MTS FSE MODULAR TRAINING

Grips

February 7, 2017 Rev B

be certain.

Grips – Descriptions

- Grips are used to quickly and efficiently install test specimens into a load frame.
- Grips are available in both hydraulic operated and manually operated.
- This module will focus on hydraulic grips

Grips

- Grips available in axial only and axial torsional models
- Inserts are available for round, flat, or threaded specimens

Grip Types

- One version of hydraulic grips is the 646 collet grip.

- A collet type grip has a segmented sleeve which clamps around a specimen to grip it. This is similar to how a drill chuck grips a drill bit.

Grip Types

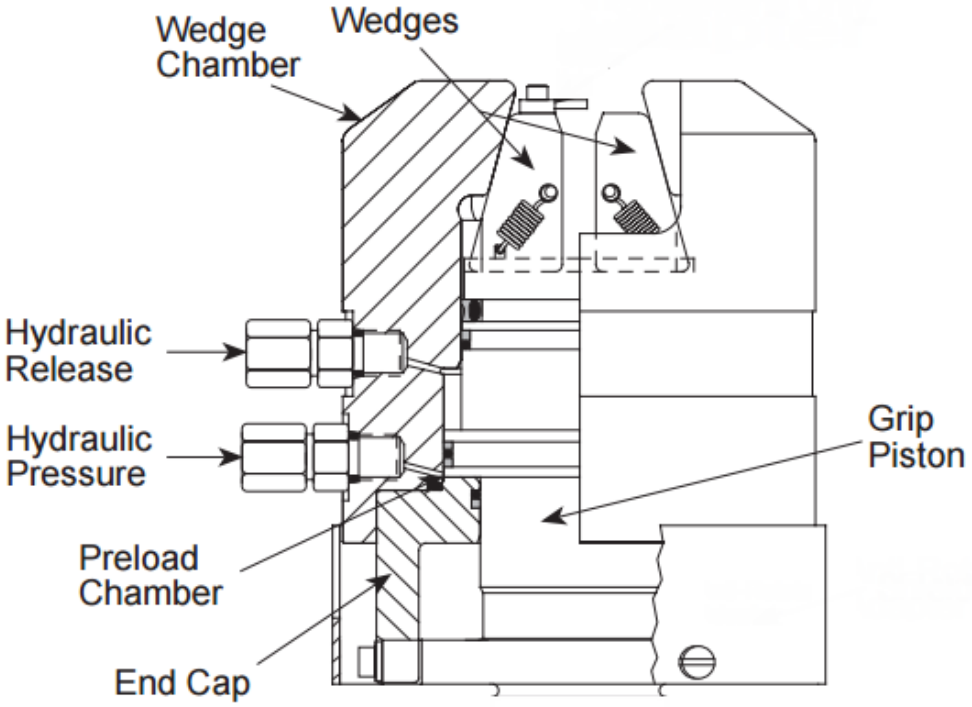
» Another version of hydraulic grips is the 647 wedge grip. This grips the specimen by closing a wedge shaped insert which clamps the specimen.

Grips

- Grips are available with water cooling for both the grip and the inserts.
  - This allows the grips to be placed inside of a oven for elevated temperature testing.
- Grips are also available with pressure rating up to 10000 PSI.
  - This allows greater clamping forces.
- A variety of wedges are available for different specimen dimensions and gripping methods.

Grips – Basic operation

- Both collet and wedge type grips operate on the same principle. Hydraulic pressure is applied to a piston to grip the specimen. To release the specimen, pressure is applied to the opposite side of the piston.
- The flow rate determines the rate at which the grips open and close
- The pressure establishes the amount of grip force applied to the specimen



Grips – Temperature Ranges

» Grips are available in different configurations allowing for testing over several temperature ranges

» Temperatures above 77°C/150°F require a stand-alone grip supply.
- When using 647 grips extension rods are also required above 77°C/150°F.

Grip Model	Temperature Range
646	-40°C to 65°C (-40°F to 150°F)
647	-18°C to 65°C (0°F to 150°F)
647	-40°C to 177°C (-40°F to 350°F)
647 All Temperature	-129°C to +315°C (-200°F to +600°F)
647 All Temperature	-129°C to +540°C (-200°F to +1000°F)

Grips – Safety

- Beware of the pinch points and crush zones of grips. Keep all body parts out of pinch points.
  - A pinch point is present from both the closing of the grips and between the upper an lower grips.
- Beware of high pressure oil. Some grips operate as high as 10000 PSI. This requires hoses and fittings which are rated for this pressure.

Grips – Static and Dynamic Ratings

- Grips can be rated for only static testing or both static and dynamic testing.
- MTS hydraulic grips are rated for both types of testing
- The static rating is typically higher than the dynamic rating

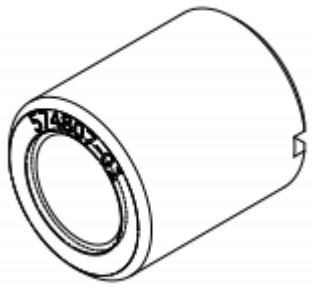
Model	Static Force	Dynamic Force	Grip Pressure
647.02B[1]	31 kN (7 kip)	25 kN (5.5 kip)	21 MPa (3,000 psi)
647.10[2]	120 kN (27 kip)	100 kN (22 kip)	21 MPa (3,000 psi)
647.25[3]	333 kN (75 kip)	250 kN (55 kip)	69 MPa (10,000 psi)
647.50	550 kN (120 kip)	500 kN (110 kip)	69 MPa (10,000 psi)
647.100	1200 kN (264 kip)	1000 kN (220 kip)	69 MPa (10,000 psi)

Installation

- Older legacy grips were specifically made for either Metric or Imperial threads.

- Modern grip kits contain thread inserts for both Metric threads and Imperial threads.
  - This allows the same grip assembly to be used for either type of installation.
  - Choose the correct insert to match the threads of the load cell and actuator studs.
  - Lubricate the threads with MolyKote Gn paste prior to installing the insert into the grip.

- Before attaching grips to a load cell or actuator stud lubricate the threads of the stud with MolyKote Gn paste.



Installation

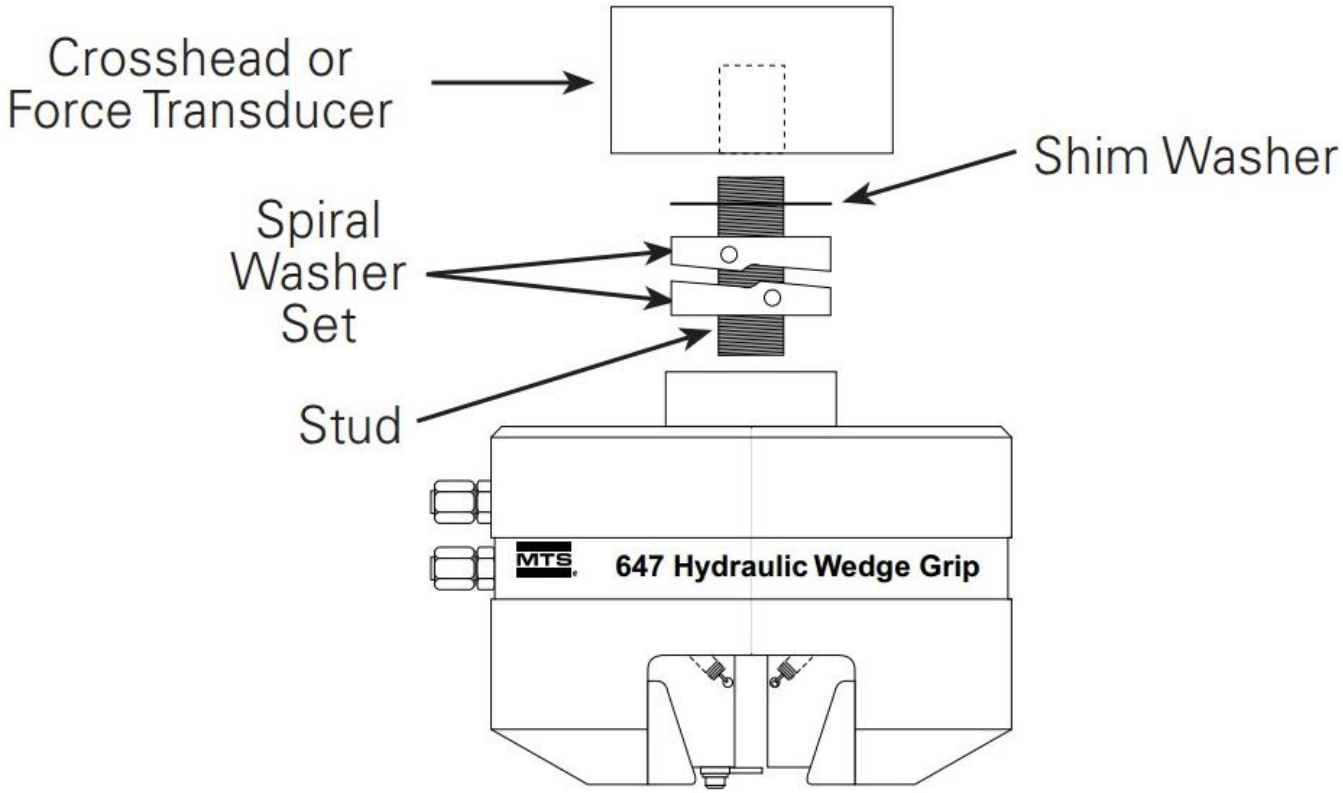
» Both the 646 collet grips and the 647 wedge grips have 2 eye bolt holes opposite each other. These can be used to lift the grip into place.

