Vibrating Wire Load Cell
Installation and User Manual

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REVISION HISTORY

Rev.	Revision History	Date	Prepared By	Approved By
D	Significant content reorganization and formatting; second sample calibration sheet removed; A and B values in sample calculation corrected; ancillary equipment, ordering information, and standard VW load cell dimension sheet removed; copy editing.	November 14, 2019	MP	QR
E	Updates based on feedback from Technical Documentation Review Committee. Removed Section 6: Options. Under Specifications, removed capacity above 1000 kips and custom hole size. Replaced CR800/CR1000 to CR6 Logger. Included sweep frequency to read the load cell in overview. Changed DT2055 readout to DT2055B-T Data Logger. Added “Load cells can be supplied with a standard 19 pin connector for direct connection to a VW2106 Readout box or with bare leads to connect directly to a data logger terminal clock.” Formatting Changes. Changed Section 3 title from “Calibrate the Vibrating Wire Load Cell” to “RST Calibration Procedure for Vibrating Wire Load Cell”	December 4, 2023	AV, SM	CA, TW

1 OVERVIEW

RST Instruments' Vibrating Wire (VW) Load Cells are constructed from high tensile, heat-treated, and stress-relieved steel with precision machined loading surfaces. The surfaces of the high tensile RST load plates that mate with the load cell are also precision machined providing a smooth, parallel, bearing surface, which spreads the load evenly and eliminates any residual eccentricity. Annular and solid models are available for measuring loads in compressive (such as piles or piers) and tensile (such as tie backs) applications.

Annular cells, as shown in Figure 1, incorporate vibrating wire strain sensors mounted parallel to the longitudinal axis in a radial pattern. Depending on the size of the load cell, 3, 4, or 6 sensors are used. Each sensor is read individually, and a switch box is used to sequentially switch between them. Because the sensors are read via a "pluck and read" technique, a variety of options are available for logging the data, including:

- Using a VW2106 readout with built in MUX, which automatically multiplexes the sensors used, enables the user to monitor each sensor using the readout. The readout will display to screen, and log to memory the output of each sensor and display the averaged sum. The sweep frequency to read the load cell should stay at default value of 1200-3550Hz.
- Using a DT2055B-T Data Logger.
- Using a CR6 data logger. This can be set up to select the number of sensors used and display to screen, and log to memory, the output of each sensor. The CR6 can be programmed to convert the data into engineering units.

Load cells can be supplied with a standard 19 pin connector for direct connection to a VW2106 Readout box or with bare leads to connect directly to a data logger terminal clock.

Using a multi-sensor configuration makes it possible to obtain accurate readings under eccentric loading conditions, and to tension strands uniformly in multi-strand anchors by monitoring each sensor.

Solid load cells use three vibrating wire sensors mounted parallel to the longitudinal axis in a radial pattern of the load cell and are typically used for measuring loads in piles, struts and bridge piers.

A cable gland connection protrudes from the side of the cable gland adapter on the load cell and seals the electrical cable. The electrical cable to the readout can be hard wired, outfitted with a MIL-spec type bayonet connector or a 19-pin connector.

