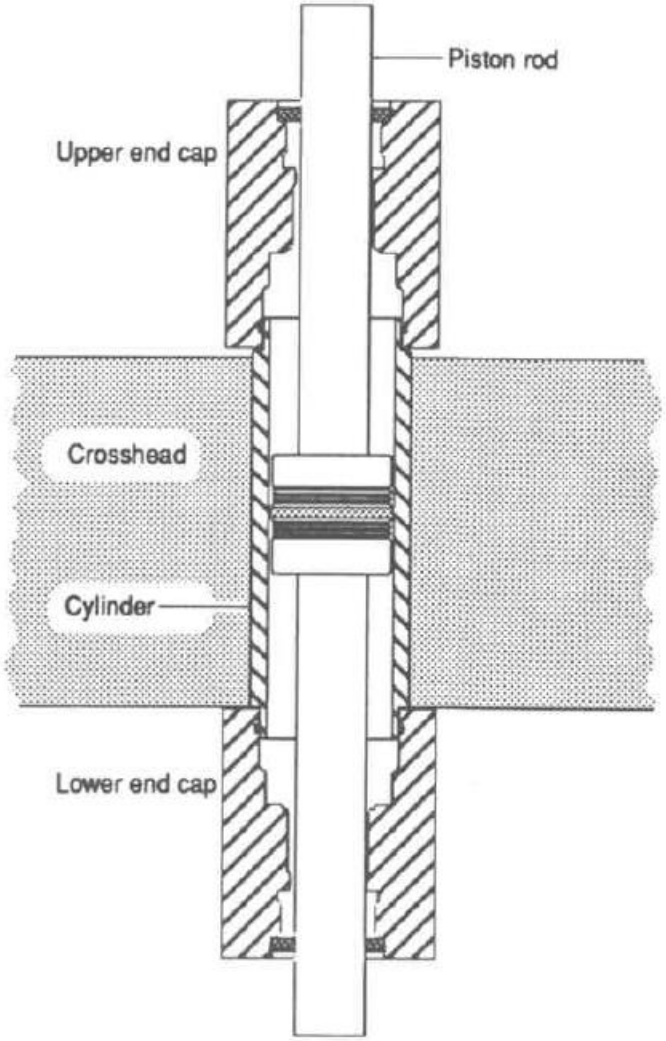
- This is the rear view of the modern Axial / Torsional load frame.
- The rotary actuator is mounted on top of the linear actuator. They are attached using a spline coupling.
- The rotary actuator turns the piston rod of the linear actuator to apply torsional forces.
- Note 2 servovalves on the manifold. One is for Axial. The other is for Torsional.



Rear View of an Axial-Torsional Load Unit

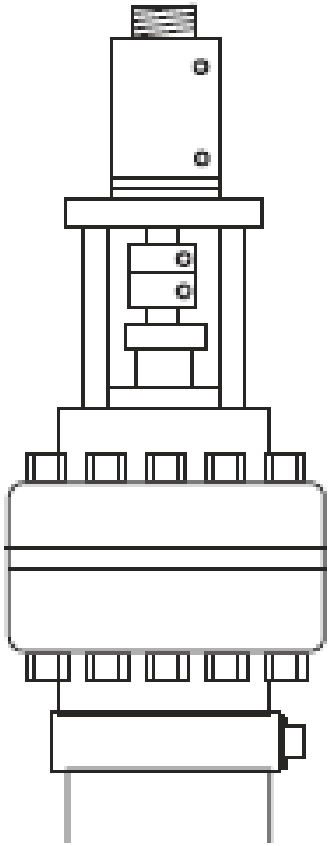
Linear Actuator

- The load frame has an insert in the crosshead which is the cylinder.
- The upper end cap is on top of the crosshead and the lower end cap is on the bottom of the crosshead.



