

Model **TV-25/35** Viscometer



responding swiftly to your needs

 **TOKI SANGYO**

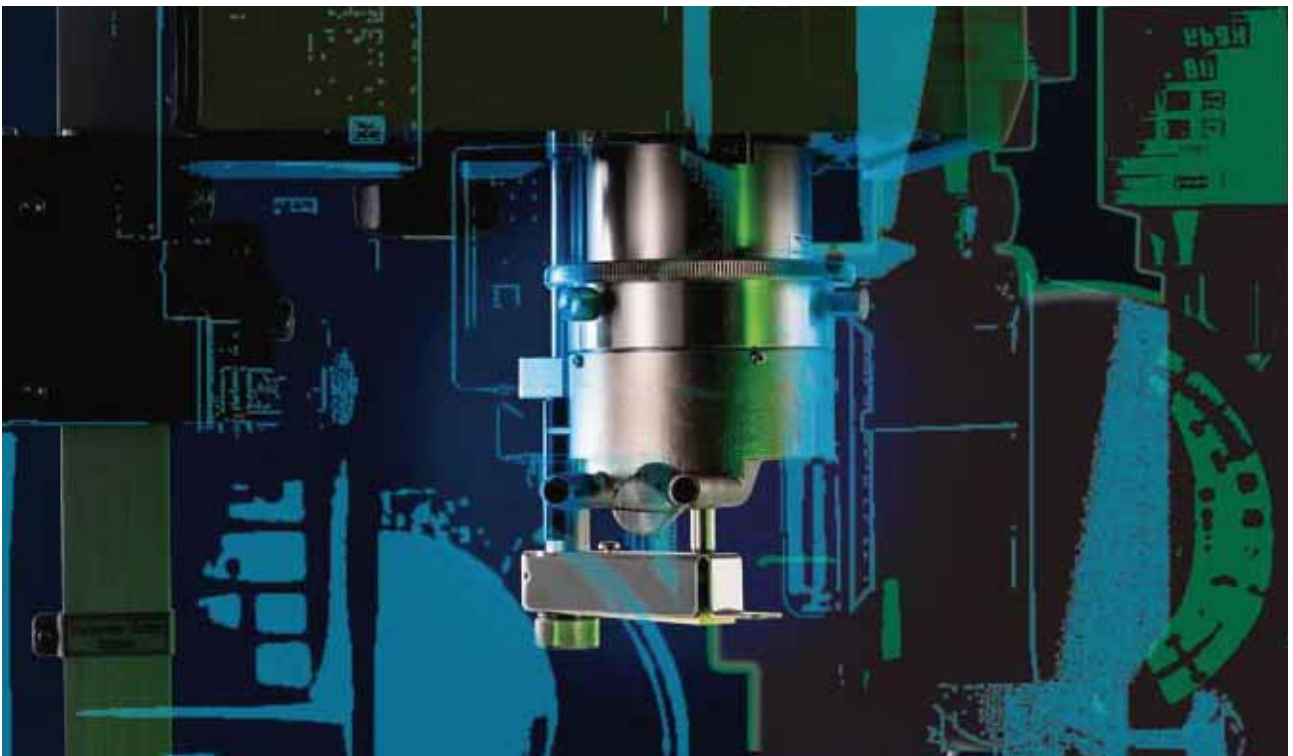
Getting a program measurement more easy-to-use by auto-range^(*) making the best use of dynamic range.

Superior linearity and repeatability actualize by a design which incorporates a unique combination of a “Pivotless Mechanism” with a “Torque Balance Servo Method”

“Pivotless Mechanism” not to use a jewel bearing insures a dependable measurement result superior to linearity and repeatability in a wide measurement range.

The power of Model TV-25/35 lies in its multi-range capability which enables a eight-fold expand and measure a viscosity continuously without changing a rotor.

Users will also be impressed with the Model's cost performance ability of efficient measurement in combination with Program measurement and Auto-range measurement functions.