Model	Thread
647.01/02	None. Lift by hand.
647.10	M10 X 1.5 5/8" DP
647.25	M10 X 1.5 5/8" DP
647.50	M10 X 1.5 5/8" DP
647.100	M10 X 1.5 5/8" DP

Model	Thread
646.10	M10 X 1.5 5/8" DP
646.25	M10 X 1.5 5/8" DP

Installation – Spiral Washers

» Most grip installations use spiral washers.
  - For spiral washer pre-loading and installation guidelines see either the Linear Actuator or Servohydraulic Load Frame module.



Spiral Washer Shims

- Use shim washers to align the upper and lower grips. Kits which contain several thickness shims are available in different sizes to match standard MTS stud diameters.
- The chart on the following page lists shim kit part numbers along with the correct shim thickness and part number to use for common rotational increments.
- Example: If you have a ½" – 20 stud one complete turn is 0.050" travel. If you need to rotate the grip 90 degrees you would use a 0.012" thickness shim P/N 443665-17

				APROX. ½ TURN (180°)	APROX. ¼ TURN (90°)	APROX. ⅛ TURN (45°)	APROX. 1/16 TURN (22.5°)
PART NUMBER (KIT NUMBER)	REV	THREAD SIZE ACTUATOR (OD)	REF. TRAVEL OF FULL TH'D	SHIM NUMBER THICK. (QTY)	SHIM NUMBER THICK. (QTY)	SHIM NUMBER THICK. (QTY)	SHIM NUMBER THICK. (QTY)
521050-01	B	½" - 20 358 ACT (1.12)	.050"	443665-16 .025 (1)	443665-17 .012 (1)	443665-13 .006 (1)	443665-18 .003 (1)

Shim Kit Part Number Reference

				APROX. ½ TURN (180°)	APROX. ¼ TURN (90°)	APROX. ⅛ TURN (45°)	APROX. 1/16 TURN (22.5°)
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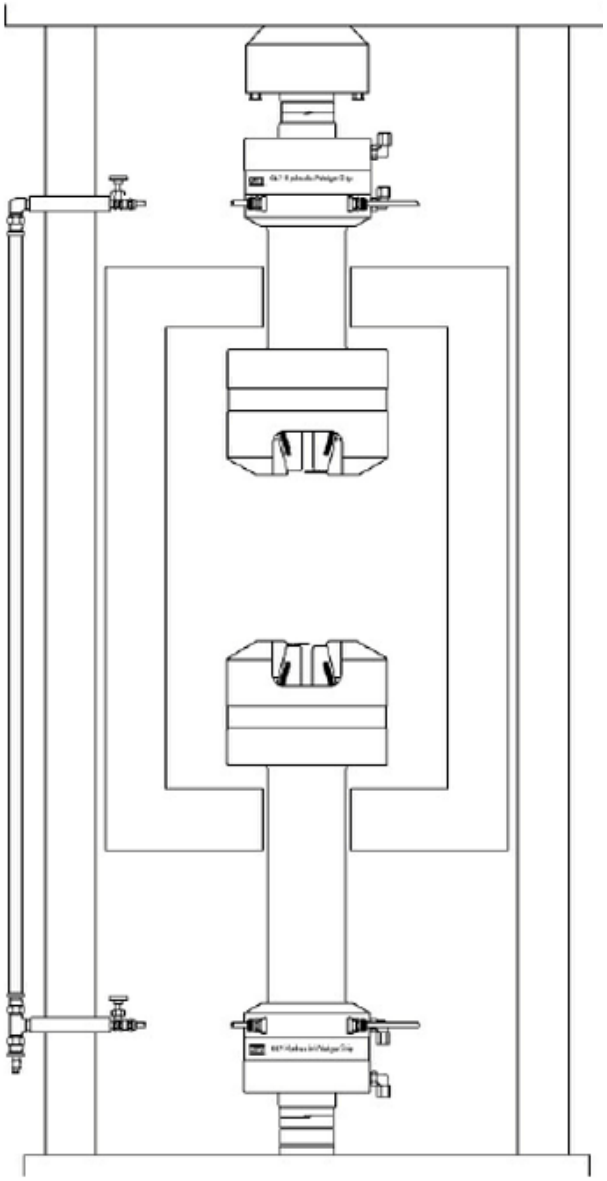
521050-01	B	½" - 20 358 ACT (1.12)	.050"	443665-16 .025 (1)	443665-17 .012 (1)	443665-13 .006 (1)	443665-18 .003 (1)
521050-02	A	M12 x 1.25mm 358 ACT (1.12)	.049"	443665-16 .025 (1)	443665-17 .012 (1)	443665-13 .006 (1)	443665-18 .003 (1)
521050-03	A	½" - 20 318 ACT (1.62)	.050"	443665-19 .025 (1)	443665-20 .012 (1)	443665-07 .006 (1)	443665-21 .003 (1)
521050-04	A	M12 x 1.25mm 318 ACT (1.62)	.049"	443665-19 .025 (1)	443665-20 .012 (1)	443665-07 .006 (1)	443665-21 .003 (1)
521050-05	A	1" - 14 318 ACT (2.62)	.071"	443665-22 .035 (1)	443665-24 .009 (2)	443665-24 .009 (1)	443665-25 .005 (1)
521050-06	A	M27 x 2mm 318 ACT (2.62)	.079"	443665-23 .020 (2)	443665-23 .020 (1)	443665-24 .009 (1)	443665-25 .005 (1)
521050-07	A	1-1/2" - 12 318 ACT (3.62)	.083"	443665-26 .020 (2)	443665-26 .020 (1)	443665-02 .006 (2)	443665-02 .006 (1)
521050-08	A	M36 x 2mm 318 ACT (3.62)	.079"	443665-26 .020 (2)	443665-26 .020 (1)	443665-27 .005 (2)	443665-27 .005 (1)
521050-09	A	2" - 12 318 ACT (4.62)	.083"	443665-28 .020 (2)	443665-28 .020 (1)	443665-15 .010 (1)	443665-29 .005 (1)
521050-10	A	M52 x 2mm 318 ACT (4.62)	.079"	443665-28 .020 (2)	443665-28 .020 (1)	443665-15 .010 (1)	443665-29 .005 (1)
521050-11	A	M76 x 2mm 311 ACT (7.00)	.079"	443665-35 .020 (2)	443665-35 .020 (1)	443665-36 .010 (1)	443665-37 .005 (1)
521050-12	A	M27 x 2mm 311 ACT (3.62)	.079"	443665-47 .020 (2)	443665-47 .020 (1)	443665-48 .009 (1)	443665-49 .005 (1)

Grips – Elevated Temperature Oil Requirements

- All load frame mounted 3000 psi and 10,000 psi grip supplies use standard Mobil DTE-25 hydraulic fluid from the HPU. The grips that use this fluid are rated to 65 °C (150 °F) maximum.
- All other hydraulic grips that are used within a chamber are rated to maximum of 177 °C (350 °F). These grips require the use of a stand alone grip supply that uses Mobil SHC 525 hydraulic fluid.
- This fluid has a flash point and overall temperature rating higher than 177 °C (350 °F).
- MTS does not recommend the use of hydraulic grips that have hydraulic fluid inside chambers rated at temperatures higher than 177 °C (350 °F). .

Installation – All Temperature Grips

- When testing at elevated temperatures inside of an oven all temperature grips are commonly used. These allow the gripping mechanism to remain inside the oven and the piston, seals, and hydraulic fluid to be outside of the oven.
- The grip mechanism (the wedge chamber and wedges) is fully enclosed in the environmental chamber to secure the specimen under test.
- The grip actuating mechanism (the end cap, preload chamber, and piston) is outside the environmental chamber, eliminating the need for high-temperature hydraulic fluid and allowing a broader temperature range for testing.

