VISCONLINE

INSTRUCTION MANUAL

Rev.1 / 18.09.07

Please read this manual carefully before starting to use the Online Viscometer System.

This manual describes how the Online Viscometer works and how to get the most out of it in terms of performance. The sections deal with appearance and usage of Viscometer and contain necessary information regarding operation and maintenance. Read this manual thoroughly before using the Online Viscometer and Keep it at hand for future reference.

Warning! Using the system not according these instructions may cause unsafe operation.

SAFETY PRACTICES

General

The following safety practices are intended to insure the safe operation of the equipment.

Electrical Hazards

1. Removal of some panels exposes potentially dangerous voltage. Disconnect the instrument from all power sources before removing protective panels.
2. Do not use power cords with frayed insulation.
3. Check actual line voltage to confirm it is the value for which the system is wired. Be sure the power cords are plugged into correct voltage sources.
4. Do not subject the system or any component to water.

SPECIFICATIONS

Viscosity Measurement Method	After extractive sampling fluid is conditioned and its viscosity is measured by sine-wave type Vibro viscometer. After that the fluid is sent back to process line without any lose or waste
Viscosity Measurement Range	0.3 to 10000 mPa.S
Repeatability	1 % (standard deviation)
Accuracy	± 3 % (1 to 1000 mPa.S)
Viscosity Units	mPa.s, Pa.s, cP, P
Measured and displayed values	Instant viscosity and temperature values are measured, normalized viscosity at reference temperature is calculated
Response Time	Depends upon sampling line length, however not higher than 3min
Ambient Operating Temperature	10 to 40 ^{o}C
Fluid Temperature Range In The Measuring Cell	Up to 70 ^{o}C
Data Transmission	RS-232C standard, analogue mA or VDC optional
Fluid Inlet Pressure	Up to 100 bars
Fluid Inlet Flow	Dependent upon process conditions
Fluid Return Flow To Process Line	Dependent on the fluid temperature and pressure in the process line
Enclosure	Whole system is installed in NEMA4 enclosure to assure protection against rain, wind, dust, snow etc.
Design Flexibility	Temperature and pressure parameters can be differently designed in order to fit to specific applications; please consult the factory
Ex-proof	All electrical part ex-proof approved
Power Requirement	380VAC-3p, 50Hz; 0.5kVA
Utility	6 bar, dry, dust free instrument air

Compliance with Council Directives

Viscometer:

Complies with the protection requirements of Council Directive 89/336/EEC, of the Member States relating to Electromagnetic Compatibility

Ⓔx Conforms with the protection requirements of Council Directive 94/9/EC, concerning equipment and protective systems intended for use in potentially explosive atmospheres

Level & Flow Sensors:

Ⓔx Conforms with the protection requirements of Council Directive 94/9/EC, concerning equipment and protective systems intended for use in potentially explosive atmospheres

Pneumatic Valve:

Ⓔx Conforms with the protection requirements of Council Directive 94/9/EC, concerning equipment and protective systems intended for use in potentially explosive atmospheres

CE **Motor:**

Ⓔx Conforms with the protection requirements of Council Directive 94/9/EC, concerning equipment and protective systems intended for use in potentially explosive atmospheres

Peristaltic Pump:

Ⓔx Conforms with the protection requirements of Council Directive 94/9/EC, concerning equipment and protective systems intended for use in potentially explosive atmospheres

Power Panel:

Ⓔx Conforms with the protection requirements of Council Directive 94/9/EC, concerning equipment and protective systems intended for use in potentially explosive atmospheres

Resistance:

Ⓔx Conforms with the protection requirements of Council Directive 94/9/EC, concerning equipment and protective systems intended for use in potentially explosive atmospheres

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1. INTRODUCTION

Features

- Visconlie does extractive sampling.
- Whole system is a closed loop for the fluid, with no waste and no external input to contaminate.
- Whole system is installed in NEMA4 (IP56) enclosure to assure protection against dust, rain, snow, wind etc.
- Measure instant viscosity and temperature and calculate the normalized viscosity at reference temperature.
- Normalization temperature is operator adjustable.
- Data transmission format can be digital or analogue.
- Temperature and pressure parameters can be differently designed in order to fit to specific applications; please consult the factory
- Nearly all parts used are made of stainless steel.
- All electrical parts are ex-proof approved.
- The system requires 6 bar, dry, dust free instrument air as utility.
- Achieves a high measurement accuracy of ± 3 % (1 to 1000 mPa.S).
- Non-Newtonian fluid can be measured. Foaming samples can be measured without breaking minute foams and with less influence scattering large foams.