Features

Features of main function

● Torque balance servo system

The TV-25/35 employs the “zero method” of measurement structured on a torque balance servo system provides for superior linearity in a wide measurement range, does not detract from repeatability.

● Multi-range function

The TV-25/35's dynamic range function permits wide-range measurement which enables an eight-fold expand (*2) and measure a viscosity continuously without changing a rotor.

● Pivotless mechanism

A pivotless arrangement which employs a flexible hinge replaces the traditional pivot and jewel bearing mechanism. This eliminates parts wear and insures that the instrument's high initial repeatability is maintained over time.

Features of TV-35

● Program measurement

The TV-35 enables set 40 steps at maximum in program measurement. User can make choices of RETURN and REPEAT measurement modes.

● Auto range

The TV-35 switches each measurement range automatically and measures a viscosity, making use of multi-range function. In combination with program function, user can measure a viscosity efficiently.

● Thixotropic coefficients measurement function (STI value measurement)

This function calculates and displays the ratio of two viscosity values as measured in the programmed measurement mode.

TI value indicates a ration of two viscosities at any two rotational speeds, in general set any rotational speed at 1:10

Common Features of TV-25 / TV-35

● Rotational speed

Users can set a rotational speed from 0.1 rpm to 100.0 rpm per 0.1 rpm.

● Auto zero-User span

This function let users calibrate a viscometer and correct unit-to-unit variables easily.

● Measurement conditions memorized function

This function can memorize 5 patterns of measurement conditions in manual, auto-stop(Time • Visco), program mode(*1)each.

● Autostop Function

Measurement is automatically terminated at a prescribed time or when the liquid measured attains a preset viscosity.

● Remote control function

To start and stop the main unit can be operated by outer signal(dry contact). And using out put signal (open collector), the situation of viscometer can be confirmed by buzzer and lamp.

● Upper and lower limit warning

This function informs users with buzzer as a viscosity exceeds an upper or lower viscosity prescribed beforehand.

● Preheat function

Viscosity measurement can be automatically started at a pre-selected time to allow for a preheat “Waiting” period.

● Data interchangeability

Data is cross compatible with that of conventional viscometers, conforms JIS and ISO standards.

* Note1): Function of Model TV-35 * Note2): Ratio of torque in U range to H.



Model **TV-25** Viscometer

There are 2 types of TV25 features a multi-range function, B type (spindle type) and E type (Cone-plate type) that only needs small amount of 1ml (*3)

* Note3): In case of standard cone rotor (1°34'xR24)

Model **TV-35** Viscometer

TV35 features a program and multi-range function, meets various fluid, measurement requirements and measures a viscosity efficiently. Setting a rotational speed per 0.1rpm expands measurement range.



Specifications

	TV-25	TV-35
Rotational Speed	0, 0.1 ~ 100.0 rpm	
Steps	1,001 Steps per 0.1rpm	
Measurement Mode	Manual, Auto-Stop Time, Auto-Stop Viscosity	Manual, Auto-Stop Time, Auto-Stop Viscosity Program (40 steps at maximum)
Measurement Memory	5 Patterns in each mode	
Measurement Range	Refer to the following measurement range table	
Viscosity Display	% / mPa·s / Pa·s / kPa·s (cP/P switching possible)	
Accuracy	less than ± 1.0 % of Full Scale (*4)	
Repeatability	less than ± 0.2 % of Full Scale	
Sample Measurement Range	10 – 60	
Digital Output	RS232C, USB	
Input Signal	Start Signal (Non-voltage contact)	
Output Signal	On measuring signal, Buzzer signal, Measuring stop signal (In case of Auto-Stop Mode) *All output signals are open collector	
Ambient Temperature Range	0 – 40	
Ambient Humidity	less than 90% Relative Humidity (Non condensation)	
Power	AC100 ~ 230V, 50/60Hz (Standard power cable is only available for AC125V) (*5)	
Power consumption	less than 20 VA	
Wetted Material	Stainless Steel	
Dimension of main unit	105(W)x 220(D)x 320(H)mm	
Dimension of roller stand	290(W)x 300(D)x 430(H)mm	
Weight	Spindle type(TVB type)Approximate 8.0 kg including roller stand set Cone-Plate type(TVE type)Approximate 9.0kg including roller stand set	

* Note 4) : In case of use of TM1, TH2, Standard cone rotor (1°34'xR24) * Note 5) : In case a voltage exceeds rating voltage of AC125V, please prepare a power cable separately.