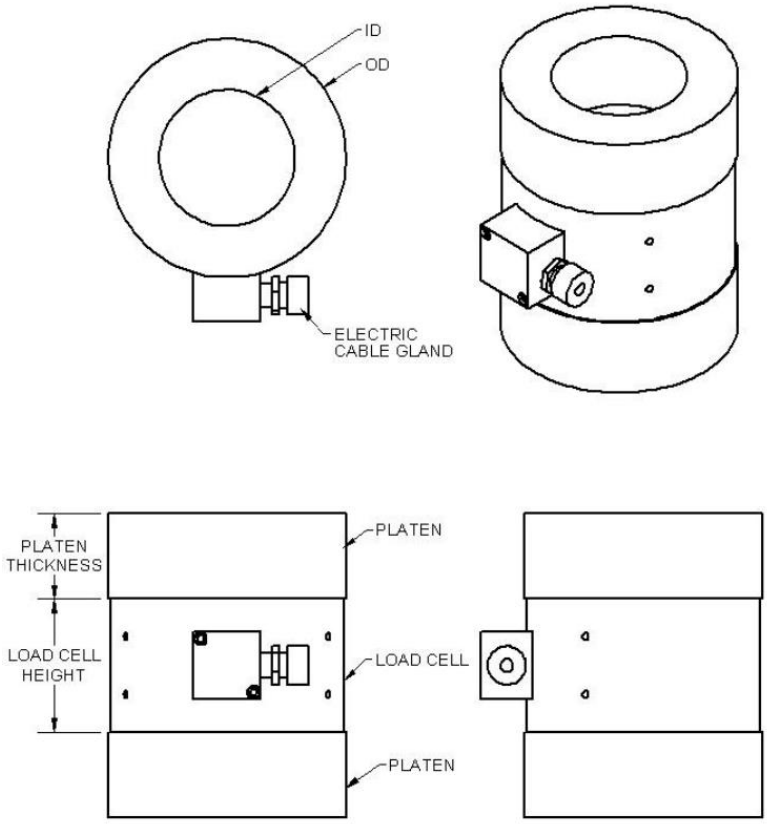

Figure 1: Vibrating Wire Load Cell Overview

1.1 Intended Audience

This guide is for the personnel responsible for installing or using an RST Vibrating Wire Load Cell.

1.2 Icons and Conventions Used In This Guide

This guide uses the following icons to call attention to important information.

	WARNING: This icon appears when an operating procedure or practice, if not correctly followed, could result in personal injury or loss of life.
	CAUTION: This icon appears when an operating procedure or practice, if not strictly observed, could result in damage to or destruction of equipment.
	NOTE: This icon appears to highlight specific non-safety related information.

2 INSTALLATION

2.1 INSTALLATION GUIDELINES

Make sure of the following when installing a Vibrating Wire Load Cell:

- The load cell and platens are parallel, concentric, and have smooth surfaces.
- The load is applied evenly, that is, the centroid of load is in line with the centroid of the load cell.

3 RST CALIBRATION PROCEDURE FOR VIBRATING WIRE LOAD CELLS

Vibrating Wire Load Cells are calibrated using the following procedure:

1. Cycle each load cell three times, taking 10 equally spaced readings each cycle, to load capacity.

2. Average the readings.

3. Complete a regression with Applied Load vs. the Averaged Readings to get the load cell constants for scale “B” and zero “A”.

4. Use the constants in the formula below to calculate the current load.

$$F = (A - average) \cdot B$$

Where:

F	=	Load, typically in kips (kilo instructions per second)
A	=	Averaged readings at rest, B units (from calibration sheet)
Average	=	Average of current readings
B	=	Load cell constant, kips/B unit (from calibration sheet)

For example, values of **A = 7384.7**, and **B = 0.12717** were obtained from the three sets of data shown in the sample calibration sheet in Appendix A.

3.1 SAMPLE LOAD CALCULATION

Using the following values from the sample calibration sheet in Appendix A:

A = 7384.7

B = 0.12717

If the following readings were obtained from the readout:

Sensor number	Sensor reading
1	5776.0
2	6178.2
3	5478.0

the average would then be:

(5776.0+ 6178.2 + 5478.0)/3 = **5810.7**

Using the above formula, the result would be:

F = (7384.7 – 5810.7) * 0.12717

F = (1574.0)*0.12717

F = 200.2 kip

4 OPERATION

To operate a Vibrating Wire Load Cell, complete the following steps:

1. Connect the vibrating wire load cell to the readout unit.
2. Refer to the readout unit's manual for information on reading data.

5 PRODUCT SPECIFICATIONS

Item	Specification
Capacity	200-1000kips (890-4448kN)
Over Range Capacity	150% full scale
Sensitivity	0.01% full scale
Accuracy	0.5% full scale
Temperature Range	-20˚C to 80˚C (-4˚F to 176˚F)
Material	High tensile, stress relieved steel

6 SERVICE, REPAIR AND CONTACT INFORMATION

This product does not contain any user-serviceable parts. Contact RST for product services or repairs.