2. PRINCIPLE OF OPERATION

2.1 Overall System Description

P&ID diagram of the system is shown in Figure 1. Sample fluid is continuously withdrawn from process line, with average linear velocity within the process line without disturbing flow pattern. Withdrawn fluid is sent to the tank (036) where the sample's temperature and pressure are brought to desired values. Temperature is adjusted via resistance (056) which is installed within 036. Whatever the absolute pressure of fluid within the process line, the pressure of sample withdrawn is brought to atmospheric pressure within the tank (036). From the tank (036) the sample is sent to the cell of the viscometer with an adjustable flow rate with the aid of peristaltic

pump (054). Here, the viscosity and temperature of the sample fluid is measured. After the viscometer cell the sample is sent back to the tank (036) again. Content of the tank (036) is continuously replaced with inlet and outlet stream.

2.2 Vibro Viscometer Operation Principles

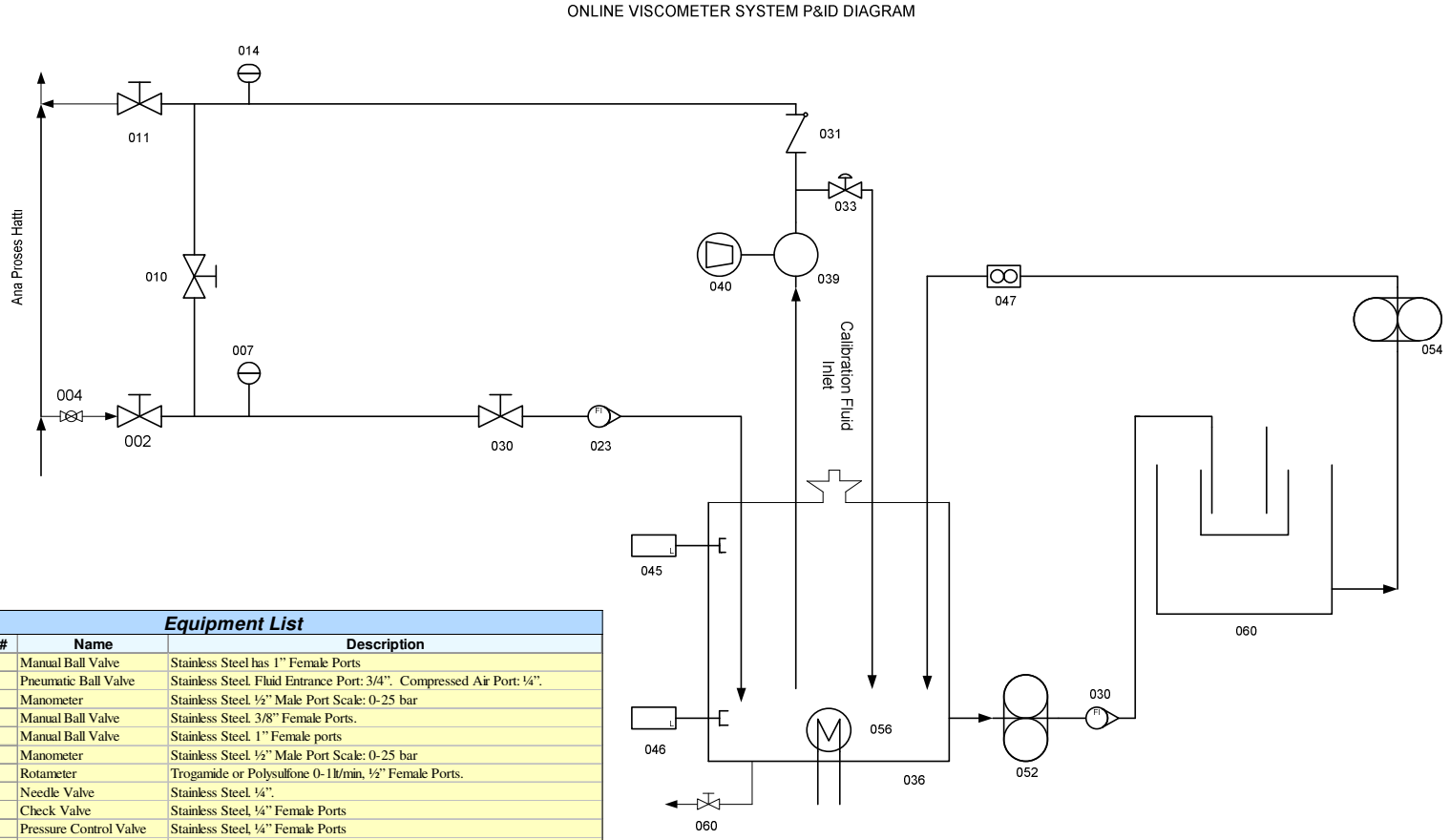
As shown in figure 2, the thin sensor is immersed into the sample. When the spring plates are vibrated with a uniform frequency, the amplitude varies in response to quantity of the frictional force produced by the viscidity between the sensor plates and sample. The vibro viscometer controls driving electric current to vibrate the spring plates in order to make uniform amplitude.

