Bulletin 208

PARTS LIST
and
OPERATING PROCEDURE
for
SKIDMORE-WILHELM

MODEL J

BOLT TENSION CALIBRATOR

Skidmore-Wilhelm Mfg. Co.
442 South Green Road Cleveland, Ohio 44121
Phone: (216) 481-4774 Fax: (216) 481-2427

Rev 7/95

SKIDMORE-WILHELM BOLT TENSION CALIBRATORS

Skidmore-Wilhelm Bolt Tension Calibrators are designed for testing a wide variety of fasteners and for calibrating impact wrenches. Each calibrator is essentially 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 J Bolt Tension Calibrator and use it to test fasteners and verify power tool output.

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 J.

5. **For power tool output testing:** Skidmore-Wilhelm has special Test Bolt Assemblies available for testing power tools. The assembly consists of a plate, a threaded bushing or nut, a thrust washer, and a test bolt. The plate and bushing are installed as described in 3 and 4 above.

Insert the test bolt assembly as follows: Attach the plate from the test bolt assembly to the front of the Model J. Fit the bronze thrust washer into the hole in the plate. Insert the test bolt through the plate and thrust washer and thread the bolt into the test bushing. The bushing fits over the back of the dowel pin and is held in place with the bushing retainer. (item 15)

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 J:

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 torque’s 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.

Verifying the Accuracy of Power Tools

The Model J calibrator can test the output of all types of power tools, including electric, pneumatic, and hydraulic impact wrenches, nutrunners, and stall tools. You must set up a standardized testing program using the Model J 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 providing very low co-efficient 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.

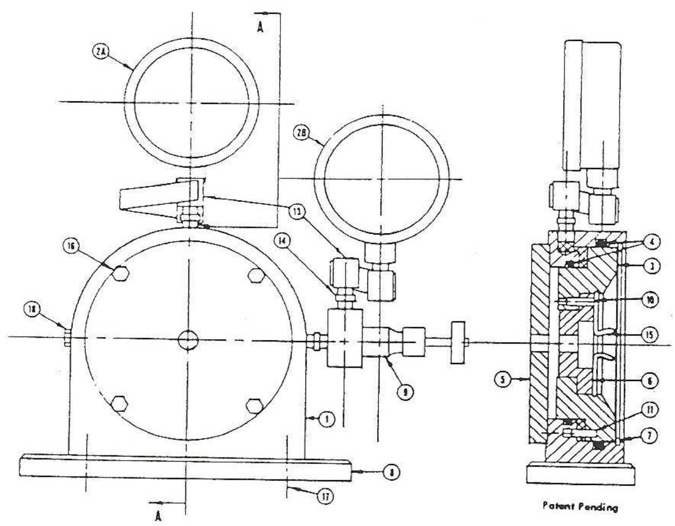
If you wish to keep a "torque" reading as part of your tool record, determine the torque as follows: Establish the bolt tension "norm" as in steps 1-8 above. Back off the test bolt. Then retighten it using a hand torque wrench. Continue to tighten until the gage dial reading matches the "norm". Use the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

Selecting Test Bolt Assemblies

Consistent, accurate power tool output testing requires standard, repeatable test conditions. Production fasteners are poorly suited for this, being subject to many variations and to physical changes from repeated tightening. Skidmore-Wilhelm Precision Test Bolt Assemblies, made of a special hardened steel alloy, guarantee uniform, repeatable test conditions.

Two test bolt assembly sizes are available for the Model J. Base your selection on the square drive size of the tool being tested.

Test Bolt Assembly Part Number	Test Bolt Size	Power Tool Square Drive	Hex Socket	Maximum "Norm"
J-110	5/8	1/4, 3/8, 1/2	9/16	15,000
J-114	7/8	1/2, 5/8, 3/4	7/8	30,000



Parts List

Item No.	Part No.	Name
1	J-001	Body
2A	J-02A	30,000# gage
2B	J-02B	10,000# gage
3	J-003	Piston
4	J-004	Packing
5	J-500	Bolt plate
6	J-600	Standard hex bolt bushing When ordering parts J-500 and J-600, specify size: #10, 1/4, 5/16, 3/8, 7/16, 1/2, 9/16 inches.

Item No.	Part No.	Name
7	J-007	Snap ring
8	J-008	Base
9	J-009	Shut-off valve
10	M-010	Bushing dowel pin
11	J-011	Dowel pin
13	M-013	Gage saver
14	M-014	1/4-inch pipe coupling
15	J-015	Bushing retainer
16	J-016	3/4-inch plate screw (4)
17	J-017	Base screws (4)
18	M-021	1/4-inch pipe plug

Bulletin 209

MAINTENANCE MANUAL
for
SKIDMORE-WILHELM

MODEL J

BOLT TENSION CALIBRATOR

Skidmore-Wilhelm Mfg. Co.
442 South Green Road Cleveland, Ohio 44121
Phone: (216) 481-4774 Fax: (216) 481-2427

Rev 7/95

1. Verifying calibrator accuracy.

The accuracy of the calibrator gages 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 gages.

