

**PARTS LIST  
and  
OPERATING PROCEDURE  
for  
SKIDMORE-WILHELM**

**MODEL H**

**BOLT TENSION CALIBRATORS**

**BASE MOUNTED STYLE**



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## SKIDMORE-WILHELM BOLT TENSION CALIBRATORS

Skidmore-Wilhelm Bolt Tension Calibrators are designed for testing a wide variety of fasteners and for calibrating impact wrenches. Essentially, each calibrator is a hydraulic load cell with a hole in the center for inserting a sample bolt, nut and washer. As the bolt and nut are tightened, they compress the load cell, creating an internal pressure. A gage measures the pressure and provides a dial readout calibrated in pounds-tension equivalent to the tension created in the fastener.

The instructions in this bulletin explain how to set up your Model H Bolt Tension Calibrator and use it to test fasteners and verify power tool output.

### A. Basic Calibrator Setup

1. Secure the calibrator to a test bench.
2. For fastener testing: Select a sample fastener. Attach the plate (item 5), appropriately sized for the bolt, to the front of the calibrator using four cap screws. If you change to a different size bolt for the test, you will also need to change the plate.
3. Insert the bushing (item 6) into the back of the calibrator. Like the plate, the bushing is sized for the bolt. The bushing fits over the dowel pin in the back of the piston and is held in place with the bushing retainer. (item 15)
4. For hex-head bolts, insert the bolt through the back of the calibrator so that the hex head fits into the bushing slot. This prevents the bolt from turning during tightening. From the front side of the calibrator, first place a hardened washer over the bolt, then tighten the nut so it is snug against the plate. The hardened washer prevents the nut from galling the plate. For longer bolts, it may be necessary to add a spacer under the nut.

See the following section “Testing Fasteners,” in this bulletin for specific types of tests you can perform with the Model H.

5. **For power tool output testing:** Skidmore-Wilhelm has special Test Bolt Assemblies available for testing power tools. The assembly consists of a bolt, nut, washer and plate.

Insert the test bolt assembly as follows: Attach the plate from the test bolt assembly to the front of the Model H using the four ¼” cap screws. Insert the test bolt through the plate and place the washer over the bolt. The bolt fits over the back of the dowel pin and is kept in place with the retainer. (item 15) Thread the nut onto the test bolt. Refer to page 3 for more detailed information on setting up a tool testing program.

## B. Testing Fasteners

Fastener testing allows you to ensure that:

- Fasteners are adequate for joint tightness requirements.
- Fasteners are not oversized for an application, resulting in unnecessary fastener expense.

All tests require comparing the tension registered on the calibrator gage to the applied torque as registered by a torque wrench or other tightening device capable of indicating torque.

### The following tests are possible with the Model H:

1. **Proof load test.** Determine the point at which increasing the applied torque no longer increases fastener tension at the same rate. This is the point of permanent set.
2. **Ultimate strength test.** Determine the amount of tension required to produce fastener failure. Compare to fastener strength specifications and to the tightness requirements of the assembled product.
3. **Torque-tension relationship.** Determine for a given joint the amount of torque required to produce a standard tension in the fastener. Accounts for joint setup variables such as lubrication, washers, surface textures, paint or plating. Eliminates the inaccuracies that result from using torque values based on formulas.
4. **Prevailing torque test.** Record maximum and minimum torques applied to tighten and back off a test bolt and nut assembly to a specified tension for a set number of repetitions. Compare readings to those established in standard prevailing-torque tables for applicable fastener classes.
5. **Rotational test.** Determine a fastener's ability to be rotated, without stripping or otherwise failing, beyond the number of turns normally required to produce a standard tension in the fastener.

### Other Fastener Testing Applications

- Establish torque-tension tightening standards for assembled joints.
- Control assembly time and component material costs.
- Spot-check fastener quality.
- Measure the effects of modifying joint variables: plating, lubrication, fastener and washer types, construction materials.
- Set and check power tool output to maintain assembly specifications.