Since frictional force of viscidity is directly proportional to viscosity, the driving electric current (driving power) for vibrating the spring plates with a constant frequency to make uniform amplitude is also directly proportional to the viscosity of each sample.

The vibro viscometer measures the driving electric current to vibrate the sensor plates with a uniform frequency and amplitude, and then viscosity is given by the positive correlation between the driving electric current and the viscosity.

2.3 Data Manipulations

As the temperature and viscosity of the fluid is measured in the cell of the viscometer, the viscosity is normalized to a temperature basis. The normalization temperature can be adjusted by the operator. The temperature dependence of viscosity is assumed as Arhenius function and Arhenius parameters are entered by the operator. Parameters of programming of temperature normalized viscosity calculation can be advised by Terralab, provided that a 200cc sample is sent prior to shipment of the complete system.



Equipment List		
Part#	Name	Description
002	Manual Ball Valve	Stainless Steel has 1" Female Ports
004	Pneumatic Ball Valve	Stainless Steel. Fluid Entrance Port: 3/4". Compressed Air Port: ¼".
007	Manometer	Stainless Steel. ½" Male Port Scale: 0-25 bar
010	Manual Ball Valve	Stainless Steel. 3/8" Female Ports.
011	Manual Ball Valve	Stainless Steel. 1" Female ports
014	Manometer	Stainless Steel. ½" Male Port Scale: 0-25 bar
023	Rotameter	Trogamide or Polysulfone 0-1lt/min, ½" Female Ports.
030	Needle Valve	Stainless Steel. ¼".
031	Check Valve	Stainless Steel, ¼" Female Ports
033	Pressure Control Valve	Stainless Steel, ¼" Female Ports
036	Tank	Stainless Steel. Volume: 3lt All Ports are ¼" Female.
039	Gear Pump	Stainless Steel. 4cc
040	Motor	0.37 kW (ATEX)
045	High Level Sensor	Ultrasonic Liquid Level Sensor (ATEX)
046	Low Level Sensor	Ultrasonic Liquid Level Sensor (ATEX)
047	Flow Sensor	Ultrasonic Liquid Level Sensor (ATEX)
052	Pump Head 1	2.4 mm Tube Wall. Stainless Steel. 313D
054	Pump Head 2	2.4 mm Tube Wall. Stainless Steel. 314D
056	Resistance	Stainless Steel 220Vac. 620 Watt. (ATEX)
060	Viscometer	(0.3-10,000cP) or (1,000-100,000cP) (ATEX)

