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Using the Orbis and Tornado Mk II, and Vortex Torque Cell Accuracy Check Rig

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431-454-02

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System name

This document describes assembly and use of the Mecmesin Orbis Mk II, Tornado Mk II, and Vortex, Torque Cell Accuracy Check Rig, used to check the accuracy of Orbis and Tornado Mk II digital torque instruments, and static torque sensors rated from 1.5 N.m to 10 N.m.

Advisories

Any masses supplied with this product will not have been trimmed to a local 'g' value. This means that they will not necessarily accurately apply their stated weight at every location.

It is recommended that masses are trimmed specifically for the location in which they are to be used, or that local 'g' value is taken into account when comparing applied load to measured load.

The use of this check rig does not replace the need for required periodic traceable Mecmesin calibration.

Unless otherwise stated, the masses supplied with this product have been calibrated to:

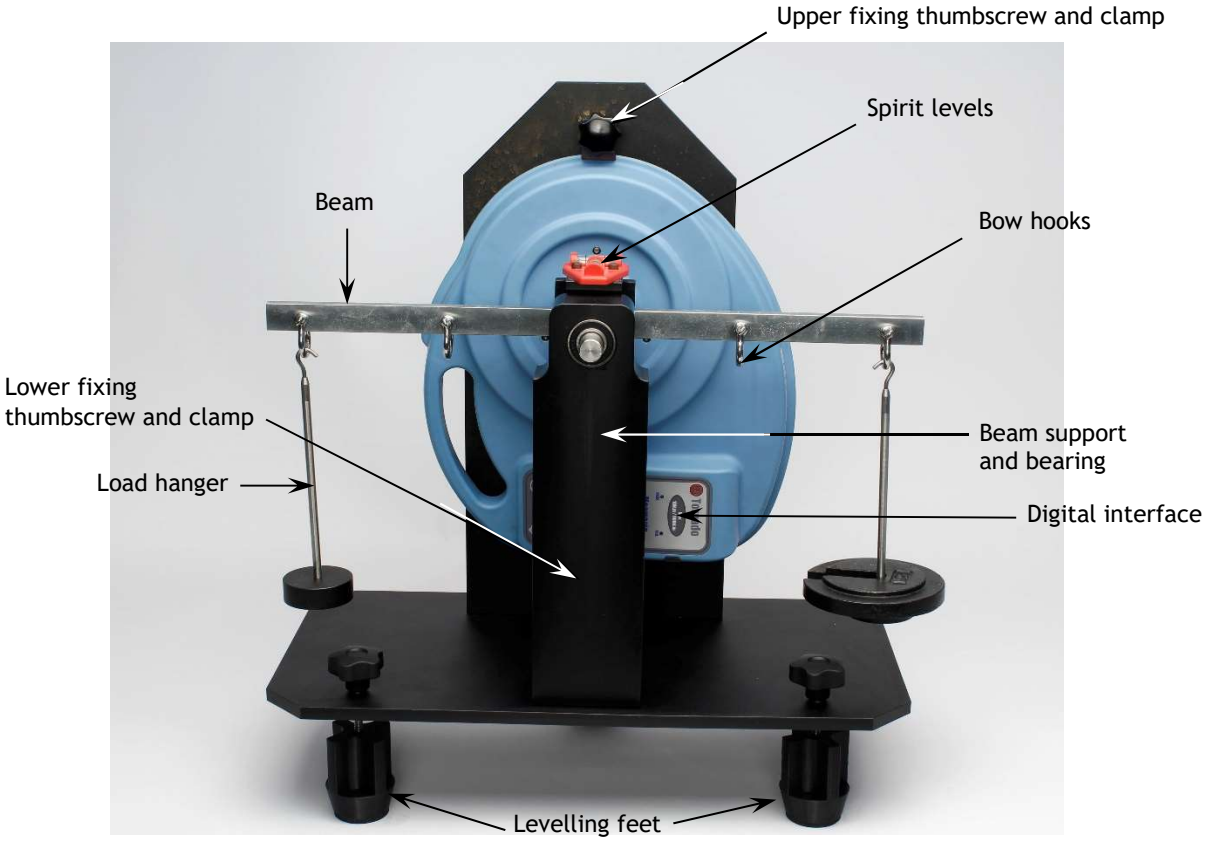
Class M1 using a 'g' value of **9.813 m/s²**