## C. Verifying the Accuracy of Power Tools

The Model H calibrator can test the output of all types of power tools, including electric, pneumatic and hydraulic impact wrenches, nutrunners and stall tools. You can improve performance and reduce maintenance costs by setting up a standardized testing program using the Model H and Skidmore-Wilhelm Precision Test Bolt Assemblies.

**A standardized testing program enables you to:**

- Periodically compare power tool output to established norms, individualized for each tool.
- Verify settings for adjustable output power tools.
- Determine the need for power tool maintenance.

**Establish your testing program as follows:**

1. Select the proper size test bolt. Always use the same size test bolt each time you test a specific power tool. See the section below, "Selecting Test Bolt Assemblies".
2. Apply a recommended lubricant to the bolt and nut, including the areas under the bolt and nut face. Skidmore-Wilhelm recommends Keystone Velox 3, an extreme-pressure grease that provides a consistent, low coefficient of friction.
3. Tighten the test bolt assembly finger-tight.
4. Apply the power tool to the test bolt assembly for a set (standard) amount of time, usually 5 seconds. The time should be adequate to allow the tool to stall or shut off. An air timer control device can be purchased from S-W that insures the power tool will only be "energized" for the set amount of time.
5. Record the dial reading on the calibrator gage. The reading shows bolt tension.
6. Reverse the tool and back off the test bolt. Be sure that the retainer (item 15) is in place to prevent the nut from backing off the dowel pin (item 10).
7. Repeat the procedure two more times.
8. From the three gage readings, determine the average reading. This becomes the "norm" for the power tool.
9. Keep a tool record by serial number. Include all the test parameters, including the date, test bolt size, air pressure if a pneumatic tool and the "norm" gage reading.

If you wish to keep a "torque" reading as part of your tool record, you can determine the torque as shown below or use one of our factors. Establish the bolt tension "norm" as in steps 1-8 above. Back off the test bolt. Then retighten it using a hand torque wrench. Continue to tighten until the gage dial reading matches the "norm". Use the torque registering on the wrench at that point for your tool record.

**PARTS LIST FOR MODEL H**



## TEST BOLT INFORMATION MODEL H

PART NO.	TEST BOLT SIZE	POWER TOOL SQUARE DRIVE (in)	HEX SOCKET (in)	MAXIMUM NORM (lbf)
H-116	1"	3/4, 1	1 5/8	70,000
H-120	1 1/4"	1, 1 1/2	2	110,000
H-124	1 1/2"	1, 1 1/2	2 3/8	170,000

### H-112 3/4" TEST BOLT ASSEMBLY

H-212	3/4" bolt
H-312	3/4" nut
R-412	3/4" washer
H-513	3/4" plate

### H-116 1" TEST BOLT ASSEMBLY

H-216	1" bolt
H-316	1" nut
R-416	1" washer
R-517	1" plate

### H-120 1-1/4" TEST BOLT ASSEMBLY

H-220	1-1/4" bolt
H-320	1-1/4" nut
R-420	1-1/4" washer
H-521	1-1/4" plate

### H-124 1 1/2" TEST BOLT ASSEMBLY

H-224	1 1/2" bolt
H-324	1 1/2" nut
K-424	1 1/2" washer
H-525	1 1/2" plate

### PART NO.: NAME:

H-002	BODY
H-005	170,000# GAGE
H-003	PISTON
H-004	PACKING/O-RINGS (Specify Serial No.)