- For sales information: sales@rstinstruments.com
- For technical support: support@rstinstruments.com
- Website: www.rstinstruments.com
- Toll free: 1-800-665-5599

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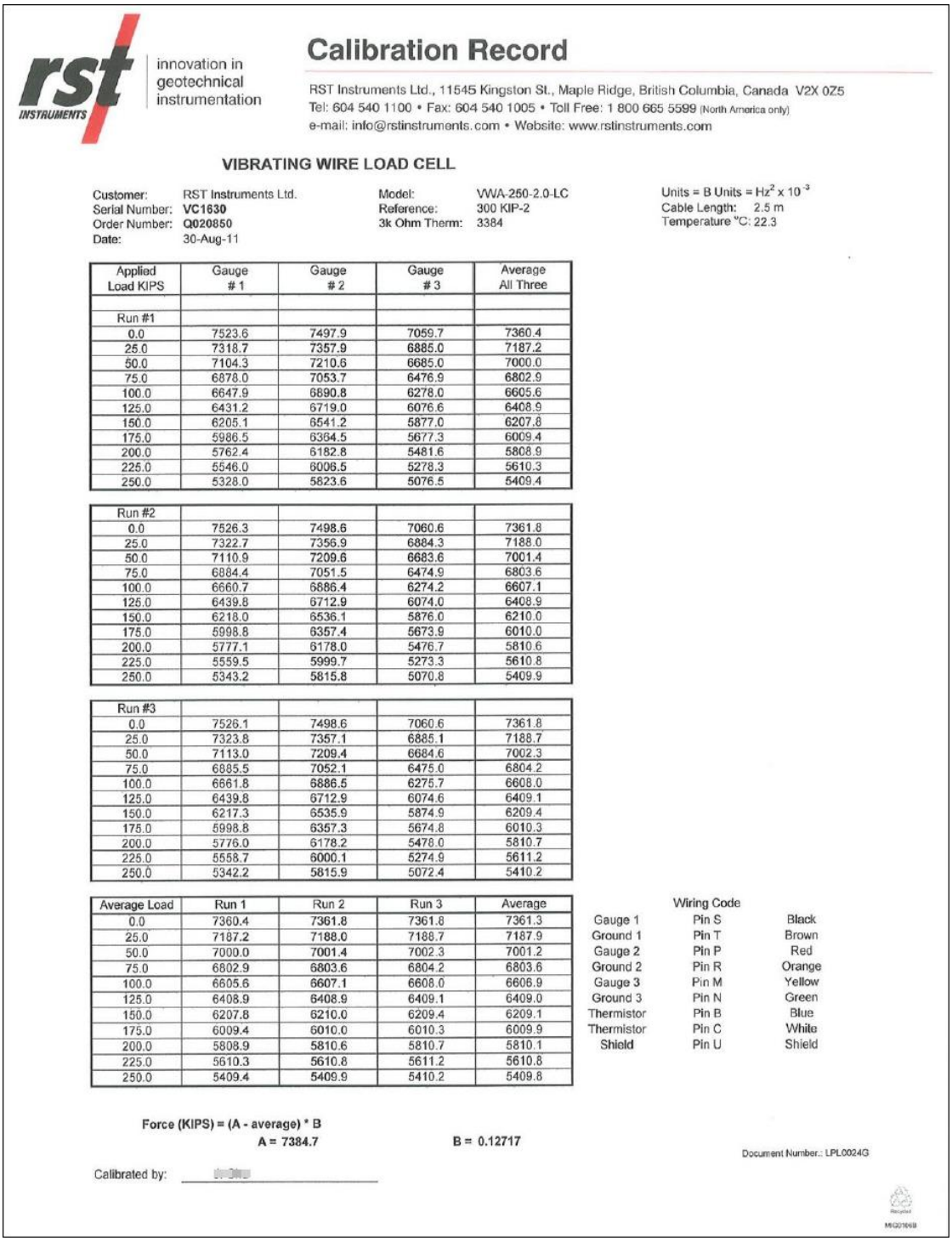
APPENDIX A: SAMPLE CALIBRATION CERTIFICATE



