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Eclipse Refractometer General Models



User Guide



***Bellingham
+ Stanley***

Eclipse Refractometer User Guide (Eng)

General Models

B + S Code: 45-095

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<i>Order Code</i>	<i>Range</i>	<i>Order Code</i>	<i>Range</i>
45-01	0 – 15 °Brix	45-45	30 to -40°F Antifreeze
45-02	0 – 30 °Brix	45-46	0 – 60% Vol. Antifreeze
45-03	0 – 50 °Brix	45-65	0 – 28% Salinity (NaCl)
45-05	45 – 80 °Brix	45-66	1.33 – 1.42 Refractive Index
45-06	72 – 95 °Brix	45-81	0 – 50 °Brix (low volume)
45-07	0 – 32 °Brix	45-82	45 – 80 °Brix (low volume)
45-08	28 – 65 °Brix	45-91	0 – 30 °Brix ATC
45-26	0 – 30% Starch	45-92	0 – 16 °Baumé/0 – 18 AP
45-27	10 – 30% Water in Honey	45-93	0 – 130 Oechsle/0 – 30 °Brix
45-41	1.33 – 1.42 Refractive Index	45-94	30 – 130 Oechsle/0 – 30 °Brix
45-44	0 to -40°C Antifreeze		

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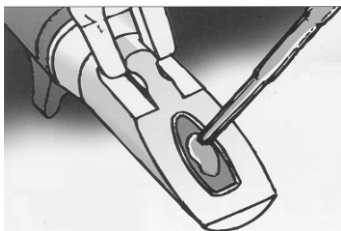
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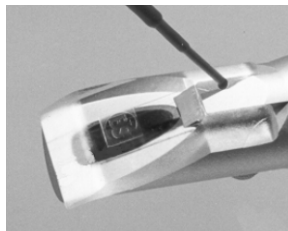
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Applying the sample to the refractometer

Lift the illuminator flap, drip the sample on to the prism then close the illuminator flap, alternatively use the dribble feature; drip sample into the top of the closed flap.



Applying sample directly to the prism



Applying sample using the dribble feature

Optical glass is relatively soft and care should be taken not to scratch the prism surface. Do not use metal spatulas or glass rods to apply samples but instead use softer materials such as plastic.

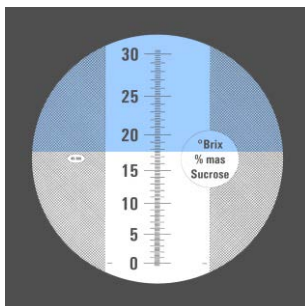
The Eclipse can also be used for testing solid substances such as apples, melons, grapes, sugarbeet and potatoes. Cut a slice of the sample about 2mm thick and slightly smaller than the prism area. With the flap lifted, apply the slice to the surface of the prism taking care to obtain a good contact.

Focussing the scale:

Hold the instrument up to a suitable light source and look through the eyepiece. Rotate the eyepiece to focus the scale.

Taking a reading:

Take a reading from the scale at the border of the light and dark areas. If the scale is completely light then the sample concentration may be too high for the instrument range.



Cleaning the prism:

Thoroughly clean the prism after use with water or other suitable solvent and dry with clean tissue.

The prism surface could be damaged by strong alkalis or acids if left in contact for long periods of time. Clean samples from the prism as soon as practicable.

Wiping the prism surface occasionally with alcohol will remove any build-up of oils left from the samples.

Precautions to improve accuracy

Make sure that the prism is cleaned and dried between each reading, using a little clean water at room temperature, and a soft cloth to dry.

Make sure the scale of the instrument is in sharp focus before taking readings, adjust the eyepiece if necessary.

Look at the quality of borderline obtained. Poor sharpness may indicate insufficient sample on prism, or temperature gradients across the prism, or that the prism was not properly cleaned and dried after the last reading.

If in doubt, clean and dry the prism, leave for a while, and repeat measurements from the start. Measuring the same sample twice in quick succession is a useful indication of the reliance that should be placed on the results obtained. Always clean the plastic illuminator plate when cleaning the prism.