Part no. 431-454-02

Contents

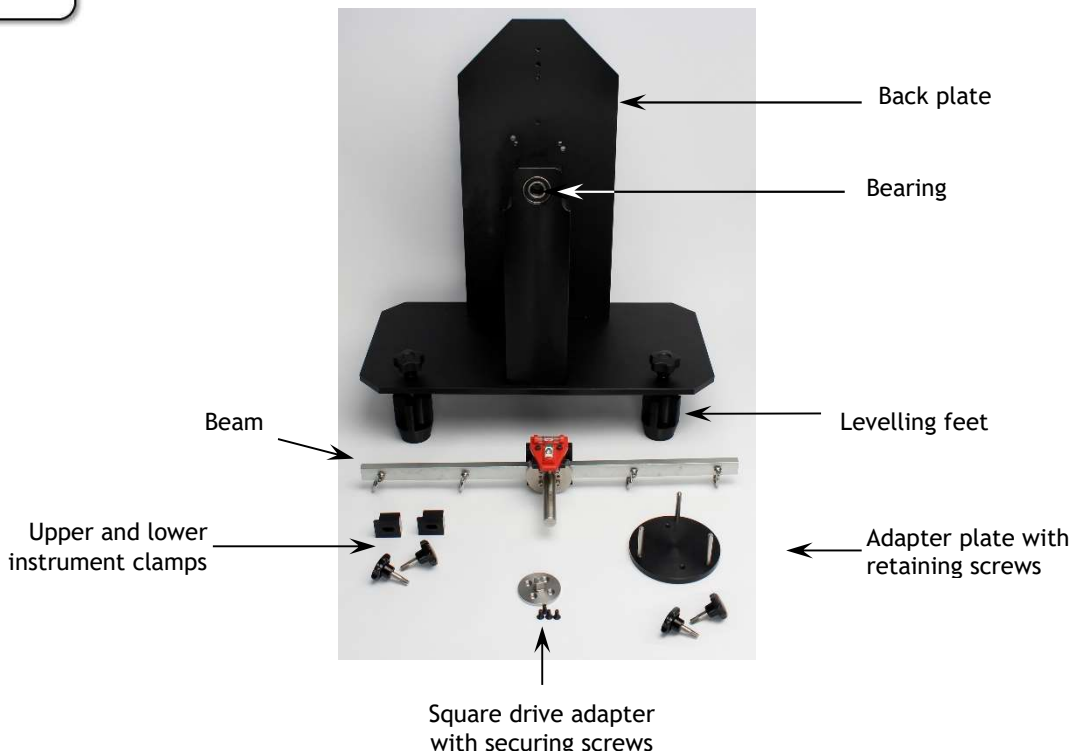
1. Feature Identification

The assembled torque cell accuracy check rig with an instrument installed, will look like this.



2. Before you Start

Make sure you know the capacity of the instrument or torque cell and see the tables in Appendix A for the weight values to be applied to your device.



Supplied masses are not trimmed to the local 'g' value.

Please see the advisory on page 2 for more information.

Torque cell accuracy check rig parts supplied, and the hooks and masses

To perform an accuracy check, you will also need:

1. A record sheet
2. A timer or watch with a second hand

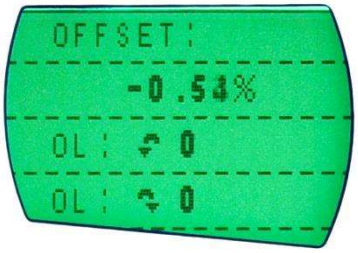
Presuming the frame is ready assembled, the following steps take you through the torque cell accuracy and linearity checking process.

2.1 Instruments: check sensor offsets

ORBIS

Place the instrument horizontally on a flat, level surface and turn it on. Press and hold the UNITS key. The display will show 0000. Press RESET four times (to enter 0000 as the password). The screen will show the current offset of the sensor as a percentage, and any overloads (OL) in ACW and CW directions.

Press MAX to revert to normal display.



TORNADO

Place the gauge horizontally on a flat, level surface and turn it on. Press and hold the MENU key. If Password is enabled, enter the password. The display will then show menu page 1. Press the MENU key again to show menu page 2.

