Reasons for Selecting the " VISCO™ "

Vs B-type Viscometers

What sort of measuring instrument would undoubtedly be found in QC labs and R&D labs of all kinds of industries? It might possibly be a "viscometer." Among these instruments, B-type viscometers are very widespread, and can be found across a range of various industries such as food, chemical, and industrial. It would not be an overstatement to say that they are an indispensable measuring instrument for all manufacturing industries.

B-type viscometers have a long history; the pioneering company that began manufacturing and selling them have a history of more than 70 years. The use of B-type viscometers is largely demanded by industrial type regulations. However, since they are old instruments, the standards they are used to determine are also old and have remained unchanged, resulting in the present situation wherein users are bound by old standards.

When it comes to important aspects of measurement, accuracy and precision is of course first and foremost, but convenience is also an element that must not be overlooked. It improves productivity by enhancing workers' efficiency, and it is an aspect that is sought after for instilling motivation toward measurement and for safe, reliable measurement. This situation has led to the continued traditional use of B-type viscometers since the past. Standards that have become commonly accepted for no reason as "the norm" has resulted in essential improvements that should be made being put aside, and has bred an unfortunate state where workers have "normalized inconvenience."

In the world of B-type viscometers, this "measurement based on the measuring instrument" sort of condition has been going on since the past. One factor that can surely be pointed out as having contributed to this state is the fact that from a global perspective, the market is dominated by 1 company. As long as their instrument is selling well, they do not place any importance on improving the nature of the industry.

In order to overthrow the present situation, other viscometer manufacturers must take action. For this very reason, ATAGO has developed the VISCO. Through the pursuit of the essence of "a convenient and easy to use instrument for workers," the VISCO was developed with the intent to spark innovation in

the world of viscosity measurement.

In comparison, the VISCO surpasses B-type viscometers in the following points.

【1】Same Measurement Principle

It may be paradoxical, but the fact that the VISCO utilizes the same measurement principle as B-type viscometers, yet surpasses them is a major feature of the VISCO. For those who prefer measurement principles different from B-type viscometers, many kinds of viscometers exist that are capable of simple, quick measurements. However, among all those types, it is difficult to obtain the same stable, steady measurements as with B-type viscometers. Details will be further explained in the following section, Vs Viscometers Utilizing Other Measurement Principles. The fact that simple, quick measurements have been made possible while utilizing the same "rotational" measurement principle as B-type viscometers is a revolutionary aspect of the VISCO.

【2】Reduced Size / Reduced Required Space

Comparison of the VISCO's size using ATAGO's B-type viscometer as an example.

	VISCO	B-type Viscometer
Dimensions	120mm * 120mm * 200mm	310mm * 318mm * 395mm
Weight	1200g (895g)	3400g

From the table above, it is plain to see that compared the B-type viscometer, the size of the VISCO is substantially smaller and more compact. An array of measuring instruments can be found lined up atop the desks of QC and R&D labs, causing a tendency for space to disappear. We've received comments from users such as, "I would like to purchase a new measuring instrument, but there isn't any more space." Small dimensions mean there is a high possibility users

will incorporate the instrument into their lab based on size alone. Still more, starting with sample, many kinds of materials need to be prepared for measurement. A reduced size and reduced required space ensures extra space for measurement, assisting users with smooth measurement operations.
Size isn't the only criteria, the fact that the instrument has been kept down to about 1/3 of the weight of B-type viscometers is also important. This feature has made it possible for the unit to be "carried and transported on-site," a feat which was impossible with B-type viscometers. The very fact that the instrument can be transported on-site means that measurement values in the lab and in the manufacturing site can be standardized, liberating users from the troublesome task of conversion arising from the differences of various kinds of viscometers. Furthermore, it is not necessary to purchase multiple viscometers. The fact that one VISCO unit is enough for all applications is certainly an economical advantage.