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Calibration Record

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VIBRATING WIRE LOAD CELL

Customer: RST Instruments Ltd.
Serial Number: **VC1630**
Order Number: **Q020850**
Date: 30-Aug-11

Model: VWA-250-2.0-LC
Reference: 300 KIP-2
3k Ohm Therm: 3384

Units = B Units = $Hz^2 \times 10^{-3}$
Cable Length: 2.5 m
Temperature °C: 22.3

Applied Load KIPS	Gauge # 1	Gauge # 2	Gauge # 3	Average All Three
Run #1				
0.0	7523.6	7497.9	7059.7	7360.4
25.0	7318.7	7357.9	6885.0	7187.2
50.0	7104.3	7210.6	6685.0	7000.0
75.0	6878.0	7053.7	6476.9	6802.9
100.0	6647.9	6890.8	6278.0	6605.6
125.0	6431.2	6719.0	6076.6	6408.9
150.0	6205.1	6541.2	5877.0	6207.8
175.0	5986.5	6364.5	5677.3	6009.4
200.0	5762.4	6182.8	5481.6	5808.9
225.0	5546.0	6006.5	5278.3	5610.3
250.0	5328.0	5823.6	5076.5	5409.4
Run #2				
0.0	7526.3	7498.6	7060.6	7361.8
25.0	7322.7	7356.9	6884.3	7188.0
50.0	7110.9	7209.6	6683.6	7001.4
75.0	6884.4	7051.5	6474.9	6803.6
100.0	6660.7	6886.4	6274.2	6607.1
125.0	6439.8	6712.9	6074.0	6408.9
150.0	6218.0	6536.1	5876.0	6210.0
175.0	5998.8	6357.4	5673.9	6010.0
200.0	5777.1	6178.0	5476.7	5810.6
225.0	5559.5	5999.7	5273.3	5610.8
250.0	5343.2	5815.8	5070.8	5409.9
Run #3				
0.0	7526.1	7498.6	7060.6	7361.8
25.0	7323.8	7357.1	6885.1	7188.7
50.0	7113.0	7209.4	6684.6	7002.3
75.0	6885.5	7052.1	6475.0	6804.2
100.0	6661.8	6886.5	6275.7	6608.0
125.0	6439.8	6712.9	6074.6	6409.1
150.0	6217.3	6535.9	5874.9	6209.4
175.0	5998.8	6357.3	5674.8	6010.3
200.0	5776.0	6178.2	5478.0	5810.7
225.0	5558.7	6000.1	5274.9	5611.2
250.0	5342.2	5815.9	5072.4	5410.2

Average Load	Run 1	Run 2	Run 3	Average
0.0	7360.4	7361.8	7361.8	7361.3
25.0	7187.2	7188.0	7188.7	7187.9
50.0	7000.0	7001.4	7002.3	7001.2
75.0	6802.9	6803.6	6804.2	6803.6
100.0	6605.6	6607.1	6608.0	6606.9
125.0	6408.9	6408.9	6409.1	6409.0
150.0	6207.8	6210.0	6209.4	6209.1
175.0	6009.4	6010.0	6010.3	6009.9
200.0	5808.9	5810.6	5810.7	5810.1
225.0	5610.3	5610.8	5611.2	5610.8
250.0	5409.4	5409.9	5410.2	5409.8

Wiring Code

Gauge 1	Pin S	Black
Ground 1	Pin T	Brown
Gauge 2	Pin P	Red
Ground 2	Pin R	Orange
Gauge 3	Pin M	Yellow
Ground 3	Pin N	Green
Thermistor	Pin B	Blue
Thermistor	Pin C	White
Shield	Pin U	Shield

Force (KIPS) = (A - average) * B
A = 7384.7 **B = 0.12717**

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Calibrated by: [redacted]