Viscosity Measurement Range

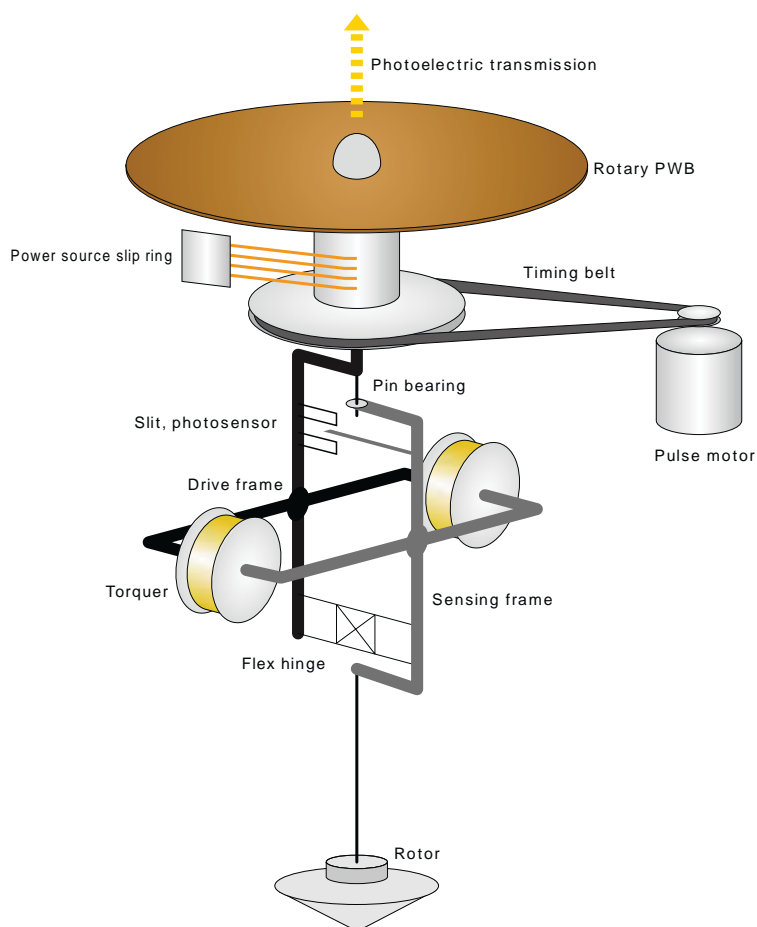
Types	Measurement Range	Full-Scale Torque ($\mu\text{N}\cdot\text{m}$)	Viscosity Measurement Range (mPa·s)
TVB-25L TVB-35L	M	67.37	15 ~ 6,000,000
			(1 ~ 600,000) (*6)
	2.5M	168.4	25 ~ 15,000,000
	5M	336.9	50 ~ 30,000,000
TVB-25H TVB-35H	H	718.7	100 ~ 40,000,000 (*7)
	R	1437.4	100 ~ 80,000,000 (*7)
	U	5749.6	400 ~ 320,000,000 (*7)
	S	2156.1	150 ~ 120,000,000 (*7)
TVE-25L TVE-35L	M	67.37	0.608 ~ 6,076 (*8)
	2.5M	168.4	1.52 ~ 15,190 (*8)
	5M	336.9	3.04 ~ 30,380 (*8)
TVE-25H TVE-35H	H	718.7	6.48 ~ 64,820 (*8)
	R	1437.4	13.0 ~ 129,600 (*8)
	U	5749.6	51.9 ~ 518,500 (*8)

* Note 6) : In case of attaching an optional L-Adaptor set.