Adjusting the Calibration

All Eclipse refractometers are calibrated to read correctly at 20°C. The refractive index of the measured sample will vary with temperature and the calibration should be adjusted to take account of this prior to taking any initial readings. The calibration method and Certified Reference Material (CRM) to use will depend on the scale range of the Eclipse refractometer.

Calibration Method – low range models able to measure water

Firstly loosen the adjuster locking nut (the larger diameter knob). Next apply distilled water at 20°C to the prism and rotate the smaller knob to adjust the reading until correct, then carefully retighten the locking nut.

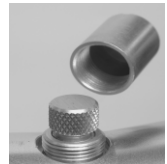


Alternative Method for low range models

1. Stabilise the instrument at ambient temperature.
2. Apply distilled water to the prism and adjust the reading to zero as described above.
3. Sample readings will then be correct at the ambient temperature.

Calibration Method – high range models unable to measure water

Unscrew the protective cap. Apply the appropriate CRM at 20°C and rotate the knob to adjust the reading until correct, then replace the protective cap.



Notes

- It is also recommended that periodically the higher end of the scale is verified using a suitable CRM.
- The ATC models are corrected for ambient temperatures in the range 10-30°C, and so should never require adjustment.
- The R.I. Aviation Eclipse refractometer (code 45-66) has a fixed calibration at 20°C
- Further information on CRM's can be found on our website at: -
<http://www.bellinghamandstanley.com/ltd/newcalibration/materials.html>
- The Eclipse User Guide is also available in other languages at: -
<http://www.bellinghamandstanley.com/ltd/literature.html>
- If the flap should become damaged, a replacement can be clipped on easily – part number 45-003 (pack of 5).

Temperature Correction Table

The corrections necessary to remove the effects of temperature on the °Brix (% Sucrose) scale are shown in the table below. Please note that the Alternative Method for calibrating the low range models, as mentioned earlier will effectively compensate for this correction factor.

This table gives mass fraction corrections to refractometric tables for sucrose solutions at 589nm for temperature different from 20°C. Taken from ICUMSA, Appendix 2, SPS-3 (1998) page 8.