Using up/down buttons select '**CALIBRATION**' and press the ENTER key. The display will show 0000. Press ENTER four times (to enter 0000 as the password), a screen displaying the current offset of the sensor as a percentage, and any overloads (OL) in ACW and CW directions.

Press ESC twice to revert to normal display.

Interpretation

If the displayed offset is between ±5 and 10%, adjustment maybe required. This should only be done by an authorised Mecmesin representative.

If the displayed offset is greater than 10%, a replacement sensor may be required.

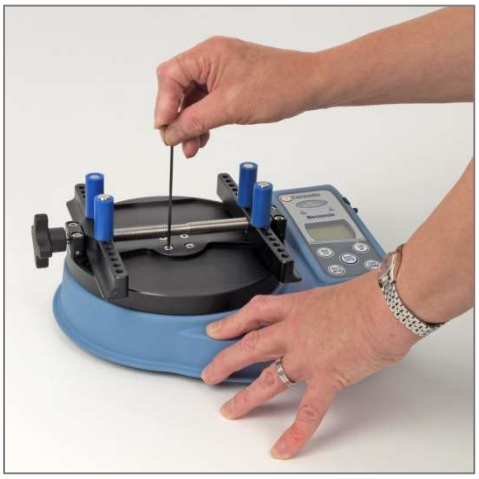
These values are given as an indication only—the need for calibration/repair may vary according to the individual characteristics of the sensor.

If in doubt, call the Mecmesin Service Department on +44 (0)1403 799921, or your local distributor.

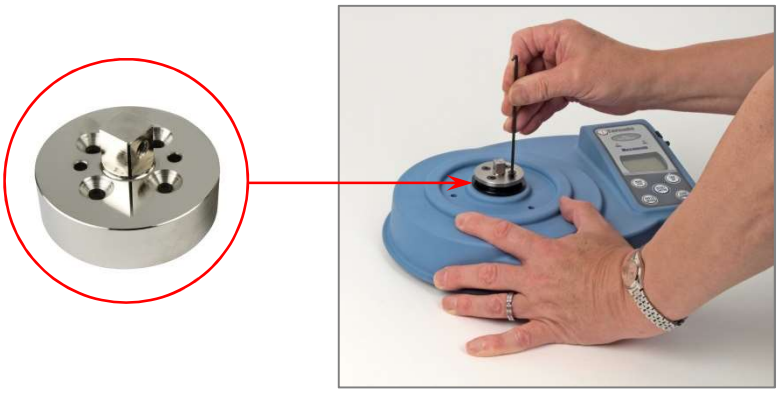
3. Assembly for Instruments

Remove the adapter plate from the rear of the accuracy check rig by unscrewing the two retaining screws.

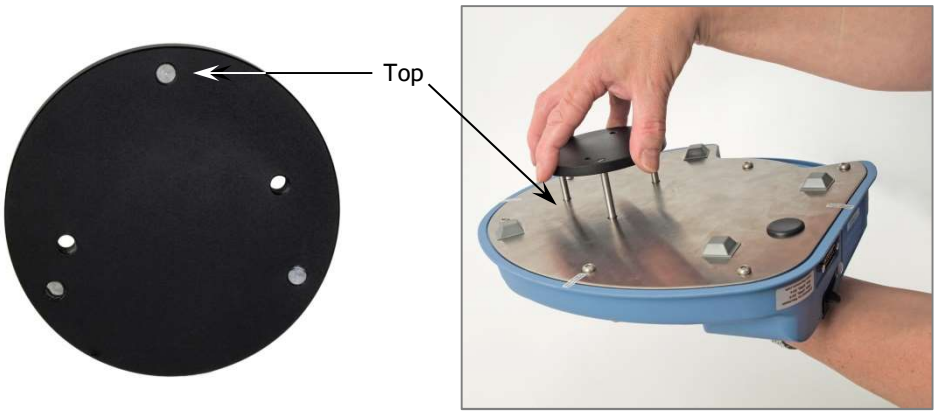
Remove any grip fixture from the Orbis or Tornado instrument (example shown below).