【3】Small Sample Amount

B-type viscometers generally require 500mL of sample. This amount is required for just 1 measurement, so when multiple samples are repeatedly measured, the amount of sample required becomes enormous. If it is a sample that can be prepared in large quantities, that may be fine for those cases, but as for valuable samples that can only be prepared in small amounts, there are even cases where viscosity measurement must be abandoned altogether.
The VISCO is capable of measuring viscosity with 100mL or 15mL of sample. For users, this means valuable sample can be conserved, which leads to a reduction in running costs for viscosity measurement. Samples necessary for viscosity measurement are namely fluids that are viscous, thus there are many that are sticky and/or thick and syrupy. These kinds of samples adhere to containers and washing them off requires a great deal of effort. The hassle involved with cleaning containers was an unavoidable problem with viscosity measurement. If the sample amount is small, then the amount that sticks to the container is also reduced, thereby making container clean-up that much easier—a definite advantage of the VISCO.

【4】Disposable Containers

As explained in the previous section, in addition to small sample amount, and with the goal of increasing the cleanliness of the containers even more, we have made it possible for the VISCO to use disposable containers “that can be disposed of without having to wash them in the first place.” By using the special cup adapter, it is possible to use a 90mL paper cup or a 90mL plastic cup. The VISCO is designed to use paper and plastic cups that are of course available from ATAGO, as well as general 90mL paper and plastic cups that are available on the market without any issues. (Note that some products may not be suitable.)

Conventional containers are made of glass, so their fragility makes it difficult to transport and use at food manufacturing sites. Disposable containers virtually eliminate this problem.

“VISCO Package A” is available at ATAGO as an all-in-one kit to introduce customers to this new measurement method. The package includes: ① VISCO unit, ② Cup adapter, ③ 90mL paper cups (50 pcs.), and ④ 90mL plastic cups (50 pcs.) as a 4 piece set. By purchasing this package, users will be able to readily take measurements with disposable containers.

【5】Battery Operated

In the quest for superb portability, we made the VISCO capable of running on batteries. When measuring at a manufacturing site, you are limited to locations with power supply facilities that are near the sample you wish to measure. In these cases, using an extension cord from the power supply to the instrument is one way of powering the device, but in a manufacturing site that constantly has people and machinery on the move, this poses a risk of becoming the source for a potential hazard which is an element that people would like to eliminate as much as possible. Battery operated means that you don’t need to worry about tangled extension cord wires; all that’s needed is to take the VISCO near the sample you wish to measure and just take measurements. The VISCO makes viscosity measurements possible at “any place” and under “any conditions.”

A battery life capable of providing approx. 7 hours of continuous measurement ensures there is no worry over the batteries running out in the middle of a full day of measurement. Moreover, its superb portability not only eliminates any

location restrictions at manufacturing sites, its effectiveness can certainly be fully demonstrated in laboratory settings as well. Naturally, the VISCO is also capable of using standard AC power supply. This allows the user to determine which power supply method to use and select the option that's most convenient.

【6】Easy Operation

Compared to B-type viscometers, the VISCO has extremely pleasant, simple operability. There is only 1 button used when operating the VISCO which is a jog dial located in the rear of the unit. Use a finger to slide the jog dial left and right and select an item. Push the jog dial with the same finger to confirm an item. All delicate and precise operations necessary for viscosity measurement can be performed with just these 2 easy gestures. As instruments become highly specialized with precision functionality, dissatisfied user comments such as, "Which button should I press to start measurement?" and "I accidentally performed an unintentional operation and I can't cancel it!" tend to increase. However, as for the VISCO, it can be said that this tendency doesn't apply.

If operations are easy to understand, it follows that the display will also be intuitive and readily understood. User-friendly functions can be seen everywhere on the VISCO, through features such as a large display of measurement value numbers and a design wherein how to turn individual settings on/off is instantly understood.

