ISO 9001:2008 CERTIFIED
BROOKFIELD AMETEK

Small Sample Adapter
Assembly & Operating Instructions

These instructions apply to both the Standard Coupling Nut and EZ-Lock Coupling for Spindle Connection.

This instruction sheet applies to the Small Sample Adapter with stainless steel chamber (with black water jacket) as well as disposable sample chamber (with gray water jacket) that will be used with either the Standard spindle coupling nut or the EZ-Lock spindle coupling system. Spindles that can be used with the Small Sample Adapter are identified in Tables 2 and 4.

1. Mount the viscometer securely on its laboratory stand per the operating instructions that came with the laboratory stand.

2. Attach the locating channel (alignment bracket) to the viscometer (refer to illustration on pages 2 and 3) by threading the mounting screw into the tapped hole in the Viscometer pivot cup. **Do not overtighten.** Note the position of the locating pin.

3. Connect a length of 1/4 or 5/16 inch inside-diameter hose from the circulating bath outlet to the lower (inlet) fitting on the water jacket. Connect another length of hose from the upper (outlet) fitting to the bath (inlet) fitting. Hoses should be long enough to allow proper flow to the water jacket without exerting any "side thrust" on the assembly during operation. Minimum temperature is 0°C and maximum temperature is 100°C; over 60°C, use high temperature tubing. For tubing and fluid recommendations, see Table 1.

Table 1
Tubing Specification

Fluid Temperature	Recommended Fluid	Recommended Tubing	Note
-10°C to 15°C	50/50 Ethylene Glycol/Water[1]	Fluran[R,2] (black) Part No. ULA-45B	Do Not Use Gum Rubber Tubing with This Fluid
15°C to 65°C	Water	Gum Rubber (amber) or Fluran[R] (black) Part No. HT-TUBING	
65°C to 100°C	Silicone Oil[3]	Fluran[R] (black) Part No. ULA-45B	Do Not Use Gum Rubber Tubing with This Fluid

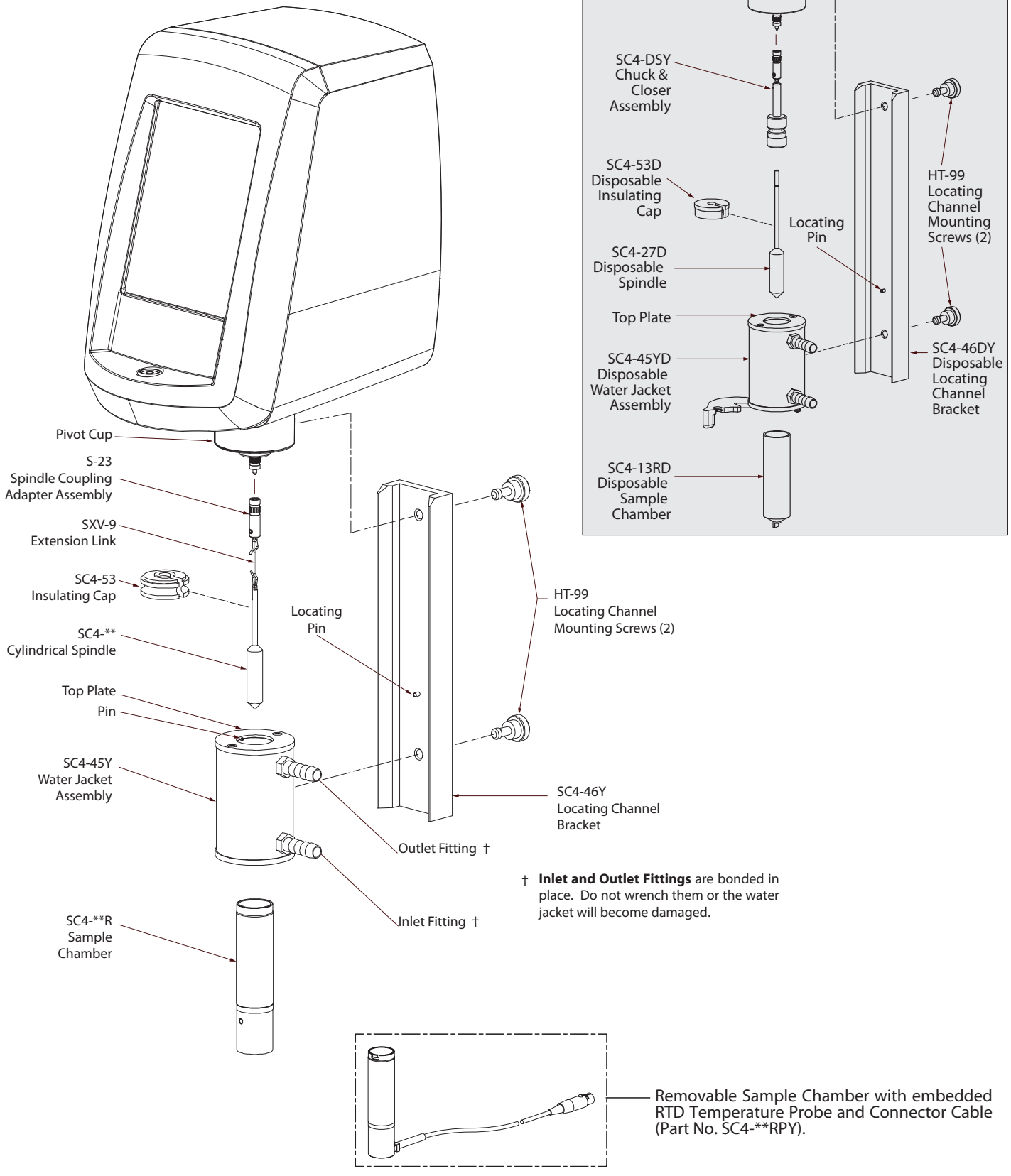
[R] Fluran is a registered trademark of Norton Co.
[1] Use only laboratory grade ethylene glycol. Do not use automobile anti-freeze which contains materials that can damage the equipment.
[2] Fluran tubing (5/16-inch ID) and clamps are offered in a kit, Part ULA-54A.
[3] Do not use high viscosity oil. Recommended fluid is 50 centipoise.