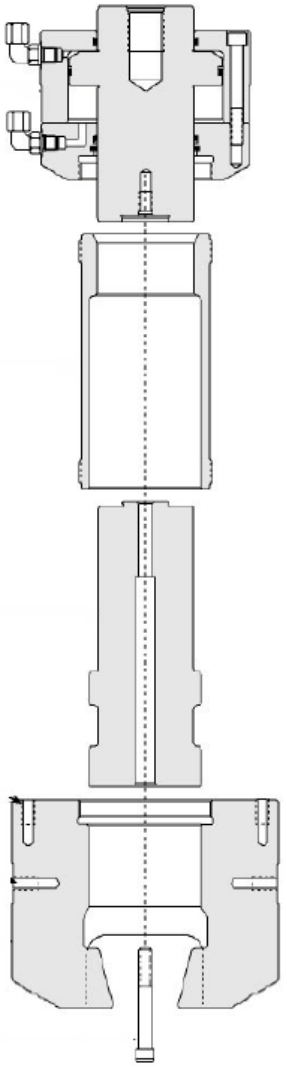


Installation – All Temperature Grips

- The grip apply and release hoses remain outside of the oven. The connections are located in the area that remains at room temperature.
- The oil is not exposed to elevated temperatures allowing DTE-25 and load frame mounted controls to be used.
- The grip actuating mechanism is water cooled/warmed to protect it from temperature extremes.

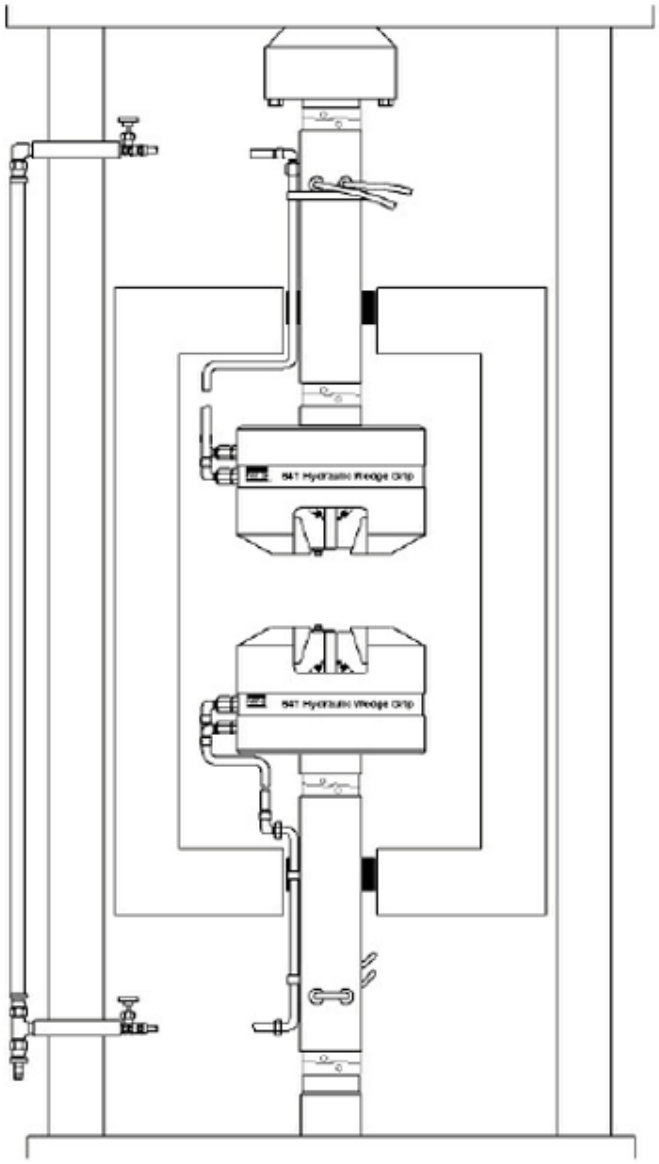
Installation

- When there is an environmental chamber or oven which does not have removable plugs to allow the chamber to be moved into place after installing grips the extensions must be removed.
  - Use the appropriate manuals and drawings to locate proper fastener torques.



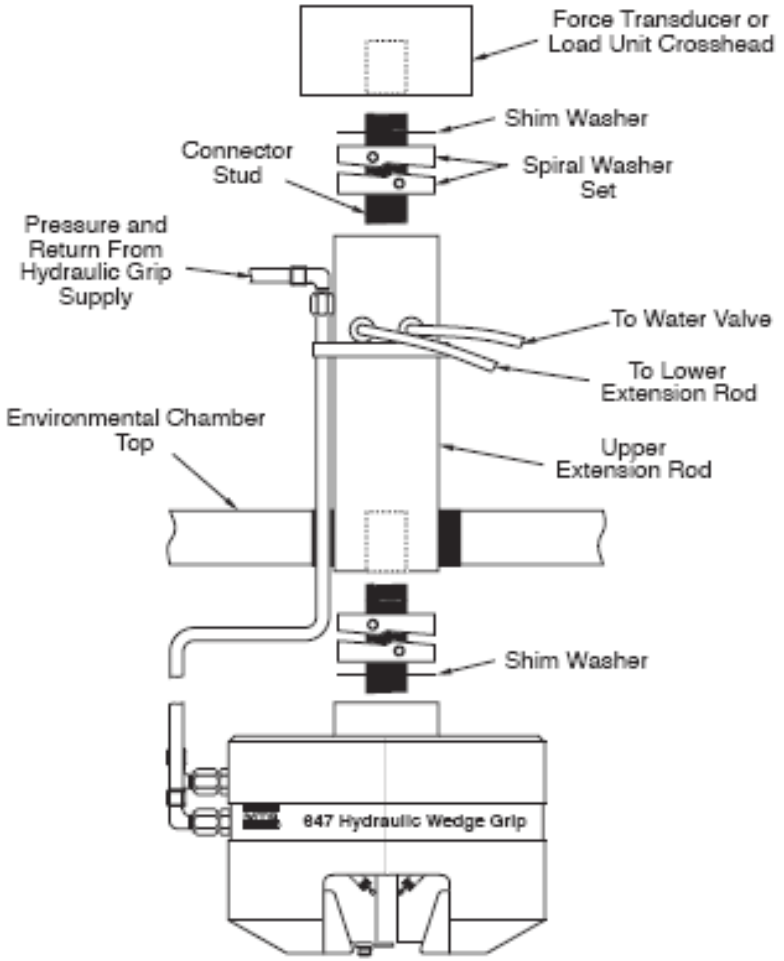
Installation – Grip Extensions

- Another method for mounting grips when used in an oven is to use grip extensions.
- In this case the complete grip is located in the oven and is exposed to elevated temperatures. Do not exceed 177 °C (350 °F).
- High temperature grips require the use of a high flash point oil and seals which can sustain the higher temperatures.



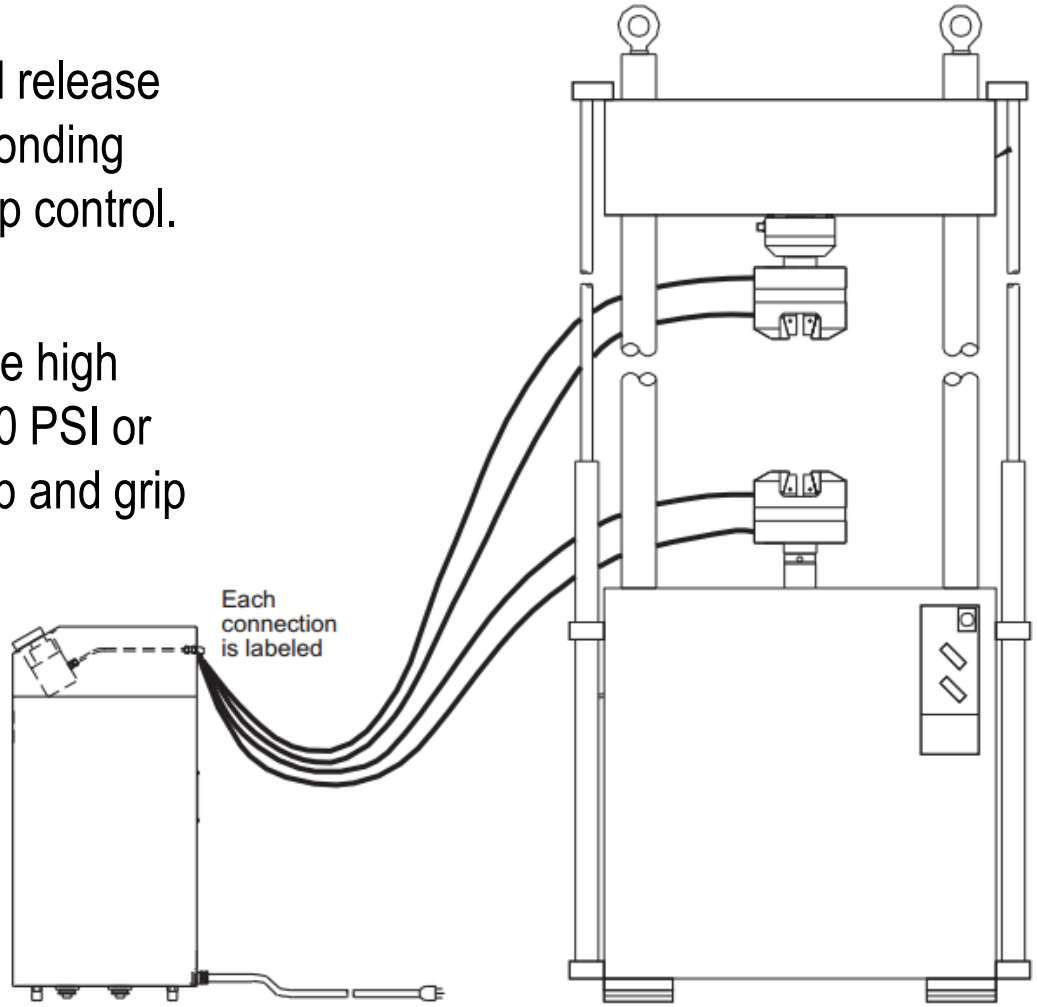
Installation – Grip Extensions

- When mounting grips in this type of configuration stainless steel tubing is used for hydraulic connections to the apply and release ports.
- This prevents hoses from being exposed to high temperatures.