【7】Digital Level Adjustment

One interesting characteristic of the VISCO is that it has a "digitally displayed level (stability)" feature. If rotational viscometers are not placed in a level, stable location they can't demonstrate their full performance capabilities. After setting up an instrument, it is necessary to check that it is balanced and stable before taking measurement. Until now, B-type viscometers had a part called a "(spirit) level" in the measuring instrument itself. This part is filled with a small amount of water in a way that creates air bubbles. Visual confirmation of air bubbles within the round, indicator line located in the center was performed by

peering into the level from directly above. It was necessary to perform this kind of confirmation procedure while using adjustment screws to adjust the level. This was namely an “analog”method of level adjustment. When peering into the air bubbles, it must be done from directly overhead, which puts the user in an uncomfortable posture. It is decidedly not an easy task. Despite the fact that it was an essential step for measurement, it harbored an element of psychological avoidance.
The VISCO is equipped with an internal gyro sensor and can digitally display a level on its screen. The display section is outfitted with organic electroluminescence (OLED), providing a wide and plentiful viewing angle. This allows for level confirmation from any angle. It is absolutely unnecessary to put yourself in an uncomfortable position in order to check the level, as with the conventional method.
Through “digital” level adjustment, “easy and proper measurement” has become a reality.

【8】 Advanced Software

① Auto-stop Feature

It depends on the properties of the sample itself, but unless continuous force is applied to the sample with a spindle for a certain period of time, there are cases where stable measurement values will not be displayed. Samples with these kinds of properties are generally referred to as “non-Newtonian fluids” and there are various particular categories such as “thixotropic fluids” and “rheopectic fluids,” but as far as users are concerned, they are all “samples whose proper measurement values cannot be quickly displayed upon measurement.” It can be said that these types of samples are troublesome. The reason is, suppose measurement values stabilize exactly 10 minutes after the start of measurement. If the conditions of those measurement values are designated as standard values, measurement values must be read after precisely 10 minutes. Throughout the duration of those 10 minutes from the start of measurement, the user cannot move from that spot. It stands to reason that the user would like to use those 10 minutes to leave and do some other task, but if more than 10 minutes have passed when the user returns, the entire process has to be repeated from step 1. Even if the user returns quickly, they are ultimately left waiting with extra time. The entire process carries a

lingering sense of inconvenience.
What if measurement automatically stopped at 10 minutes and continuously displayed the measurement result from that exact point?
The user would become able to leave that spot and when the user returns, whether it's 30 minutes or 1 hour later, the displayed value will be the result obtained at exactly 10 minutes. Therefore, all the user would need to do is simply read the measurement value.

For instances when not only "time," but also "torque" and "viscosity" are standard values, the VISCO is equipped with an all-inclusive "auto-stop function."

The auto-stop feature dependent on these 3 criteria is a function that is not installed in the basic model of the B-type viscometer, a point which makes the VISCO far superior.

② User Scales Feature

Using this feature, the VISCO's displayed values can be made to match the displayed values obtained with B-type viscometers. A major reason some users hesitated to replace their current instrument is that they were "unable to discard the measurement values used until now." By using the user scales feature, it is possible to apply an offset to measurement values used until now, that is to say, to measurement values obtained with a B-type viscometer, which means this problem can be eliminated. If the same measurement values can be obtained, then it should be obvious which instrument would be the most beneficial when comparing the VISCO and B-type viscometers.
When programming user scales, users are not forced to do any complicated calculations. By inputting 3 viscosity values measured with the VISCO and 3 from a B-type viscometer, the built-in software does the calculation and automatically applies a conversion formula.

③ Moving Average Feature

The VISCO is installed with a "moving average feature" that displays the average value of the 5 most recent measurements. For example, there are cases where continuous measurements of viscosity will not yield stable measurement values, and this is particularly true for samples with extremely low viscosity. In these

instances, by enabling the moving average feature, it is possible to display stable measurement values.

【9】Price / Performance Ratio

No matter how exceptional an instrument is, if it has a high price beyond what users can afford, then surely it can be said that it amounts to nothing more than useless, pie in the sky. No matter how grand an idea of an instrument, if it remains simply an idea that cannot be used realistically, then it is meaningless. The VISCO's development was fraught with many hardships, but through these monumental efforts, we were able to produce an instrument that possessed features that outperformed B-type viscometers in all areas. Such a "high value product" as the VISCO may be considered a "high cost product" due to its great properties, however this will never be the case.

