

**PARTS LIST
and
OPERATING PROCEDURE
for
SKIDMORE-WILHELM

MODEL M
MODEL ML

BOLT TENSION CALIBRATORS**



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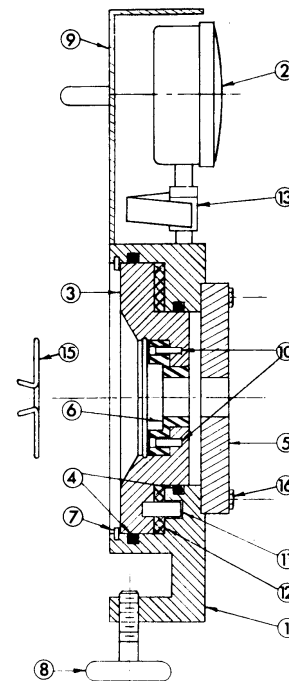
SKIDMORE-WILHELM BOLT TENSION CALIBRATORS

Skidmore-Wilhelm Bolt Tension Calibrators are designed exclusively for calibrating impact wrenches (and other types of installation tools) and testing high-strength fasteners used on structural steel. 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 internal hydraulic pressure. A gage measures the pressure and provides a dial readout calibrated in pounds-tension equivalent to the tension created in the fastener.

OPERATING INSTRUCTIONS FOR CALIBRATING IMPACT WRENCHES AND OTHER INSTALLATION TOOLS

Basic Calibrator Setup

- a. Clamp the calibrator on a convenient beam or column using the two wing screws. Do not over tighten. Excessive force can damage the body.
- b. Select a sample bolt for the wrench calibration test. Attach plate (item 5) appropriately sized for the bolt to the front of the calibrator using four cap screws (item 16). Any time you change to a different size bolt for the test, you will need to change the plate as well.
- c. Insert the bolt bushing (item 6) into the back of the calibrator. The bushing fits over the back of the two dowel pins and is held in place with the bushing retainer (item 15). Note that ML bushings (1 1/8" and larger) do not use the retainer.
- d. Insert the bolt from 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. If the bolt is longer than 3 inches, it may be necessary to add a spacer under the nut.
- e. Tighten the bolt with an impact wrench, hand torque wrench or other installation tool.
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Parts List

Item	Part No.	Name
1	M-001	Body
2	M-002	110,000# gage (50,000 kg)
3	M-003	Piston
4	M-004	Packing
5	M-500	Bolt plate
6	M-700	Heavy hex bolt bushing
<i>When ordering parts M-500 and M-700, specify size: 5/8, 3/4, 7/8, 1, 1-1/8, 1-1/4 inches. Metric equivalents available at no extra cost.</i>		
7	M-007	Snap ring
8	M-008	Mounting screw
9	M-009	Gage guard
10	M-010	Bushing dowel pin
11	M-011	Dowel pin
12		Oil reservoir
13	M-013	Gage saver
15	M-015	Bushing retainer
16	M-016	1" plate screw
	ML-016	1-1/4" plate screw

Test Procedures

Based on methods recommended by the Research Council on Structural Connections

Following are descriptions of the fastener installation methods acceptable to the Research Council on Structural Connections. We have listed the appropriate procedures for using each method to calibrate your wrenches.

Perform your selected test procedure at least three times. Each time, use a new fastener, but be sure all three are identical in grade, length and diameter. The fasteners must be chosen from among those you intend to use in the actual bolted connection.

1. CALIBRATED WRENCH METHOD

Calibrated wrenches may be used to achieve minimum bolt tension provided the wrenches are checked **on a daily basis** in a tension measuring device for consistent tightening performance. Furthermore, a hardened washer must be used under the part of the fastener that turns during tightening.

Procedure:

- a. Insert the bolt, hardened washer and nut as described in the Basic Calibrator Setup.
- b. Tighten the nut with the wrench to be calibrated.
- c. Adjust the torque control mechanism or the air pressure up or down so that the reading on the calibrator dial is at least 5% greater than the minimum tension required for the size of the fastener. Minimum fastener tension requirements for A325 and A490 fasteners, as specified by the Research Council on Structural Connections, are printed on the dial of the gage.

2. ALTERNATE DESIGN BOLTS (TENSION-CONTROL BOLTS)

Tension control bolts are fasteners that undergo a physical change at installation, such as the shearing off of a splined end. Although these bolts may require special installation tools, they can be tested in the calibrator in the same manner as standard bolts. Some tension control bolts have a round head instead of a hex head. Special adapters are available from the factory for these bolts. Testing sample bolts will ensure that the installation tools and fasteners are performing to their manufacturer's specifications.

Procedure:

- a. Install the special bushings available from Skidmore-Wilhelm for use with tension-control bolts. When using these special bushings, the M-010 dowel pins (1/4" x 3/4") must be replaced with T-0110 dowel pins (1/4" x 1/2"). The pins are removed by pushing them out from the front of the unit
- b. Use the same plate you would use for regular hex head bolts. Also install any special hardened flat washers used in the actual joint.
- c. Tighten the tension-control bolt, according to the manufacturer's installation procedures, until twist-off. The reading on the calibrator dial should be at least 5% greater than the minimum tension required.