4. Attach the water jacket to the locating channel with the mounting screw. **Do not overtighten**. The top plate of the water jacket should contact the locating pin when ready to begin viscosity testing.

5. Load the removable sample chamber with the specified amount of sample fluid (refer to Table 2) by leaning the chamber at a 45° angle and pouring the sample fluid slowly down the inside wall of the chamber to avoid air bubble entrapment. **The sample fluid must be bubble-free to ensure an accurate reading**.

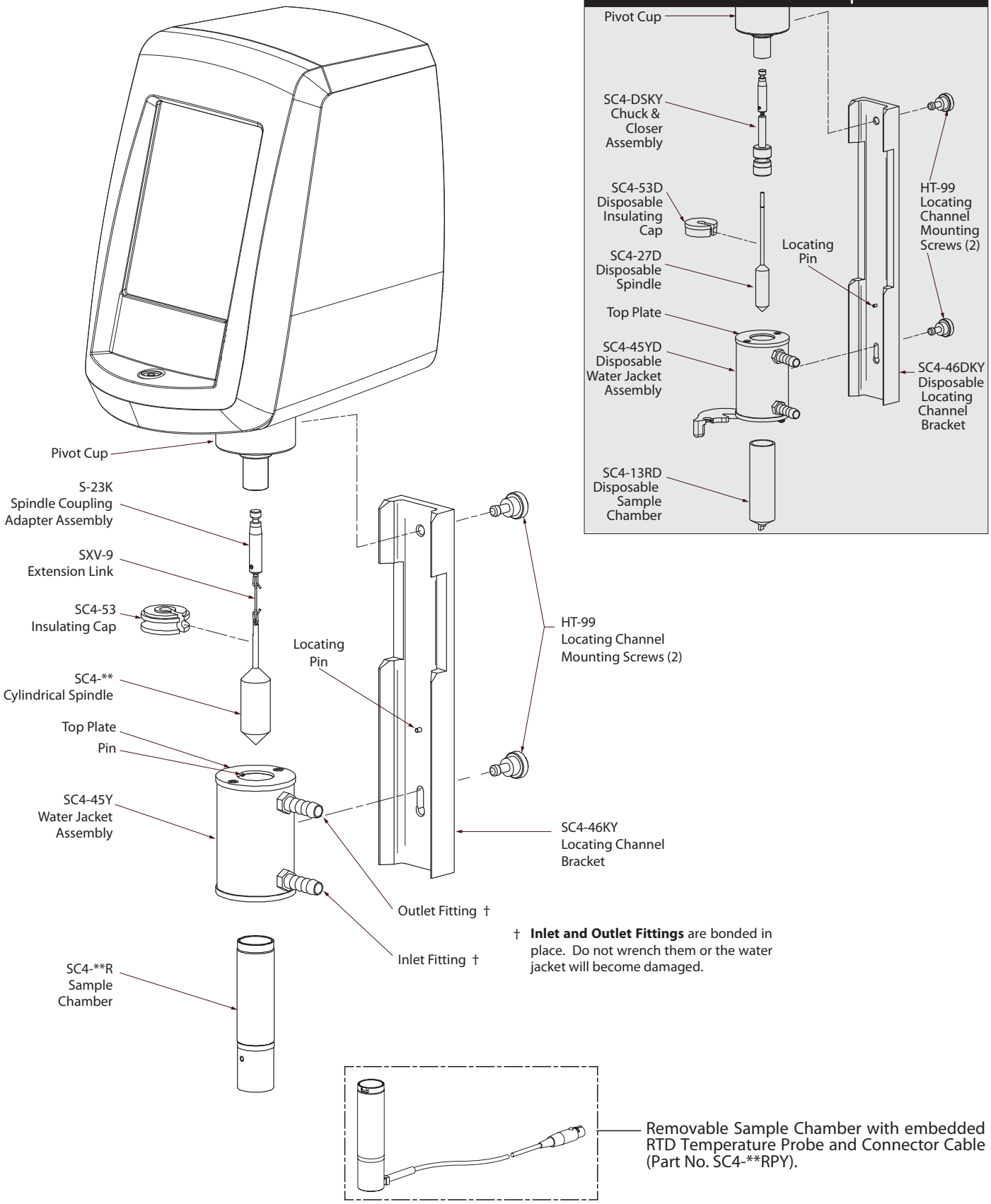
Small Sample Adapter

(Shown on DV2T Viscometer - similar assembly on Dial, DV-E, DV-I Prime and DV3T Viscometers/Rheometers)



Small Sample Adapter with EZ-Lock System

(Shown on DV2T Viscometer - similar assembly on Dial, DV-E, DV-I Prime and DV3T Viscometers/Rheometers)



† **Inlet and Outlet Fittings** are bonded in place. Do not wrench them or the water jacket will become damaged.

Removable Sample Chamber with embedded RTD Temperature Probe and Connector Cable (Part No. SC4-**RPY).

Table 2

Small Sample Adapter Viscosity Ranges cP(mPa•s)

MODEL	Spindle: SC4-18 Sample Chamber: * SC4-13R(P) Sample Volume: 6.7mL Shear Rate (sec⁻¹): 1.32N	Spindle: SC4-31 Sample Chamber: * SC4-13R(P) Sample Volume: 9.0mL Shear Rate (sec⁻¹): .34N	Spindle: SC4-34 Sample Chamber: * SC4-13R(P) Sample Volume: 9.4mL Shear Rate (sec⁻¹): .28N	Spindle: SC4-16 Sample Chamber: * SC4-6R(P) Sample Volume: 4.2mL Shear Rate (sec⁻¹): .29N	Spindle: SC4-25 Sample Chamber: * SC4-13R(P) Sample Volume: 16.1mL Shear Rate: (sec⁻¹): .22N	Spindle: SC4-21 Sample Chamber: * SC4-13R(P) Sample Volume: 7.1mL Shear Rate (sec⁻¹): .93N	Spindle: SC4-27(D) Sample Chamber: * SC4-13R(P) Sample Volume: 10.4mL Shear Rate (sec⁻¹): .34N	Spindle: SC4-15 Sample Chamber: * SC4-7R(P) Sample Volume: 3.8mL Shear Rate (sec⁻¹): .48N	Spindle: SC4-28 Sample Chamber: * SC4-13R(P) Sample Volume: 11.0mL Shear Rate (sec⁻¹): .28N	Spindle: SC4-29 Sample Chamber: * SC4-13R(P) Sample Volume: 13.5mL Shear Rate (sec⁻¹): .25N	Spindle: SC4-14 Sample Chamber: * SC4-6R(P) Sample Volume: 2.1mL Shear Rate (sec⁻¹): .40N
