How To Measure Yield Stress For Mining Slurries
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Tim's Top Tips: Rheology Solutions for the Mining Industries

How To Measure Yield Stress For Mining Slurries

**Key Words:** Rheology, rotational, liquid, viscosity, thixotropy, yield stress.

**About The Author**

Tim has a background in engineering and specifically in rheology, with a B.Eng and Ph.D. in Chemical Engineering and has held postdoctoral research positions in engineering rheology. Tim’s research has continued for the last seven years and recent interests and publications include the application of rheology and rheometry to mineral, food, polymer and surface coatings systems. His current position encompasses the management of customer contract testing and also includes customer focussed education and training. Additionally he is available to provide technical input for existing or proposed materials characterisation systems for both laboratory and production.

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**Introduction**

Often the hydrometallurgical industries must overcome problems related to (and often dominated by) the flow properties of their product, though the relationships between these properties and production related issues are not always immediately apparent. It is the purpose of this series of articles, “Rheology Solutions for the Mining Industries”, to help illuminate the issues faced by the industry, how they relate to the flow properties of problem materials and how they can be successfully measured and controlled with a view to better processing.

**Definitions**

Yield stress is the minimum force required to initiate flow. It is often seen at start-up of rakes, mixers and pumps, when a higher than usual energy is required to begin rotation. This peak in energy required is due to the yield stress, which causes the material to display solid-like properties until the yield stress has been exceeded. Once the yield stress has been overcome, the material behaves like a liquid and will flow.

**Background and Discussion**

Yield stress has an impact on the mining industry in a variety of ways. In pumping and mixing at start-up, it must be overcome so that the impellers can turn. In pipeline transport yield stress influences the velocity profile of the material, and under some circumstances can cause the material to flow as a solid plug carried by a lubricating liquid layer at the wall where shear stresses are high. The yield stress of a material dictates whether or not a solid fraction will settle to the bottom of a tank, pipe or other container, and also whether gaseous materials can rise through it. Disposal of mining waste is an important issue and the yield stress influences the slope of beaches in disposal areas, the ability of high solids pastes to be compressed and to flow after disposal and so on.

Note: Working definitions are provided at the end of the paper.
Measurement Techniques and Pitfalls

1.0 The vane technique

This is the most straightforward technique for direct measurement of the yield stress.

1.1 To make a measurement you will need:

- A viscometer or rheometer
  Most mid-range viscometers will suffice, the key criteria are good resolution of the torque and good range and control of rotational speed, in particular a capability for constant, very low rpm, rotation. Most controlled stress (CS) rheometers are capable of this kind of performance, as well as mid-range and high-end viscometers.

- A suitable vane
  Usually 4 or 6 blades and with a surface area large enough to provide a torque reading within the specifications of the viscometer.

- A container
  This measurement should occur in an ‘infinite sea’ of material (i.e. the walls and bottom of the container are far enough from the sensor as to have no effect on the reading. The minimum container size is illustrated in Figure 1.

1.2 Theory

The theory behind this type of measurement is that the vane turns extremely slowly, stretching the internal structure of the material. As the structure is progressively stretched, the force required by the viscometer to maintain its rotational speed increases. As soon as the force applied in this manner exceeds the yield stress of the material, its structure fails and the material flows. As a result the forces required to turn the sensor diminish again. In this way a peak shear stress is generated and the peak occurs at the yield stress. Locating the peak provides a measure of the yield stress.

1.3 Experimental procedure

The experimental layout has been shown in Figure 1.

- The container is filled with sample and the sensor system is lowered (or, more commonly, the sample is raised on a lab-jack or similar) until the vane is immersed as shown in Figure 1.
- A low rpm (below 0.5 rpm is usually fine) is chosen and the sensor rotated.
- The stress build-up and decay is monitored and the peak stress taken. This is the yield stress.

1.4 Results

The results of a vane test are shown in Figure 2.

![Figure 1: Layout for yield stress measurement using the vane technique](image1)

![Figure 2: Data from yield stress (τ₀) analysis using the vane technique](image2)
1.5 Benefits of the vane technique

- **Low level of disturbance**
  The presence of a yield stress indicates that a structure exists in the material. The shape of the vane (low profile entering the material) allows minimal disturbance to this structure. This is a significant advantage over all other measuring geometries.

- **Can use a controlled rate (CR) viscometer**
  CR viscometers are comparatively low cost compared with CS rheometers, which invariably require clean dry compressed air for near frictionless performance and good precision at low stresses and strains. It is important that the viscometer chosen has good resolution at low rpm, since it is here that the structure can be gradually 'stretched' until it yields.

- **Quick test**
  The vane test can be relatively quick, usually complete in a matter of a couple of minutes, depending on the yielding behaviour of the material.

- **Intuitive interpretation of the data**
  The meaning of the peak is easily understood, and the magnitude of the yield stress is immediately apparent.

- **Simple measurement and simple analysis**
  The measurement is quite simple to execute and the data is straightforward to process.

1.6 Potential problems with the vane technique

Other rheological measurements (other than yield stress) are not reliable using the vane, it should not be used for viscosity measurements. One of the most common problems with the vane sensor is that many users utilise it for measurements other than yield stress. The sensor was not designed to measure any other flow property.

- **Not enough data points**
  If insufficient data are collected there is a danger that the peak stress will not be captured and so a lower than actual yield stress will be measured.

- **Temperature control**
  Yield stress often changes with temperature and temperature control of such large volumes is often difficult.

- **Large agglomerates**
  Large agglomerates often occur in mineral slurries and pastes, these can interfere with the rotation of the vane.

- **Correct insertion of the vane into the material**
  If the vane is not correctly inserted, so that the shaft is at right angles to the surface of the liquid, then inaccurate measurements will be made.

