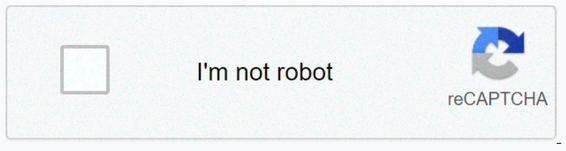
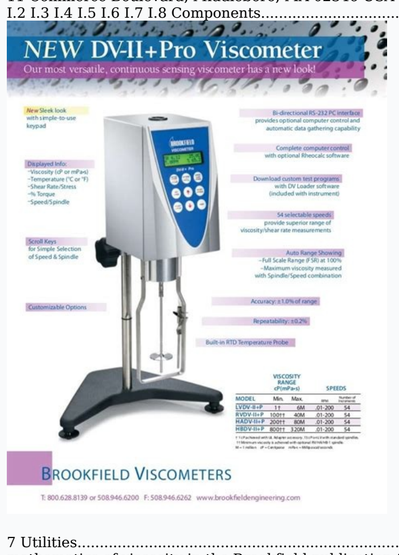


Continue

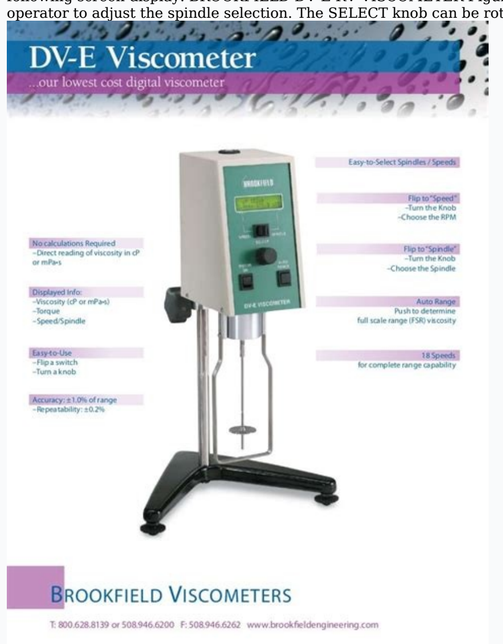
Brookfield digital viscometer model dv-e manual

BROOKFIELD DIGITAL VISCOMETER MODEL DV-E Operating Instructions Manual No. M98-350-J0912 SPECIALISTS IN THE MEASUREMENT AND CONTROL OF VISCOSITY with offices in: Boston • Chicago • London • Stuttgart • Guangzhou BROOKFIELD ENGINEERING LABORATORIES, INC.
11 Commerce Boulevard, Middleboro, MA 02346 USA TEL 508-946-6200 or 800-628-8139 (USA excluding MA) FAX 508-946-6262 INTERNET Brookfield Engineering Labs., Inc. Page 1 Manual No.Brookfield Engineering Labs., Inc. Page 2 Manual No.Table of Contents I. INTRODUCTION..... 5 I.1 I.2 I.3 I.4 I.5 I.6 I.7 I.8 Components..... 5 Instrument Dimensions.....