**\*H-500 BOLT PLATE**

**\*H-600 STAND. HEX BUSHING**

**H-700 HEAVY HEX BUSHING**

### PART NO.: NAME:

H-007	SNAP RING
H-008	BASE
K-011	DOWEL PIN (BUSHING)
H-013	DOWEL PIN (PISTON)

R-0050 KEYSTONE GREASE (QRT.CAN)

M-013 GAGE SAVER

J-015 BUSHING RETAINER

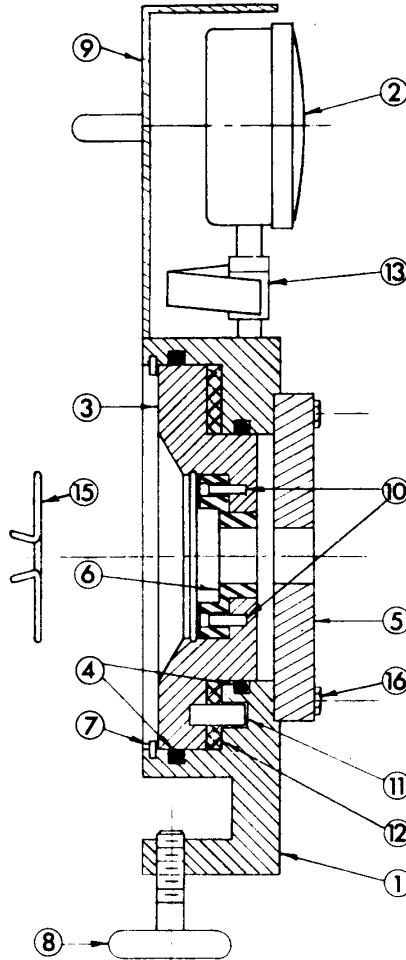
M-016 PLATE SCREWS

J-017 BASE SCREWS

### Please specify required size when ordering:

Also, because both standard hex head bolts and heavy hex head bolts are available, please specify which bolts you are using and the bolt diameter being tested.

## Model H Base Mount Exploded View



### Parts List

Item	Part No.	Name
1	H-002	Body
2	H-005	170,000# gage ( 75,000 kg)
3	H-003	Piston
4	H-004	Packing
5	H-500	Bolt plate
6	H-700	Heavy hex bolt bushing
<i>When ordering parts H-500 and H-700, specify size: 3/4,-1-1/2 inches. Metric equivalents available at no extra cost.</i>		
7	H-007	Snap ring
8	H-008	Base
9	M-009	Gage guard
10	K-011	3/8 Bushing dowel pin
11	H-013	1 " Dowel pin
12		Oil reservoir
13	M-013	Gage saver
15	J-015	Bushing retainer
16	M-016	1" plate screw
	ML-016	1-1/4" plate screw

Please Note: Picture for exploded view is actually for clamp mount Model so the picture is not entirely accurate. Item #8 is pictured as a screw and is actually a flat base at the bottom of the tester. Also, body image (item #1) should have a flat bottom, but this will give you an accurate breakdown of parts.

**Bulletin 419**

**MAINTENANCE MANUAL  
for  
SKIDMORE-WILHELM  
MODEL H  
BOLT TENSION CALIBRATOR**



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**1. Verifying calibrator accuracy.**

The accuracy of the calibrator gage can be verified by placing the unit in a compression press, applying a **known** load through the center and comparing the known load to the dial reading on the gage.

To conduct this test, place the calibrator in the press on a special fixture or adapter so that the load can be applied through the center of the calibrator and perpendicular to the face. The unit should lie flat with the gage facing up. One or more bolt plates can be put on the face of the calibrator to apply the test load.

**IMPORTANT: Test plates and adapters are available from Skidmore-Wilhelm for testing calibrators in a compression press. If you do not use the adaptor, be sure that the bolt plate (item 5) is thick enough to take the highest test load.**

## 2. Adjusting the gage.

During a calibrator accuracy test, compare the gage reading to the applied load at a number of different points. If the gage is off by the same small increment at each point, adjust using one of the following methods:

- a. For gages with a "Recalibration Screw" on the gage face:
  - 1) Remove the gage lens.
  - 2) Place a small screwdriver into the recalibration screw slot and turn the screw right or left (as necessary) so that the pointer moves by the amount of the error.
- b. For gages with a "micrometer" style pointer:
  - 1) Remove the gage lens.
  - 2) With one hand, carefully hold the pointer.
  - 3) Insert a screwdriver into the slot in the top of the gear that adjusts the pointer. Turn the screw right or left to move the pointer by the amount of the error.
- c. For liquid filled gages, drain the glycerin from the case before following the steps above.