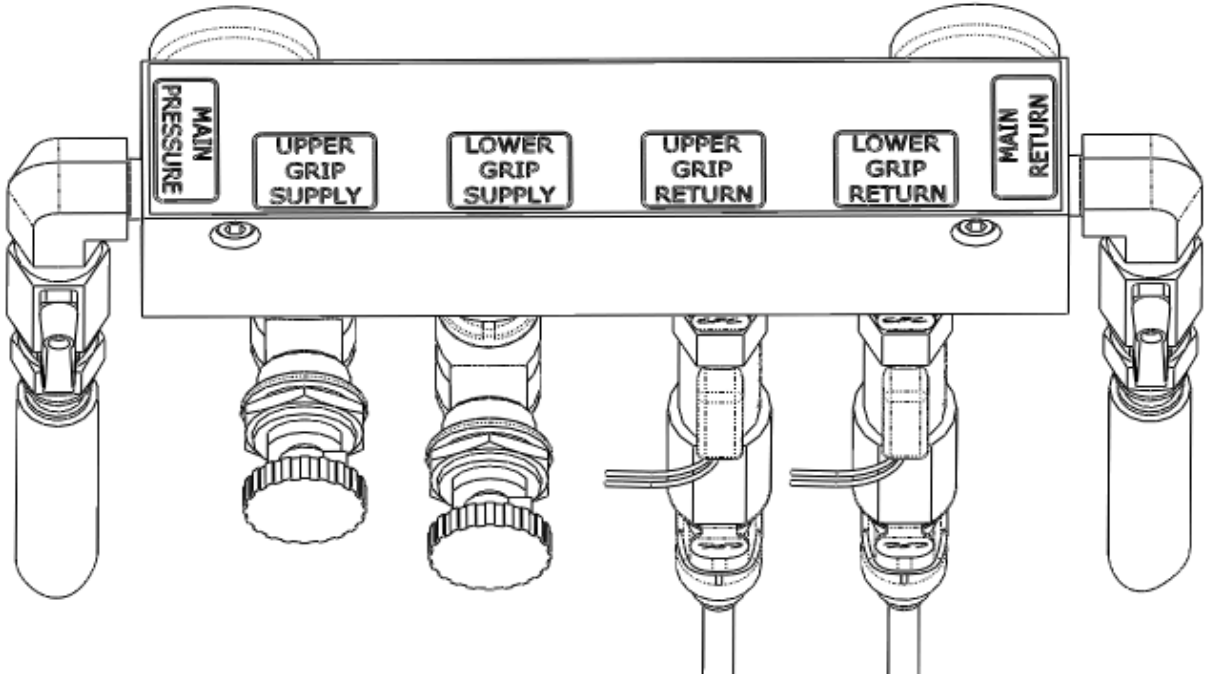
Installation – Hydraulic Hoses

- Each grip has an apply and release fitting which match corresponding fittings on grip supply or grip control.
- Both of these fittings receive high pressure hoses, either 3000 PSI or 10000 PSI to match the grip and grip supply rating.



Installation – Water Cooling

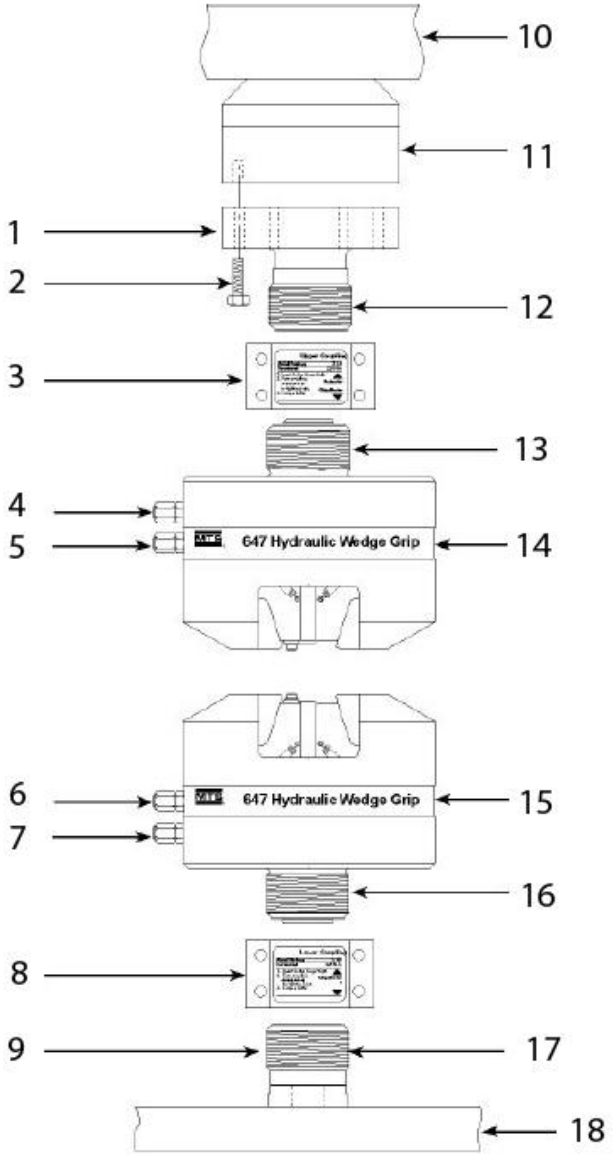
- When a water cooling option is supplied it will include a manifold and tubing
  - The manifold is magnetically mounted to the load frame
  - There are flow switches in each water return circuit at the manifold which can be connected to the controller to sense absence of water flow and shut down the heating.
  - Cooling water should not exceed 35°C (95°F)
  - Flow requirements are 3.8 L/min (1 gpm) minimum, at 0.276 MPa (40 psi)



Installation – Axial Torsional Load Frames

- When installing an axial torsional grip a clamping mechanism is used. For details on assembly procedures for the split clamps see the 319 Axial Torsional load frame module.

Item	Description	Item	Description
1	Adapter	10	Crosshead
2	Socket Head Cap Screw	11	Force Transducer
3	Upper Coupling	12	Left Hand Thread
4	Release Pressure	13	Right Hand Thread
5	Clamp Pressure	14	Upper Grip
6	Release Pressure	15	Lower Grip
7	Clamp Pressure	16	Left Hand Thread
8	Lower Coupling	17	Right Hand Thread
9	Actuator Rod	18	Load Unit Base Plate



Grip Pressure

- Grip pressure is selected so there is enough clamping force to keep the specimen gripped during the test without deforming the specimen.
- Insufficient grip pressure can result in the specimen or inserts slipping which could damage the grips.
- Minimum grip pressure for round and flat specimens can be calculated using standard formulas found in the 646 collet grip and 647 wedge grip product manuals.

Specimen Insertion Depth

- When using 647 wedge grips with a round or flat specimen the specimen must be inserted to within 6.3 mm (0.25 in) of the bottom of the wedge.
  - Failure to fully insert specimen without touching the bottom will result in damage to grips including cracking the wedges.

- When using 646 collet grips with a round or flat specimen the specimen must be inserted to the minimum depth shown on the table below.
  - Failure to fully insert the specimen to the minimum insertion depth will result in damage to the grips and to the collets.

Model	Minimum Specimen Insertion
646.10	25.4 mm (1 in)
646.25	50 mm (2 in)

Collet Grip - Collets

- There are many different collets available for MTS 646 grips.
  - Round, Flat, Threaded
- Each collet is designed to for a specimen sized to exact dimensions.
- For collet part number and dimensional information see the 646 collet grip product manual.

Collet Grip Specimen Tolerances

- When using 646 Collet grips the test specimen must be within tightly controlled tolerances to ensure the proper gripping force.

- Failure to use a specimen that meets these tolerances can result is the specimen slipping during testing and damaging either the specimen or grips.

Collet Grip Specimen Tolerances

» Round Specimens: Tolerance for diameter of specimen at gripping area of collet.
- Diameter +/- 0.025 mm (+/-0.001 in)

» Flat Specimens: Tolerance for width and thickness at gripping area of collet.
- Width +/- 0.254 mm (+/- 0.01 in)
- Thickness +0.000, -0.051 mm (+0.000, - 0.002 in)

Wedge Grip - Wedges

- Wedges are available for round and flat specimens.
- The wedge gripping area has different surfaces available.
  - Diamond Serrated
  - Surffaloy
    - Surffaloy is a coating applied to the gripping surface which increases specimen grip and increases the life of the wedge
- Wedges are also available with a water cooling option.