7 Utilities.....Brookfield Engineering Labs., Inc. Page 4 Manual No.I. INTRODUCTION I. INTRODUCTION The Brookfield DV-E Viscometer measures fluid viscosity at given shear rates. Viscosity is a measure of a fluid’s resistance to flow. You will find a detailed description of the mathematics of viscosity in the Brookfield publication “More Solutions to Sticky Problems”, a copy of which was included with your DV-E and can be downloaded in pdf form from the Brookfield website, www.brookfieldengineering.com.Component DV-E Viscometer Model A laboratory stand Spindle Set with Case: LVDV-E set of four spindles RVDV-E set of six spindles (#2-#7) HA/HBDV-E set of six spindles (#2-#7) Power Cord: for 115 VAC for 230 VAC Guard Leg: LVDV-E RVDV-E Carrying Case Shipping Cap Part Number varies Model AK Quantity 1 1 SSL SSR SSH 1 1 1 or or DVP-65 DVP-66 1 1 or B-20Y B-21Y 001Y B-30-3 1 1 1 1 or DV-E Viscometer Model A Laboratory Stand Shipping Cap Guard Leg Figure I-1 Brookfield Engineering Labs., Inc.I.2 Instrument Dimensions 11 47/64” [29.8 cm] DV-E VISCOMETER 6” [15.3 cm] 4 5/64” [10.4 cm] 14 41/64” [37.2 cm] B-20Y LV GUARD LEG ASSEMBLY 7 13/32” [18.8 cm] 16 23/64” [41.5 cm] 1 7/16” [3.7 cm] 10 7/8” [27.6 cm] Brookfield Engineering Labs., Inc. VS-1Y LAB STAND BASE ASSEMBLY Figure I-2 Page 7 Manual No.I.3 Utilities Input Voltage: Input Frequency: Power Consumption: Power Cord Color Code: Hot (live) Neutral Ground (earth) 115 VAC or 230 VAC 50/60 Hz Less than 20 WATTS United States Black White Green Outside United States Brown Blue Green/Yellow Input voltage can only be internally selected by a qualified technician from Brookfield or an authorized Brookfield dealer. I.4 Specifications Speeds: Weight: 0.3, 0.5, 0.6, 1.0, 1.5, 2.0, 2.5, 3.0, 4.0, 5.0, 6.I.5 Set-Up Note: “IQOQPQ”, a guideline document for installation, operation and performance validation for your DV-E Viscometer, can be downloaded from our website: www.brookfieldengineering.com. 1. To assemble the Model A Laboratory Stand, place the upright rod into the base (refer to assembly instructions in Appendix E). 2. Insert the mounting rod on the back of the DV-E Viscometer into the hole on the clamp assembly. (Refer to Appendix E). 3. The Viscometer must be leveled.In case of emergency, turn off the instrument and then disconnect the electrical cord from the wall outlet. The safety of any system, incorporating this instrument, is the responsibility of the assembler of the system. The user should ensure that the substances placed under test do not release poisonous, toxic or flammable gases at the temperatures to which they are subjected to during the testing.

I.7 Instrument Controls The following describes each switch’s function: MOTOR ON Turns the motor ON or OFF.I.8 Cleaning Make sure the instrument is in a decent working environment (dust-free, moderate temperature, low humidity, etc.). Make sure the instrument is on a level surface. Hands/fingers must be clean and free of residual sample. Not doing so may result in deposit build up on the upper part of the shaft and caue interference between the shaft and the pivot cup. Be sure to remove the spindle from the instrument prior to cleaning. Note lefthand thread.II. GETTING STARTED II.1 Power Up Turn the power switch (located on the rear panel) to the ON (I) position. This will result in the following screen display: BROOKFIELD DV-E RV VISCOMETER Figure II-1 After a few seconds, the following screen appears: BROOKFIELD VERSION: DV-E 1.00 Figure II-2 After a short time, the display will clear and the default screen is displayed: cP 10OFF % S02 Figure II-3 II.Setting the SPEED/SPINDLE switch to the right position will allow the operator to adjust the spindle selection. The SELECT knob can be rotated until the desired spindle number is selected.