Figure 1. P&ID diagram of the Online Viscometer System

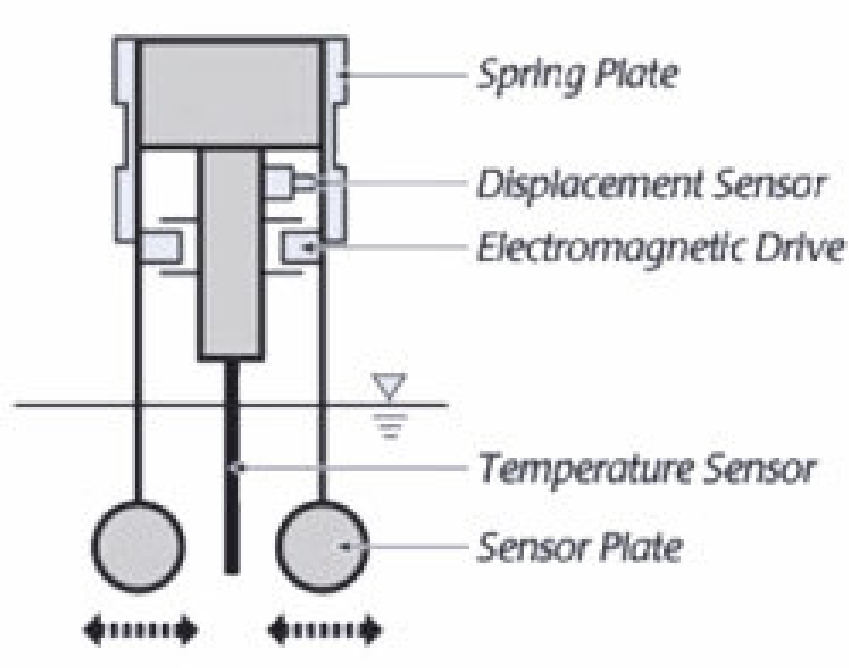


Figure 2. Measurement unit of viscometer

3. START-UP AND SHUT-DOWN

3.1 Start-Up

S1 button on the power panel is switched on
V automates on the power panel are switched on
Inlet Valve (002) (shown in the P&ID) is opened
Recycle Valve (010) (shown in the P&ID) is opened

Wait until you can see the flow in the small rotameter (030)

Adjust flow from (023) and (030) until you obtain the steady flow.

Caution: If over flow is observed in the viscometer cell then unplug the 052 inlet line and wait until the fluid level in the bath decreases in the meantime let that inlet line flow in to a container.

Adjust the valve 031 such that rotameter (030) always shows flow.

If all the conditions above are satisfied that means system reaches steady state. System reaches to steady state in approximately 30 minutes.

After steady state is reached;

Outlet Valve (011) (shown in the P&ID) is opened
Recycle Valve (010) (shown in the P&ID) is closed

3.2 Shut-Down

Shutting-down is relatively easier that start-up.
Close the valve 002 (shown in the P&ID) and wait about 10 minutes. In this 10 minutes system sends the fluid inside into the process line.
When you observe no-flow in the 030 close the 011 valve (shown in the P&ID)
And finally cut the electric energy from the power panel.

4. MAINTENANCE

4.1 Sensor Plate

Question: can a user exchange the sensor plate?
Answer: No. If the sensor plate should be damaged or you cannot get rid of the congealed sample from the sensor plate, please send us the measurement unit with the display unit for exchanging and adjustment.

4.2 Tubing

Question: How often should the tubing of the peristaltic pumps should be changed?
Answer: Tubing of the peristaltic pumps should be changed once a month.

4.3 Cleaning

Question: How should I clean the measurement unit?
Answer: after measurement, please clean the sensor plates, temperature sensor and protector with a cleaning agent or a solvent to remove residue of a sample attached to them. Especially if it is a curing sample, clean it as soon as possible after the measurement. Clean the sample cup as well. If the cleaning agent is not volatile, wipe it off with purified water, so as not to affect on the next measurement sample.

How to clean: Hold the sensor plate or temperature sensor lightly with a tissue between your fingers and wipe off any attached sample with the tissue by sliding it from the upper side to the lower side. Please note that if you slide it from lower side to upper side the sensor plate may be buckled and damaged. After that, soak the tissue with a cleaning agent or solvent and then clean in the same way using the tissue. Clean with purified water if necessary.

Normally, being pressed lightly between your fingers will not damage sensor plates, temperature sensor plates, or protector. However, do not add any unnatural force more than necessary to them.

5. TROUBLESHOOTING and WARNINGS

- **As fluid level decreases in the tank (036)**; then signal light 070 lights. System automatically closes fluid outlet and fill the tank until the desired fluid level is reached.
- **As fluid level in the tank(036) increases**; then signal light 072 on the power panel lights and system automatically closes fluid inlet until the desired fluid level is reached.
- **If peristaltic pump's tubing punctures;** signal light 073 lights and system automatically closes the oil inlet. Here tubing should be changed by the user. After the tubing is changed bring the S2 button on the power panel to "B" position. Wait until signal light 073 turns off and then bring the S2 button on the power panel to "A" position.

Question: When display does not become stable.

Is the ambient environment free from vibration and draft?

- Avoid direct drafts in the vicinity of the viscometer.