Fit the ⅜" male adapter to the front of the instrument using the four countersunk screws supplied, applying them diagonally, and tighten them evenly:



Fit the three locating pins of the adapter plate (removed above) through the underside of the instrument. Note the orientation of the fixing holes:



Push the adapter plate flush with the underside of the instrument:

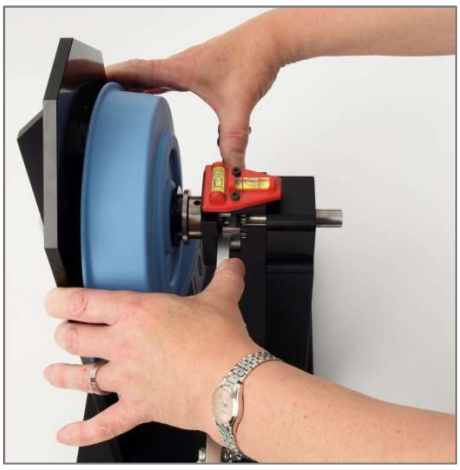
Mount the accuracy check rig on a flat, level surface, and fit the crossbeam through the beam support pillar, and pull it forward flush against the support bearing:

Loosely attach the lower instrument clamp. The instrument casing will rest on this during assembly, and it will be tightened to grip later.

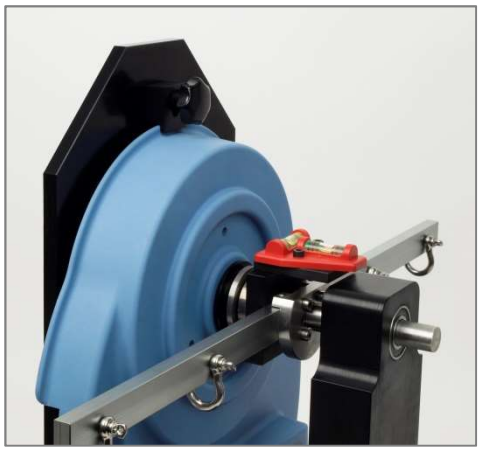
Holding the instrument on end, with its control panel downwards, introduce it between the back plate and beam. You can rest it on the lower clamp while locating the retaining screws through the two clear holes in the back plate. Secure the adapter plate loosely. You will need some freedom of movement in locating the beam.

Manipulate the instrument position as you push the beam back onto the square drive, until it is fully engaged:

Tighten the two adapter plate retaining screws so that the instrument is securely fastened against the rig back plate, and pull the beam and gauge together to ensure complete engagement.



Attach the upper instrument clamp and tighten both clamps. The instrument is now secure.



Upper fixing

Lower fixing

4. Assembly for Vortex Torque Cells

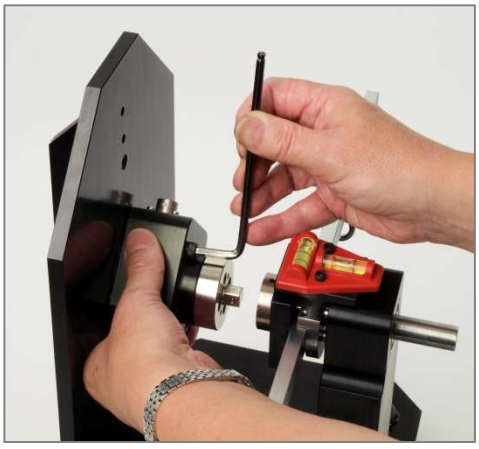
Remove the instrument adapter plate from the rig using an M5 Allen key, if it is assembled. The torque cell will be secured directly to the rig back plate.

Secure the Vortex top load tray in mid position, and disconnect the torque cell cable from the Vortex body.

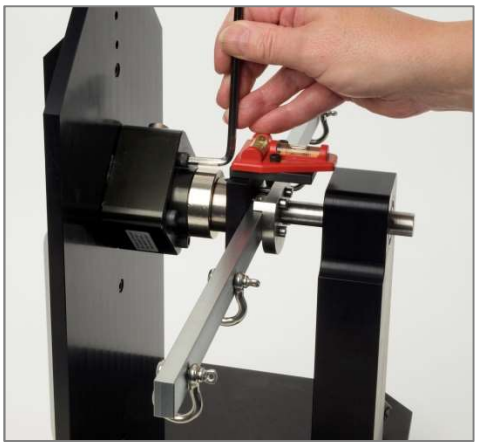
Release and lift the crossbeam away from the Vortex, and stand it upside down on the load tray.

