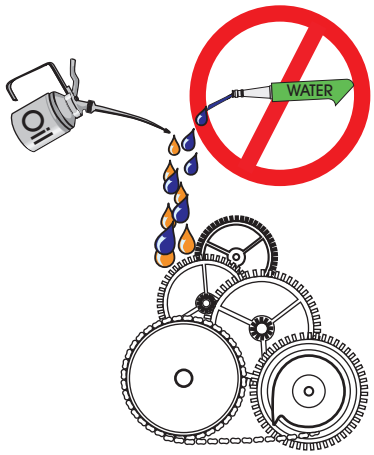
Sandy Brae Laboratories, Inc.

Water Test Kit Instructions



The Water Test Kit can be used to determine the percentage of water in various fluids. Typically these fluids are hydraulic oil, lubrication oil, fuels, biodiesel, and vegetable oil. The Water Test Kit has five ranges from .005% to12% water. It also can read as high as 50% water content.

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Sandy Brae Water Test Kit Instructions

CAUTION! USING THE WATER TEST KIT CAN BE DANGEROUS!

YOU MUST READ AND UNDERSTAND THE FOLLOWING

PRECAUTIONS BEFORE YOU BEGIN TO USE THE WATER TEST KIT!

WARNING:

The Reagent A in this kit contain Calcium Hydride which can cause eye and skin burns. Calcium hydride, in contact with water, will produce hydrogen gas which is highly flammable.

Avoid getting the chemical on your skin or in your eyes. Keep the kit and Reagent A away from water and water vapor. DO NOT use the kit near an open flame or sparks. DO NOT permit smoking when the kit is being used.

Never use more than one packet of Reagent A per test. Excessive hydrogen gas could be produced causing injury to you or damage to the water test vessel.

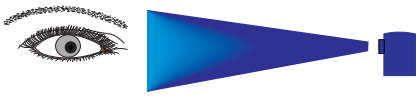
FIRST AID:

In case of contact with Reagent A powder, immediately flush eyes or skin with water for at least 15 minutes. Remove contaminated clothing. Wash skin contact area with soap and water. Call a physician.

The Sandy Brae Water Test Kit can be used to test for water content measured as Parts Per Million or as a percent (%) of volume. The test can be performed on any liquid which is not based on water. Any fluid can be tested as long as the two following requisites are met: a. the water must be in the form of free molecules or droplets and not be chemically or physically bound; b. the fluid should not attack the water vessel components which are anodized aluminum, viton gasket, and brass.

CAUTION:

When releasing pressure from the vessel via the "Pressure Relief Button", Do Not aim the discharge spray at your face or eyes!



Kit Contents:

Each Deluxe Water Test Kit contains the following items:

Water Test Vessel consisting of cup, cap, gage, gasket, pressure relief valve
Reagent A (calcium hydride), one bottle containing 24 grams and a micro-spoon
Reagent B (dried solvent), 3 pints
Syringes: 10 ml for oil sample, 30 ml for Reagent B
safety glasses, disposable gloves, wash bottle
Instructions

Principle of Operation:

Reagent A reacts with water and produces hydrogen gas. When an oil sample and a dry solvent (Reagent B) are placed in the vessel in the proper ratio, the pressure produced is proportional to the amount of water present. A sample with .1% (1000 PPM) water content will produce a pressure of 10 pounds per square inch (PSI) @ 25°C. Since the pressure gage has a full scale value of 15 PSI, a maximum reading of .15% (1500 PPM) water is possible on the low range. There are a total of five ranges with the following full scale values: 0.15%, 1.5%, 3.0%, 6.0%, and 12.0%. Higher water content can be determined by following the instructions. on page 8.

When using the test vessel, the operator should make sure that the pressure does not exceed 15 PSI, since over-pressurizing the gage will damage it. Should you encounter a sample with a water content which will produce a pressure equal to or greater than 14 PSI, release the pressure immediately. The preferred procedure is to watch the gage as the reaction takes place, observing the pressure. When the pressure reaches 14 PSI, intervene and stop the test by pressing the relief valve or loosening the lid. Test on next highest range.