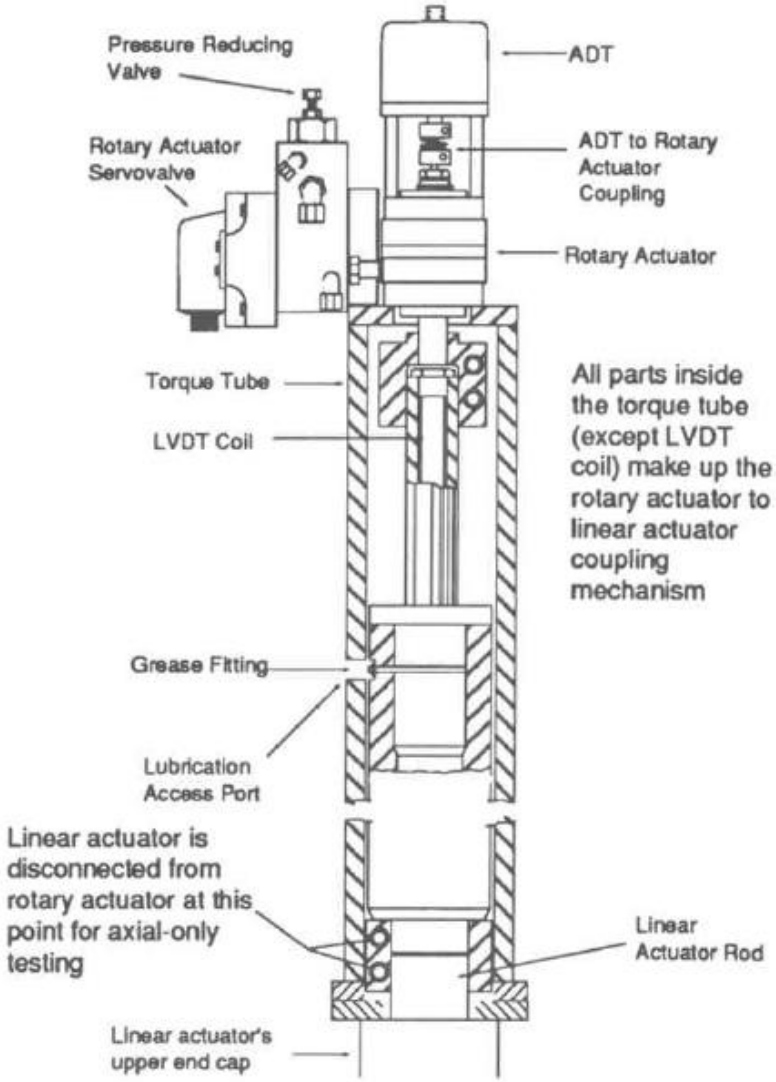
Rotary Actuator

- The rotary actuator is mounted on the end of the torque tube which houses a spline coupling.
- This rotary actuator nameplate may have a pressure rating of 3000 PSI however for MTS application there is a pressure reducing valve located on the manifold which is adjusted to the minimum pressure where the rotary can achieve 200 Nm torque.
  - This is typically 1000 psi
- An ADT for measuring angular displacement is mounted on the back of the rotary actuator



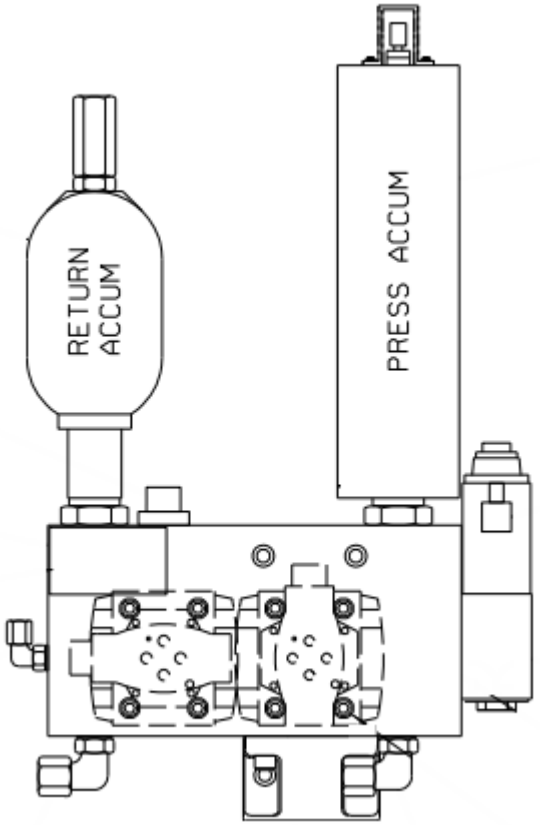
Spline Coupling

- This is a detail view of the spline coupling which connects the rotary actuator to the linear actuator.
- The LVDT coil for the linear actuator is located in the torque tube which houses the spline coupling on the Axial Torsional models.



Hydraulic Service Manifold

- The are several variations of the HSM.
  - No pressure Off/On Control
  - Off / On pressure control
  - Off / Low / High pressure control using proportional valve.
- These frames do not use a standard 298 HSM.



Servovalves

- The axial only manifold has a single location for one servovalve.

- The older axial torsional manifolds have a single valve located on the linear manifold for the linear actuator and a remote mounted manifold near the rotary actuator for the rotary actuator.
  - The manifold with the servovalve for the rotary actuator also contains the pressure reducing valve for the rotary actuator.