Once the desired spindle number is shown on the display, set the SPINDLE/SPEED switch to the middle position. Note: Verify the proper spindle entry code for the selected spindle found in Appendix C. Not all spindles have an entry code number that is the same as the spindle number.cP 12RPM % S02 (MOTOR ON) Figure II-5 cP 12OFF % S02 (MOTOR OFF) Figure II-6 Note: When the motor switch is in the ON position, any change to the selected speed will be effective immediately. When collecting data at multiple speeds, you may wish to leave the SPEED/SPINDLE switch in the left position to facilitate speed changes. Also, when the motor switch is turned off, the display will hold the last measured torque value and measured viscosity.II.4 Autorange and CGS or SI Units Selection The AUTO RANGE key allows you to determine the maximum calculated viscosity (full scale reading) possible with the current spindle/speed setting. Pressing the key at any time will cause the current viscosity display to change and show that maximum viscosity. The screen torque display will now display “%100” to indicate this special condition. This maximum viscosity and %100 value will be displayed for as long as the AUTO RANGE key is depressed.cP 360 10RPM % 9.0 S02 Figure II-9 Negative % (Torque) will be displayed as shown in Figure II-10. Viscosity values will be displayed as “- - - -” when the % (Torque) is below zero. cP ---10RPM %-1.0 S02 Figure II-10 II.6 Operation The following procedure is outlined for making a viscosity measurement in the recommended 600 mL low form Griffin beaker. 1. Insert and center spindle in the test material until the fluid’s level is at the immersion groove on the spindle’s shaft.Appendix A - Viscosity Ranges Appendix A - Viscosity Ranges LV and RV,HA,HB Viscometers Viscometer Viscosity Range (cP) Minimum Maximum LVDV-E 15 2M RVDV-E 100* 13 M HADV-E 200* 26 M HBDV-E 800* 106 M *Minimum viscosity with optional RV/HA/HB-1 spindle Small Sample Adapter (SSA) and Thermosel (Tsel) SSA/ Thermosel Spindle Viscosity (cP) Shear Rate (1/SEC) LVDV-E SC4-16 (SSA) 0.29 N 120 - 400 K SC4-18 (SSA/Tsel) 1.32 N 3 - 10 K SC4-25 (SSA) 0.22 N 800 - 1.UL Adapter Viscosity (cP) UL Spindle Shear Rate (1/SEC) LVDV-E RVDV-E HADV-E HBDV-E YULA-15 or 15Z 1.224N 1.0 - 2 K 6.4 - 2 K 12.8 - 2 K 51.2 - 2 K DIN Adapter Accessory Viscosity (cP) DAA Spindle Shear Rate (1/SEC) 85 1.29N 1.2 - 3.8 K 12 - 5K 24 - 5K 98 - 5K 86 1.29N 3 - 10 K 36 - 10 K 73 - 10 K 292 - 10 K 87 1.In taking viscosity measurements with the DV-E Viscometer, there are two considerations which pertain to the low viscosity limit of effective measurement. 1) Viscosity measurements should be accepted within the equivalent % Torque Range from 10% to 100% for any combination of spindle/speed rotation. 2) Viscosity measurements should be taken under laminar flow conditions, not under turbulent flow conditions. The first consideration has to do with the accuracy of the instrument.Appendix B - Variables in Viscosity Measurement As with any instrument measurement, there are variables that can affect a viscometer measurement. These variables may be related to the instrument (viscometer), or the test fluid. Variables related to the test fluid deal with the rheological properties of the fluid, while instrument variables would include the viscometer design and the spindle geometry system utilized.The shear rate of a given measurement is determined by: the rotational speed of the spindle, the size and shape of the spindle, the size and shape of the container used and therefore, the distance between the container wall and the spindle surface.Appendix C - Spindle and Model Codes Appuuoijpoiendix C - Spindle and Model Codes Each spindle has a two digit code which is scrolled via the select knob on the DV-E. The spindle code directs the DV-E to calculate viscosity for the spindle that is being used. The spindle multiplier constant (SMC) is used to calculate full scale viscosity range for any spindle/speed combination. Use of Guard Leg is required.
Spindle codes are listed in Table C-1.VISCOMETER MODEL TORQUE CONSTANT TK MODEL CODE ON DV-E SCREEN LVDV-E 0.09373 LV RVDV-E 1 RV HADV-E 2 HA HBDV-E 8 HB SPECIAL ORDER TORQUE SPRINGS VISCOMETER MODEL TORQUE CONSTANT TK MODEL CODE ON DV-E SCREEN 2.5xLVDV-E 0.2343 2.5LV 5xLVDV-E 0.4686 5LV 1/4 RVDV-E 0.25 1/4RV 1/2 RVDV-E 0.5 1/2RV 2xHADV-E 4 2HA 2.5xHADV-E 5 2.5HA 2xHBDV-E 16 2HB 2.5xHBDV-E 20 2.Appendix D - Calibration Check Procedures Brookfield’s accuracy statement for viscometers used with standard spindles is +/- 1% of full scale range. When measuring viscosity with a specific spindle rotating at a defined speed, the maximum viscosity that can be measured is defined as full scale range. For digital viscometers, this value is easily determined by pressing the “AUTORANGE” key. The display will how the full scale range viscosity in cP or mPa•s and the torque value will show “100%”.Normal 25°C Standard Fluids Viscosity (cP) Viscosity (cP) 5 10 50 100 500 1000 5,000 12,500 30,000 60,000 100,000 High Temperature Standard Fluids for use with Thermosel Accessory HT-30,000 HT-60,000 HT-100,000 Calibrated at three viscosity/temperatures 25°C, 93.3°C, 149°C Refer to the Brookfield Catalog for more information.air bubbles beneath the disk by first immersing the spindle at an angle, and then connecting it to the viscometer. 4) The viscosity standard fluid, together with the spindle and guard leg (if supplied), should be immersed in the bath for a minimum of 1 hour, stirring the fluid periodically, prior to taking measurements. 5) After 1 hour, check the temperature of the viscosity standard fluid with an accurate thermometer. Fluid must be within ± 0.1°C of the specified temperature, normally 25°C.When a Thermosel is used, the controller stabilizes the Thermo Container at the test temperature. 1) Install the tube end cap and put the proper amount of HT viscosity standard fluid into the HT-2 or HT-2DB sample chamber. The amount varies with the spindle used. (Refer to the Thermosel instruction manual). 2) Place the sample chamber into the Thermo Container.3) Attach the tube to the mounting channel. 4) Lower the tube into the water bath reservoir, or if using the ULA-40Y water jacket, connect the inlet/outlets to the bath external circulating pump. 5) Allow 30 minutes for the viscosity standard, sample chamber and spindle to reach test temperature. 6) Measure the viscosity and record the viscometer reading. Note: The spindle must rotate at least five (5) times before a viscosity reading is taken.1) Calculate full scale viscosity range using the equation: Full Scale Viscosity Range [cP] = TK * SMC * 10,000 RPM Where: TK SMC = = 1.0 from Table C-2 (in Appendix C) 10 from Table C-1 (in Appendix C) Full Scale Viscosity Range = 1 * 10 * 10,000 = 50,000 cP 2 2) The viscosity is accurate to (+/-) 500 cP (which is 1% of 50,000) The viscosity standard fluid is 12,257 cP. Its accuracy is (+/-)1% of 12,257 or (+/-)122.57 cP. 3) Total allowable error is (122.57 + 500) cP = (+/-) 622.57 cP.Appendix E - Model A Laboratory Stand 1 UP/DOWN KNOB VISCOMETER HEAD CLAMP KNOB BROOKFIELD LABORATORY VISCOMETER TENSION SCREW 5 2 4 3 ITEM 1 2 3 4 5 6 PART # VS-CRA-14S VS-1 VS-3 VS-21 BLM-4E VSXA-17A DESCRIPTION UPRIGHT ROD AND CLAMP ASSEMBLY BASE LEVELING SCREW JAM NUT ROD EXTENSION - 4” LONG * CLAMP ASSEMBLY FOR EXPLOSION PROOF QTY. 1 1 3 1 OPTIONAL OPTIONAL *for use with Thermosel and Water Baths Figure E-1 Brookfield Engineering Labs., Inc. Page 30 Manual No.Unpacking Check carefully to see that all the components are received with no concealed damage. 1 base (VS-1) 3 leveling screws (VS-3) 1 jam nut (VS-21) 1 clamp and rod assembly (VS-CRA-14S) Open and discard all packaging materials for the base. Remove the three (3) leveling screws from the base. Remove the jam nut from the upright rod. Assembly (Refer to Figure E-1) Screw the leveling screws into the base.Appendix F - The Brookfield Guardleg The guard leg was originally designed to protect the spindle during use. The first applications of the Brookfield Viscometer included hand held operation while measuring fluids in a 55 gallon drum. It is clear that under those conditions the potential for damage to the spindle was great. The current guard leg is a band of metal in the shape of the letter U with a bracket at the top that attaches to the pivot cup of a Brookfield Viscometer/Rheometer.The guard leg is a part of the calibration check of the Brookfield LV and RV series Viscometer/ Rheometer. Our customers should be aware of its existence, its purpose and the effect that it may have on data.