## 3. Determining the need for gage repair or replacement.

Sometimes during a calibrator accuracy test, when you compare the gage reading to the applied load at various points, the gage will be off by varying increments rather than by the same increment at each point. Adjusting the gage as described in procedure 2 will not correct this condition. In such cases, Skidmore-Wilhelm does not recommend attempting to adjust or repair the gage in the field. Instead, the gage should be replaced or returned to the factory for repair.

**IMPORTANT: Calibrate the gage and calibrator as a unit.**

You may replace the gage yourself, following procedure 7, below. However, the gage and the calibrator will not be in calibration **as a unit**. Replacement gages are not shipped with a new Calibration Test Report.



If you cannot calibrate the gage and calibrator unit in a compression press or if you do not have access to a test laboratory capable of performing the test for you, your unit cannot be considered in calibration. Therefore, if your gage needs repair we recommend that you send the entire unit--gage and calibrator--back to us. We will repair or replace the gage, test the entire unit, and send it back to you along with a new Test Report.

#### **4. Determining whether the calibrator oil level is low.**

Either of two symptoms usually indicates your calibrator is low on oil:

- A noticeable gap appears between the piston and the snap ring when no load is applied to the calibrator.
- The calibrator operates to a reading short of its maximum, then the piston bottoms out against the body. No higher reading or compression of the unit is possible.

To check oil level, do the following:

- a. Turn the calibrator on its side so that the 1/4" pipe plug is at the 12 o'clock position.
- b. Remove the pipe plug and look into the opening. If the oil level is not at the top of the opening, add oil. See procedure 5.

#### **5. Adding hydraulic oil to the calibrator - gage in place.**

- a. Repeat procedure 4 above, if necessary.
- b. Add hydraulic oil through the pipe plug opening until oil flows out the top of the opening. Use oil that is Buna-N compatible.
- c. Work the calibrator piston back and forth to force out trapped air. Add more oil as needed.
- d. When all air has been forced out and the oil level is at the top of the pipe plug opening, replace the plug. Use pipe thread tape or pipe dope on the plug threads.
- e. If air still remains in the system, you will have to remove the gage to get all the air out. See procedure 9 below.
- f. Calibrate the gage and calibrator as a unit.

#### **6. Determining the cause of low oil level.**

Low oil level usually means a leak somewhere in the calibrator. Visually inspect the following as the source of the leak:

- Pipe plug is loose or its threads are damaged. Tighten or replace.
- Gage is loose, its threads are damaged, or it has internal leakage. Tighten or replace.

- Gage saver is loose, threads are damaged, or has a break. Tighten or replace.
- Calibrator packing is worn or damaged and needs replacement.

You may need to replace pipe thread tape or pipe dope to remedy leaks around plug, gage, or gage saver threads.

## **7. Replacing the gage.**

- Remove the gage guard.
- Select a small shim and position it between the two metal blocks that are part of the gage saver. Then tighten a C-clamp around the gage saver blocks and the shim.
- Using the C-clamp as a handle to hold the gage saver stationary, unscrew the gage and remove it.
- Look down into the gage saver and check that it is full of oil. If it is not full, add hydraulic oil according to the steps in procedure 9.
- Apply pipe thread tape or pipe dope to the gage threads, then screw the new gage onto the gage saver. Hold the gage saver stationary with the C-clamp to tighten the gage. The new gage has oil; you need not add oil to it.
- Calibrate the gage and calibrator as a unit and reattach the gage guard.