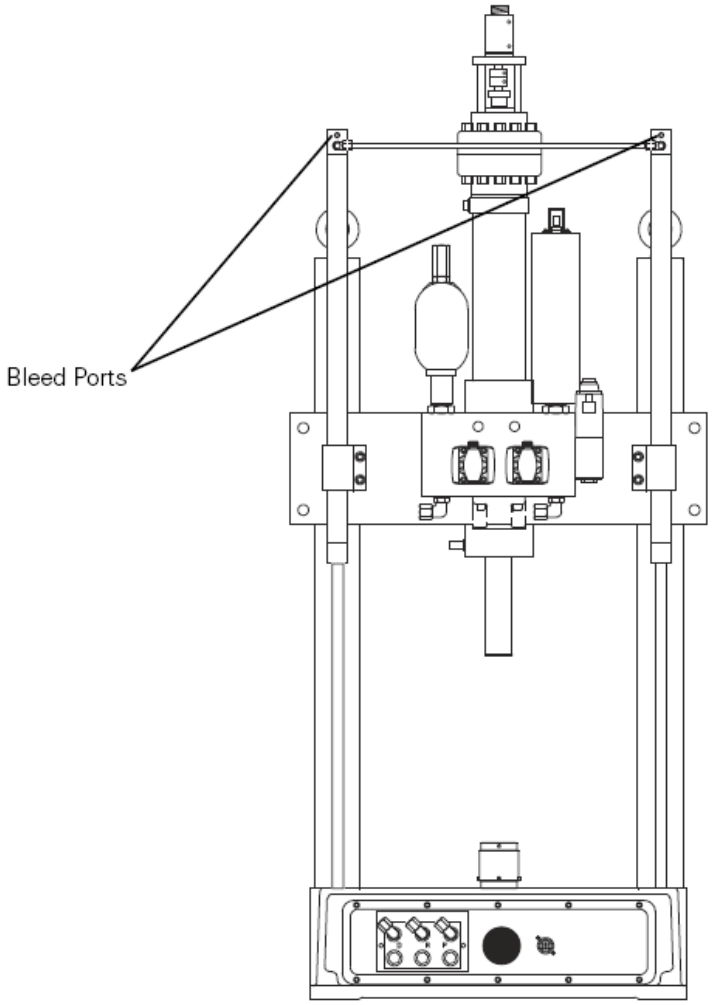
- The modern version the manifold mounted to the linear actuator has 2 servovlaves. One for the linear actuator and one for the rotary actuator.
  - This manifold also contains the pressure reducing valve for the rotary actuator.

Crosshead Hydraulic Lifts

- Hydraulic locks were optional on older models of this load frame. The lock circuit is the same as used for the 318 load frame using a pilot operated check valve to control the lock and unlock condition.
  - For additional details see the 312 / 318 load frame module
- Older models had optional hydraulic lifts. The lift and lower rates were adjustable using needle valves.
- On modern models hydraulic lifts with manual locks were optional. Hydraulic locks were not available.
- Modern version with lifts only uses a manifold with a manual 3 way hydraulic valve to port oil to and from the lift cylinder. The lift and lower rates are fixed. The rate is controlled by a non-adjustable orifice.

Crosshead Hydraulic Lifts – Bleed Ports

- Since the lift cylinder is mounted upside down the bleed screws are located at the top of the lift cylinder near the hydraulic connections.



Installation

- Secure Load frame to table top
- Connect cables
- Connect hydraulic hoses
- Turn on hydraulics, check for leaks.
- Bleed lift cylinders if present, unlock crosshead if lift cylinders are present, verify crosshead up / down operation.
- Check emergency stop
- Install Torsional adapter

Securing the Table Top Load Frame

» The table top load frame must be secured to a suitable table prior to operation.

- Do not raise the crosshead until the load frame is secure.

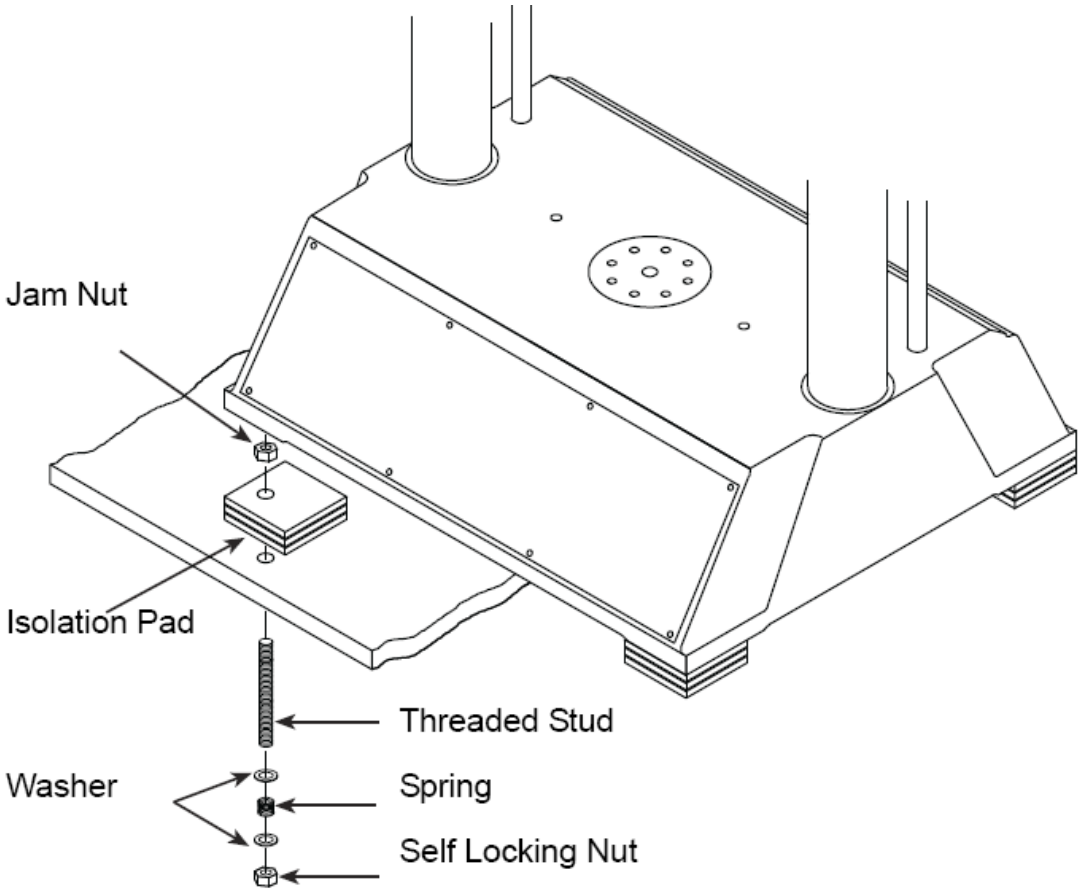
- With the crosshead raised the load frame has a high center of gravity due to the actuator being mounted on the crosshead. This can cause the load frame to become unstable.