	Ranges	Analog Gage Resolution	Acc. ± 2% $F_{ull}S_{cale}$	Digital Gage Resolution	Acc. ± 1% $F_{ull}S_{cale}$
A.	.15% 1,500 PPM	.001% 10 PPM	± .003% ± 30 PPM	.0001% 1 PPM	± .0015% ± 15 PPM
B.	1.50% 15,000 PPM	.01% 100 PPM	± .03% ± 300 PPM	.001% 10 PPM	± .015% ± 150 PPM
C.	3.0% 30,000 PPM	.02% 200 PPM	± .06% ± 600 PPM	.002% 20 PPM	± .030% ± 300 PPM
D.	6.0% 60,000 PPM	.04% 400 PPM	± .12% ± 1200 PPM	.004% 40 PPM	± .060% ± 600 PPM
E.	12.0% 120,000 PPM	.08% 800 PPM	± .24% ± 2400 PPM	.008% 80 PPM	± .120% ± 1200 PPM

DIGITAL PRESSURE GAGE

The digital pressure gage has a precise +/- 1.0% full scale accuracy. The full scale is 15 PSI which gives an accuracy of +/- 0.15 PSI. The 4 digit display will reduce the potential for errors in readings by eliminating the parallax error commonly produced by analog gages.

The gage is battery powered and has an auto-shut off to conserve battery life. A two button key pad allows easy access to features without the need to work through complex menus. These features include auto zero and conversion of the pressure units. **The water test kit is calibrated to PSI (pounds per square inch).**

Functions:

On/Off: *Press ON/OFF to toggle on and off. Device will automatically shut off after 20 minutes if not used.*
Zero: *Zeros the display - Push & hold for 2 seconds to zero the display. Do not use the zero button when pressure is applied.*
Units: *To change units, press both On/Off and Zero buttons simultaneously.*

Overpressure Indicator: *The LCD will flash "OFL", if the pressure applied is over 15.75 PSI.*

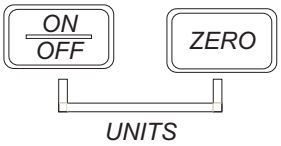
Maintenance:
Battery Removal: Remove the single screw on backplate. Lift backplate off by hand. Replace battery per polarity indicator.

A "LOW BAT" descriptor indication will appear on the display when the battery needs to be replaced.

BATTERY: *9 volt alkaline battery.*

CAUTION!
Always use the silver 1" hex at the base of the housing to tighten the gage. Do not apply wrench to housing.

Digital Gage Button Operation



SPECIFICATIONS: *Digital Gage*
Housing Materials: *ABS Plastic*
Accuracy: *± 1.0% F.S. (Includes linearity, hysteresis, repeatability).*
Pressure Limits: 30 PSI MAXIMUM
Temperature Limits: *30 to 120°F (-1 to 49°C).*
Thermal Effect: *0.05% FS/°F.*
Display: *4 digit LCD (.425" H x .234" W).*
Agency Approval: *CE*

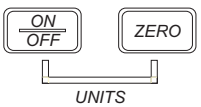
To Turn On & Off:

Press to turn unit on.
Press again to turn unit off.

To Zero Display:

To zero display, release pressure. Press and hold zero button until the LCD displays "----", then release.

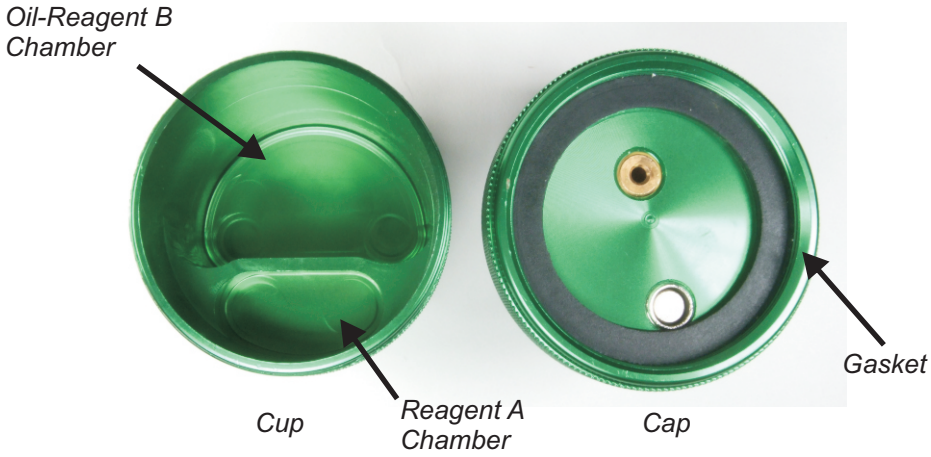
To Change Units:



To change units, disconnect gage from pressure. Press both  *&*  *buttons simultaneously until desired units are displayed. The Water Test Kit is calibrated to pounds per square inch (PSI).*

Nomenclature & Part Numbers:

The illustrations below identifies the parts of the water test kit.



Physical Data

Test Vessel #190-WATER-VESSL

Size: 2.9" H x 2.5 Dia.
Weight: 8.0 oz., 230 gm.

Material: anodized aluminum, chrome plated brass, viton gasket, teflon tape

Water Test Kit (analog).....01-WTK-DELUXE
Water Test Kit (digital)..... 01-WTK-DELUXEDP

<u>Replacement Parts</u>
Test Vessel (analog complete)..... 01-WTK-WATERSB
Test Vessel (digital complete)..... 01-WTK-WATERSBD
Vessel only (Cap & Cup) 190-WATER-VESSL
15 PSI analog gage..... 110-GAGE-15PSI
15 PSI digital gage..... 110-GAGE-15DPSI
Pressure button..... 110-VALV-BUTTON
Viton gasket..... 110-GSK-WATVESL
Syringe 10 ml..... 01-SYRINGE10
Syringe 30 ml..... 01-SYRINGE30
Reagent A, bottle of 24 grams.....01-REAGENT-A
Reagent B, 1 Quart..... 01-REAGENT-B-QT
Reagent B, 1US Gallon..... 01-REAGENT-B GL

Low Range Test Procedure: *0.15% 1,500 PPM Full Scale*

1. Using the 30 ml syringe, measure 30 milliliters of sample oil and inject it into the Oil-Reagent B Chamber. Be careful not to spill any fluids into the Reagent A Chamber.

2. Using the 10 ml syringe, measure 10 ml of Reagent B injecting it into the Oil-Reagent B Chamber.

3. Place 3 heaping micro-spoonfuls of Reagent A into the Reagent A Chamber, being careful not to spill any powder into the Oil-Solvent Chamber.

4. Keeping the cup vertical so as to not spill or mix the contents, tightly screw the cap on to the cup making sure there is a very tight seal of the gasket. **DO NOT HOLD THE GAGE TO TIGHTEN THE CAP**.

5. Using the "Pressure Relief Button", release any pressure which may have accumulated in the vessel.

6. Shake the vessel vigorously for twenty seconds, then observe the pressure gage to insure that the pressure has not exceeded 14 PSI. If the pressure has reached 14 PSI, STOP the test by pressing the relief valve or loosening the cap. Go to the next section titled "1.5% Full Scale" for instructions on testing samples with water content greater than .14%.

7. Shake the vessel vigorously for another twenty seconds, observing the pressure gage to insure that the pressure has not exceeded 14 PSI.

8. Shake the vessel vigorously again for another twenty seconds, observing the pressure gage to insure that the pressure has not exceeded 14 PSI.

9. Set the vessel down and wait one minute. Shake the vessel for 10 seconds once every minute and take the final reading **15 TO 20 minutes** *after you have started the test.*

10. Measure the temperature of the oil-Reagent B mixture and refer to the temperature compensation chart to correct the reading due to the effects of temperature.

Reading the Gage:

The scale is from 0 to 15 PSI (pounds per square inch) with the smallest scale division being 0.2 PSI on the analog dial. 0.01 PSI is the lowest reading on the digital meter.