Temp. / °C	Measured Sucrose °Brix (Mass Fraction)																	
	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85
15	-0.29	-0.30	-0.32	-0.33	-0.34	-0.35	-0.36	-0.37	-0.37	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.37	-0.37	-0.37
16	-0.24	-0.25	-0.26	-0.27	-0.28	-0.28	-0.29	-0.30	-0.30	-0.30	-0.31	-0.31	-0.31	-0.31	-0.31	-0.30	-0.30	-0.30
17	-0.18	-0.19	-0.20	-0.20	-0.21	-0.21	-0.22	-0.22	-0.23	-0.23	-0.23	-0.23	-0.23	-0.23	-0.23	-0.23	-0.23	-0.22
18	-0.12	-0.13	-0.13	-0.14	-0.14	-0.14	-0.15	-0.15	-0.15	-0.15	-0.15	-0.15	-0.15	-0.15	-0.15	-0.15	-0.15	-0.15
19	-0.06	-0.06	-0.07	-0.07	-0.07	-0.07	-0.07	-0.08	-0.08	-0.08	-0.08	-0.08	-0.08	-0.08	-0.08	-0.08	-0.08	-0.07
20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
21	0.06	0.07	0.07	0.07	0.07	0.07	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.07
22	0.13	0.14	0.14	0.14	0.15	0.15	0.15	0.15	0.16	0.16	0.16	0.16	0.16	0.16	0.15	0.15	0.15	0.15
23	0.20	0.21	0.21	0.22	0.22	0.23	0.23	0.23	0.23	0.24	0.24	0.24	0.24	0.23	0.23	0.23	0.23	0.22
24	0.27	0.28	0.29	0.29	0.30	0.30	0.31	0.31	0.31	0.32	0.32	0.32	0.32	0.31	0.31	0.31	0.30	0.30
25	0.34	0.35	0.36	0.37	0.38	0.38	0.39	0.39	0.40	0.40	0.40	0.40	0.40	0.39	0.39	0.38	0.38	0.37
26	0.42	0.43	0.44	0.45	0.46	0.46	0.47	0.47	0.48	0.48	0.48	0.48	0.48	0.47	0.47	0.46	0.46	0.45
27	0.50	0.51	0.52	0.53	0.54	0.55	0.55	0.56	0.56	0.56	0.56	0.56	0.56	0.55	0.55	0.54	0.53	0.52
28	0.58	0.59	0.60	0.61	0.62	0.63	0.64	0.64	0.64	0.65	0.65	0.64	0.64	0.63	0.63	0.62	0.61	0.60
29	0.66	0.67	0.68	0.70	0.71	0.71	0.72	0.73	0.73	0.73	0.73	0.73	0.72	0.72	0.71	0.70	0.69	0.67
30	0.74	0.76	0.77	0.78	0.79	0.80	0.81	0.81	0.82	0.82	0.81	0.81	0.80	0.80	0.79	0.78	0.76	0.75
31	0.83	0.84	0.85	0.87	0.88	0.89	0.89	0.90	0.90	0.90	0.90	0.89	0.89	0.88	0.87	0.86	0.84	0.82
32	0.92	0.93	0.94	0.96	0.97	0.98	0.98	0.99	0.99	0.99	0.99	0.98	0.97	0.96	0.95	0.93	0.92	0.90
33	1.01	1.02	1.03	1.05	1.06	1.07	1.07	1.08	1.08	1.08	1.07	1.07	1.06	1.04	1.03	1.01	1.00	0.98
34	1.10	1.11	1.13	1.14	1.15	1.16	1.16	1.17	1.17	1.16	1.16	1.15	1.14	1.13	1.11	1.09	1.07	1.05
35	1.19	1.21	1.22	1.23	1.24	1.25	1.25	1.26	1.26	1.25	1.25	1.24	1.23	1.21	1.19	1.17	1.15	1.13
36	1.29	1.30	1.31	1.33	1.34	1.34	1.35	1.35	1.35	1.34	1.34	1.33	1.31	1.29	1.28	1.25	1.23	1.20
37	1.39	1.40	1.41	1.42	1.43	1.44	1.44	1.44	1.44	1.43	1.43	1.41	1.40	1.38	1.36	1.33	1.31	1.28
38	1.49	1.50	1.51	1.52	1.53	1.53	1.54	1.54	1.53	1.53	1.52	1.50	1.48	1.46	1.44	1.42	1.39	1.36
39	1.59	1.60	1.61	1.62	1.63	1.63	1.63	1.63	1.63	1.62	1.61	1.59	1.57	1.55	1.52	1.50	1.47	1.43
40	1.69	1.70	1.71	1.72	1.73	1.73	1.73	1.73	1.72	1.71	1.70	1.68	1.66	1.63	1.61	1.58	1.54	1.51

% Water in Honey Temperature Correction for 45-27 Eclipse refractometer

Refractive Index is temperature dependant. It is therefore necessary to make corrections for measurements taken at temperatures other than the reference temperature (20°C). For correcting measurements of “Water in Honey” the following table may be used. Note that the table shows two decimal places in order that the value may be rounded up or down accordingly.

For example, a sample is measured at 25°C and gives a value from the refractometer of 15% Water in Honey. By using the table below, the corrected reading is: 15 + (-0.44) = 14.56%