With this knowledge, the viscometer user may make modifications to the recommended method of operation to suit their needs. B-20KY Guard Leg For LV Torque B-21KY Guard Leg For RV Torque 5 7/8 5 5/32 3 3/16 1 7/16 Figure F-1 Brookfield Engineering Labs., Inc. Page 33 Manual No.Appendix G - Fault Diagnosis and Troubeshooting Listed below are some of the more common problems that you may encounter while using your DV-E Viscometer. Review these items before you contact Brookfield. Spindle Does Not Rotate o Make sure the viscometer is plugged in. o Check the voltage rating on your viscometer (115V, 220V): it must match the wall voltage. o Make sure the power switch is in the ON position. o Make sure the speed set knob is set properly and securely at the desired speed.Appendix H - Online Help and Other Resources www.brookfieldengineering.com** The Brookfield website is a good resource for additional information and self-help whenever you need it. Our website offers a selection of “how to” videos, application notes, conversion tables, instruction manuals, material safety data sheets, calibration templates and other technical resources. Brookfield has its own YouTube channel.Appendix Appendix IH- Warranty - WarrantyRepair Repairand andService Service Warranty Brookfield Viscometers are guaranteed for one year from date of purchase against defects in materials and workmanship. They are certified against primary viscosity standards traceable to the National Institute of Standardsd and Technology (NIST). The Viscometer must be returned to Brookfield Engineering Laboratories, Inc. or the Brookfield dealer from whom it was purchased for no charge warranty evaluation service.MODEL SPINDLE RPM DIAL READING % TORQUE BY: DATE: FACTOR VISCOSITY SHEAR cP RATE TEMP °C FOR: TIME NOTES BROOKFIELD ENGINEERING LABORATORIES, INC. • 11 Commerce Blvd. • Middleboro, MA 02346 • Tel: 508-946-6200 or 800-628-8139 Fax: 508-946-6262 • www.brookfieldengineering.com • VTR1207 CONCLUSIONS: SAMPLE TEST INFORMATION: VISCOSITY TEST REPORT This tear-off sheet is a typical example of recorded test data.Page 2 Brookeld Engineering Labs., Inc. Page 3 Manual No. M98-350-J0912I. INTRODUCTION ..... 5 I.1 Components ..... 5 I.2 Instrument Dimensions ..... 7 I.3 Utilities ..... 8 I.4 Specications ..... 8 I.5 Set-Up ..... 9 I.6 Safety Symbols and Precautions ..... 9 I.7 Instrument Controls ..... 10 I.8 Cleaning ..... 11II. GETTING STARTED ..... 12 II.1 Power Up..... 12 II.2 Spindle Selection ..... 12 II.3 Speed Selection & Setting..... 13 II.4 Autorange and CGS or