* Note 7) : In case of attaching a TH1 rotor.

* Note 8) : In case of use of standard cone rotor (1°34'xR24). Please refer to Upper measurement range table to know each measurement range of optional cone rotors.

Principle of Operation



At the heart of TV25/35 is the sensing frame which is linked to the drive frame via a flexi hinge (flat spring joint). The flex hinge allows small angular deflection (oscillation) of the sensing frame relative to the drive frame.

As the drive frame, sensing frame and rotor rotate, viscous torque acts on the rotor immersed in the sample liquid. This force twists the sensing frame and deflects the flex hinge from its zero position.

A servo amplifier mounted to the top of the drive frame outputs a feedback current to the torquers which is proportional to the amount of deflection (voltage change) picked up by the photosensors. The torquers exert a force on the sensing frame which returns it to a position where photo sensor voltage becomes zero and maintains zero deflection ("null method"). The feedback current is precisely proportional to viscous torque and functions as the viscosity output signal.

Configurations

Items	Model / Spindle Type		Model / Cone-Plate Type	
	TVB-25L TVB-35L	TVB-25H TVB-35H	TVE-25L TVE-35L	TVE-25H TVE-35H
Measurement range	Low viscosity range	High viscosity range	Low viscosity range	High viscosity range
Instrument configuration				
Viscometer Main Unit				
Rotor Set	TM Rotor Set(4pcs) (TM1 ~ TM4)	TH Rotor Set(6pcs) (TH2 ~ TH7)	Standard Cone Rotor	Standard Cone Rotor
Rotor Stand				
Sample Cup Base				
Guard	TM Guard	TH Guard		
Roller Stand Set				
Carrying Case(main unit)				
Carrying Case(rotor)				
Other Standard Accessories				

Standard Accessories



TM Rotor Set for TVB-L type TM Guard



Standard Cone Rotor for TVE type



Roller Stand Set



TH Rotor Set for TVB-H type TH Guard



Carrying Cases

A Variety of Cone Rotor



● Scrolled Parallel Plate (SPP) Rotor Set

SPP is most effective to a high viscous sample produces a slip during measurement and ideal for use in prevention of sample from not being outside forced out of cone rotor by influence of elasticity.

denotes optional accessories * Note9): N denotes a rotational speed.

Cone Rotor	Sample Volume (ml)	Shear Rate (s^{-1})	Viscosity Measurement Range
1° 34' × R24 (Standard)	1.1	3.83N(*9)	Refer to Page 5
1° 34' × R12 ()	0.2	3.83N(*9)	8-fold of standard cone rotor
0.8° × R24 ()	0.6	7.5N(*9)	A half of standard cone rotor
0.8° × R12 ()	0.1	7.5N(*9)	4-fold of standard cone rotor
3° × R24 ()	2.0	2.0N(*9)	2-fold of standard cone rotor
3° × R17.65 ()	0.8	2.0N(*9)	5-fold of standard cone rotor
3° × R14 ()	0.4	2.0N(*9)	10-fold of standard cone rotor
3° × R12 ()	0.3	2.0N(*9)	15-fold of standard cone rotor
3° × R9.7 ()	0.2	2.0N(*9)	30-fold of standard cone rotor
SPP ()	0.3	2.0N(*9)	30-fold of standard cone rotor

Options

● Viscosity Data Input Software [Visco-Viewer]

The TV-25/35 series viscometer runs software and output data to PC's. We highly recommend this software with the TV-25/35 series viscometer.

● Printer

The DPU-414 thermal printer provides hard-copy printouts of measurement data from the TV-25/35 viscometer.



Printing Method	Thermal serial dot
Printing Digits	40 digits
Paper Width	Approx. 90mm
Printing Speed	52.5 cps (Max)
Dimensions	160(W) x 170(D) x 66.5(H) mm
Weight	Approx. 700g (Inc. Battery)
(Thermal Paper)	
Paper Width	112mm
External Diameter	48mm
Length	Approx. 28m

● T-Bar Stage [TS-20]

The T-bar stage enables accurate measurement of substances such as pastes and gels that are subject to structural failures due to yield values and shear characteristics (thixotropic substances, mayonnaise, etc.) and is ideal for use in manufacturing processes and quality control.