Wedge Grip - Wedges

Flat – Surffaloy coated

Flat – Serrated
Water Cooled

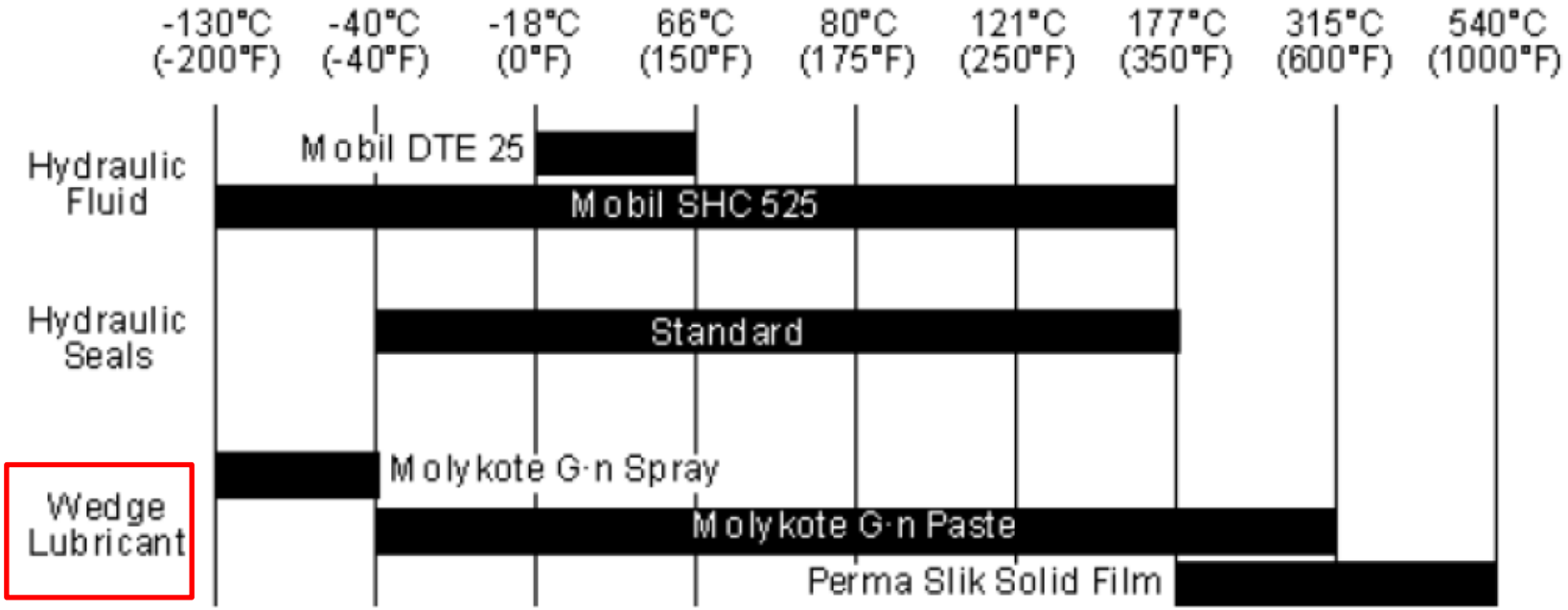
Wedge Grip - Wedges

Vee – Round Specimens
Serrated

Round - Surfalloy coated
Water Cooled

Wedge and Collet Lubricant Chart

» Prior to installing wedges or collets into the grip, lubricate them using the appropriate grease that matches the range of temperatures the grips will be used at.
  - For most applications the grease is MolyKote Gn paste

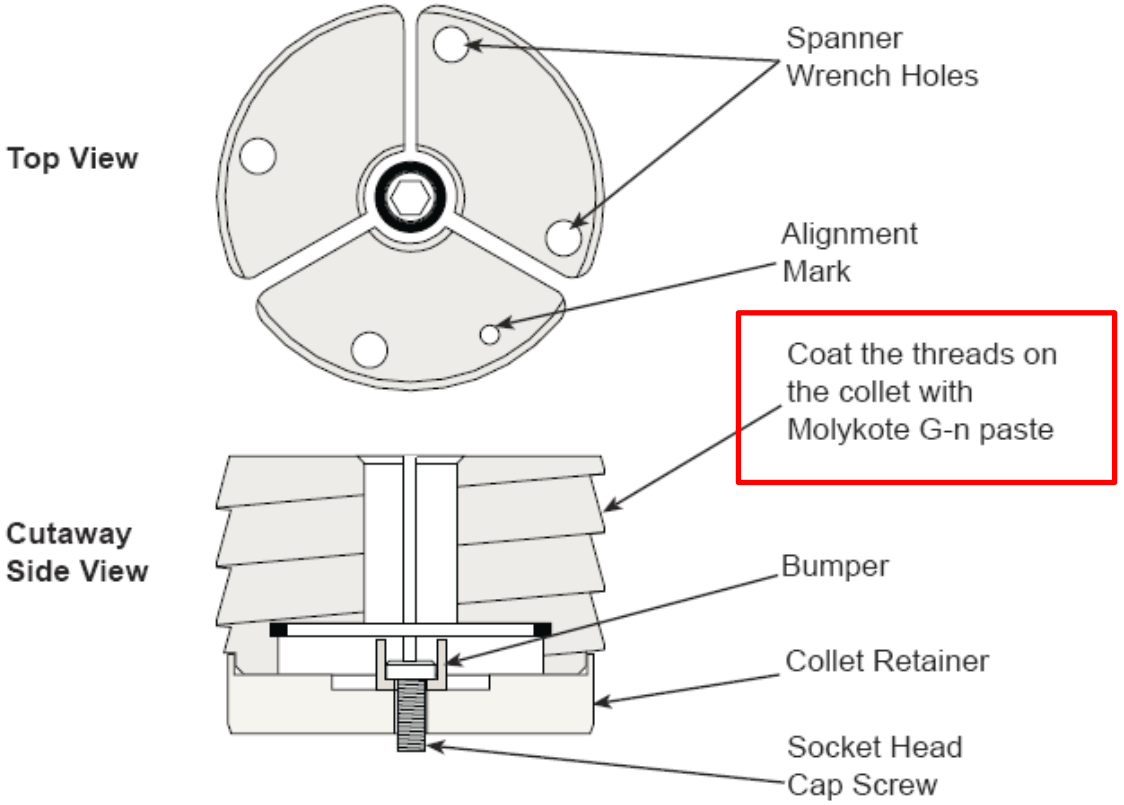


Collet Installation

- Use the following procedure to install a collet into the grip
- Ensure grips are in the released position and hydraulic power is off.
- Clean the specimen mating surfaces with acetone or other solvent which does not leave a residue.

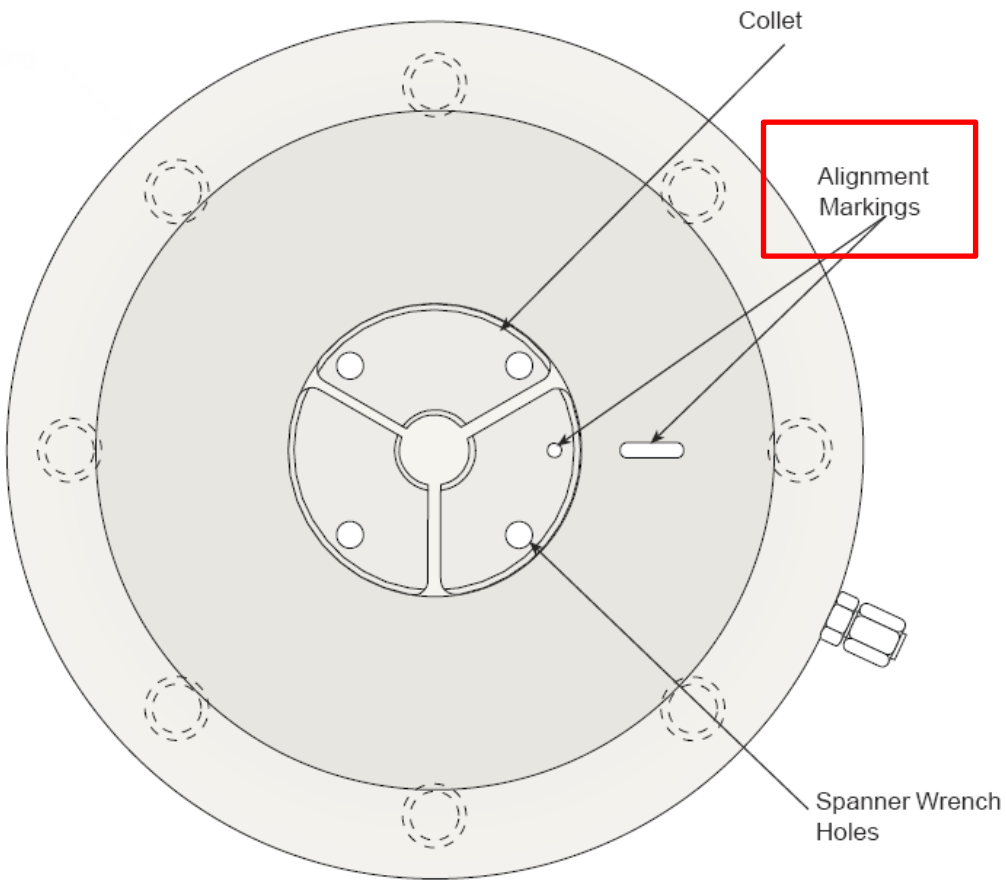
Collet Installation

» Clean and apply a thin layer of Molykote Gn paste to the collet threads.