SI Units Selection .....

You will find a detailed description of the mathematics of viscosity in the Brookfield publication “More Solutions to Sticky Problems”, a copy of which was included with your DV-E and can be downloaded in pdf form from the Brookfield website, www.brookfieldengineering.com. The principle of operation of the DV-E is to rotate a spindle (which is immersed in the test fluid) through a calibrated spring. The viscous drag of the fluid against the spindle is measured by the spring deflection. Spring deflection is measured with a rotary transducer which provides a torque signal. The measurement range of a DV-E (in centipoise or milliPascal seconds) is determined by the rotational speed of the spindle, the size and shape of the spindle, the container in which the spindle is rotating, and the full scale torque of the calibrated spring. There are four basic spring torque series offered by Brookfield: Model Spring Torque dyne-cm milli Newton-m LVDV-E 673.7 0.0673 RVDV-E 7,187.0 0.7187 HADV-E 14,374.0 1.4374 HBDV-E 57,496.0 5.7496 The higher the spring torque, the higher the measurement range. The viscosity measurement range for each spring torque may be found in Appendix A. All units of measurement are displayed according to either the CGS (cP) system or the SI (mPa•s) system. 1.Viscosity appears in units of centipoise (shown as “cP”) or milliPascal-seconds (shown as “mPa•s”) on the DV-E display.

2.Torque appears in units of dyne-centimeters or Newton-meters (shown as percent “%” in both cases) on the DV-E display. TheequivalentunitsofmeasurementintheSIsystemarecalculatedusingthefollowingconversions: Viscosity: SI = CGS 1 mPa•s 1 cP Torque: 1 Newton-m= 107 dyne-cm References to viscosity throughout this manual are made in CGS units. The DV-E Viscometer provides equivalent information in SI units (see Section II.4 AUTORANGE).

I.1 Components Please check to be sure that you have received all components, and that there is no damage. If you are missing any parts, please notify Brookfield Engineering or your local Brookfield agent immediately. Any shipping damage must be reported to the carrier.