The device vertically raises and lowers the sample allowing a "T" shaped spindle (T-bar) to describe a helical path through the sample so that the spindle always comes into contact with fresh parts of the sample. Slipping ("channeling") and thixotropic breakdown of the sample is avoided to provide stable and accurate measurement.



● Temperature Display [TD-100]



Measured Value Display Range	0~100
Display Resolution	0.1
Display Accuracy	±0.6 (±0.3 between 20 and 40)
Ambient Conditions for Use Temperature	0~40
External Dimensions	155(W) x 182(D) x 85(H) mm
Weight	Approx. 650g

● Small Sample Adaptors (Circulator type · Immersion type)

The small sample adaptor is attached to spindle type viscometers to enable viscosity measurement of small volume samples. For small samples (8-13ml), these adaptors must be used in combination with temperature baths for proper temperature control. Temperatures can be regulated quickly due to the small volume of such samples. Circulator or immersion type small sample adaptors can be selected for use with the temperature baths.



Circulator Type



Immersion Type

● Low Viscosity Adaptor



This adaptor for TVB-25/35 Series viscometers enables measurement of low viscosity samples.

● TH1 Rotor

This TH1 rotor is used for TVB-25H/35H viscometers measures high viscosities and allows the extension of the measurement range in the low viscosity range.



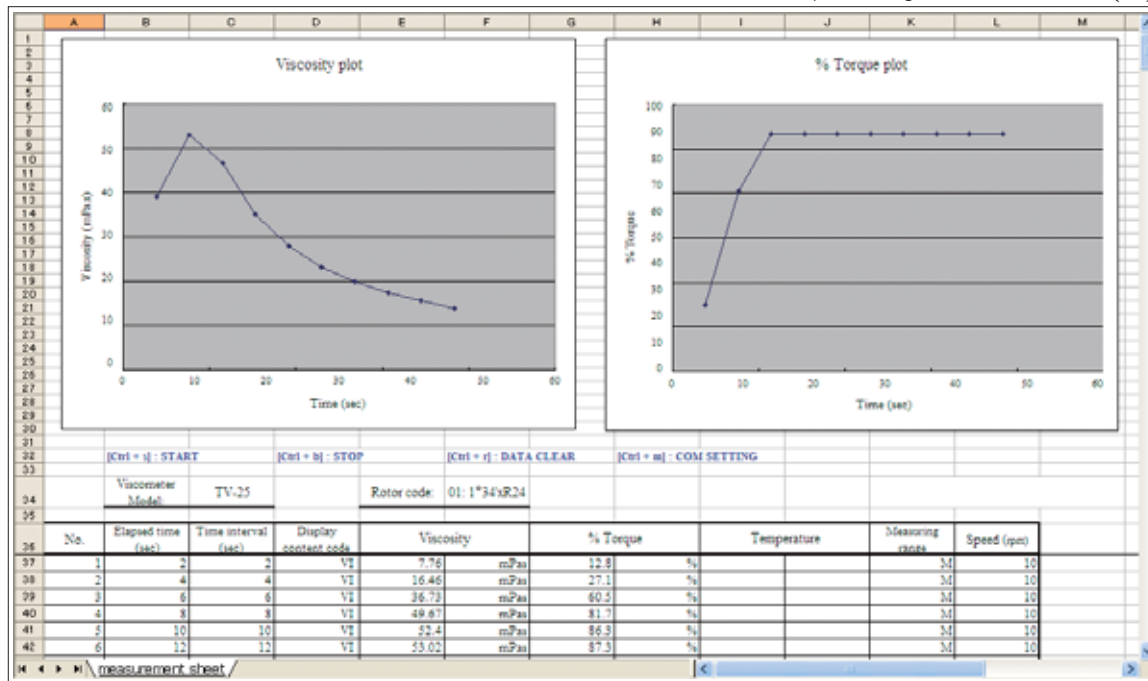
● Temperature baths

These baths control the temperatures of samples and are used in combination with the small sample adaptor.



