RST INSTRUMENTS LTD.

VW Load Cell
Instruction Manual

RST Instruments Ltd.
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VW Load Cell Instruction Manual

Product: VW Load Cell Instruction Manual

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Revision: C
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Table of Contents

FIGURES

1 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 and concentric, and have smooth surfaces.
2. The load is applied evenly (i.e. the centroid of load is inline with the centroid of the load cell).

2 INTRODUCTION

RST Instruments 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 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.

3 CALIBRATION PROCEDURE

Each load cell is exercised in incremental steps recording data along the way.

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.

F = (A – average)B

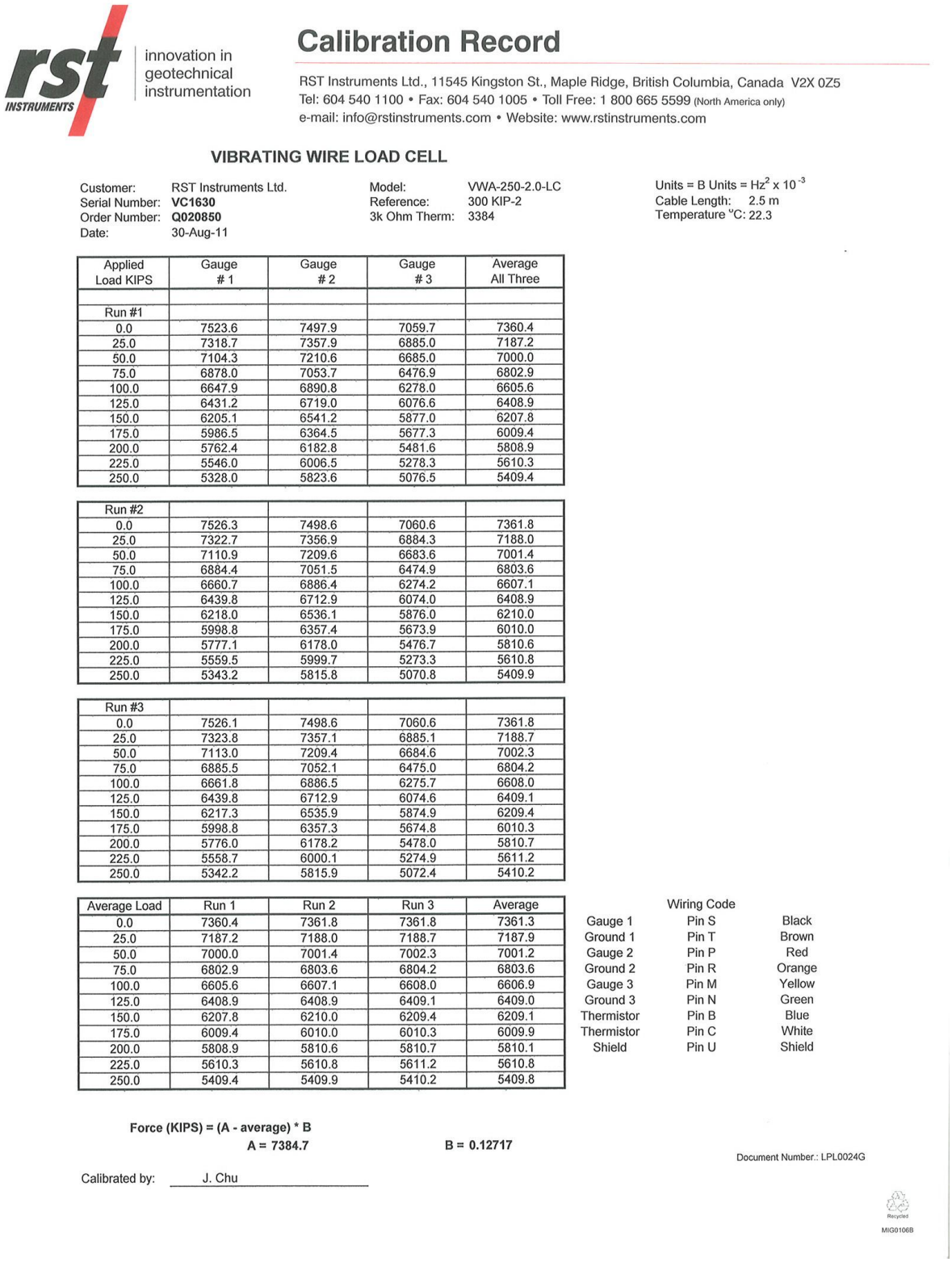
F = Load (typically in Kips)