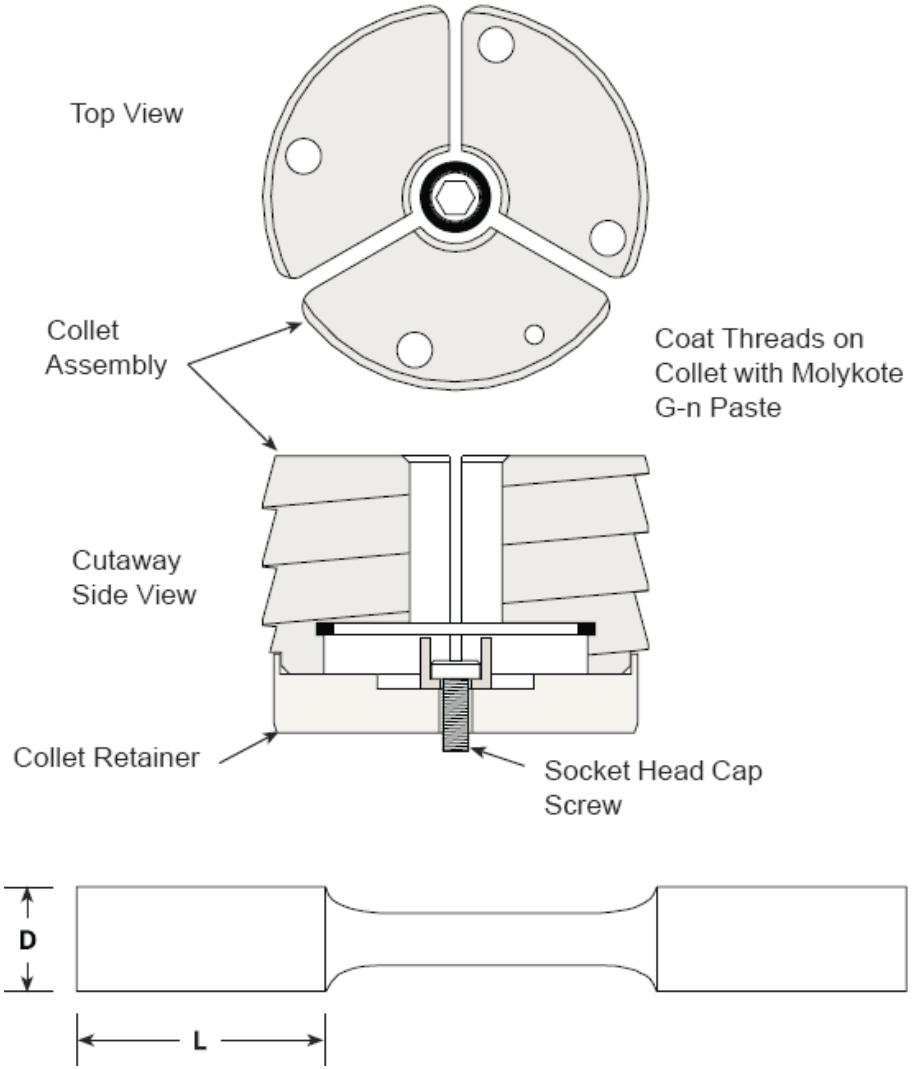
Collet Installation

- Use a spanner wrench to thread the collet assembly into the grip housing until the top surface of the collet is flush with the top surface of the grip housing.
- Adjust the collet assembly as necessary until the alignment mark on the collet corresponds to the alignment mark on the grip housing.
- Collets for round, flat and threaded specimens all have an alignment mark and should be installed using the same general procedure.



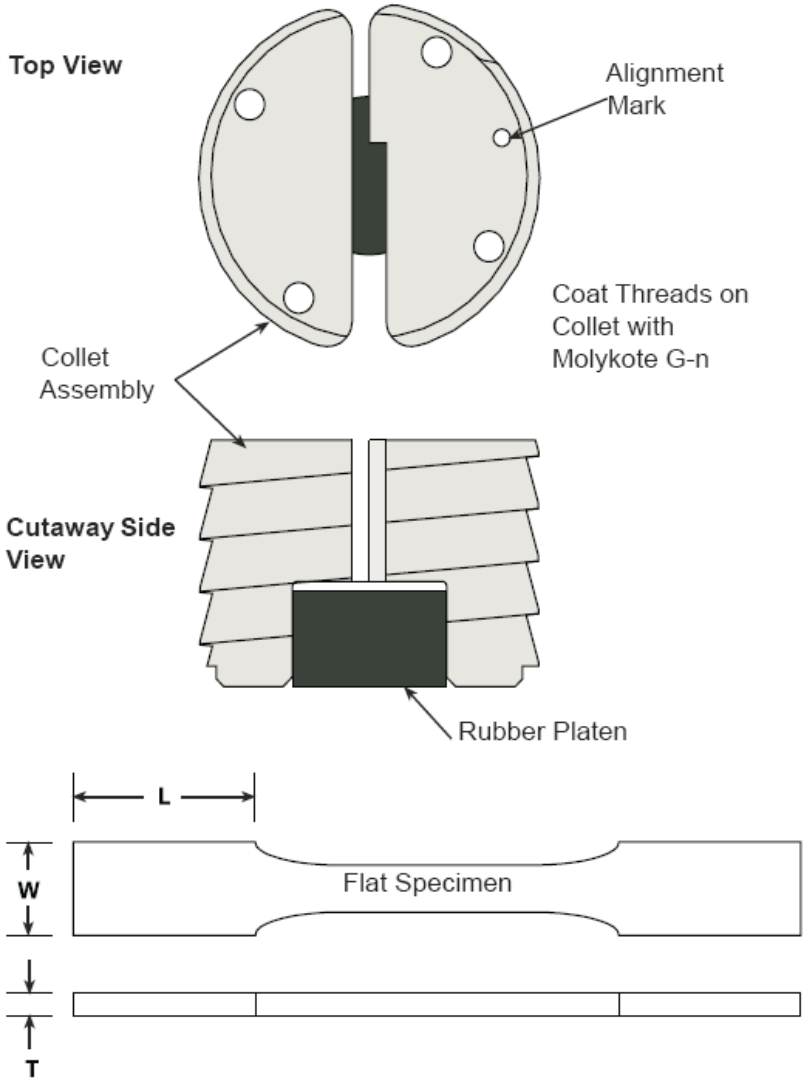
Collet Installation

- The round collet has a rubber bumper which is retained at the bottom of the collet with a socket head cap screw.



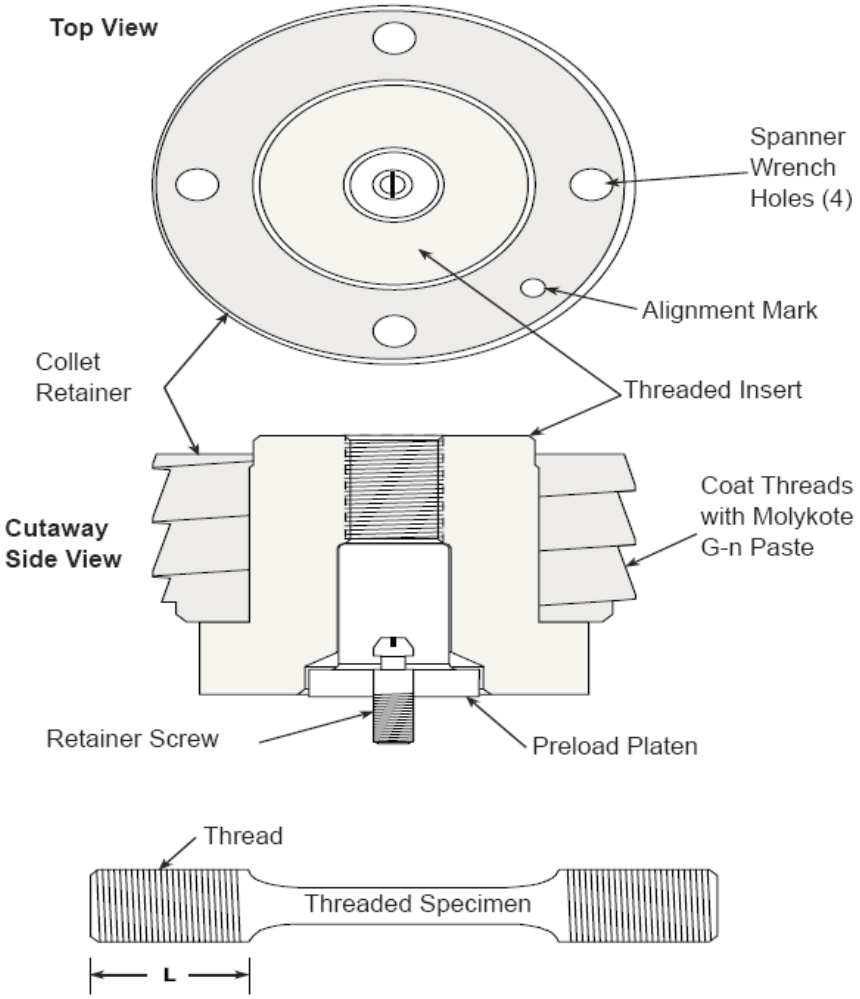
Collet Installation

- The flat collet has a rubber platen which is installed simultaneously with the collet. There is no bolt. The platen is retained by the collet.