Software Sample View

Sample showing the use of visco-viewer().



is an optional accessory.

Form of Flow Curve

Newtonian	Non-Newtonian					
	Pseudoplastic (Structural viscosity)	Dilatant	Plastic		Time-Dependent	
			Bingham	Non-Bingham	Thixotropy	Rheopexy
$s = \mu D$ <ul style="list-style-type: none"> Water Solvent Motor oil Vegetable oil Sugar water solution Salt water Liquid paraffin Glycerin Silicone grease Oil-based cosmetics Water-based cosmetics Sodium alginate 	$s = \mu D^n$ $1 > n > 0$ <ul style="list-style-type: none"> Highly polymerized solution and solution Rubber solution Adhesive starch Starch paste Viscose Latex Acetate spinning liquid Emulsion Cellulose lacquer/Vanish Coating/Dye Wax Grease Lard Condensed milk Condensed fruit juice Pulp(Paper) Aluminum soap Gasoline solution 	$s = \mu D^n$ $n > 1$ <ul style="list-style-type: none"> Starch solution Powder solution of mica/quartz Suspension (high concentration) Clay slurry Shifting sand/ Wet seaside sand Coating Carbontetrachloride Chocolate made with buttermilk 	$s = s_0 + \eta_p D$ s_0 : Yield value η_p : Plastic viscosity <ul style="list-style-type: none"> Tomato ketchup Margarine Toothpaste Various slurry Ceramic paste/ Raw china clay Flour water suspension Whipped egg whites Putty Nutritious cream Limecream Konjak flour solution (Good quality) 	$s = s_0 + \eta D^n$ s_0 : Yield value <ul style="list-style-type: none"> Coating Printing ink Mayonnaise Konjak flour solution (High quality) Asphalt Dense suspension 	 <ul style="list-style-type: none"> Coating Cocoa Heavy printing ink Cleansing cream Vanishing cream Clay suspension Grease Toothpaste 	 <ul style="list-style-type: none"> Clay slurry

s: Shear stress N: Rotational speed : Indicated value : Newtonian viscosity μ : Non-Newtonian viscosity coefficient D: Shear rate a: Apparent viscosity(Non-Newtonian) n: Non-Newtonian Viscosity Index
[The source : Shigeharu Onogi, Rheology Theory, 1968]

Upper Measurement Limit Tables (mPa · s)

TVB-25L TVB-35L

Rotational Speed (rpm)

Rotor	60	30	12	6	3	1.5	0.6	0.3
L/Adp	10	20	50	100	200	400	1,000	2,000
No.1	100	200	500	1000	2,000	4,000	10,000	20,000
No.2	500	1,000	2,500	5,000	10,000	20,000	50,000	100,000
No.3	2,000	4,000	10,000	20,000	40,000	80,000	200,000	400,000
No.4	10,000	20,000	50,000	100,000	200,000	400,000	1,000,000	2,000,000

TVB-25L x2.5 TVB-35L x2.5

Rotational Speed (rpm)

Rotor	60	30	12	6	3	1.5	0.6	0.3
L/Adp	25	50	125	250	500	1,000	2,500	5,000
No.1	250	500	1,250	2,500	5,000	10,000	25,000	50,000
No.2	1,250	2,500	6,250	12,500	25,000	50,000	125,000	250,000
No.3	5,000	10,000	25,000	50,000	100,000	200,000	500,000	1,000,000
No.4	25,000	50,000	125,000	250,000	500,000	1,000,000	2,500,000	5,000,000

TVB-25L x5 TVB-35L x5

Rotational Speed (rpm)