T °C \ WH	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
10	0.87	0.88	0.88	0.89	0.89	0.90	0.90	0.90	0.91	0.91	0.92	0.92	0.93	0.93	0.94	0.94	0.95	0.95	0.96	0.96	0.97
11	0.78	0.79	0.79	0.80	0.80	0.81	0.81	0.81	0.82	0.82	0.83	0.83	0.83	0.84	0.84	0.85	0.85	0.86	0.86	0.86	0.87
12	0.70	0.70	0.70	0.71	0.71	0.72	0.72	0.72	0.73	0.73	0.73	0.74	0.74	0.75	0.75	0.75	0.76	0.76	0.76	0.77	0.77
13	0.61	0.61	0.62	0.62	0.62	0.63	0.63	0.63	0.64	0.64	0.64	0.65	0.65	0.65	0.66	0.66	0.66	0.67	0.67	0.67	0.68
14	0.52	0.53	0.53	0.53	0.53	0.54	0.54	0.54	0.55	0.55	0.55	0.55	0.56	0.56	0.56	0.56	0.57	0.57	0.57	0.58	0.58
15	0.44	0.44	0.44	0.44	0.45	0.45	0.45	0.45	0.45	0.46	0.46	0.46	0.46	0.47	0.47	0.47	0.47	0.48	0.48	0.48	0.48
16	0.35	0.35	0.35	0.35	0.36	0.36	0.36	0.36	0.36	0.37	0.37	0.37	0.37	0.37	0.37	0.38	0.38	0.38	0.38	0.38	0.39
17	0.26	0.26	0.26	0.27	0.27	0.27	0.27	0.27	0.27	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.29	0.29	0.29	0.29
18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19
19	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.10	0.10	0.10	0.10
20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
21	-0.09	-0.09	-0.09	-0.09	-0.09	-0.09	-0.09	-0.09	-0.09	-0.09	-0.09	-0.09	-0.09	-0.09	-0.09	-0.09	-0.09	-0.09	-0.09	-0.09	-0.09
22	-0.17	-0.17	-0.17	-0.17	-0.18	-0.18	-0.18	-0.18	-0.18	-0.18	-0.18	-0.18	-0.18	-0.19	-0.19	-0.19	-0.19	-0.19	-0.19	-0.19	-0.19
23	-0.26	-0.26	-0.26	-0.26	-0.26	-0.27	-0.27	-0.27	-0.27	-0.27	-0.27	-0.28	-0.28	-0.28	-0.28	-0.28	-0.28	-0.28	-0.28	-0.29	-0.29
24	-0.34	-0.35	-0.35	-0.35	-0.35	-0.36	-0.36	-0.36	-0.36	-0.36	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.38	-0.38	-0.38	-0.38	-0.38
25	-0.43	-0.43	-0.44	-0.44	-0.44	-0.44	-0.45	-0.45	-0.45	-0.45	-0.46	-0.46	-0.46	-0.46	-0.47	-0.47	-0.47	-0.47	-0.47	-0.48	-0.48
26	-0.52	-0.52	-0.52	-0.53	-0.53	-0.53	-0.54	-0.54	-0.54	-0.54	-0.55	-0.55	-0.55	-0.56	-0.56	-0.56	-0.56	-0.57	-0.57	-0.57	-0.57
27	-0.60	-0.61	-0.61	-0.61	-0.62	-0.62	-0.63	-0.63	-0.63	-0.64	-0.64	-0.64	-0.65	-0.65	-0.65	-0.66	-0.66	-0.66	-0.66	-0.67	-0.67
28	-0.69	-0.69	-0.70	-0.70	-0.71	-0.71	-0.71	-0.72	-0.72	-0.73	-0.73	-0.73	-0.74	-0.74	-0.75	-0.75	-0.75	-0.76	-0.76	-0.76	-0.77
29	-0.78	-0.78	-0.79	-0.79	-0.80	-0.80	-0.80	-0.81	-0.81	-0.82	-0.82	-0.83	-0.83	-0.83	-0.84	-0.84	-0.85	-0.85	-0.85	-0.86	-0.86
30	-0.86	-0.87	-0.87	-0.88	-0.88	-0.89	-0.89	-0.90	-0.90	-0.91	-0.91	-0.92	-0.92	-0.93	-0.93	-0.94	-0.94	-0.94	-0.95	-0.95	-0.96
31	-0.95	-0.96	-0.96	-0.97	-0.97	-0.98	-0.98	-0.99	-0.99	-1.00	-1.00	-1.01	-1.01	-1.02	-1.02	-1.03	-1.03	-1.04	-1.04	-1.05	-1.05
32	-1.04	-1.04	-1.05	-1.05	-1.06	-1.07	-1.07	-1.08	-1.08	-1.09	-1.09	-1.10	-1.11	-1.11	-1.12	-1.12	-1.13	-1.13	-1.14	-1.14	-1.15
33	-1.12	-1.13	-1.14	-1.14	-1.15	-1.15	-1.16	-1.17	-1.17	-1.18	-1.19	-1.19	-1.20	-1.20	-1.21	-1.22	-1.22	-1.23	-1.23	-1.24	-1.24
34	-1.21	-1.22	-1.22	-1.23	-1.24	-1.24	-1.25	-1.26	-1.26	-1.27	-1.28	-1.28	-1.29	-1.30	-1.30	-1.31	-1.32	-1.32	-1.33	-1.33	-1.34
35	-1.29	-1.30	-1.31	-1.32	-1.32	-1.33	-1.34	-1.35	-1.35	-1.36	-1.37	-1.37	-1.38	-1.39	-1.40	-1.40	-1.41	-1.42	-1.42	-1.43	-1.44
36	-1.38	-1.39	-1.40	-1.40	-1.41	-1.42	-1.43	-1.44	-1.44	-1.45	-1.46	-1.47	-1.47	-1.48	-1.49	-1.50	-1.50	-1.51	-1.52	-1.52	-1.53
37	-1.47	-1.48	-1.48	-1.49	-1.50	-1.51	-1.52	-1.53	-1.53	-1.54	-1.55	-1.56	-1.57	-1.57	-1.58	-1.59	-1.60	-1.60	-1.61	-1.62	-1.63
38	-1.55	-1.56	-1.57	-1.58	-1.59	-1.60	-1.61	-1.61	-1.62	-1.63	-1.64	-1.65	-1.66	-1.67	-1.67	-1.68	-1.69	-1.70	-1.71	-1.71	-1.72
39	-1.64	-1.65	-1.66	-1.67	-1.68	-1.69	-1.69	-1.70	-1.71	-1.72	-1.73	-1.74	-1.75	-1.76	-1.77	-1.78	-1.78	-1.79	-1.80	-1.81	-1.82
40	-1.72	-1.73	-1.74	-1.75	-1.76	-1.77	-1.78	-1.79	-1.80	-1.81	-1.82	-1.83	-1.84	-1.85	-1.86	-1.87	-1.88	-1.89	-1.89	-1.90	-1.91