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 = 7108.5**, and **B = 0.102** were obtained from the 3 sets of data shown in



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Calibration Record

RST Instruments Ltd., 11545 Kingston St., Maple Ridge, British Columbia, Canada V2X 0Z5
Tel: 604 540 1100 • Fax: 604 540 1005 • Toll Free: 1 800 665 5599 (North America only)
e-mail: info@rstinstruments.com • Website: www.rstinstruments.com

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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Figure 1.

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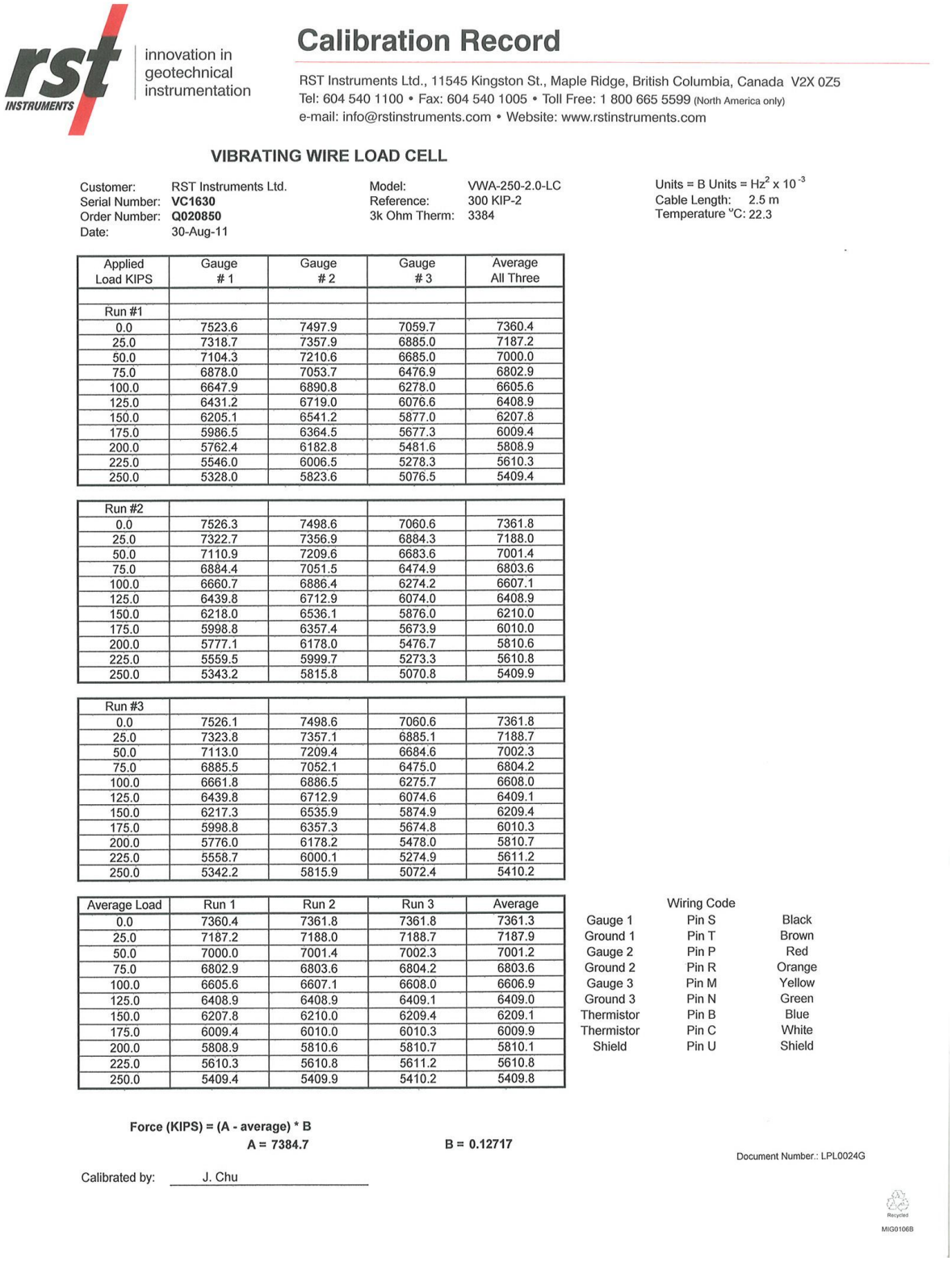
4 SAMPLE LOAD CALCULATION