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 gages facing up. One or more bolt plates can be put on the face of the calibrator to allow application of 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 adapter, be sure that the bolt plate (item 5) is thick enough to take the highest test load.

2. Adjusting the gages.

During a calibrator accuracy test, compare the reading on the gage 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 slot of the recalibration screw and turn the screw right or left as needed 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 located on the top of the gear that adjusts the pointer. Turn the screw left or right so that the pointer moves 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 4 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. Replacing the gage.

a. 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.

b. Using the C-clamp as a handle to hold the gage saver stationary, unscrew the gage and remove it.

Alternate procedure: By springing the gage saver slightly open, you can fit a 7/8-inch open end wrench into the gage saver, holding it in place while removing the gage. Use care, however, to avoid damaging the gage saver.

c. 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 7.

d. 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 or open end wrench to tighten the gage. A new gage from the factory has oil; you need not add oil to it. Check other gages for the presence of air. Never install a gage that contains trapped air.

e. Calibrate the gage and calibrator as a complete system.

5. Replacing a gage saver.

a. Remove the gage as in steps 4a-4c. Invert the gage so that it does not lose it's oil.
b. Remove the old gage saver using the proper-sized wrench.
c. Apply pipe thread tape or pipe dope to the male threads on both the new gage saver and gage, then tighten it with the wrench.
d. Fill the new gage saver with hydraulic oil (Buna-N compatible) as described in procedure 8.
e. Shim the gage saver blocks and attach a C-clamp or use a 7/8-inch open end wrench as you did before.

f. Hold the gage saver stationary with the C-clamp or wrench and replace the gage.
g. Calibrate as a complete system

6. 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 and 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 (item 18) plug is at the 12 o'clock position.
b. Push the piston all the way in, against the snap ring.
c. Remove the pipe plug and look into the opening. If the oil level is not at the top of the opening, the calibrator is low on oil. (see step 7) Remove old pipe thread tape or pipe dope and re-apply new thread tape to the 1/4" pipe plug.

7. Adding hydraulic oil to the calibrator -- gages 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 gages to get all the air out. (see procedure 8)
f. Calibrate as a complete system.

8. Adding oil to the calibrator with the gages removed.

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 shut-off valve.
b. As you begin to add oil through the pipe plug hole on the side of the calibrator, open the shut-off valve. This allows oil to rise into the gage saver.
c. When the lower gage saver is full, close the shut-off valve. Then continue to 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 as a complete system.

9. 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:

- One or both gages are loose, gage threads are damaged or they have internal leakage. Tighten or replace.
- One or both gage savers are loose, their threads are damaged or they have a break. Tighten or replace.
- Calibrator packing is worn or damaged and needs replacement.
- Use of a hydraulic load reliever (Skidmore-Wilhelm Model LR-100) has moved too much oil from the calibrator into the load reliever pump. Although not a leak, this condition should be remedied. Close the shutoff valve on the calibrator, reattach the load reliever hose and pump the handle to transfer oil back into the calibrator. Be careful not to put too much oil in the calibrator (in which case the piston bottoms against the snap ring). See the instruction sheet included with you r LR-100 Load Reliever for details.

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

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 gages and gage savers as in procedures 4 and 5.

b. Drain the oil from the calibrator.

c. Remove the snap ring and the piston.

d. Remove the old O-rings and replace with new O-rings. Wipe them with a small amount of hydraulic oil to ease reassembly.

e. Reassemble the piston and calibrator body. Tap the piston lightly to avoid cutting the Orings.

f. Push the piston all the way back into the body.

g. Reassemble the gage savers.

h. Refill with hydraulic oil according to procedure 8.

i. Reassemble the gages.

j. Calibrate as a complete system.

11. Replacing the dowel pin for the bolt bushing.

A hardened and ground dowel pin (item 10) fits into the back of the piston (item 3). The pin prevents the bushing (item 6) from rotating while the nut is turned. Occasionally, the pin breaks if overloaded. Normally breakage does not affect calibration.

Note: *You can buy replacement pins locally or order them from Skidmore-Wilhelm. Our pins are 1/4" round by 7/8" long. Quality hardened and ground pins must be used.*

Replace a broken pin as follows:

a. Remove the bushing (item 6) and the bolt plate (item 5).

b. Knock the damaged pin out from the front of the calibrator.

c. Check the condition of the reamed hole to ensure a light press-fit.

d. Tap in the new pin until seated.