Brookfield Engineering Labs., Inc. Page 5 Manual No. M98-350-J0912 Component Part Number Quantity DV-E Viscometer varies 1 Model A laboratory stand Model AK 1 Spindle Set with Case: SSL 1 or LVDV-E set of four spindles RVDV-E set of six spindles (#2-#7) SSR 1 or HA/HBDV-E set of six spindles (#2-#7) SSH 1 Power Cord: DVP-65 1 or for 115 VAC for 230 VAC DVP-66 1 Guard Leg: B-20Y 1 or LVDV-E RVDV-E B-21Y 1 Carrying Case 001Y 1 Shipping Cap B-30-3 1 DV-E Viscometer Model A Laboratory Stand Shipping Cap Guard Leg Figure I-1 Brookfield Engineering Labs., Inc. Page 6 Manual No. M98-350-J0912 I.2 Instrument Dimensions 11 47/64” [29.8 cm] DV-E VISCOMETER 6” 4 5/64” [15.3 cm] [10.4 cm] B-20Y 14 41/64” LV GUARD LEG [37.2 cm] ASSEMBLY 7 13/32” [18.8 cm] 1 7/16” [3.7 cm] 10 7/8” [27.6 cm] VS-1Y LAB STAND BASE ASSEMBLY Figure I-2 Brookfield Engineering Labs., Inc. Page 7 Manual No. M98-350-J0912 I.3 Utilities Input Voltage: 115 VAC or 230 VAC Input Frequency: 50/60 Hz Power Consumption: Less than 20 WATTS Power Cord Color Code: United States Outside United States Hot (live) Black Brown Neutral White Blue Ground (earth) Green Green/Yellow Input voltage can only be internally selected by a qualified technician from Brookfield or an authorized Brookfield dealer. I.4 Specifications Speeds: 0.3, 0.5, 0.6, 1.0, 1.5, 2.0, 2.5, 3.0, 4.0, 5.0, 6.0, 10, 12, 20, 30, 50, 60, 100 RPM Weight: Gross Weight 20 lb 9 kg Net Weight 17 lb 7.7 kg Carton Volume 1.65 cu ft 0.05 m3 Carton Dimension 19 x 10 x 15 in 48 x 25 x 38 cm Operating Environment: 0°C to 40°C Temperature Range (32°F to 104°F) 20% - 80% R.H.: non-condensing atmosphere Accuracy: ±1.0% Full Scale Range in Use (See Appendix D for details) Reproducibility: 0.2% of Full Scale Range Electrical Certifications: Conforms to CE Standards: BSEN 61326: Electrical equipment for measurement, control and laboratory use - EMC requirements BSEN 61010-1: Safety requirements for electrical equipment, for measurement, control and laboratory use. NOTICE TO CUSTOMERS: This symbol indicates that this product is to be recycled at an appropriate collection center. Users within the European Union: Please contact your dealer or the local authorities in charge of waste management on how to dispose of this product properly. All Brookfield offices and our network of representatives and dealers can be found on our website: www.brookfieldengineering.com.

Users outside of the European Union: Please dispose of this product according to your local laws. Brookfield Engineering Labs., Inc. Page 8 Manual No. M98-350-J0912 I.5 Set-Up Note: “IQOQPQ”, a guideline document for installation, operation and performancevalidationforyourDV-EViscometer,canbedownloaded from our website: www.brookfieldengineering.com. 1.To assemble the Model A Laboratory Stand, place the upright rod into the base (refer to assembly instructions in Appendix E). 2.Insert the mounting rod on the back of the DV-E Viscometer into the hole on the clamp assembly. (Refer to Appendix E). 3.The Viscometer must be leveled. The level is adjusted using the three leveling screws on the base.

Adjust so that the bubble level on top of the DV-E is centered within the circle. Note: Check level peroiodically during use. 4.Remove theViscometer shipping cap from the pivot cup. This cap is designed to protect the Viscometerspindlecouplingnutduringshipment. Do not attempt to operate the Viscometer with the shipping cap in place! Save this cap for future use. 5.Make sure that the power switch at the rear of the DV-E is in the OFF (0) position. Connect thepowercordtothesocketonthebackpaneloftheinstrumentandplugitintotheappropriate AC power line. The AC input voltage and frequency must be within the appropriate range as shown on the name plate of the viscometer.