Is the protector or sensor protective cover in contact with the sensor plates or temperature sensor?

- Attach the protector and the sensor protective cover properly so that they do not touch the sensor plates or temperature sensor.
- Remove the protector or the sensor protective cover when necessary.

Has the sample surface been adjusted to the center of narrow part of the sensor plates?

- Adjust the table height by turning the knob so that the center of narrow part of the sensor plates is on the sample.

Are the positions of the left and right sensor plates in the sample surface will be leveled.

- Is not the same, level viscometer using the level feet so that liquid surface will be leveled? The gradients in front of and back do not have much measuring sensitivity because the sensor plate is only 0.3 mm thick.

Are the sensor bent?

- If bent, contact the local KSV dealer for repair.

Does the sample generate bubbles because of the differences in the sample temperature and the ambient temperature and do the bubbles stick to the sensor plates?

Is calibration performed?

- When the absolute viscosity value is important, it is recommended that a periodic calibration be performed using a standard viscosity fluid.

Question: When the temperature values are not correct.

Is the display unit connected the main unit properly the connection cable?

Answer: Since the measurement unit and display unit are adjusted in pair, you should not perform adjustment of units with different serial No.

In case only the left sensor plate is vibrating vigorously: this kind of behavior sometimes occurs when only the left sensor plate sets in a sample during a curing process measurement. In such a case, agitate the sample well to make the sample state the same quality in the right and left sides contacting the both sensor.

6. STANDARD EQUIPMENT

Visconline includes the following parts; all installed on the complete unit. Device is ready to be used upon connection to the inlet and outlet flanges, electricity and pneumatic air. The following table includes the part number, name, description and technical specification of each part. Please refer to Figure:1 and the following table, when ordering replacement parts.

Part Number	Equipment	Description	Specification
VZ-ST-MK-001	Flange	Viscometer System Begins With This Flange	Stainless Steel. Mounts 1” Tubings.
VZ-ST-MK-002	Manual Ball Valve	Opens or Closes the Inlet Way of Fluid Manually	Stainless Steel has 1” female ports
VZ-ST-MK-003	Reducer	Mounted to the Outlet Port of VZ-ST-MK-002	Stainless Steel. Reduces 1” Outlet to 3/8”
VZ-ST-MK-004	Pneumatic, Ball Valve	Comes After VZ-ST-MK-002. Opens/Closes With 6 Bar Compressed air. Controls The Fluid Inlet	Stainless Steel. Akışkan giriş Fluid Enterace Port: 3/4”. Compressed Air Port: ¼”
VZ-ST-MK-005	TEE	Divides the Entrance Line to Recycle and Inlet	Stainless Steel.3/8” Male Ports
VZ-ST-MK-006	TEE	For the Montage of VZ-ST-MK-007	Stainless Steel. ¼” Male Ports
VZ-ST-MK-007	Manometer	Measures the Sample Inlet Pressure	Stainless Steel. ½” Male Port Scale: 0-25 bar

VZ-ST-MK-008	Nuts and Ferrules	Montage of all Ports	Stainless Steel. 3/8”
VZ-ST-MK-009	Union	Helps to Transfer the Fluid Inside the Cabinet	Stainless Steel, 3/8” Male Ports
VZ-ST-MK-010	Manual Ball Valve	Conjoins Fluid Inlet and Outlet Lines	Stainless Steel. 3/8” Female Ports.
VZ-ST-MK-011	Manual Ball Valve	Opens or Closes Outlet Way of Fluid	Stainless Steel has 1” female ports
VZ-ST-MK-012	TEE	Divides the Exit Line to Recycle and Outlet.	Stainless Steel has ¼” Male Ports
VZ-ST-MK-013	TEE	For Montage of VZ-ST-MK-014	Stainless Steel has ¼” Male Ports
VZ-ST-MK-014	Manometer	Measures the Sample Outlet Pressure	Stainless Steel. ½” Male Port Scale: 0-25 bar.
VZ-ST-MK-015	Flange	Cabinet Ends With this Flange	Stainless Steel. Conjoins two 1” Tubing
VZ-ST-MK-016	Elbow Union	For the Montage of VZ-ST-MK-017	Stainless Steel 3/8”
VZ-ST-MK-017	Teflon Tubing	Transfers the Sample Fluid to VZ-UR-MK-022	Teflon ¼”. Length: 1m
VZ-ST-MK-018	Elbow Union	For the Montage of VZ-ST-MK-019	Stainless Steel 3/8”
VZ-ST-MK-019	Teflon Tubing	Transfers the Fluid from VZ-UR-MK-022 To out of Cabinet	Teflon ¼”. Length: 1m
VZ-ST-MK-020	Union	Conjoins	Stainless Steel 3/8”