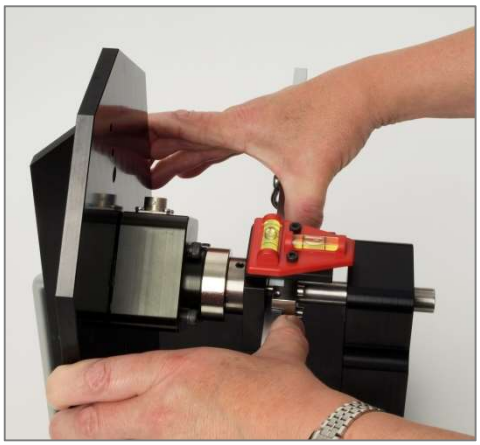
Disconnect the torque cell cable from the torque cell. Remove the four cap-head bolts securing the torque cell, and carefully lift the torque cell away:

Fit the torque cell to the rig back plate using the same four cap-head bolts and secure loosely. You will need some freedom of movement in locating the beam. Ease the beam back onto the torque cell's square drive and manipulate into position until fully engaged:



Tighten the four bolts and then pull the beam and back plate together to fully engage the beam with the torque cell:





4.1 Reading the torque cell

You will now need to connect the torque cell back to the Vortex:

Vortex-*i*

Connect the torque cell to the crossbeam, and the crossbeam to the Vortex base. Connect the Vortex to your controlling PC. Switch on normally and log in to Emperor

Vortex-*xt*

Connect the torque cell to the crossbeam, and the crossbeam to the Vortex base. Switch on normally and log in to Emperor-*xt* on the touch-screen console, in Quick Test mode.

Vortex-*d*

Connect the Torque cell to your AFTI digital instrument, and turn it on.

5. Accuracy Checking Procedure Outline

- For the following linearity and creep tests, refer to Appendix A for weights to apply and for required result limits.
- Wherever possible, the measurement units should be set to the same units as used in the adjustment. Most Mecmesin torque devices are now adjusted using N.m.
- If any recorded reading is not within required limits, contact your distributor for assistance.

If you are calibrating a 1.5 N.m or 3 N.m instrument, place the two shorter load hangers on the outer bow hooks and the two longer load hangers on the inner bow hooks. Otherwise, just use the two shorter load hangers on the outer bow-hooks and omit the longer load hangers. If in doubt, refer to **Appendix A** on how to distribute the weights on the hangers.

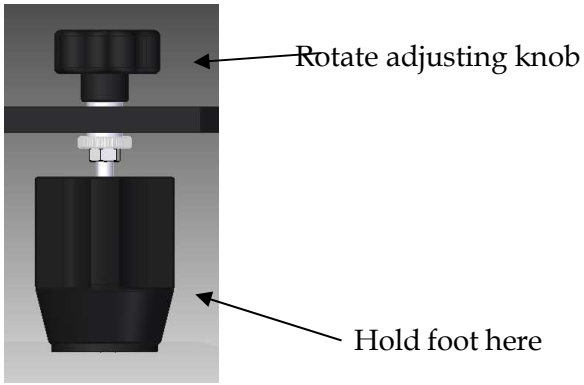
5.1 Levelling the beam

At various points during the accuracy check you are instructed to level the beam. The three feet can be used to achieve this. Follow these steps to adjust the feet.

Front feet

1. Loosen thumb nut underneath the base

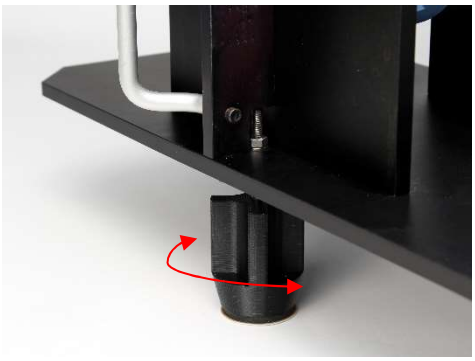
2. Hold the foot firmly in place by hand then rotate the adjusting knob to adjust the foot height as required



3. Tighten the thumb nut to lock the foot in place at the required height

Back foot

The back foot has no locking mechanism. Simple rotate the foot to adjust the height.



Once the adjustment is complete the two spirit level bubbles should be centered.