The DV-E must be earth grounded via its power mains cable plug/socket for electrical safety and to ensure against electronic failure!! I.6 Safety Symbols and Precautions Safety Symbols The following explains safety symbols which may be found in this operating manual. Indicates hazardous voltages may be present. Refer to the manual for specific warning or caution information to avoid personal injury or damage to the instrument. Precautions If this instrument is used in a manner not specified by the manufacturer, the protection provided by the instrument may be impaired. This instrument is not intended for use in a potentially hazardous environment. Brookfield Engineering Labs., Inc. Page 9 Manual No. M98-350-J0912 In case of emergency, turn off the instrument and then disconnect the electrical cord from the wall outlet. The safety of any system, incorporating this instrument, is the responsibility of the assembler of the system. The user should ensure that the substances placed under test do not release poisonous, toxic or flammable gases at the temperatures to which they are subjected to during the testing. I.7 Instrument Controls The following describes each switch’s function: MOTOR ON Turns the motor ON or OFF.

AUTO RANGE Presentsthe maximum(100%torque)viscosity attainable using the selected spindle at the selected speed. This value is referred to as full scalerange. Theallowableerrorfortheviscosity measurement is ± 1% of full scale range. Note: Pressing and holding the AUTO RANGE key during power on will enable the viscosity display to be read in either CGS (cP) or SI (mPa•s) units. SPEED/SPINDLE SWITCH Setstheviscometerineitherspeedselectorspindle select(seeTableC-1inAppendixC)mode. When set in the left position, the operator may select speed of rotation. When set in the right position, the operator may select spindle. Note: This is a three (3) position switch. We recommend that the switch be set to the Figure I-2 middlepositionwhenfinishedwithspindleorspeedadjustment. Thiswillprevent an accidental change of parameters during a test. SELECT KNOB This knob is used to scroll through the available speed or spindle selections (see Table C-1 in AppendixC). Thisknobisactivewhentheswitchissettotheleft(speed)orright(spindle)position. Rotate the knob clockwise to increase value and counter-clockwise to decrease value. Brookfield Engineering Labs., Inc.

Page 10 Manual No. M98-350-J0912 I.8 Cleaning Make sure the instrument is in a decent working environment (dust-free, moderate temperature, low humidity, etc.). Make sure the instrument is on a level surface. Hands/fingers must be clean and free of residual sample. Not doing so may result in deposit build up on the upper part of the shaft and caue interference between the shaft and the pivot cup. Be sure to remove the spindle from the instrument prior to cleaning. Note lefthand thread. Severe instrument damage may result if cleaned in place. Instrument and Keypad: Clean with dry, non-abrasive cloth. Do not use solvents or cleaners.

Immersed Components (spindles): Spindles are made of stainless steel. Clean with non- abrasiveclothandsolventappropriateforsamplematerial that is not aggressive to immersed components. When cleaning, do not apply excessive force which may result in bending spindles.

Brookfield Engineering Labs., Inc. Page 11 Manual No. M98-350-J0912 II. GETTING STARTED II.1 Power Up Turn the power switch (located on the rear panel) to the ON (I) position. This will result in the following screen display: BROOKFIELD DV-E RV VISCOMETER Figure II-1 After a few seconds, the following screen appears: BROOKFIELD DV-E VERSION: 1.00 Figure II-2 After a short time, the display will clear and the default screen is displayed: cP 10OFF % S02 Figure II-3 II.2 Spindle Selection LVDV-E Viscometers are provided with a set of four spindles and a narrow guardleg; RVDV-E Viscometers come with a set ofsixspindlesanda“wider”guardleg;HADV-EandHBDV-E Viscometers come with a set of six spindles and no guardleg.

(See Appendix F for more information on the guardleg.) Thespindlesareattachedtotheviscometerbyscrewingthemto the male coupling nut (see Figure II-4). Note that the spindles and coupling have a left-hand thread. The lower shaft should be held in one hand (lifted slightly), and the spindle screwed to the left. The face of the spindle nut and the matching surface onthecouplingnutshaftshouldbesmoothandcleantoprevent eccentric rotation of the spindle. Spindles can be identified by the number on the side of the spindle coupling nut. The DV-E musthaveaSpindleEntryCodenumbertocalculate viscosity values. The DV-E memory contains parameters for all standard Brookfield spindles and the two digit entry code for each spindle (the complete list of spindle entry codes may be found in Appendix C). Note: The DV-E will display the Spindle Entry Code which was in use when the power was turned off. Figure II-4 Brookfield Engineering Labs., Inc. Page 12 Manual No. M98-350-J0912