		VZ-ST-MK-017 and VZ-UR-MK-022	
VZ-ST-MK-021	Union	Conjoins VZ-ST-MK-019 and VZ-UR-MK-022	Stainless Steel 3/8”
VZ-UR-MK-022	Block 1	Inlet and Outlet Lines Passes Through	Aluminum. All Ports are Female with Different Sizes
VZ-ST-MK-023	Rotameter	Shows Sample Inlet Flow Rate	Trogamide or Polysulfone 0-1lt/min, ½” Female Ports
VZ-ST-MK-024	Union	Conjoins VZ-ST-MK-023 and VZ-UR-MK-022	Stainless Steel. ½”
VZ-ST-MK-025	Rotameter	Shows the Sample Flow Rate to Viscometer Cell	Trogamide or Polysulfone 0-400ml/min, ½” Female Ports
VZ-ST-MK-026	Union	Conjoins VZ-ST-MK-025 and VZ-UR-MK-022	Stainless Steel. ½”
VZ-ST-MK-027	Manometer	Mounted on VZ-UR-MK-022 Measures Cabinet Outlet Pressure	Stainless Steel.1/2” Female. Scale: 0-25 bar
VZ-ST-MK-028	Union	Conjoins VZ-ST-MK-027 and VZ-UR-MK-022	Stainless Steel. ¼”

VZ-ST-MK-029	Muff	Conjoins VZ-ST-MK-028 and VZ-UR-MK-022	Stainless Steel. ¼”
VZ-ST-MK-030	Needle Valve	Regulate Fluid Inlet Flow rate	Stainless Steel. ¼”
VZ-ST-MK-031	Check Valve	Prevents the Back Flow of Outlet Stream	Stainless Steel, ¼” Female Ports
VZ-ST-MK-032	Blind Flange	Closes the Ports of VZ-UR-MK-022 that are not Used	Stainless Steel. 3/8”
VZ-ST-MK-033	Pressure Control Valve	Sends some Portion of Outlet Fluid Back to Tank	Stainless Steel, ¼” Female Ports
VZ-ST-MK-034	Filter	Filters the inlet Fluid	Stainless Steel
VZ-ST-MK-035	Pipe Clip	Tubing Montage of Rotameter	Stainless Steel, ¼”
VZ-UR-MK-036	Tank	Pressure Relief Tank	Stainless Steel. Volume: 3lt All Ports are ¼” Female
VZ-ST-MK-037	PVC Tubing	Transfers Fluid from VZ-ST-MK-023 to VZ-UR-MK-036	¼” od. Length: 30cm
VZ-ST-MK-038	PVC Tubing	Transfers Fluid from VZ-ST-MK-025 to VZ-UR-MK-036	¼” od. Length: 60cm
VZ-ST-MK-039	Gear Pump	Pumps the Sample Outside of the	Stainless Steel. 4cc

		Cabinet	
VZ-ST-MK-040	Motor	Drives VZ-ST-MK-039	0.37 kW
VZ-UR-MK-041	Block 2	Flow Sensor is Mounted on it.	Stainless Steel. Port 1: VZ-06-00-0493 Port 2: VZ-ST-MK-042 Port 3: VZ-ST-MK-044 All Ports ¼" Female
VZ-ST-MK-042	Tubing	Transfers Fluid From VZ-UR-MK-022 to VZ-UR-MK-036	Stainless Steel. Male Ends. ¼" Od. Length: 110cm
VZ-ST-MK-043	Tubing	Transfers Fluid From VZ-UR-MK-036 to VZ-ST-MK-041	Stainless Steel. Male Ends. ¼" Od Length: 100cm
VZ-ST-MK-044	Tubing	Transfers Fluid From VZ-UR-MK-039 to VZ-UR-MK-036	Stainless Steel. Male Ends. ¼" Od. Length: 110cm
VZ-ST-MK-045	High Level Sensor	Mounted on the Higher Sensor Port of VZ-UR-MK-036	Ultrasonic Liquid Level Sensor
VZ-ST-MK-046	Low Level Sensor	Mounted on the Lower Sensor Port of VZ-UR-MK-036	Ultrasonic Liquid Level Sensor
VZ-ST-MK-047	Flow Sensor	Mounted on VZ-UR-MK-041	Ultrasonic Liquid Sensor