6. Running the Check Tests

A **full test** is run in both clockwise and anticlockwise directions.

For **levelling the beam**, see Section 5, *Accuracy Checking Procedure Outline*.

For the **table of weights** appropriate to the torque cell being checked, and how they are to be applied, see Appendix A.

6.1 Clockwise linearity check and creep test

1. Make sure the beam is level at the start of the test.
2. Pre-stress the sensor to 100% of the instrument capacity in the clockwise direction, by loading the beam with full capacity for the torque cell.

The picture shows the instrument being tested in the clockwise direction.

3. Remove the weights, level the beam using the three levelling feet, and steady the hooks. Tare the load by pressing the Zero key (or the Zero Load button in Emperor).
4. Apply the first weight (refer to Appendix A) to the right-hand side, and **level the beam**.

5. When the digital reading has settled, and if it is within required limits, record the reading. If it is not within required limits, contact the Mecmesin Service Department, or your distributor.
6. Apply the subsequent weights as listed in Appendix A, recording each reading after **levelling the beam**, for each new weight applied.
7. Remove all weights and **level the beam**. Steady the beam—make sure that there is no swaying of the hooks.
8. When the digital reading has settled, and if it is within required limits, record the reading. If it is not within required limits, contact the Mecmesin Service Department, or your distributor.

6.2 Anti-clockwise linearity check and creep test

1. Pre-stress the sensor to 100% of the instrument capacity in the anticlockwise direction, by loading the beam with full capacity for the torque cell.
2. Remove the weights, **level the beam**, steady the hooks and tare the load by pressing the Zero key (or the Zero Load button in Emperor).
3. Apply the first weight (refer to Appendix A) to the left-hand side, and **level the beam**.
4. When the digital reading has settled, and if it is within required limits, record the reading. If it is not within required limits, contact the Mecmesin Service Department, or your distributor.
5. Apply the subsequent weights as listed in Appendix A, recording each reading after **levelling the beam**, for each new weight applied.
6. When all the required weights have been applied, leave the instrument with full load and start the timer. This will test whether the instrument stays with required limits under sustained torque.
7. **After 30 seconds:**
    a. if the reading is within half of the acceptable limits (Appendix A), record the reading and then proceed to the next step below.
    b. if the reading is *not within half* of the required limits, but still within the required limits, wait for a further 3 minutes. If after 3 minutes the reading has moved outside the required limits, contact the Mecmesin Service Department, or your distributor.
8. Remove the load, **level the beam** and record the zero reading. Start the timer.
9. **After 30 seconds:**
    a. if the reading is within half of the required limits, record the reading and then proceed to the next step below.
    b. if the reading is not within half of the required limits, but still within the required limits, wait for a further 3 minutes. If after 3 minutes the reading has moved outside the required limits, contact Mecmesin, or your distributor.

7. Disassembly: Releasing the Instrument or Cell

7.1 Instruments

Pull the cross-beam forward away from the instrument and disengage it.

Release the upper instrument clamp and remove it. Loosen the lower clamp.

Supporting the instrument with one hand, unscrew the two adapter plate retaining screws at the back of the rig.

Carefully withdraw the instrument, and then withdraw the adapter plate from the underside of the instrument:

If the adapter plate does not withdraw easily, push the pins out from the front of the instrument, using an Allen key. **Do not insert a screwdriver or other lever between the plate and the instrument. If the plate is stuck then use an adapter plate retaining screw to pull adapter off the equipment.**

Place the instrument on its feet and remove the four screws retaining the square drive adapter. Replace any grip fixture that was removed before the checking process, applying the countersunk screws diagonally, and tighten them evenly.

Ensure all loose parts are bagged and retained with the accuracy check rig for storage.

7.2 Torque cells

1. Exit Emperor (Vortex-xt or Vortex-*i*).
2. Switch off the Vortex and/or AFTI (Vortex-*d*).
3. Disconnect all cables.
4. Remove the 4 bolts holding the torque cell.
5. Reattach the Torque cell to the Vortex crossbeam.
6. Replace the crossbeam on the Vortex, and secure.
7. Reconnect all cables as normal.