Using the sample calibration sheet in



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Wiring Code

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

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Figure 1,

A = 7384.7

B = 0.12712

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

Sensor No.	Sensor Reading
1	5776.0
2	6178.2
3	5478.0

then **average** would be:

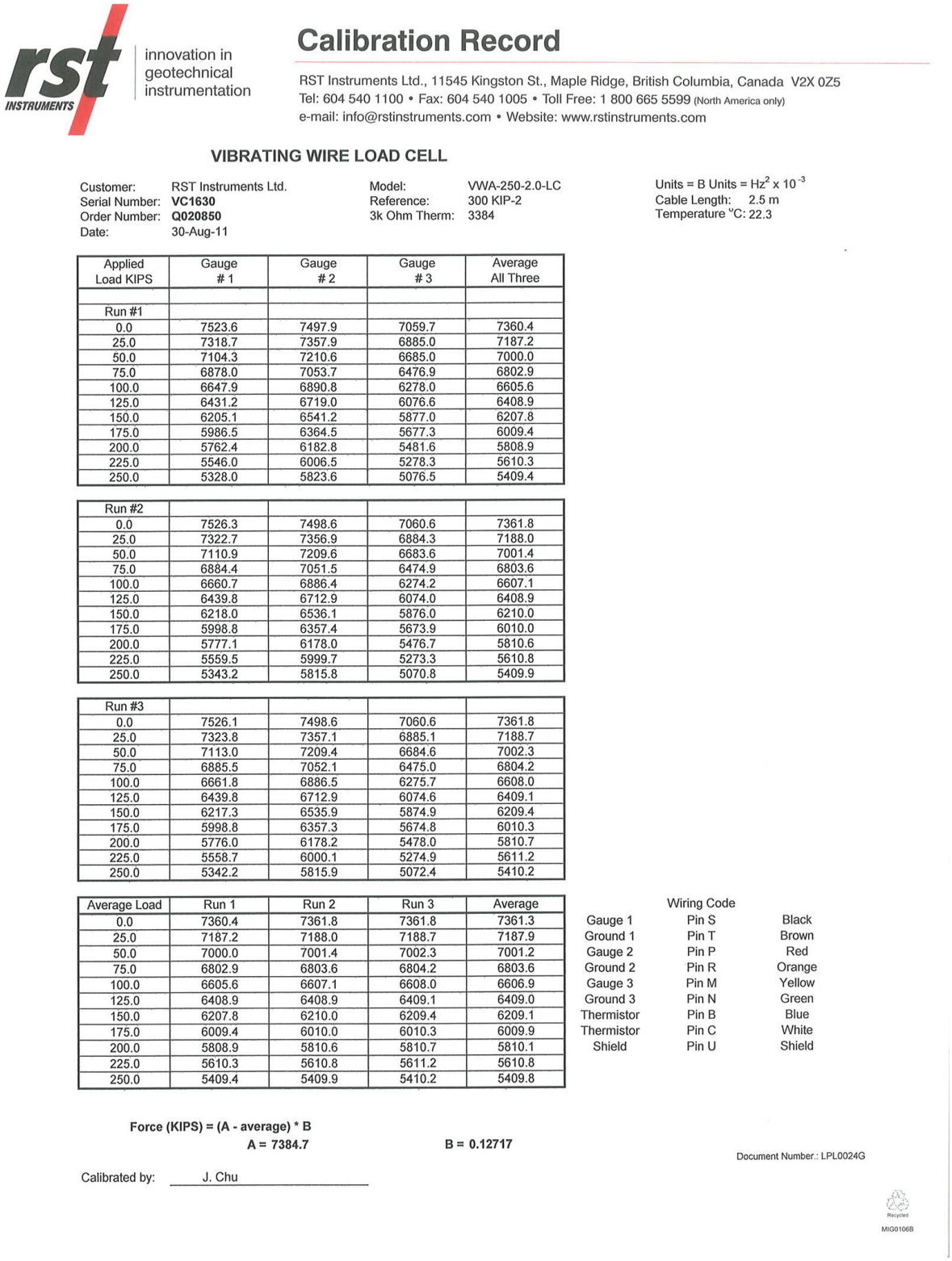
(5776.0+ 6178.2 + 5478.09)/3 = **5810.7**

