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Vibrating Wire Load Cell Instruction 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.	2019-Nov-14	MP	QR

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1 INTRODUCTION

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 (e.g. piles or piers) and tensile (e.g. tie backs) applications.

Annular cells, as shown in Figure 1-1, incorporate VW 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:

1. 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.

2. Using a DT2055 readout.

3. Using a CR800/CR1000 Data logger 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 CR800/CR1000 can be programmed to convert the data into engineering units.

Using a multi sensor configuration makes it possible:

- To obtain accurate readings under eccentric loading conditions.

- To tension strands uniformly in multi strand anchors, by monitoring each sensor.

Solid load cells use one VW sensor installed longitudinally through the center of the load cell and are typically used for measuring loads in piles and bridge piers.

A cable gland connection protruding 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.

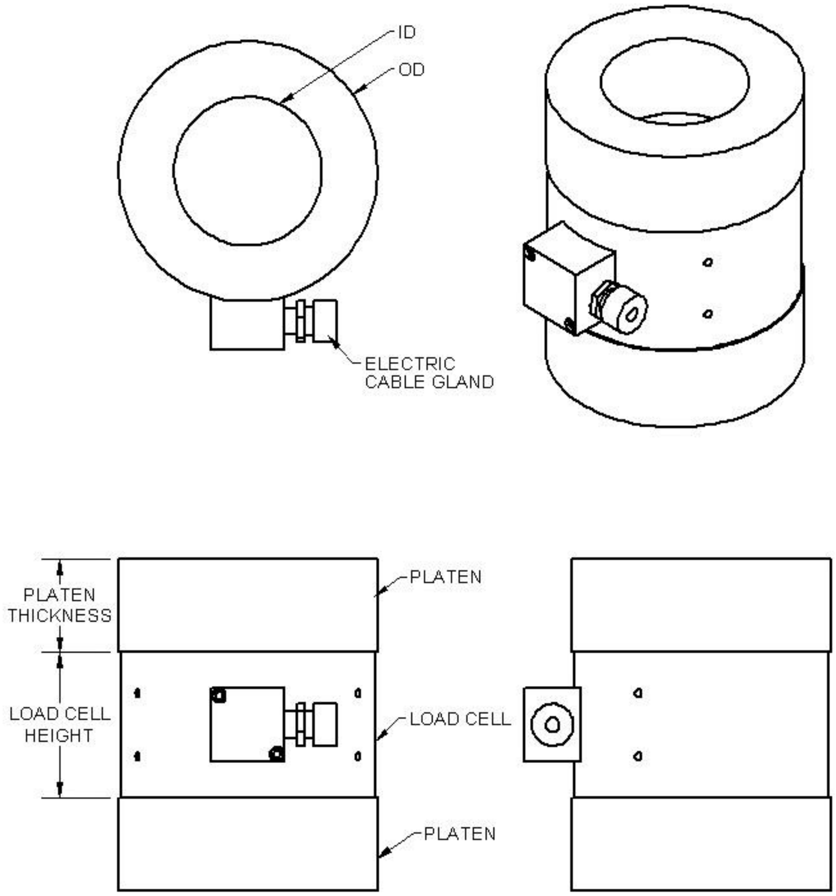

FIGURE 1-1 VW LOAD CELL OVERVIEW

2 INSTALLATION NOTES

To ensure accurate and consistent results when installing a VW load cell, it is important to make sure of the following:

1. The load cell and platens are parallel, concentric, and have smooth surfaces.
2. The load is applied evenly (i.e. the centroid of load is in line with the centroid of the load cell).

3 CALIBRATION PROCEDURE

Each load cell is exercised in incremental steps recording data along the way, as illustrated in Figure 3-1, a sample calibration sheet.

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**

Calibrated by: J. Chu

Document Number.: LPL0024G

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FIGURE 3-1 VW LOAD CELL CALIBRATION SHEET

The following is a typical calibration routine:

1. Each load cell is cycled 3 times, taking 10 equally spaced readings each cycle, to load capacity.

2. The readings are then averaged, and a regression is done with Applied Load vs the Averaged Readings to get the load cell constants for scale “B” and zero “A”. The constants are used in the formula below for calculating the current load.

EQUATION 3-1 CURRENT LOAD CALCULATION

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

F = Load (typically in Kips)

A = Averaged readings at rest, B units (Obtained from calibration sheet)

average = average of current readings.

B = Load cell constant, Kips/B unit (Obtained from calibration sheet)

For instance, values of **A = 7384.7**, and **B = 0.12717** were obtained from the 3 sets of data shown in Figure 3-1.

4 SAMPLE LOAD CALCULATION

Using the sample calibration sheet in Figure 3-1,

A = 7384.7

B = 0.12717

Thus, if the following readings were obtained from the readout:

TABLE 4-1 EXAMPLE SENSOR READINGS

Sensor No.	Sensor Reading
1	5776.0
2	6178.2
3	5478.0

then **average** would be:

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

Therefore, using the above formula, the result would be:

F = (7384.7 – 5810.7) * 0.12717

F = (1574.0)*0.12717

F = 200.2 Kips

5 SPECIFICATIONS

Capacity	50 – 2400 kips (225 – 10675 kN)
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
Hole Size	As required

6 OPTIONS

Optional configurations of the standard RST VW Load Cell are available:

- Armored electrical cable
- Grease blocked electrical cable
- Auto-resonant gauges vs. “pluck and read”
- Metal mil-spec bayonet type electrical cable connectors
- Custom designs to meet specific loads and/or size restrictions
- Stainless steel construction
- Direct burial / submersible