

|   |  |   |                             |                   |
|---|--|---|-----------------------------|-------------------|
| <u>Lebow Model Number</u><br>2110<br>Capacity: 5,000.00 lb-in | <b>Lebow Force Transducer<br/>Strain Gage Test &amp;<br/>Calibration Procedure</b> |   | <u>Customer Part Number</u> |                   |
| <u>Ambient Conditions</u><br>20 Deg C 24 %                    | Quality Procedure: QAWI612<br>Date Calibrated: 1/17/01 11:15:32AM                  | <u>Serial Number</u><br>1034                  | <u>Bridge Number</u><br>A   |                   |
| Keithley Cal Rig SN#101                                       |  | Equipment Used : Beam Length= 40              |                             | Control No. = 937 |
| Weights or Reference Cell Used:                               |  | 25LBS. 16,34,29,54,36                         |                             |                   |
| Electrical Input Resistance: 350.02 Ohms                      | Electrical Output Resistance: 350.01 Ohms  | Insulation Resistance: > 5000 M Ohms @ 50 VDC |                             |                   |
| Excitation Voltage: 10.00 Volts DC                            | Calibration Procedure Number: Cal Sheet 19   | Number of Times Exercised: 3                  |                             |                   |

| (% of F.S.) | <u>Theoretical Output</u> |                      | <u>Run Data (mV)</u> |                      | <u>Deviation from Theoretical</u> |                      |
|-------------|---------------------------|----------------------|----------------------|----------------------|-----------------------------------|----------------------|
|             | Tension<br>(CW)           | Compression<br>(CCW) | Tension<br>(CW)      | Compression<br>(CCW) | Tension<br>(CW)                   | Compression<br>(CCW) |
| 0.00        | 0.000                     | 0.000                | 0.001                | 0.000                | 0.001                             | 0.000                |
| 20.00       | 4.826                     | -4.824               | 4.827                | -4.821               | 0.001                             | 0.003                |
| 40.00       | 9.652                     | -9.648               | 9.653                | -9.644               | 0.001                             | 0.004                |
| 60.00       | 14.478                    | -14.472              | 14.479               | -14.468              | 0.001                             | 0.004                |
| 80.00       | 19.304                    | -19.296              | 19.303               | -19.293              | 0.001                             | 0.003                |
| 100.00      | 24.131                    | -24.120              | 24.129               | -24.117              | 0.002                             | 0.003                |
| 60.00       | 14.478                    | -14.472              | 14.479               | -14.468              | 0.001                             | 0.004                |
| 0.00        | 0.000                     | 0.000                | 0.002                | 0.000                | 0.002                             | 0.000                |

|                             | <u>Clockwise (Tension)</u>              | <u>Counter- Clockwise (Compression)</u>  |
|-----------------------------|---|--|
| Maximum Full Scale Output   | 24.129 mV @ 5,000.00 lb-in              | -24.117 mV @ 5,000.00 lb-in              |
| Shunt Cal (mv)              | 14.538 mV @ 60.00 K Ohms, Pins A,B      | -14.547 mV @ 60.00 K Ohms, Pins B,D      |
| Shunt Cal (Equivalent Load) | 3,012.54 lb-in @ 60.00 K Ohms, Pins A,B | 3,015.898 lb-in @ 60.00 K Ohms, Pins B,D |

|                              | <u>Non-Linearity</u> | <u>Hysterisis</u> | <u>Zero Balance</u> | <u>Zero Return</u> |
|------------------------------|----------------------|-------------------|---------------------|--------------------|
| Allowable:                   | 0.10 %               | 0.10 %            | 1.00 %              | 0.10 %             |
| Measured Maximum Error:      | 0.004 mV             | 0.100mV           | 0.000 mV            | 0.004mV            |
| Measured Full Scale Error %: | -0.020 %             | 0.004 %           | 0.020 %             | 0.000 %            |

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*DesChamps* Approved: \_\_\_\_\_

## Product Information

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### SHUNT CALIBRATION TRANSFER

The purpose of this technique is to provide the transducer user with a means of easily performing an accurate system calibration using a Lebow supplied shunt cal resistor and its electrical signal equivalent value.

Possibility One → The instrument and interconnecting cable were provided to Lebow for the actual calibration: Use the electrical signal equivalent value supplied by Lebow and adjust the instrument display or output to the equivalent load value with the shunt resistor connected on the instrument and activated.

Possibility Two → The instrument and interconnecting cable were not provided to Lebow for the actual calibration: The actual calibration was performed using Lebow's instrument and a short interconnecting cable to determine electrical signal equivalent value with a shunt resistor. Since a different cable and instrument will be used in your application, the following method should be used to calibrate the system:

1. Connect the instrument to the transducer using the actual interconnect cable.
2. Shunt the appropriate pins at the transducer receptacle with the shunt resistor provided by Lebow, using short pigtail leads.
3. Adjust the instrument readout or output for the electrical equivalent value supplied by Lebow.
4. Disconnect the pigtails and shunt cal resistor from the transducer receptacle.
5. Install the shunt cal resistor on the instrument.
6. Press the cal buttons one at a time. Read and record the display or output on the instrument. This is the new electrical equivalent value to be used when the shunt resistor is installed and activated on the instrument and using the actual cable.
7. Steps 1 through 6 should be repeated whenever the cable and/or instrument is changed.