thus using the above formula, the result would be:

F = (7384.7 – 5810.7) * 0.12717

F = (1574.0)*0.12717

F = 200.2 Kips



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	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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Figure 1: VW Load Cell Calibration Sheet

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	-40˚C to 75˚C (-40˚F to 167˚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

7 ANCILLARY EQUIPMENT

Additional equipment supplied by RST Instruments Ltd., include:

- Manual readout (VW2106)
- Data Loggers (CR800/CR1000)
- Manual switch boxes
- Electrical cable
- DT2055
- Terminal stations
- Load Platens
- Centralizer bushings (if required)

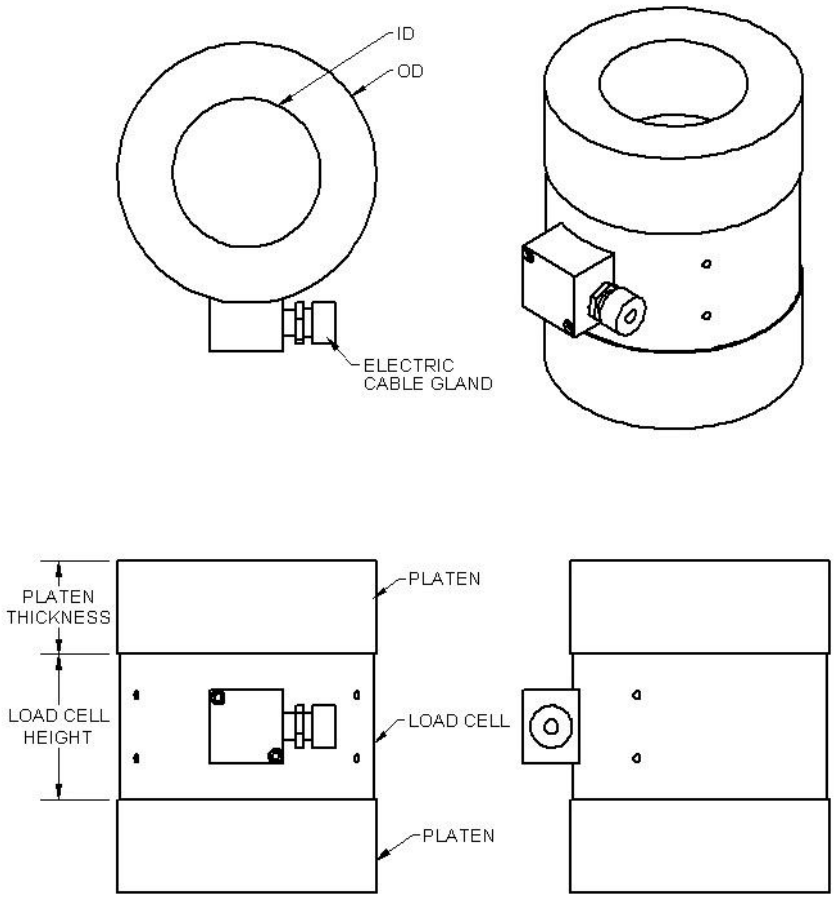
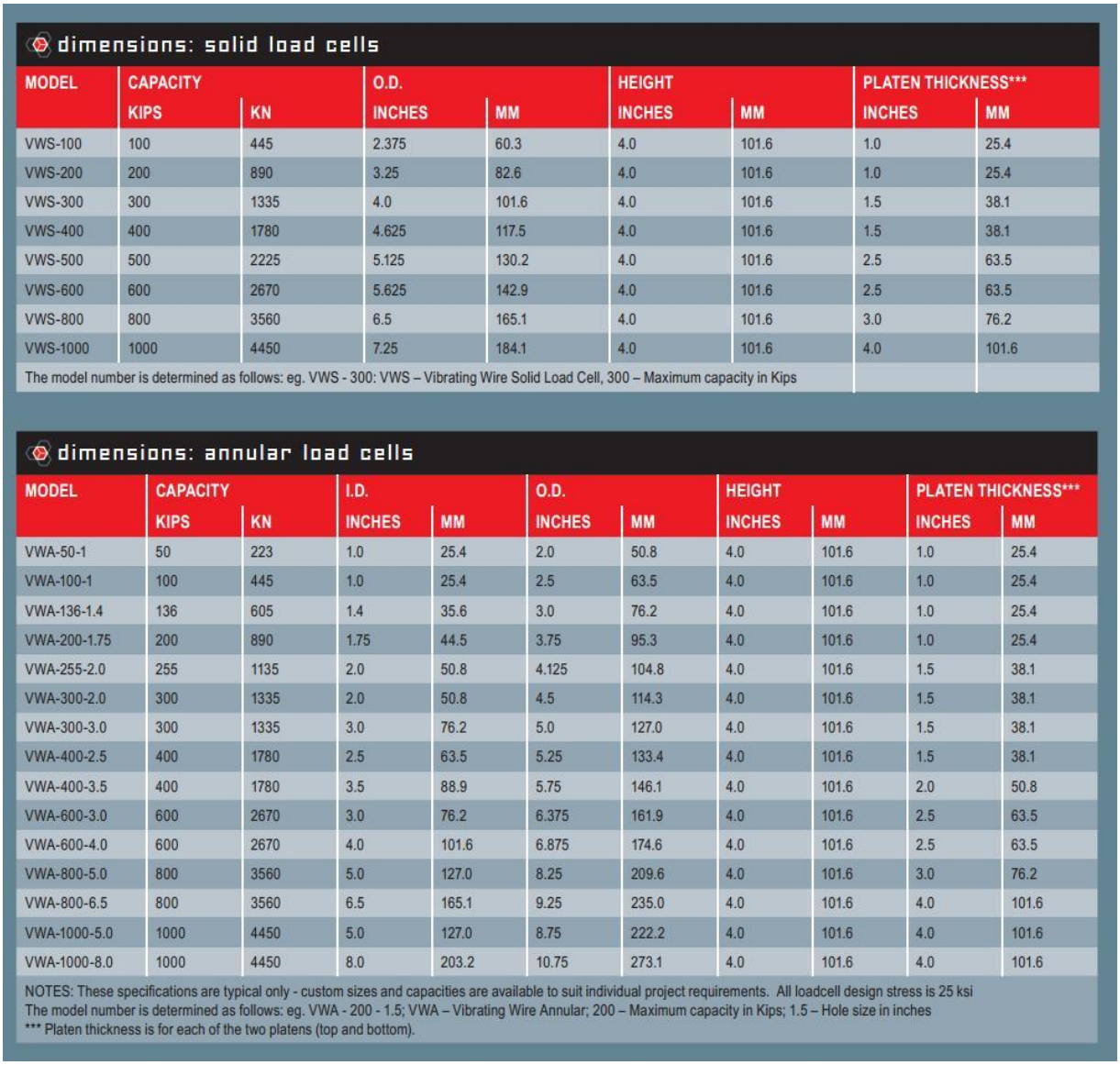