Rotor	60	30	12	6	3	1.5	0.6	0.3
L/Adp	50	100	250	500	1,000	2,000	5,000	10,000
No.1	500	1,000	2,500	5,000	10,000	20,000	50,000	100,000
No.2	2,500	5,000	12,500	25,000	50,000	100,000	250,000	500,000
No.3	10,000	20,000	50,000	100,000	200,000	400,000	1,000,000	2,000,000
No.4	50,000	100,000	250,000	500,000	1,000,000	2,000,000	5,000,000	10,000,000

TVE-25L TVE-35L

Rotational Speed (rpm)

Cone Rotor	100	50	20	10	5	2.5	1	0.5
1°34'xR24	6.076	12.15	30.38	60.76	121.5	243.0	607.6	1,215
48°xR24	3.103	6.206	15.52	31.03	62.06	124.1	310.3	620.6
3°xR17.65	29.25	58.50	146.3	292.5	585.0	1,170	2,925	5,850
3°xR14	58.61	117.2	293.1	586.1	1,172	2,344	5,861	11,720
3°xR12	93.08	186.2	465.4	930.8	1,862	3,723	9,308	18,620
3°xR9.7	176.2	352.4	881.0	1,762	3,524	7,048	17,620	35,240

TVE-25L x2.5 TVE-35L x2.5

Rotational Speed (rpm)

Cone Rotor	100	50	20	10	5	2.5	1	0.5
1°34'xR24	15.19	30.38	75.95	151.9	303.8	607.6	1,519	3,038
48°xR24	7.758	15.52	38.79	77.58	155.2	310.3	775.8	1,552
3°xR17.65	73.13	146.3	365.7	731.3	1,463	2,925	7,313	14,630
3°xR14	146.5	293.0	732.5	1,465	2,930	5,860	14,650	29,300
3°xR12	232.7	465.4	1,164	2,327	4,654	9,308	23,270	46,540
3°xR9.7	440.5	881.0	2,203	4,405	8,810	17,620	44,050	88,100

TVE-25L x5 TVE-35L x5

Rotational Speed (rpm)

Cone Rotor	100	50	20	10	5	2.5	1	0.5
1°34'xR24	30.38	60.76	151.9	303.8	607.6	1,215	3,038	6,076
48°xR24	15.52	31.04	77.60	155.2	310.4	620.8	1,552	3,104
3°xR17.65	146.3	292.6	731.5	1,463	2,926	5,852	14,630	29,260
3°xR14	293.1	586.2	1,466	2,931	5,862	11,720	29,310	58,620
3°xR12	465.4	930.8	2,327	4,654	9,308	18,620	46,540	93,080
3°xR9.7	881.0	1,762	4,405	8,810	17,620	35,240	88,100	176,200

TVB-25H
TVB-35H

Rotational Speed (rpm)

Rotor	100	50	20	10	5	2.5	1	0.5
No.1	100	200	500	1,000	2,000	4,000	10,000	20,000
No.2	400	800	2,000	4,000	8,000	16,000	40,000	80,000
No.3	1,000	2,000	5,000	10,000	20,000	40,000	100,000	200,000
No.4	2,000	4,000	10,000	20,000	40,000	80,000	200,000	400,000
No.5	4,000	8,000	20,000	40,000	80,000	160,000	400,000	800,000
No.6	10,000	20,000	50,000	100,000	200,000	400,000	1,000,000	2,000,000
No.7	40,000	80,000	200,000	400,000	800,000	1,600,000	4,000,000	8,000,000

TVB-25H(R)
TVB-35H(R)

Rotational Speed (rpm)

Rotor	100	50	20	10	5	2.5	1	0.5
No.1	200	400	1,000	2,000	4,000	8,000	20,000	40,000
No.2	800	1,600	4,000	8,000	16,000	32,000	80,000	160,000
No.3	2,000	4,000	10,000	20,000	40,000	80,000	200,000	400,000
No.4	4,000	8,000	20,000	40,000	80,000	160,000	400,000	800,000
No.5	8,000	16,000	40,000	80,000	160,000	320,000	800,000	1,600,000
No.6	20,000	40,000	100,000	200,000	400,000	800,000	2,000,000	4,000,000
No.7	80,000	160,000	400,000	800,000	1,600,000	3,200,000	8,000,000	16,000,000