Collet Installation

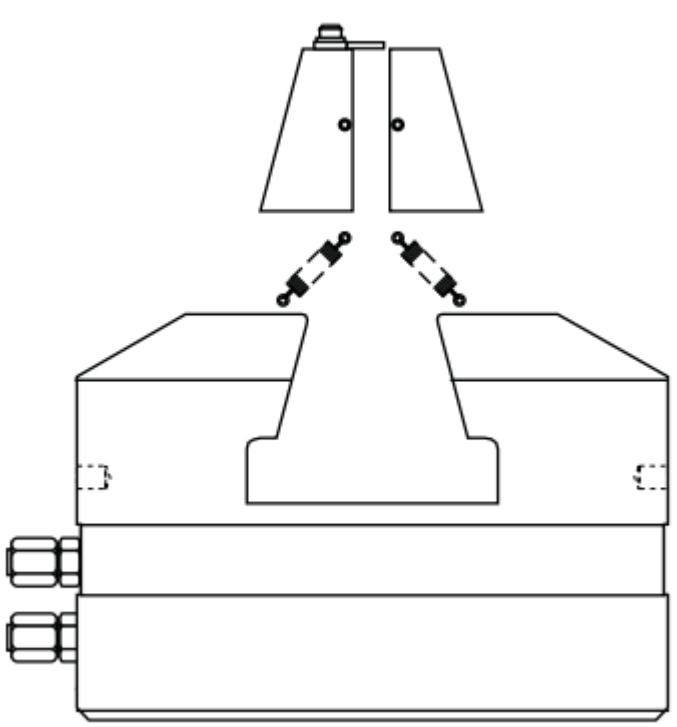
- The threaded collet has a rubber preload platen which is installed into the collet prior to installing the collet into the grip body and retained by a socket head cap screw.



Wedge Installation

- Remove any specimen installed in the grips. Leave both grip controls in the release position. Position the actuator or crosshead as necessary for convenient access to the grip wedges. Remove system hydraulic pressure and grip supply pressure.

- Using the utility packing hook, disconnect both springs from the spring posts on the corresponding wedge. It is not necessary to remove the springs from the spring anchors. Inspect the springs and replace them, if necessary.



Wedge Installation

- Remove the wedge by sliding it towards the center of the grip and then lifting it out of the grip.
- If test temperature range is between -40 C to +315 C (-40 F to +600 F), apply a thin coat of MolyKote Gn paste lubricant to the edges of the replacement wedge where it contacts the chamber and piston. If testing outside of these temperature ranges see, the wedge lubricant chart located in this training module for proper lubricant selection.
- Place the wedge into the center of the grip and then slide it towards the chamber.
- Using the utility packing hook, connect the springs from the spring anchor on the grip piston to the spring post on the corresponding wedge.

Wedge Maintenance

- After approximately 100 lock and release cycles, remove the wedges from the hydraulic wedge grips and re-apply the proper lubricant to the edges of the wedge which contact the wedge chamber and grip piston.
- The edges of the wedge which contact the chamber and piston should be lubricated after approximately 25 hours of operation or after the test.
- For Model 647.250 Grips, also apply a thin layer of lubricant to the bracket surface that contacts the spring block.

Seal Replacement

» The seals in the grips are field replaceable. These should be replaced when there is signs of leakage. Use the product manual or the service catalog to locate the correct seal kit part number.

646.xx Seal Kits

Model	Rating	Description	Part Number
646.10A	100 kN/22 kip	Seal Kit	038-400-501
646.10B	100 kN/22 kip	Seal Kit	042-739-101
646.25A	250 kN/55 kip	Seal Kit	038-400-701
646.25B	250 kN/55 kip	Seal Kit	042-739-201

647.xx Seal Kits (seals for upper and lower grip)

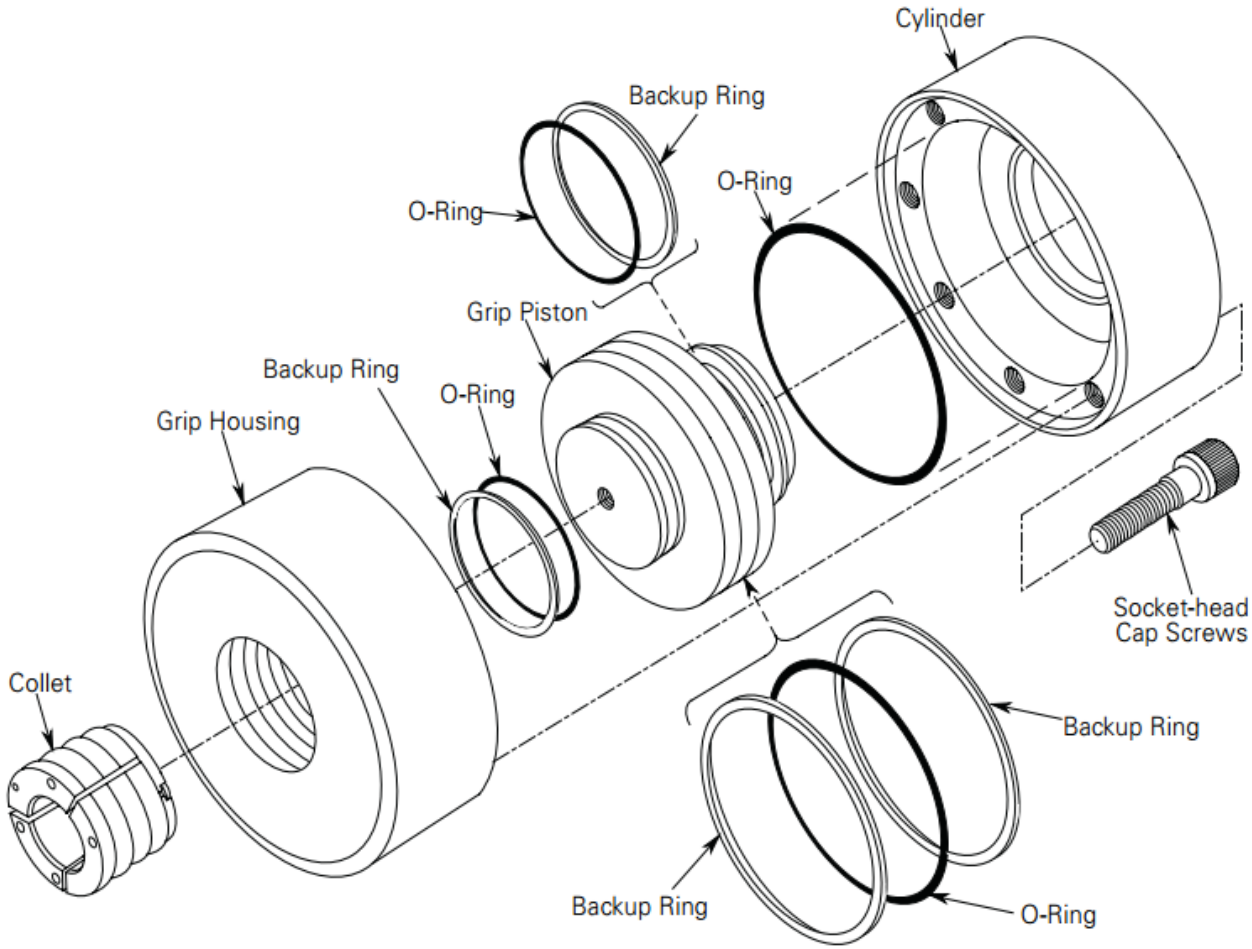
Model	Rating	Description	Temperature Range	Part Number
647.02	25 kN/5.5 kip	Seal Kit	–17/+65°C (0/+150°F	047-810-701
647.02	25 kN/5.5 kip	Replacement Springs		010-086-754
647.02	25 kN/5.5 kip	Spring Anchors		038-529-001
647.02	25 kN/5.5 kip	Seal Kit (high temp)	–40/+175°C (–40/+35	047-810-702
647.02B	25 kN/5.5 kip	Seal Kit	–40/+120°C (–40/+25	056-143-501
647.02B	25 kN/5.5 kip	Seal Kit (high temp)	–40/+175°C (–40/+35	056-143-502
647.10B	100 kN/22 kip	Seal Kit	–17/+65°C (0/+150°F	047-810-901

646 Collet Grip Seal Replacement

- To Disassemble the 646 collet grip:
- Remove the socket head cap screws securing the end cap to the wedge chamber.
- Slide the end cap off the piston.
- Separate the piston from the chamber.