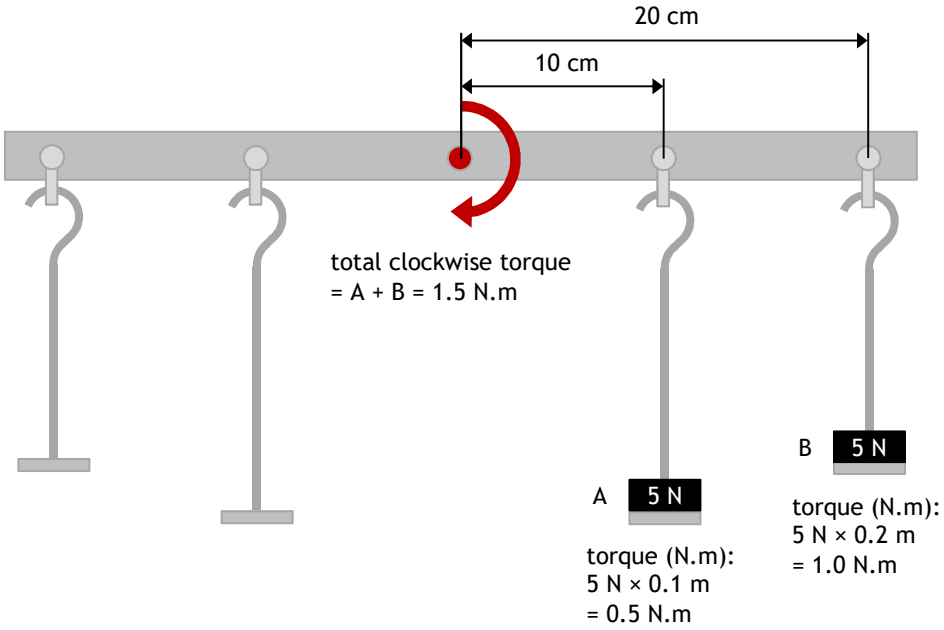
Appendix A
Applied Weights by Sensor to be Checked

Where inner hooks are used, the zero value MUST be obtained with both sets of hooks present and they must all remain in place throughout the accuracy check routine.

The following weights are quoted assuming that the weights to be used are those listed at the beginning of this document. Other masses may be used, provided they are class M1 masses. To calculate the applied torque, divide the weight hanging from outer hook by 5 and inner hooks by 10.

Example: 5 N hanging on an outer hook + 5 N hanging on an inner hook on the same side:

total torque = (5 N × 0.2 m) + (1 N × 0.1 m) = 1.5 N.m



Sensor: 1.5 N.m		
Permissible accuracy: ±0.0075 N.m		
applied torque	**outer masses**	**inner masses**
0 N.m		
0.3 N.m	1 N	1 N
0.6 N.m	1 N + 1 N + 1 N	
0.9 N.m	1 N + 1 N	5 N
1.2 N.m	5 N + 1 N	
1.5 N.m	5 N + 1 N + 1 N	1 N

You may use either N.m or mN.m for this measurement, but if mN.m are used then multiply all values above by 1000.

Sensor: 3 N.m		
Permissible accuracy: ±0.015 N.m		
applied torque	outer masses	inner masses
0 N.m		
0.5 N.m		5 N
1.0 N.m	5 N	
1.5 N.m	5 N	5 N
2.0 N.m	10 N	
2.5 N.m	10 N	5 N
3.0 N.m	10 N + 5 N	

Sensor: 6 N.m		
Permissible accuracy: ±0.03N.m		
applied torque	outer masses	inner masses
0 N.m		
1.0 N.m	5 N	
2.0 N.m	10 N	
3.0 N.m	10 N + 5 N	
4.0 N.m	20 N	
5.0 N.m	20 N + 5 N	
6.0 N.m	20 N + 10 N	

Sensor: 10 N.m		
Permissible accuracy: ±0.05N.m		
applied torque	outer masses	inner masses
0 N.m		
2.0 N.m	10N	
4.0 N.m	20N	
6.0 N.m	20N + 10N	
8.0 N.m	20N + 20N	
10.0 N.m	20N + 20N +10N	

8. User Notes

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Since 1977, Mecmesin has assisted thousands of companies achieve enhanced quality control in design and production. The Mecmesin brand represents excellence in accuracy, build, service, and value. In production centres and research labs worldwide, designers, engineers, operators, and quality managers endorse Mecmesin force and torque testing systems for their high performance across countless applications.

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