» The mounting bolt hole pattern is available to the customer in the product manual

- This pattern can be used by the customer to drill holes in a customer supplied mounting table for the fasteners.

Securing the Table Top Load Frame

» Attach the load frame to the table as shown in the image below.
  - Place the isolation pads between the table and the load frame

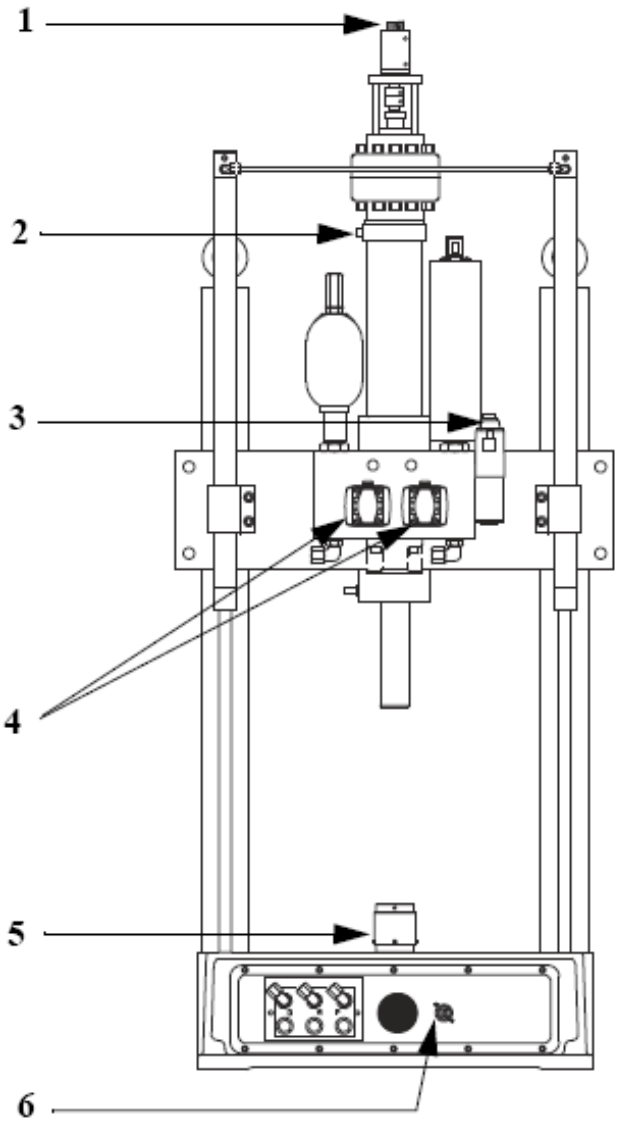


Load Frame Cable Connections

- The connections for this load frame are similar to other load frames.
  - Linear actuator LVDT
  - Rotary actuator ADT – Located on top of rotary actuator if one is present
  - Axial / Torsional force cell
    - This has 2 connections present on the load cell, one for the axial force and one for the torsional force.
  - HSM – Standard proportional valve connection
  - Load Frame Emergency stop
  - Ground

Load Frame Cable Connections

1. The ADT connects to a DC conditioner in the controller for the torsional channel.
2. The LVDT connects to an AC conditioner in the controller for the axial channel.
3. The manifold connects to the hydraulic service manifold connection at the controller.
4. The servovalves connect to a valve driver in the controller.
5. The force transducer connects to a DC conditioner in the controller. An axial torsional force transducer has two connectors which are connected to two DC conditioners.
6. The load unit control panel connects to the controller. It contains the **Emergency Stop** signal.