LVDV-IIIU	1.2-30K	12-300K	24-600K	48-1.2M	192-4.8M	Not applicable for historical reasons. However, it is possible					
LVDV-II+P	1.5-30K	15-300K	30-600K	60-1.2M	240-4.8M	to use the above spindles with any of these instruments.					
LVDV-IP	3-10K	30-100K	60-200K	120-400K	800-1.6M	Digital Viscometers/Rheometers will automatically calculate					
LVDVE	3-10K	30-100K	60-200K	120-400K	800-1.6M	viscosity. Please contact Brookfield or an authorized dealer					
LVT	5-10K	50-100K	100-200K	200-400K	800-1.6M	if you require information on viscosity range.					
RVDV-IIIU						20-500K	100-2.5M	200-5M	200-5M	400-10M	500-12.5M
RVDV-II+P						25-500K	125-2.5M	250-5M	250-5M	500-10M	625-12.5M
RVDV-IP						50-170K	250-830K	500-1.7M	500-1.7M	1K-3.3M	1.25K-4.2M
RVDVE		Not applicable for historical reasons.				50-170K	250-830K	500-1.7M	500-1.7M	1K-3.3M	1.25K-4.2M
RVT		However, it is possible to use the above				50-100K	250-500K	500-1M	500-1M	1K-2M	1.25K-2.5M
HADV-IIIU		spindles with any of these instruments.				40-1M	200-5M	400-10M	400-10M	800-20M	1K-25M
HADV-II+P		Digital Viscometers/Rheometers will				50-1M	250-5M	500-10M	500-10M	1K-20M	1.25K-25M
HADV-IP		automatically calculate viscosity. Please				100-300K	500-1.7M	1K-3.3M	1K-3.3M	2K-6.7M	2.5K-8.3M
HADVE		contact Brookfield or an authorized dealer if				100-300K	500-1.7M	1K-3.3M	1K-3.3M	2K-6.7M	2.5K-8.3M
HAT		you require information on viscosity range.				100-200K	500-1M	1K-2M	1K-2M	2K-4M	2.5K-5M
HBDV-IIIU						160-4M	800-20M	1.6K-40M	1.6K-40M	3.2K-80M	4K-100M
HBDV-II+P						200-4M	1K-20M	2K-40M	2K-40M	4K-80M	5K-100M
HBDV-IP						400-1.3M	2K-6.7M	4K-13.3M	4K-13.3M	8K-26.7M	10K-33.3M
HBDVE						400-1.3M	2K-6.7M	4K-13.3M	4K-13.3M	8K-26.7M	10K-33.3M
HBT						400-800K	2K-4M	4K-8M	4K-8M	8K-16M	10K-20M