TVB-25H(U)
TVB-35H(U)

Rotational Speed (rpm)

Rotor	100	50	20	10	5	2.5	1	0.5
No.1	800	1,600	4,000	8,000	16,000	32,000	80,000	160,000
No.2	3,200	6,400	16,000	32,000	64,000	128,000	320,000	640,000
No.3	8,000	16,000	40,000	80,000	160,000	320,000	800,000	1,600,000
No.4	16,000	32,000	80,000	160,000	320,000	640,000	1,600,000	3,200,000
No.5	32,000	64,000	160,000	320,000	640,000	1,280,000	3,200,000	6,400,000
No.6	80,000	160,000	400,000	800,000	1,600,000	3,200,000	8,000,000	16,000,000
No.7	320,000	640,000	1,600,000	3,200,000	6,400,000	12,800,000	32,000,000	64,000,000

TVE-25H
TVE-35H

Rotational Speed (rpm)

Cone Rotor	100	50	20	10	5	2.5	1	0.5
1°34'xR24	64.82	129.6	324.1	648.2	1,296	2,593	6,482	12,960
48°xR24	33.10	66.20	165.5	331.0	662.0	1,324	3,310	6,620
3°xR17.65	312.1	624.2	1,561	3,121	6,242	12,480	31,210	62,420
3°xR14	625.3	1,251	3,127	6,253	12,510	25,010	62,530	125,100
3°xR12	992.9	1,986	4,965	9,929	19,860	39,720	99,290	198,600
3°xR9.7	1,880	3,760	9,400	18,800	37,600	75,200	188,000	376,000

TVE-25H(R)
TVE-35H(R)

Rotational Speed (rpm)

Cone Rotor	100	50	20	10	5	2.5	1	0.5
1°34'xR24	129.6	259.2	648.0	1,296	2,592	5,184	12,960	25,920
48°xR24	66.19	132.4	331.0	661.9	1,324	2,648	6,619	13,240
3°xR17.65	624.1	1,248	3,121	6,241	12,480	24,960	62,410	124,800
3°xR14	1,251	2,502	6,255	12,510	25,020	50,040	125,100	250,200
3°xR12	1,986	3,972	9,930	19,860	39,720	79,440	198,600	397,200
3°xR9.7	3,760	7,520	18,800	37,600	75,200	150,400	376,000	752,000

TVE-25H(U)
TVE-35H(U)

Rotational Speed (rpm)

Cone Rotor	100	50	20	10	5	2.5	1	0.5
1°34'xR24	518.5	1,037	2,593	5,185	10,370	20,740	51,850	103,700
48°xR24	264.8	529.6	1,324	2,648	5,296	10,590	26,480	52,960
3°xR17.65	2,496	4,992	12,480	24,960	49,920	99,840	249,600	499,200
3°xR14	5,002	10,000	25,010	50,020	100,000	200,100	500,200	1,000,000
3°xR12	7,943	15,890	39,720	79,430	158,900	317,700	794,300	1,589,000
3°xR9.7	15,040	30,080	75,200	150,400	300,800	601,600	1,504,000	3,008,000

denotes optional accessories

Accurate measurement values might not be obtained in the entire area indicated by dark shading or portions of the area indicated by light shading as these areas are subject to turbulent flow.

VISCOMETER



Reflecting our motto, "providing our customers what they want in the format they desire", our development effort is focused on the diverse needs of customers and underscores our ceaseless drive in improving the reliability of viscosity measurement as well as the level of our measurement expertise. As a dedicated manufacturer of rheological equipment, our viscometers are endowed with TOKI SANGYO's wealth of knowhow and depth of experience products which our customers can use with the highest degree of confidence.

This product is certified the compliance of CE mark.

Product specifications and design are subject to change or modification without notice.

⚠ Warning Do not operate equipment in flame or explosion-hazardous location.

⚠ Caution relating to safety Manual should be thoroughly read before use and equipment should be operated and handled in the prescribed correct manner.

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