The VISCO's $1,500 list price (approximate) is an astonishingly low price that falls below half the price of general B-type viscometers on the market. This is truly a remarkably affordable instrument. This has been made possible through an extensive reduction of purchasing costs, on top of ATAGO's high productivity capabilities in which the majority of component processing is done in-house. This clearly illustrates ATAGO's unwavering pursuit of the essence of outstanding customer service and our attitude of "providing quality products at a fair price" toward customers. It is uncommon for large factories and the like to have only 1 viscometer installed. Normally, each manufacturing line and station has its own unit and it isn't rare for factories to possess units of 10 or more viscometers. The user sentiment of "I want to install the most affordable product," is present in every kind of industry, regardless of the size of a company. The VISCO is certainly capable of meeting this demand as well.

Vs Viscometers Utilizing Other Measurement Principles

Pages 1 to 8 compared B-type viscometers to the VISCO and explained how the VISCO is superior. Nevertheless, the fact of the matter is both B-type viscometer and the VISCO can be lumped together under the same genre of “rotational viscometers.” They are both no more than 1 type of viscometer among the many kinds that exist. There are a variety of types aside from rotational viscometers. Krebs viscometer, Mooney viscometer, Falling Ball viscometer, Vibrational viscometer-the list of types could go on and on.

Among the countless kinds of viscometers that exist, those with a retail price exceeding $10,000 (1,000,000 yen) were not suitable for comparison with the VISCO, so the following performance comparison will be conducted based on comparatively low-priced, simple viscometers that are the VISCO’s competitors.

【1】Viscosity Cup

Sample is collected inside a metal cup with a hole on the bottom and the amount of sample that drips within a fixed period of time is measured. It is a measuring instrument that determines the viscosity of a sample depending on the amount (volume) that drips. From one side, it is an extremely simple principle that’s intuitively easy to comprehend, but on the other, the measurement method is immensely complicated. First, depending on the conditions, in order to obtain one measurement value, sample must continuously flow for 2 minutes. During that time, using a stopwatch, the user must measure the time. Still more, the user needs to hold the cup in place throughout that time. As the weight is between 200g to 300g, it’s not terribly heavy, but the slightest movement and angle will affect the measurement value, so the user must focus and continue to steadily hold the cup. Moreover, even if the cup is held continuously firmly, in the event that velocity affects the cup and causes it to sway, measurement must be redone from the very beginning.

As written above, there are many difficulties with the measurement method, and for users who actually have a viscosity cup, it’s not unusual for those users to express, “It’s a hassle, so I’m not using it after all.” This makes it meaningless as a measuring instrument. From a price perspective, viscosity cups are sold for

about $50 to $200 (5,000 to 20,000 yen) per cup. At first glance, they may seem inexpensive, but their single measurement range is incredibly narrow, and if you attempt to use viscosity cups to cover a full measurement range, multiple kinds of cups must be purchased, leading to cases where it ultimately becomes an expense of over $1,000 (100,000 yen).
With the VISCO, not only can complicated measurement methods be avoided, but a single measuring instrument is all that's needed, making viscosity management a breeze. In regards to cleanliness, the VISCO, which can use paper cups, appears to be the winner. After the sample has dripped out of the viscosity cup, naturally, the cup itself needs to be washed, as well as the container that the sample dripped into. If the sample spills out of the container, the surrounding area will also need to be cleaned. Whether the test location is in a lab or perhaps on the manufacturing floor, a clean environment is vital for industries. There are a number of machinations that exist to ensure a clean environment. The actual implementation of such devices is becoming the standard for modern industries. By switching from a viscosity cup to the VISCO, there are certainly many requirements that can be fulfilled.

Viscosity cups are largely used for coating and industrial oil; they are rarely used in the food industry.