M = 1 million K = 1 thousand N = RPM e.g. Spindle SC4-18 1.32 x 10 (rpm) = 13.2 sec-1 cP = Centipoise mPa•s = Millipascal•seconds

N/A = Not applicable for historical reasons. However, it is possible to use any spindle/chamber combination with any torque range. Digital viscometers/rheometers will automatically calculate viscosity.

* Examples

SC4-13R Sample Chamber

SC4-13RPY Sample Chamber with RTD temperature probe and cable to viscometer/rheometer

SC4-27 Stainless Steel Spindle

SC4-13RP Sample Chamber with RTD temperature probe

SC4-13RD-100 Disposable Sample Chamber available in packages of 100

SC4-27D Disposable Spindle

** Disposable chamber available in 13R size and requires SC4-45YD water jacket

Note: Hastelloy C available for some spindles/chambers - call for details

6. *Stainless Steel Sample Chambers:* Carefully guide the sample chamber into the water jacket from the bottom until it contacts the metal pin in the jacket top plate. Rotate the chamber until the pin engages the slot in the side of the chamber. Raise the chamber and rotate counterclockwise (as viewed from the top) until it stops. Release the chamber, allowing it to drop and lock into place. Attach the connector cable from the viscometer head to the chamber, if there is an embedded temperature probe in the chamber.

   Disposable Sample Chambers (Part No. SC4-13RD-100): Carefully guide the sample chamber into the water jacket from the bottom until it is inserted high enough to allow closing of the latch at the bottom of the water jacket. Be sure the latch closes completely, engaging the positive snap lock. Rotate the sample chamber until it drops into the locked position where the flat side of the pin at the bottom of the sample chamber engages a flat side of the latch. This prevents the chamber from turning with the spindle during sample measurements.

   Note: Disposable sample chambers, available in packages of 100 chambers, are replacements for SC4-13R sample chambers only.

7. Assemble the spindle, extension link and Coupling Adapter. Slowly lower the spindle into the sample fluid. Attach the Coupling Adapter to the viscometer. Position the insulating cap on the sample chamber, if desired.

   Note: 1. Spindles SC4-14, 15, 16, 21, 25Z, 27 and 29 as well as EZ-Lock spindles SC4-14K, 15K, 16K, 21K, 25KZ, 27K and 29K have solid shafts and do not require a link or a coupling adapter assembly.
   2. For EZ-Lock spindles, they are installed before the water jacket is attached.
   2. Optional #316 stainless steel spindles and chambers are available for acidic or corrosive samples. Contact AMETEK Brookfield or your local authorized dealer.
   3. Disposable spindle SC4-27D can be used with Alignment Bracket SC4-46DY (EZ-Lock part number SC4-46DKY) and Chuck Closer SC4-DSY (EZ-Lock part number SC4-DSKY).

8. Level the Viscometer. General operating procedures and spindle entry codes are described in the Viscometers' instruction manual.