Figure 2: VW Load Cell Overview



dimensions: solid load cells

MODEL	CAPACITY		O.D.		HEIGHT		PLATEN THICKNESS***	
	KIPS	KN	INCHES	MM	INCHES	MM	INCHES	MM
VWS-100	100	445	2.375	60.3	4.0	101.6	1.0	25.4
VWS-200	200	890	3.25	82.6	4.0	101.6	1.0	25.4
VWS-300	300	1335	4.0	101.6	4.0	101.6	1.5	38.1
VWS-400	400	1780	4.625	117.5	4.0	101.6	1.5	38.1
VWS-500	500	2225	5.125	130.2	4.0	101.6	2.5	63.5
VWS-600	600	2670	5.625	142.9	4.0	101.6	2.5	63.5
VWS-800	800	3560	6.5	165.1	4.0	101.6	3.0	76.2
VWS-1000	1000	4450	7.25	184.1	4.0	101.6	4.0	101.6

The model number is determined as follows: eg. VWS - 300: VWS – Vibrating Wire Solid Load Cell, 300 – Maximum capacity in Kips

dimensions: annular load cells

MODEL	CAPACITY		I.D.		O.D.		HEIGHT		PLATEN THICKNESS***	
	KIPS	KN	INCHES	MM	INCHES	MM	INCHES	MM	INCHES	MM
VWA-50-1	50	223	1.0	25.4	2.0	50.8	4.0	101.6	1.0	25.4
VWA-100-1	100	445	1.0	25.4	2.5	63.5	4.0	101.6	1.0	25.4
VWA-136-1.4	136	605	1.4	35.6	3.0	76.2	4.0	101.6	1.0	25.4
VWA-200-1.75	200	890	1.75	44.5	3.75	95.3	4.0	101.6	1.0	25.4
VWA-255-2.0	255	1135	2.0	50.8	4.125	104.8	4.0	101.6	1.5	38.1
VWA-300-2.0	300	1335	2.0	50.8	4.5	114.3	4.0	101.6	1.5	38.1
VWA-300-3.0	300	1335	3.0	76.2	5.0	127.0	4.0	101.6	1.5	38.1
VWA-400-2.5	400	1780	2.5	63.5	5.25	133.4	4.0	101.6	1.5	38.1
VWA-400-3.5	400	1780	3.5	88.9	5.75	146.1	4.0	101.6	2.0	50.8
VWA-600-3.0	600	2670	3.0	76.2	6.375	161.9	4.0	101.6	2.5	63.5
VWA-600-4.0	600	2670	4.0	101.6	6.875	174.6	4.0	101.6	2.5	63.5
VWA-800-5.0	800	3560	5.0	127.0	8.25	209.6	4.0	101.6	3.0	76.2
VWA-800-6.5	800	3560	6.5	165.1	9.25	235.0	4.0	101.6	4.0	101.6
VWA-1000-5.0	1000	4450	5.0	127.0	8.75	222.2	4.0	101.6	4.0	101.6
VWA-1000-8.0	1000	4450	8.0	203.2	10.75	273.1	4.0	101.6	4.0	101.6

NOTES: These specifications are typical only - custom sizes and capacities are available to suit individual project requirements. All loadcell design stress is 25 ksi
The model number is determined as follows: eg. VWA - 200 - 1.5; VWA – Vibrating Wire Annular; 200 – Maximum capacity in Kips; 1.5 – Hole size in inches
*** Platen thickness is for each of the two platens (top and bottom).

Figure 3: Standard VW Load Cell dimension

8 ORDERING INFORMATION

When contacting RST Instruments Ltd., it is recommended to have the following information ready:

- What kind of application
- Annular or solid
- Maximum load
- Environmental concerns
- Size limitations
- Cable type and length desired
- Cable connection method to load cell
- Options required
- Ancillary equipment desired