**Note: WHILE THIS METHOD OF SYSTEM CALIBRATION IS USUALLY VERY RELIABLE AND ACCURATE, IT IS RECOMMENDED THAT THE EQUIVALENT LOAD VALUES BE PERIODICALLY VERIFIED BY CALIBRATING THE SYSTEM WITH KNOWN, ACCURATE MECHANICAL MEANS. LEBOW RECOMMENDS A MAXIMUM OF ONE YEAR BETWEEN RECERTIFICATION.**

### **LIMITED WARRANTY - PRODUCT**

(Liability for Repair and Replacement Only)

The Company's products are warranted to be free from defects in material and workmanship for one year from date of shipment from the factory. The Company's obligations are limited to repairing, or at their option, replacing products and components which, on verification, prove to be defective, at the factory in Troy, Michigan. The Company shall not be liable for installation charges, for expenses of Buyer for repairs or replacement, for damages from delay or loss of use, or other indirect or consequential damages of any kind. The Company extends this warranty only upon proper use of the product in the application for which intended and does not cover products which have been modified without the Company's approval or which have been subjected to unusual physical or electrical stress, or upon which the original identification marks have been removed or altered.

Whenever the design of the equipment to be furnished or the system in which it is to be incorporated originate with the Buyer, manufacturer's warranty is limited specifically to matters relating to furnishing of equipment free of defects in material and workmanship and assumes no responsibility for implied warranties of fitness for purpose or use.

### **CERTIFICATE OF CALIBRATION AND TRACEABILITY**

This is to certify that the products described herein meet the specifications and performance requirements described in this manual. Test reports and other pertinent information are on file and available for inspection by your representative and or U.S. Government representative upon request.

Calibration was performed with a test system in compliance with ANSI/NCSL Z540-1-1994 utilizing a reference load cell and/or deadweights and an electronic indicator. The test system was within current calibration requirements at the time of the test and is traceable to the National Institute of Standards Technology.

# Lebow Products Inc.

P.O. Box 1089  
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Certificate No.: 20014933  
Job No.: 13175

## CALIBRATION CERTIFICATE

February 8, 2001

We certify that the item listed below was manufactured under a calibration system conforming to ANSI/NCSL Z540-1-1994, and that this test system is within current calibration requirements and is traceable to the National Institute of Standards Technology. We also certify that test reports and other pertinent information, as required, are either on file at our company or on file at the place of manufacture and may be inspected by your quality control representative and/or Government representative upon request.

Any items not meeting ALL requirements of your purchase order are listed below, with a description of the exception, under "Exceptions to this statement".

|                 |               |                       |                   |            |
|-----------------|---------------|-----------------------|-------------------|------------|
| Customer        | P.O. #        | Calibration Procedure | Calibration Date  | Recal Due  |
| INTERTECHNOLOGY | 5973/6763     | QAWI-612              | 01/17/2001        | 01/17/2002 |
| Model Number    | Serial Number | Temperature           | Relative Humidity |            |
| 2110-5K         | 1034          | 68.0 °F               | 24.0 % R.H.       |            |

REACTION TORQUE SENSOR

### CALIBRATION EQUIPMENT TRACEABILITY

| Model Number | Description         | Serial Number | Manufacturer   | NIST Number    | Recal Due  | Cal Interval |
|--------------|---------------------|---------------|----------------|----------------|------------|--------------|
| 2182         | NANO VOLT/ MICRO OH | 0715040       | KEITHLEY       | 0715040:R23410 | 08/12/2001 | 12 MONTHS    |
| 25 LB        | DEAD WEIGHTS        | 16            | TROEMNER       | MI-03-00-5502  | 03/03/2002 | 2 YEARS      |
| 25 LB        | DEAD WEIGHTS        | 34            | TROEMNER       | 822/255263-95  | 02/14/2001 | 2 YEARS      |
| 25 LB        | DEAD WEIGHTS        | 29            | TROEMNER       | MI-11-99-5389  | 11/24/2001 | 2 YEARS      |
| 25 LB        | DEAD WEIGHTS        | 54            | TROEMNER       | MI-04-99-5074  | 04/06/2001 | 2 YEARS      |
| 25 LB        | DEAD WEIGHTS        | 36            | TROEMNER       | MI-04-99-5074  | 04/06/2001 | 2 YEARS      |
| 40"          | SINGLE RIG BEAM     | C/N 937       | LEBOW PRODUCTS | 0-1516F        | 07/24/2001 | 12 MONTHS    |

CALIBRATION DATA ENCLOSED



DANIEL CONNER  
QUALITY TECHNICIAN

Exceptions to this statement:

NONE