【2】 Capillary Viscometers (U-tube Viscometers)

The test tube is shaped like the letter "U" and viscosity measurement is taken according to the amount of sample that flows through this test tube. Depending on the intricate shapes and differences in applications, there are a variety of types such as, "Cannon-Fenske viscometer," "Ubbelohde viscometer," and the "Ostwald viscometer." However, all of these are devices that measure kinematic viscosity. Another feature is their extremely high measurement accuracy. As the crucial components for their structure are merely glass tubes, their comparatively low price of around $300 (30,000 yen) per unit is also a feature. In some cases, their use is stipulated by standards per organizations such as JIS, ISO, and the Japanese Pharmacopoeia.
As mentioned above, while they are very useful viscometers, they do have shortcomings which cannot be concealed: The overwhelmingly inconvenient task of cleaning. This is just one example, but in one user's case, a single day of measurement required a cleaning regimen that spanned from one week of

pre-measurement cleaning to one week of post-measurement cleaning.
One day's worth of measurement needed a total of about 2 weeks' worth of cleaning. Capillary viscometers are built in such a way that an even thinner, finer tube runs through the inside of the glass tube. The diameter of these thin tubes is about 0.30mm. Attempting to clean these tubes is a task which requires time in and of itself. Thus, the nuisance of cleaning after measurement is a worrisome point and does not amount to "easy, carefree measurement!"
Cleaning is very simple with the VISCO. By simply wiping off the slight amount of sample that sticks to the container and spindle, it is possible to quickly proceed to measuring the next sample.
Capillary viscometers are used in the field of petroleum products and drug manufacturing. These fields demand kinematic viscosity values, rather than viscosity values, but as long as the density is known, it can be replaced with a simple conversion.

Kinematic viscosity ＝ Viscosity / Density

【3】 LST (Line Spread Test)

The line spread test is used in the medical industry to measure "thickness" of food. It may be more suitable to refer to is as a "viscosity measuring kit" rather than a "viscometer." A cylindrical "measuring ring" is placed in the center of a "thickness measuring sheet" with circular scales printed on it. After sample is poured into the measuring ring, the measuring ring is lifted upward, and the sample spreads from the center to the outer edges of the measuring sheet. The way in which the sample spreads is read from the scales written on the measuring sheet. The amount of time it takes for the sample to move (spread) is also simultaneously measured.
It surely is a considerably simple method of measuring viscosity. The Japanese Society of Dysphagia Rehabilitation (established in 1995; performs activities including research, education, popularization, and structuralization in dysphagia rehabilitation to facilitate resolving the problems in individuals with eating and swallowing difficulties), recommends the line spread test as a simple method of measuring viscosity in clinical settings of medical treatment within the organization's 2013 classification literature. Nonetheless, in samples containing oils, when the sample spreads out from the center, a phenomenon is known to

occur in which the sample “slips” toward the outer edges. Since it is uncommon for food not to contain oils, it is difficult to say this is a perfect method for measuring viscosity. In fact, proper correlation between this method and measurement values from E-type viscometers, which are specified as the standard measurement values, cannot be made.

Although it has a low price of about $20 (2,000 yen), it seems few facilities have actually adopted this method. Originally meant for clinical settings such as hospitals and nursing homes, this method has not been established within the culture of viscosity measurement. It can only be said that this may simply be due to the tendency of measurement avoidance. A sort of “spiritual culture” exists among nutritionists, nurses, and perhaps caregivers, in which they feel “in order to achieve a real, intimate connection with patients, data that cannot be quantified must be held in high regard. Relying only on experimental data leads to each patient being neglected.” Due to this sentiment, there is a facet in which the culture of quantitative management has not taken hold. Nevertheless, aspiration pneumonia ranks 4th as the cause of death among Japanese people. As a means of preventing this occurrence, topics concerning the demand for medical treatment creating awareness of this crisis have been increasing year after year. Without a doubt, managing the viscosity of dysphagia diet foods is surely a direct cure for this issue. In the medical meal service industry, the VISCO has already been implemented and we’ve received very positive reactions. The groundwork is perfect for the spread of the instrument in plenty of markets.

Compared to the line spread test, the VISCO takes predominance in regards to accurate and precise measurement values. As an instrument that will be implemented in clinical settings, it is set at a somewhat high price, but the only currently recommended method is the simple line spread test. Therefore, by spreading accurate, precise viscometers throughout this industry, the VISCO may be regarded as a pioneering device.

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