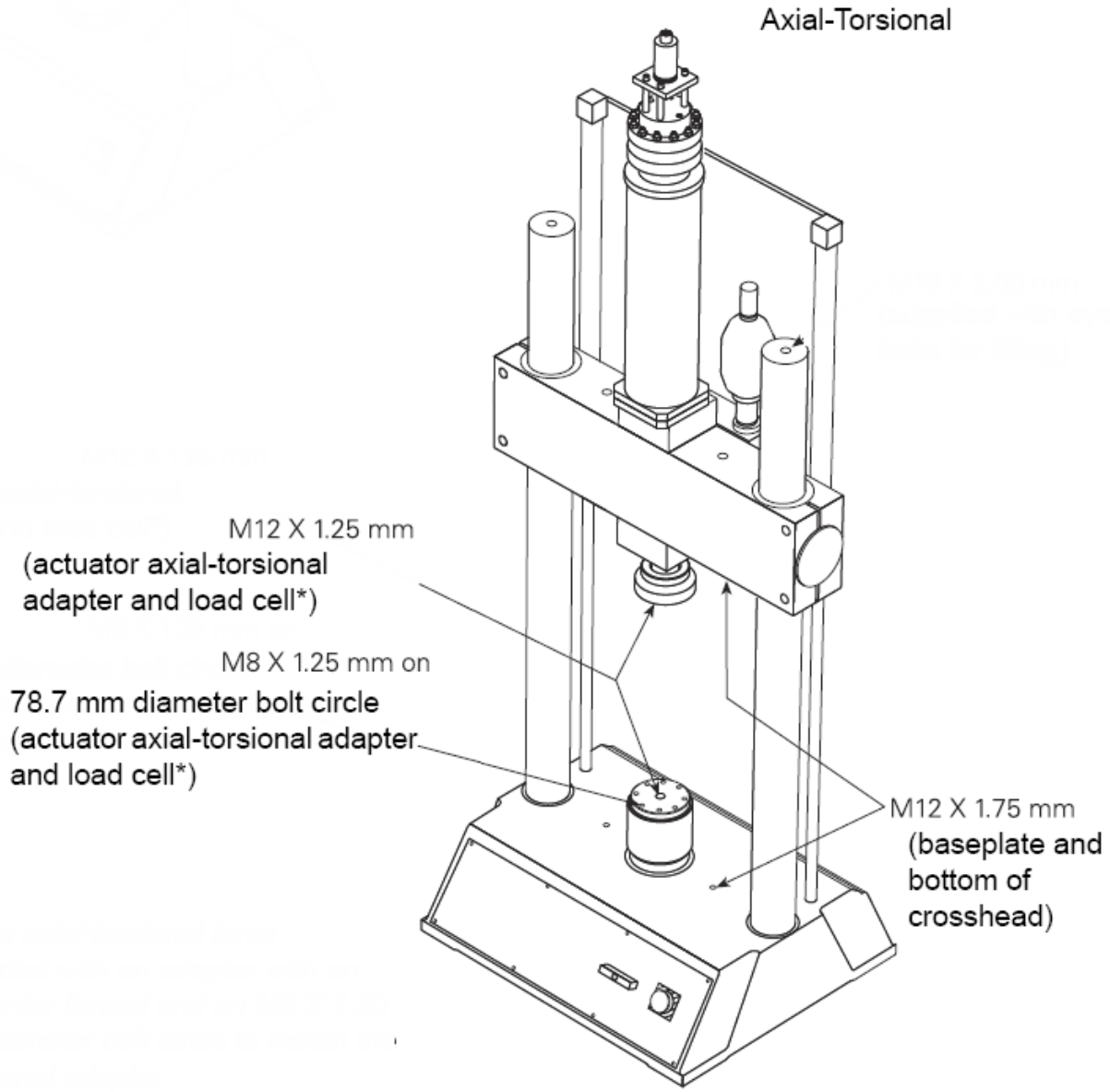


Load Cell Axial Only

» The load frames with axial only use a standard 661.19 axial load cell which has a single threaded connection.

Load Cell Axial / Torsional

- The Axial / Torsional load frame uses a 662.20 axial torsional load cell.
- This uses a bolted circle pattern to connect to the grips or fixtures.
- Some load cells also have a center threaded connection available.