Correlation of Data: Low Range - ***Multiply the Gage Reading by 0.01***

10 PSI = .10% water content, or 1,000 PPM
1 PSI = .01% water content, or 100 PPM
.2 PSI = .002% water content, or 20 PPM
.1 PSI = .001% water content, or 10 PPM

(See Page 10 - Cleaning Vessel)

See Page 9 for pressure Conversion Charts for the .15% range

Test Procedure: *1.5 %, 15,000 PPM Full Scale*

1. Using the 10 ml syringe, measure 4 milliliters of sample oil and inject it into the Oil-Reagent B Chamber. Be careful not to spill any fluids into the Reagent A Chamber.

2. Using the 30ml syringe, measure 16 ml of Reagent B injecting it into the Oil-Reagent B Chamber.

3. Place 3 heaping micro-spoonfuls of Reagent A into the Reagent A Chamber, being careful not to spill any powder into the Oil-Solvent Chamber.

4. Keeping the cup vertical so as to not spill or mix the contents, tightly screw the cap on to the cup making sure there is a very tight seal of the gasket. **DO NOT HOLD THE GAGE TO TIGHTEN THE CAP***.*

5. Using the "Pressure Relief Button", release any pressure which may have accumulated in the vessel.

6. Shake the vessel vigorously for twenty seconds, then observe the pressure gage to insure that the pressure has not exceeded 14 PSI. If the pressure has reached 14 PSI, STOP the test by pressing the relief valve or loosening the cap. Go to the next section titled "3.0% Full Scale" for instructions on testing samples with water content greater than 1.4%.

7. Shake the vessel vigorously for another twenty seconds, observing the pressure gage to insure that the pressure has not exceeded 14 PSI.

8. Shake the vessel vigorously again for another twenty seconds, observing the pressure gage to insure that the pressure has not exceeded 14 PSI.

9. Set the vessel down and wait one minute. Shake the vessel for 10 seconds once every minute and take the final reading 5 minutes after you have started the test.

10. Measure the temperature of the oil-Reagent B mixture and refer to the temperature compensation chart to correct the reading due to the effects of temperature.

Reading the Gage:

The scale is from 0 to 15 PSI (pounds per square inch) with the smallest scale division being 0.2 PSI on the analog dial. 0.01 PSI is the lowest reading on the digital meter.

Correlation of Data: 1.5% Range - **Multiply the Gage Reading by 0.1**

10 PSI = 1.0% water content, or 10,000 PPM
1 PSI = .1% water content, or 1,000 PPM
.2 PSI = .02% water content, or 200 PPM
.1 PSI = .01% water content, or 100 PPM

(See Page 10 Cleaning Vessel)

See Page 9 for pressure Conversion Charts for the 1.5% range

Should the fluid sample have greater than 1.4% water content, the concentration can still be determined by using the following procedures.

NORMAL TEST PROCEDURE for 1.5% Range:

USE ONE PACKET of Reagent A:	*Sample*	*4 ml*
	Reagent B	*16 ml*
	Total volume	*20 ml*

3.0% RANGE TEST PROCEDURE:

Use 3 heaping micro-spoonfuls of Reagent A .		
Use half the sample volume which is		*2 ml*
Use a Reagent B volume of		*18 ml*
	Total volume	*20 ml*

Water % = Gage Reading X **.2**

For example, lets say that after using 2 ml of sample and 18 ml of Reagent B, the test produces a reading of 12.0 PSI on the gage. To convert this reading to the actual % water, perform the following math:

Water % = 12.0 X .2 = 2.40%

See Page 9 for pressure Conversion Charts for the 3.0% range

6.0% Range:

Should the reading on the gage exceed 14 PSI again, stop the test and prepare a new test using 1 ml of sample and 19 ml of Reagent B. Use 3 heaping micro-spoonfuls of Reagent A. Using the following equation, determine the percent water:

Water % = Gage Reading X **.4**

Example: gage reads 11.5 PSI: Water % = 11.5 X .4 = 4.6%

See Page 9 for pressure Conversion Charts for the 6.0% range

12.0% Range:

Should the reading on the gage exceed 14 PSI again, stop the test and prepare a new test using 1/2 ml of sample and 19 1/2 ml of Reagent B. Use 3 heaping micro-spoonfuls of Reagent A. Using the following equation, determine the percent water:

Water % = Gage Reading X **.8**

Example: gage reads 10.0 PSI: Water % = 10 X .8 = 8.0%

See Page 9 for pressure Conversion Charts for the 12.0% range

Beyond 12% Water Content

It is possible to measure water content above 12%. The accuracy will depend on your laboratory technique and should be within 5 to10% of reading. The technique used to prepare the sample is known as serial dilution. The process involves taking a sample with a high water content and diluting it with a dry solvent. The resulting mixture is a sample with a water content in the range of the Water Test Kit (WTK). This diluted sample mixture is tested using the WTK and the results are multiplied by a known factor to arrive at the original sample's water content.

The chart below shows how to take a high water content sample and make an approximate 2% sample for testing on the WTK's 3% range. The chart also shows the multiplication factor needed to convert the results of the 3% range test back to the original sample's water content. The following is an example of the process.

Process Example

For this example, we use a oil sample with an assumed water content of 35%. In the chart below, go down the first column labeled "% Water in Sample" to 35%. In the second column labeled "Sample", you will see that it directs you to take 2.9ml of the high water content sample and mix it with 47.1ml of dry solvent. Mix the diluted sample (DS) well and then perform the 3% range test which is found on page 7. i.e. take 2ml of DS and 18ml of Reagent B. In this example the gage reading will be 10psi.
Water % = gage reading X .2 (10psi x .2 = 2.0%). To convert the results of the 3% range test back to the original sample's water content, multiply 2% X 17.5 (the factor listed below at 35% level). 2 X 17.5 = 35% water content.

% Water in Sample	Sample	Solvent	Factor
100	1.0 ml	49.0 ml	50.0
90	1.1 ml	48.9 ml	45.0
80	1.3 ml	48.8 ml	40.0
70	1.4 ml	48.6 ml	35.0
60	1.7 ml	48.3 ml	30.0
50	2.0 ml	48.0 ml	25.0
40	2.5 ml	47.5 ml	20.0
35	2.9 ml	47.1 ml	17.5
30	3.3 ml	46.7 ml	15.0
25	4.0 ml	46.0 ml	12.5
20	5.0 ml	45.0 ml	10.0
15	6.7 ml	43.3 ml	7.5
10	10.0 ml	40.0 ml	5.0

Conversion Charts: Gage Reading to % Water

Gage Reading in PSI = GR

Range .15%
GR X .01

GR	% Water	PPM
1	0.01%	100
2	0.02%	200
3	0.03%	300
4	0.04%	400
5	0.05%	500
6	0.06%	600
7	0.07%	700
8	0.08%	800
9	0.09%	900
10	0.10%	1000
11	0.11%	1100
12	0.12%	1200
13	0.13%	1300
14	0.14%	1400
15	0.15%	1500

Range 1.5%
GR X .1

GR	% Water	PPM
1	0.1%	1000
2	0.2%	2000
3	0.3%	3000
4	0.4%	4000
5	0.5%	5000
6	0.6%	6000
7	0.7%	7000
8	0.8%	8000
9	0.9%	9000
10	1.0%	10000
11	1.1%	11000
12	1.2%	12000
13	1.3%	13000
14	1.4%	14000
15	1.5%	15000

Range 3%
GR X .2

GR	% Water	PPM
1	0.2%	2000
2	0.4%	4000
3	0.6%	6000
4	0.8%	8000
5	1.0%	10000
6	1.2%	12000
7	1.4%	14000
8	1.6%	16000
9	1.8%	18000
10	2.0%	20000
11	2.2%	22000
12	2.4%	24000
13	2.6%	26000
14	2.8%	28000
15	3.0%	30000

Range 6%
GR X .4

GR	% Water	PPM
1	0.4%	4000
2	0.8%	8000
3	1.2%	12000
4	1.6%	16000
5	2.0%	20000
6	2.4%	24000
7	2.8%	28000
8	3.2%	32000
9	3.6%	36000
10	4.0%	40000
11	4.4%	44000
12	4.8%	48000
13	5.2%	52000
14	5.6%	56000
15	6.0%	60000