3. DIRECT TENSION INDICATORS (DTIs)

Load indicating washers or DTIs can be used in the calibrator and checked to see that they are performing properly. Special bushings that allow a socket to be placed on the nut are available for those bolts where the washer is placed under the bolt head. These bushings replace the normal bushings used to prevent bolt head rotation.

Procedure:

- a. Install the bolt, with the load indicating washer under the bolt head and any special hardened flat washers used in the actual joint, through the front plate. Installing the bolt from the front allows a feeler gage to be used to check the washer.
- b. From the back of the calibrator, install the nut onto the bolt along with any special hardened flat washers used in the actual joint. (If the nut interferes with the M-010 dowel pins, they can be removed by pushing them out from the front of the unit.)
- c. Tighten the fastener assembly according to the device manufacturer's installation procedures until the washer indicates the proper tension. Tightening the assembly will require two (2) wrenches, one wrench to tighten the nut from the back and the second wrench to prevent the bolt head from rotating.
- d. Compare the tension reading on the calibrator gage to the minimum tension required. The reading should be at least 5% greater.

4. TURN-OF-THE-NUT METHOD

This procedure is based on rotating the nut a specified fraction of a turn from a "snug" position. It's effectiveness depends upon the uniformity of the point from which turns are measured. Testing bolts from each lot in the calibrator will help to develop a consistent snug position. Once a snug position is obtained, continue tightening the bolt and check the tension reading after the proper rotation. There is a rotational tolerance of plus or minus 30 degrees, and the effect upon bolt tension can be observed.

Procedure:

- a. Tighten the nut to a snug-tight condition.
- b. Tighten further by the permitted amount of rotation based on bolt length/diameter relationship (See the related table in the Research Council Specification).
- c. Compare the tension reading on the calibrator dial to the minimum tension required. The reading should be at least 5% greater.

5. ROTATIONAL CAPACITY

Rotational capacity tests can be run using the same basic procedures described above in conjunction with the appropriate specification. Please note that bolts and nuts with unusually high friction may require considerably more torque than usual. Care must be taken to avoid shearing the dowel pins.

How To Establish A Job Inspecting Torque For Inspection Arbitration

With a Skidmore-Wilhelm Bolt Tension Calibrator and a manual torque wrench, you can easily determine an inspection torque for testing the tension of bolts already installed.

In the Bolt Tension Calibrator, tighten three representative fasteners to 15% of their required tension to establish an initial condition. The surface under the part that turns should simulate the surface conditions of the actual job. Finish tightening the bolt by any means to the required bolt tension. However, nut rotation during the final tightening cannot exceed 1-1/2 times the rotation permitted by specifications. Then apply enough torque with the job inspection wrench to turn the nut at least 5 degrees **in the tightening direction**. The average torque for the three tests is the job inspecting torque.

Using the calibrated torque wrench, test at least 10 percent of the installed bolts, but not less than two. The job inspecting torque should not turn any of the nuts or bolts. If it does, all fasteners must be retightened and reinspected.

Troubleshooting Suggestions

1. If you are not satisfied with any test results (for example, if readings are widely scattered), check the following:
 - a. Make sure you are using a hardened washer.
 - b. Make sure each bolt is properly marked A325 or A490.
 - c. Make sure that the bolts are not completely dry. On most bolts the rust preventative is sufficient lubrication. However, if the bolts are completely dry, there is a tendency for the threads to seize before the bolt gets up to tension. A small amount of oil on all bolts, both test and installation bolts, will correct this situation.
2. Use a new bolt, nut and washer for each test, since used nuts and bolts frequently give erratic calibration results. Also, the values marked on the gage dial are minimum bolt tension as approved by the Research Council on Structural Connections and endorsed by the AISC. It is recommended that the wrench be set to induce bolt tension 5% to 10% in excess of these values.
3. Daily rechecks on wrench calibration should be made. This should be done at the job site using the same length of hose and connections that will be used on the job. In this way, calibrating conditions will be identical with job conditions.

Adapters for Models M, ML, and RL Bolt Tension Calibrators

BOLT SIZE	5/8	3/4	7/8	1	1-1/8	1-1/4
PLATE Part No.	M-510	M-512	M-514	M-516	ML-518	ML-520
BUSHING - For Std. Hex Bolts Part No. Bolt Head Size Across Flats	M-610 15/16	M-612 1-1/8	M-614 1-5/16	M-616 1-1/2	ML-618 1-11/16	ML-620 1-7/8
BUSHING - For Heavy Hex Bolts Part No. Bolt Head Size Across Flats	M-710 1-1/16	M-712 1-1/4	M-714 1-7/16	M-716 1-5/8	ML-718 1-13/16	ML-720 2
BUSHING - For DTIs Part No. Bolt Head Size Across Flats	MT-610 15/16	MT-612 1-1/8	MT-614 1-5/16	MT-616 1-1/2	MT-618 1-11/16	MT-620 1-7/8

Use this list for ordering additional or replacement parts.

When ordering adapters, specify bolt size, standard or heavy hex, and serial number of calibrator. Special adapters can be made to your specifications upon request.