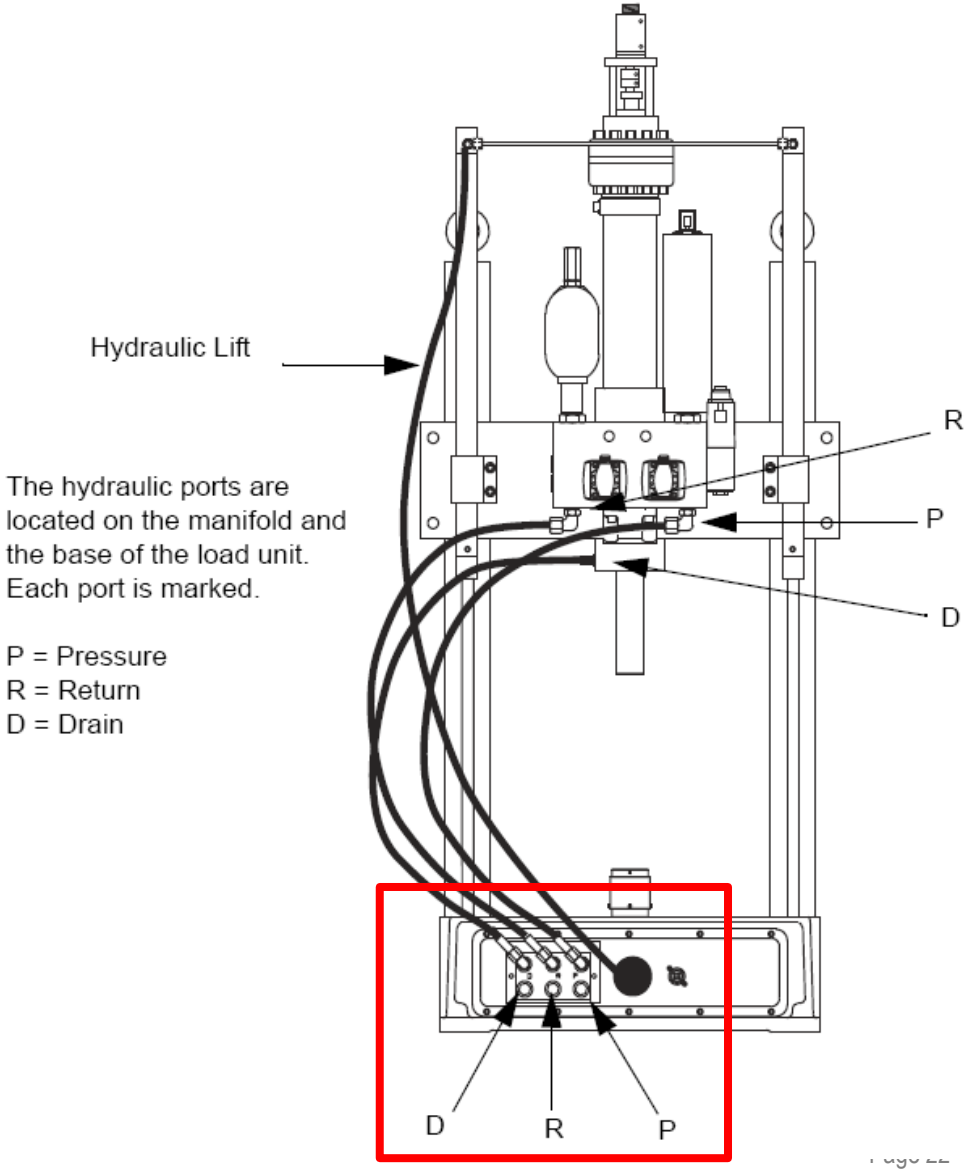


Load Cell Axial / Torsional

- This load cell has 2 connections. One for the Axial force and one for the torsional force.

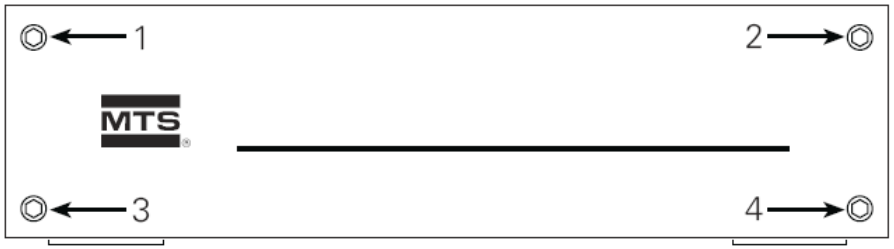
Hydraulic Connections

- A single set of hoses connects the HPU to the load frame.
  - Connect at hydraulic panel on lower rear of frame
- Hoses to the HSM, linear actuator, rotary actuator, and lifts are installed at the factory



Crosshead Locks

- On modern 359 load frames the crosshead is torqued to 135 Nm (100 lbf-ft) using the pattern and increment shown below. Older 358 load frames the crosshead bolts are torqued to 114 Nm (84 lbf-ft).
  - Verify proper torque for the system you are working on prior to locking crosshead.