646 Collet Grip Seal Replacement

- Replace all seals and backup rings.
- Lubricate all seals with clean hydraulic oil prior to installation.



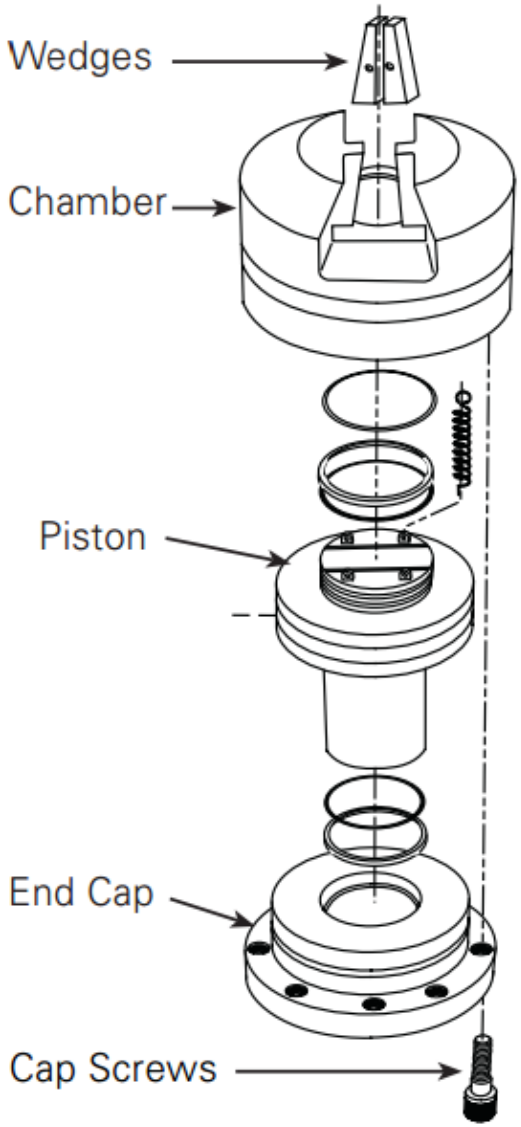
646 Collet Grip Seal Replacement

- Reassemble the grip once the seals are replaced.
- Torque the end cap bolts to the correct specification.

Model	Torque
646.10	127 N•m (94 lbf•ft)
646.25	420 N•m (310 lbf•ft)

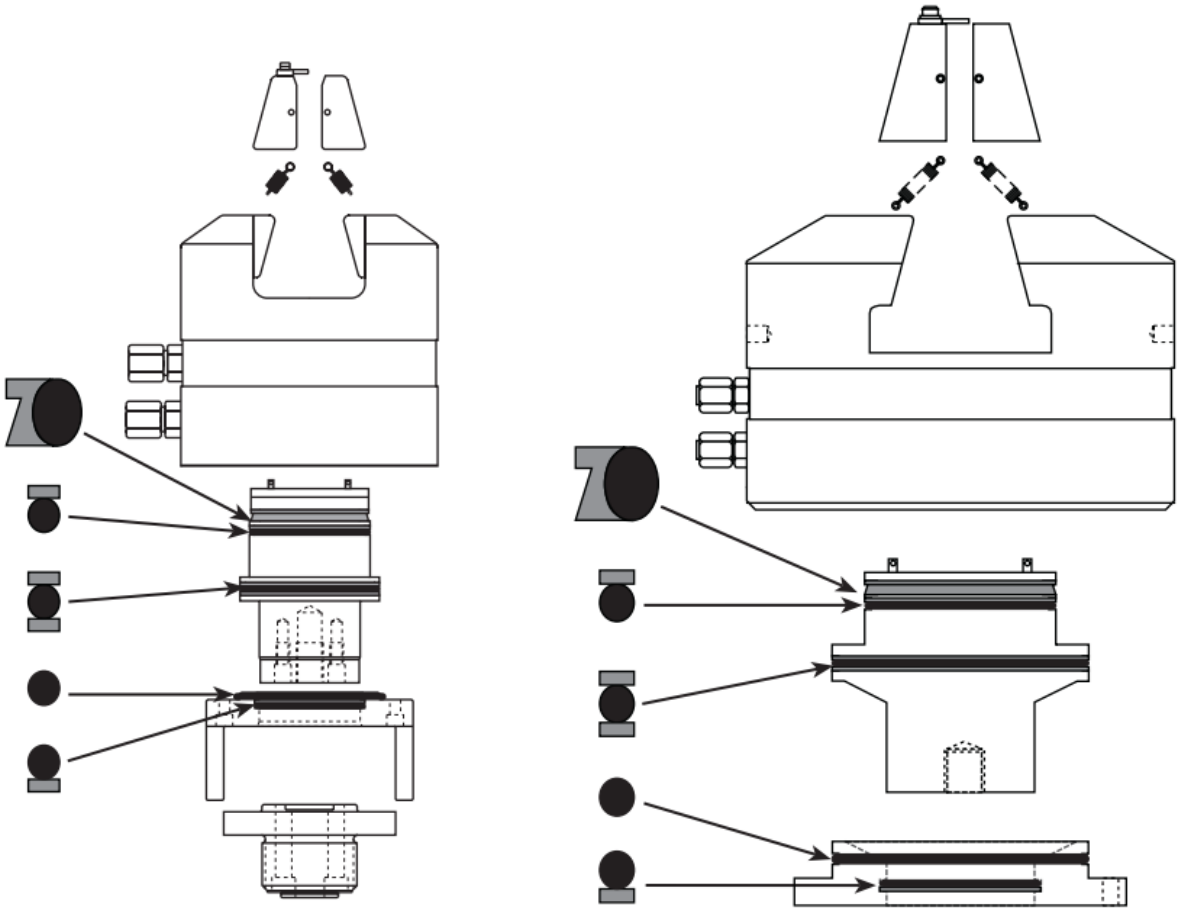
647 Wedge Grip Seal Replacement

- To Disassemble the 647 wedge grip:
- Remove the socket head cap screws securing the end cap to the wedge chamber.
- Slide the end cap off the piston.
- Separate the piston from the chamber.



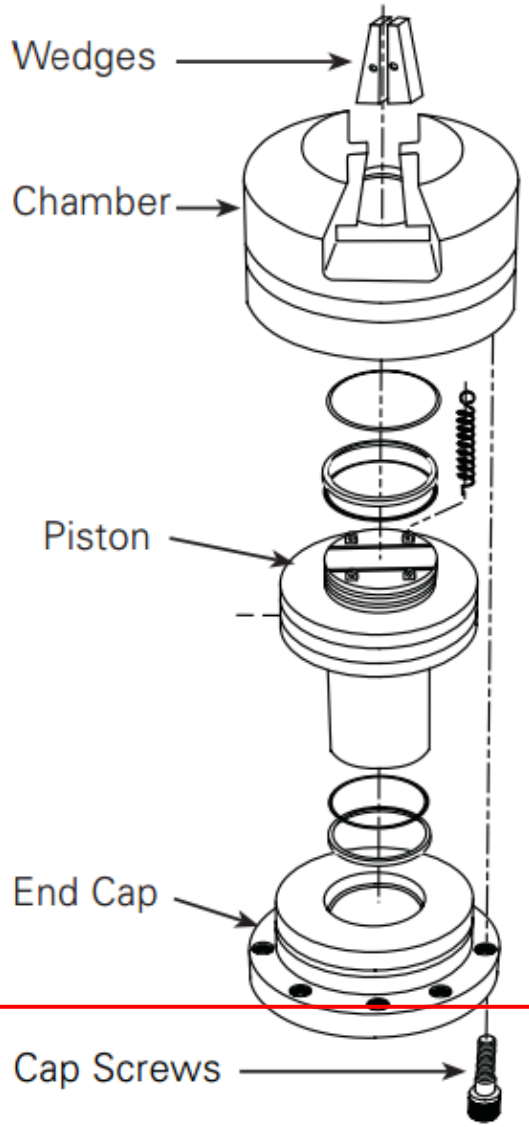
647 Wedge Grip Seal Replacement

- Remove and Replace the O-rings and other seals.
- Lubricate all replacement seals with clean hydraulic fluid prior to installation.



647 Wedge Grip Seal Replacement

- It may be necessary to warm the replacement seals to allow them to stretch for installation. Use a blow dryer or warm hydraulic oil at 125 F.
- Reassemble the grip once the seals are replaced.
- Verify the proper torque for the end cap bolts on the assembly drawing.
- Torque end cap bolts to the correct specification.



Torque to specification shown on assembly drawing –