VZ-UR-MK-048	Union	Used in all 3/8” Connections	Stainless Steel. 3/8”. Male Ends
VZ-ST-MK-049	Pneumatic Valve	Opens/Closes Pneumatic Air to VZ-ST-MK-004	220V, Ports: ¼”
VZ-ST-MK-050	Sinter Silencer	Mounted on Free Ports of VZ-ST-MK-049	Stainless Steel, ¼”
VZ-06-00-051	Peristaltic Pump	Ensures Fluid Circulation Within The Cabinet	OEM Pump. Stainless Steel. 90 RPM. 24VDC 30W
VZ-06-00-052	Peristaltic Pump Head 1	Pumps the Fluid From Tank to Viscometer Cell	2.4 mm Tube Wall. Stainless Steel. 313D
VZ-06-00-053	Tubing	Tubing of VZ-06-00-053	PVC. Tygon S50HL 8.0x2.4
VZ-06-00-054	Peristaltic Pump Head 2	Pumps the Fluid from Viscometer Cell to Tank	2.4 mm Tube Wall. Stainless Steel. 314D
VZ-06-00-055	Tubing	Tubing of VZ-06-00-055	PVC. Tygon S50HL 6.4x2.4
VZ-ST-MK-056	Heater	Immersed Within the Tank and Heats the Fluid in the Tank	Chromium, 15cm, spiral, 220Vac. 800 Watt
VZ-ST-MK-057	Thermocouple	Opens/Closes VZ-ST-MK-056	Stainless Steel. Thermocouple
VZ-UR-MK-058	Cabinet	Encloses Whole System	3mm Stainless Steel Metal Sheet. NEMA4(IP56)
VZ-UR-MK-059	Plastic Wedge	Holds Hydraulic System Within the	40x35 Plastic Wedge

		Cabinet	
VZ-18-00-060-1 VZ-18-00-060-2	Viscometer	Viscosity Measurement Unit	SV-10 (0.3-10,000cP) SV-100 (1,000-100,000cP)
VZ-ST-EL-061	Relay	Controls VZ-ST-MK-049 and VZ-ST-EL-070	220 V, 1W, 10A
VZ-ST-EL-062	Relay	Stops System When VZ-ST-EL-063 Fails and Controls VZ-ST-EL-071	220 V, 1W, 10A.
VZ-ST-EL-063	Relay	Controls VZ-ST-MK-049 and VZ-ST-EL-072	220 V, 8W, 5A, Between 1sec-30hr Time Relay
VZ-ST-EL-064	Relay	Controls VZ-ST-MK-049, VZ-ST-EL-073	220 V, 8W, 5A, Between 1sec-30hr Time Relay
VZ-ST-EL-065	Automat	Controls VZ-ST-MK-040 and VZ-ST-MK-056	Siemens C type 10A TRIFASE automatic Fuse.
VZ-ST-EL-066	Contactor	Controls VZ-ST-MK-040 and VZ-ST-MK-056	220 V, 10A

VZ-ST-EL-067	Transformer	Supplies 24VDC to VZ-06-00-051	Converts 220 AC to 24VDC
VZ-ST-EL-068	Voltage Regulator	Regulates Voltage of VZ-06-00-051 Between 0-24VDC	Regulates Transformer Outlet Voltage Between 0-24VDC
VZ-ST-EL-069	Cables	Transfers Electric and Signals Between Equipments in the VZ-UR-MK-058 and VZ-ST-EL-074	ATEX Certificated
VZ-ST-EL-070	Warning Light	Low Level Warning Light on VZ-ST-EL-074	220 V, 5W
VZ-ST-EL-071	Warning Light	Fuse Failure Warning Light on VZ-ST-EL-074	220 V, 5W
VZ-ST-EL-072	Warning Light	High Level Warning Light on VZ-ST-EL-074	220 V, 5W
VZ-ST-EL-073	Warning Light	Tubing Puncture Warning Light on VZ-ST-EL-074	220 V, 5W
VZ-ST-EL-074	Electric Panel	Encloses all Electrical Equipments	ATEX Certificated

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