9. Spindle factors for the Small Sample Adapter are shown in Table 3. The spindle factor enables the operator using a Dial Reading Viscometer to convert the torque reading to a viscosity reading in centipoise. The spindle factor, when multiplied by 100, defines the maximum viscosity in cP that can be measured.

Table 3

Spindle Factors for Small Sample Adapter
When Used with Dial Reading Viscometer

LV VISCOMETERS

SPEED RPM	SPINDLE NUMBERS				
	18	31	34	16	25
60	0.5	5	10	20	80
30	1	10	20	40	180
12	2.5	25	50	100	400
6	5	50	100	200	800
3	10	100	200	400	1.6K
1.5	20	200	400	800	3.2K
0.6	50	500	1K	2K	8K
0.3	100	1K	2K	4K	16K

RV VISCOMETERS

SPEED RPM	SPINDLE NUMBERS					
	21	27	28	29	14	15
100	5	25	50	100	125	50
50	10	50	100	200	250	100
20	25	125	250	500	625	250
10	50	250	500	1K	1.25K	500
5	100	500	1K	2K	2.5K	1K
4	125	625	1.25K	2.5K	3.125K	1.25K
2.5	200	1K	2K	4K	5K	2K
2	250	1.25K	2.5K	5K	6.25K	2.5K
1	500	2.5K	5K	10K	12.5K	5K
0.5	1K	5K	10K	20K	25K	10K

HA VISCOMETERS

SPEED RPM	SPINDLE NUMBERS					
	21	27	28	29	14	15
100	10	50	100	200	250	100
50	20	100	200	400	500	200
20	50	250	500	1K	1.25K	500
10	100	500	1K	2K	2.5K	1K
5	200	1K	2K	4K	5K	2K
2.5	400	2K	4K	8K	10K	4K
2	500	2.5K	5K	10K	12.5K	5K
1	1K	5K	10K	20K	25K	10K
0.5	2K	10K	20K	40K	50K	20K

HB VISCOMETERS

SPEED RPM	SPINDLE NUMBERS					
	21	27	28	29	14	15
100	40	200	400	800	1K	400
50	80	400	800	1.6K	2K	800
20	200	1K	2K	4K	5K	2K
10	400	2K	4K	8K	10K	4K
5	800	4K	8K	16K	20K	8K
2.5	1.6K	8K	16K	32K	40K	16K
2	2K	10K	20K	40K	50K	20K
1	4K	20K	40K	80K	100K	40K
0.5	8K	40K	80K	160K	200K	80K

K = 1000

To calculate viscosity in centipoise (cP), multiply the dial reading or % torque by the factor corresponding to the viscometer spindle and speed used.

Example: **Spindle SC4-34**
30 RPM
LV Viscometer
Factor = 20
Measured Torque = 75%
Viscosity = 75 x 20 = 1500 cP

10. Clean the spindle and chamber using appropriate cleaning solutions.

Note: The black insulating bottom of the sample chamber should not be exposed to strong solvents such as methanol, toluene, ammonia and 111 trichloroethylene. Do not totally immerse the chamber in any cleaning solution. Improper cleaning may result in separation of the black insulation from the chamber.

Table 4

DIN* Spindle Ranges for Small Sample Adapter

MODEL	VISCOSITY RANGE (cP)			
	Spindle 82		Spindle 83	
	Minimum	- Maximum	Minimum	- Maximum
LVT	5.7	10,000	18.9	37,898
LVDV-I+	3.5	10,000	11.3	37,898
LVDV-II+	1.7	10,000	5.7	50,000
LVDV-III	1.4	10,000	4.5	50,000
RVT	36.5	10,000	121.0	50,000
RVDV-I+	37.5	10,000	121.0	50,000
RVDV-II+	18.7	10,000	60.5	50,000
RVDV-III	15.0	10,000	48.3	50,000
HAT	75.0	10,000	242.0	50,000
HADV-I+	75.0	10,000	242.0	50,000
HADV-II+	37.5	10,000	121.0	50,000
HADV-III	29.2	10,000	97.0	50,000
HBT	300	10,000	967.2	50,000
HBDV-I+	300	10,000	967.2	50,000
HBDV-II+	150	10,000	483.6	50,000
HBDV-III	120	10,000	387	50,000

SMC value	3.75	12.13
SRC value	1.29	1.29
Spindle Entry Code	82	83
Sample Volume (mL)	5.5	1.5

*DIN spindles conform to DIN 53019.
The 82 spindle (SC4-DIN-82) works in an SC4-13R or SC4-13RP chamber.
The 83 spindle (SC4-DIN-83) works in an SC4-7R or SC4-7RP chamber.