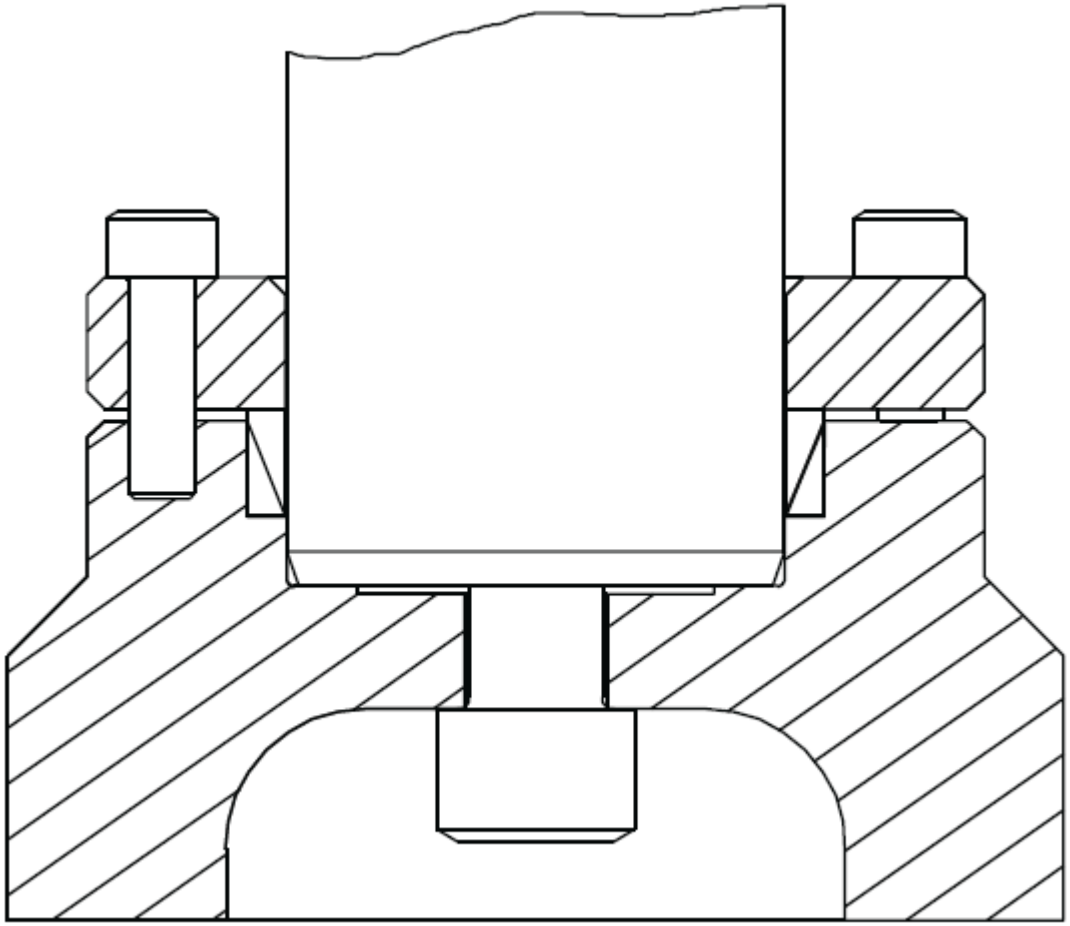


Torque the clamping bolts according to the torque settings shown for Step 1 in the following table. Use the bolt sequence shown above. Then torque the crosshead bolts to the values in Step 2 and so on until Step 4 is complete.

STEP 1	STEP 2	STEP 3	STEP 4
35 N·m (25 lbf·ft)	70 N·m (50 lbf·ft)	100 N·m (75 lbf·ft)	135 N·m (100 lbf·ft)