## **8. Replacing the gage saver.**

- Remove the gage guard and gage as in steps 7a-7c. Invert the gage so that it does not lose its oil.
- Remove the old gage saver using the proper-sized wrench.
- Apply pipe thread tape or pipe dope to the threaded end of the new gage saver.
- Fill the new gage saver with hydraulic oil (Buna-N compatible).
- Hold the gage saver so that the oil does not run out and thread it into the vacant port. Tighten with a wrench.
- Shim the gage saver blocks and attach a C-clamp as you did before. Apply pipe thread tape or pipe dope to the gage threads. Hold the gage saver stationary with the C-clamp and replace the gage. Tighten to assure a leak-proof connection.
- Calibrate the gage and calibrator as a unit and reattach the gage guard.

## **9. Adding oil to the calibrator when the gage or gage saver is removed.**

**Note:** Any time oil is added to the calibrator, air trapped inside must be removed. The oil will force the air out, but it must flow from the pipe plug opening in the side, up through the

*calibrator, and out the top. Therefore, when adding oil be sure the unit is in an upright position with the gage opening at the top.*

- a. Push the piston all the way out against the snap ring.
- b. Remove the 1/4" pipe plug on the side of the unit.
- c. Add hydraulic oil through the pipe plug opening until oil comes out the gage saver (if only the gage is removed) or out the hole at the top of the calibrator (if both the gage and gage saver are removed). Use oil that is Buna-N compatible.
- d. Reassemble the gage saver and gage as in procedure 8. Be sure the gage saver is full of oil.
- e. Calibrate the gage and calibrator as a unit and reattach the gage guard.

## **10. Replacing the calibrator packing (O-rings).**

**Note:** *You can buy replacement O-rings in standard sizes locally if you wish, or you can order them from Skidmore-Wilhelm. When ordering from us, specify the serial number from the tag permanently attached to your calibrator.*

- a. Remove the gage guard, gage and gage saver as in procedures 7 and 8.
- b. Remove the pipe plug if it is not already out.
- c. Drain the oil from the calibrator.
- d. Remove the snap ring and the piston.
- e. Remove the old O-rings and replace with new O-rings. Wipe them with a small amount of hydraulic oil to ease re-assembly.
- f. Reassemble the piston and calibrator body. Tap the piston lightly to avoid cutting the O-rings.
- g. Push the piston all the way back into the body.
- h. Refill with hydraulic oil through the 1/4" pipe plug opening on the side until oil runs out the gage saver hole at the top.
- i. Reassemble the gage saver and gage.
- j. Add oil as in procedure 9.
- k. Calibrate the gage and calibrator as a unit and reattach the gage guard.

## **11. Adding oil to calibrators having a low-range gage and a high-range gage.**

This procedure assumes that both gages are removed but both gage savers are in place.

- a. Check the oil level in the low-range gage saver first. This is the gage saver fitted with a shutoff valve.
- b. As you begin to add oil through the pipe plug hole on the side of the calibrator, open the shutoff valve. This allows oil to rise into the gage saver.
- c. When the lower gage saver is full, close the shut-off valve. Then add oil through the pipe plug hole on the side until oil runs out of the high-range gage saver.
- d. Reattach the gages as described above.
- e. Calibrate the gage and calibrator as a unit.

## **12. Replacing dowel pins for the bolt bushing. (See figure on page 1.)**

Two hardened and ground dowel pins (item 10) fit into the back of the piston (item 3). They locate the bushing (item 6) and hold the bolt stationary while the nut is turned. Occasionally, the pins break if overloaded. Normally breakage of pins does not affect calibration.

**Note:** *You can buy the pins directly from us, P/N K-011. However, quality hardened and ground pins measuring .375" x 1.00" can often be obtained locally.*

Replace broken pins as follows:

- a. Remove the bushing (item 6) and the bolt plate (item 5).
- b. Knock the damaged pins out from the front of the calibrator.
- c. Tap in the new pins until seated.