Range 12%
GR X .8

GR	% Water	PPM
1	0.8%	8000
2	1.6%	16000
3	2.4%	24000
4	3.2%	32000
5	4.0%	40000
6	4.8%	48000
7	5.6%	56000
8	6.4%	64000
9	7.2%	72000
10	8.0%	80000
11	8.8%	88000
12	9.6%	96000
13	10.4%	104000
14	11.2%	112000
15	12.0%	120000

Cleaning the Vessel:

After each use be sure to rinse out the cap and vessel thoroughly before re-using the Water Test Kit. You can use any dry petroleum solvent to clean the vessel. Do not use water or alcohol. Alcohol is hygroscopic and may leave a film of water behind. Remove all traces of unused Reagent A (undissolved particles).

DO NOT USE SOLVENTS such as Acetone, Xylene, or Toluene to clean the vessel. These solvents will dissolve the ABS plastic used for the body of the digital gage and/or the plastic lenses of both the analog and digital gages.

General Information:

To Contact:

Customer Service/Technical Assistance:

Hours: 8 AM - 4 PM Eastern Time, USA

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Wilmington, DE 19801 U.S.A.

Sandy Brae Temperature Compensation Factors

Degrees F	Factor	Degrees F	Factor	Degrees F	Factor	Degrees F	Factor
32	1.0916	54	1.0448	76	1.0019	98	0.9623
33	1.0894	55	1.0428	77	1.0000	99	0.9606
34	1.0872	56	1.0407	78	0.9981	100	0.9589
35	1.0850	57	1.0387	79	0.9963	101	0.9572
36	1.0828	58	1.0367	80	0.9944	102	0.9555
37	1.0806	59	1.0347	81	0.9926	103	0.9538
38	1.0784	60	1.0327	82	0.9908	104	0.9521
39	1.0762	61	1.0307	83	0.9889	105	0.9504
40	1.0741	62	1.0288	84	0.9871	106	0.9487
41	1.0719	63	1.0268	85	0.9853	107	0.9470
42	1.0698	64	1.0248	86	0.9835	108	0.9454
43	1.0677	65	1.0229	87	0.9817	109	0.9437
44	1.0656	66	1.0209	88	0.9799	110	0.9420
45	1.0634	67	1.0190	89	0.9781	111	0.9404
46	1.0613	68	1.0171	90	0.9763	112	0.9387
47	1.0592	69	1.0151	91	0.9746	113	0.9371
48	1.0572	70	1.0132	92	0.9728	114	0.9355
49	1.0551	71	1.0113	93	0.9710	115	0.9338
50	1.0530	72	1.0094	94	0.9693	116	0.9322
51	1.0509	73	1.0075	95	0.9675	117	0.9306
52	1.0489	74	1.0056	96	0.9658	118	0.9290
53	1.0468	75	1.0037	97	0.9641	119	0.9274
						120	0.9258

Degrees C	Factor	Degrees C	Factor	Degrees C	Factor	Degrees C	Factor	Degrees C	Factor
0	1.0916	10	1.0530	20	1.0171	30	0.9835	40	0.9521
1	1.0876	11	1.0493	21	1.0136	31	0.9803	41	0.9490
2	1.0836	12	1.0456	22	1.0102	32	0.9770	42	0.9460
3	1.0797	13	1.0420	23	1.0068	33	0.9739	43	0.9430
4	1.0758	14	1.0383	24	1.0034	34	0.9707	44	0.9401
5	1.0719	15	1.0347	25	1.0000	35	0.9675	45	0.9371
6	1.0681	16	1.0311	26	0.9967	36	0.9644	46	0.9342
7	1.0643	17	1.0276	27	0.9933	37	0.9613	47	0.9313
8	1.0605	18	1.0241	28	0.9900	38	0.9582	48	0.9283
9	1.0567	19	1.0205	29	0.9868	39	0.9551	49	0.9255

Instructions: For temperature compensation, multiply the above factor times the gauge reading for the the temperature of the sample in the test vessel. The product is the corrected percent water.