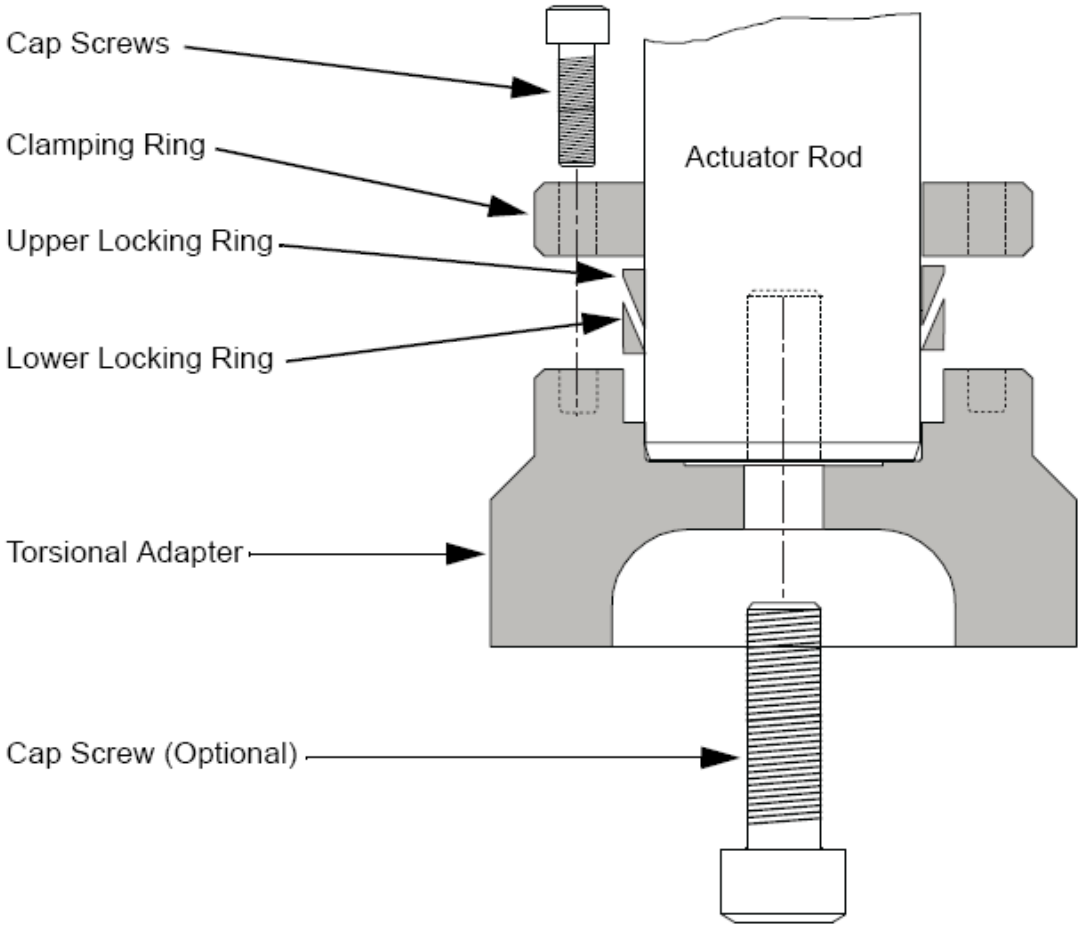
Torsional Adapter

- The torsional adapter is mounted to the end of the actuator rod using a clamping mechanism which clamps to the outside diameter of the actuator rod. There is also an optional bolt which uses the threaded hole in the actuator rod.
- This adapter has a bolt circle for the customer connection to grips or a fixture.



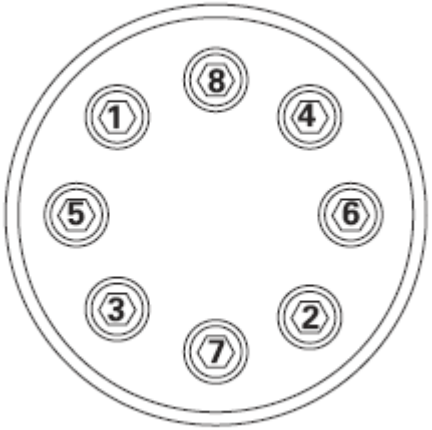
Torsional Adapter

- To install the torsional adapter:
- Clean all parts and ensure they are free of grease and oil.
- Slide the clamping ring, upper and lower locking rings, and torsional adapter onto the actuator rod
- The locking rings are different and will not work if installed upside down



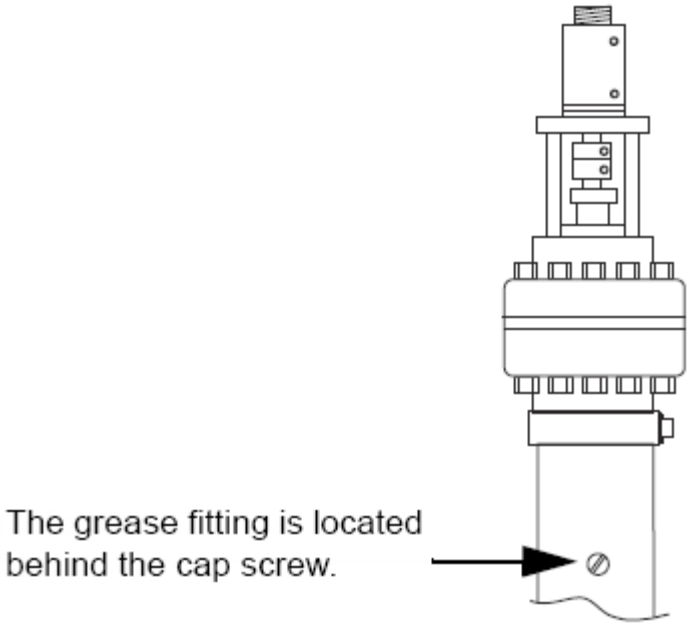
Torsional Adapter

- Lubricate the cap screws with Molykote prior to installing them in the fixture
- Torque the eight cap screws to 11 Nm (8.2 lbf-ft) in increments using the pattern shown
  - Torque increments of 25%, 50%, 75%, 100%, repeat 100% to verify equal torque on all fasteners.
- When testing above 15 kN axial or 100 Nm torsional also install the optional cap screw in the center bolt hole into the actuator rod
  - Torque to 100 Nm (75 lbf-ft)



Maintenance Items

- The spline coupling should be lubricated every 75-100 hours of operation or before starting a long duration short stroke high frequency test.
- Use Shell Alvania EP2 grease
  - MTS part number 110102-29
- On early versions of the load frame a grease injector needle may be required.



Maintenance Items – Grease Spline Coupling

» Note: The linear actuator must be fully extended to expose the grease fitting.

1. Remove the cap if present from the torque tube access hole.
2. Turn on hydraulic power.
3. Fully extend the linear actuator.
4. Turn the rotary actuator until the grease fitting appears in the access hole.
5. Turn off the hydraulic power.
6. Apply two pumps of grease to the fitting.
7. Turn on hydraulic power, cycle the actuator up and down a few times, return actuator to bottom of travel, and turn off hydraulic power.
8. Apply two more pumps of grease.
9. Reinstall the cover over the access hole.