°Brix to Refractive Index Conversion Table

The table below can be used to convert °Brix readings taken from the instrument scale into refractive index.

°Brix	Refractive Index at 589.3nm and 20.0°C	°Brix	Refractive Index at 589.3nm and 20.0°C	°Brix	Refractive Index at 589.3nm and 20.0°C
0	1.33299	30	1.38115	60	1.44193
1	1.33442	31	1.38296	61	1.44420
2	1.33586	32	1.38478	62	1.44650
3	1.33732	33	1.38661	63	1.44881
4	1.33879	34	1.38846	64	1.45113
5	1.34026	35	1.39032	65	1.45348
6	1.34175	36	1.39220	66	1.45584
7	1.34325	37	1.39409	67	1.45822
8	1.34477	38	1.39600	68	1.46061
9	1.34629	39	1.39792	69	1.46303
10	1.34782	40	1.39986	70	1.46546
11	1.34937	41	1.40181	71	1.46790
12	1.35093	42	1.40378	72	1.47037
13	1.35250	43	1.40576	73	1.47285
14	1.35408	44	1.40776	74	1.47535
15	1.35568	45	1.40978	75	1.47787
16	1.35729	46	1.41181	76	1.48040
17	1.35891	47	1.41385	77	1.48295
18	1.36054	48	1.41592	78	1.48552
19	1.36218	49	1.41799	79	1.48811
20	1.36384	50	1.42009	80	1.49071
21	1.36551	51	1.42220		
22	1.36720	52	1.42432		
23	1.36889	53	1.42647		
24	1.37060	54	1.42862		
25	1.37233	55	1.43080		
26	1.37406	56	1.43299		
27	1.37582	57	1.43520		
28	1.37758	58	1.43743		
29	1.37936	59	1.43967		

Data Source: ICUMSA Methods Book, Specification and Standard SPS-3 (2000), Refractometry and Tables - (Official)



Always check sample Health & Safety Data before applying to the refractometer.
 When applying samples to the prism which are likely to cause harm to skin or eyes, wear appropriate protective clothing and glasses.
 These refractometers are precision optical instruments and should be handled with care.
 Do not drop or subject them to sharp knocks.

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Certificate of Conformity

This Eclipse refractometer was calibrated and tested by Bellingham + Stanley and has been found to meet the published specifications for this instrument.

For the refractometer to continue to operate within our specifications, it should be kept in clean condition and well maintained in accordance with the user guide.

This certificate implies no responsibility by Bellingham + Stanley with regard to the accuracy of the instrument after the date of examination at Bellingham + Stanley.

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