- **Settling or time dependent slurries**
  Time dependent slurries change their properties with time. To repeatably measure the maximum yield stress, the material should be allowed to equilibrate. Settling slurries have the opposite problem. If possible they should be measured as quickly as possible, before appreciable settlement has taken place.

2.0 The stress ramp or CS technique

This is a highly accurate technique for direct measurement of the yield stress.

2.1 To make a measurement you will need:

- **A CS rheometer**
  CS rheometers are usually high-end instruments, with air bearings to allow near frictionless rotation and the measurement and application of small forces.

- **A container**
  For the vane, an infinite sea measurement is desirable, as described before. For the other sensor systems the container is predefined by the measuring system geometry.

- **A suitable sensor**
  A vane can be used, with the advantages as discussed in the previous section. Alternatively other (cone & plate, plate & plate or cup & bob) type sensors can be used, shown in Figure 3. Plate/plate and cup and bob sensors can be serrated to prevent slip for multi-phase materials.
2.2 Theory

The theory behind this type of measurement is that the applied stress is slowly increased and the movement of the sensor monitored. Initially there is very slight movement, as the structure stretches, and once the yield stress is overcome, the rate of deformation increases dramatically. Plotting the deformation vs. stress on logarithmic scales shows two distinct linear regimes, one before and one after yielding. The intersection of the two linear segments is the yield stress.

2.3 Experimental procedure

The experimental layout has been shown in Figure 1 for a vane, and is standard equipment set-up for the other sensor systems (Figure 3).

- The sample is loaded and the measuring geometry is closed.
- A low shear stress is chosen and imposed on the material through the sensor. The stress is gradually increased.
- The deformation of the sample is monitored and the point at which the sample begins to flow taken from the intersection of the linear segments as described previously. This is the yield stress.

2.4 Results

The results of a pair of CS yield tests on different materials are shown in Figure 4.

2.5 Benefits of the stress ramp or CS technique

- **Low level of disturbance**
  A vane can be used for this type of measurement, and the advantages or restrictions associated with the vane geometry are repeated here.

- **Other information can be generated**
  If measuring geometries other than the vane are used, a CS flow curve can also be generated with the same equipment, and a change in geometry is not necessary.

- **Small sample volumes are required**
  The measuring gap is usually small, in particular for cone and plate or plate and plate geometries.

- **Stress controlled technique**
  Control of the shear stress (as opposed to the rotation)
means that the sample is deformed only according to the stress imposed. A CR (Controlled Rate) or CD (Controlled Deformation) technique instantaneously imposes a deformation, which may mean that the yield stress is passed before the first measurement point can be taken.

- **Intuitive interpretation of the data**
The meaning of the linear displacement regions is easily understood.

- **Simple measurement and simple analysis**
The measurement is quite simple to execute and the data is straightforward to process.

- **Slip**
Slip can be overcome by using profiled cup and bob or plate and plate sensor systems.

- **Temperature control**
For cone and plate, plate and plate and cup and bob geometries temperature control is not difficult.

- **Sensor system insertion**
Using computer control, the measuring gap is always closed to the same point, at the same speed, making the measurement very repeatable.

2.6 Potential problems with the stress ramp or CS technique

- **Can be time consuming**
Compared with the vane technique, the stress ramp or CS technique can be time consuming. The time taken can be reduced by restricting the range of stresses to where the yield stress is expected to lie and by judicious selection of the rate of change of stress for the stress ramp.

- **Sample loading**
Closing the measuring gap can alter (sometimes irreversibly) the structure of the material. Because of the shape of the sensors and the small size of the measuring gap it is usually impossible to avoid this using any measuring geometry other than the vane.

- **Not enough data points**
If insufficient data are collected there is a danger that the point of inflection will not be captured or there will be insufficient data to evaluate one or both of the linear segments of the curve, leading to poor estimation of the point of inflection and so yield stress will be estimated incorrectly.

- **Agglomerates**
Agglomerates or particles (more than 1/3 of the measuring gap size, or 1/10 of the gap size for highly loaded materials) often occur in mineral slurries and pastes, these can interfere with gap closure for most geometries and may cause an apparently excessive yield stress because of solid particle(s) bridging the measuring gap.

- **Settling or time dependent slurries**
Time dependent slurries change their properties with time. To repeatably measure the maximum yield stress, the material should be allowed to equilibrate. Settling slurries have the opposite problem. If possible they should be measured as quickly as possible, before appreciable settlement has taken place.

3.0 The flow curve extrapolation technique

This is a common technique for indirect measurement of the yield stress.

3.1 To make a measurement you will need:

- **A rheometer or viscometer**
Most mid-range viscometers will suffice, the key criteria are good resolution of the torque, and good range and control of rotational speed, in particular a capability for good control and measurement at very low rpm, and small forces. The better the control and measurement capabilities are at low shear rates and shear stresses, the more accurate the final result can be expected to be. To different degrees, most viscometers and rheometers are capable of this kind of performance.

- **A suitable sensor system**
A vane cannot be used. Cone and plate, plate and plate or cup and bob type sensors can be used (Figure 3). Plate/plate and cup and bob sensors can be serrated to prevent slip for multi-phase materials.

3.2 Theory

The theory behind this type of measurement is that a flow curve is generated, which displays the relationship between the shear stress and the applied shear rate (or vice versa for a CS measurement). The curve is extrapolated back to the shear stress axis (i.e. to shear rate = 0), and the intercept is designated the yield stress.

3.3 Experimental procedure

The experimental layout is standard equipment set-up for the other sensor systems.

- **The sample is loaded and the measuring geometry is closed.**

- **A low shear rate is chosen and imposed on the material**
through the sensor. The shear rate is gradually increased to a preset value.

- The shear stress is monitored and a curve drawn through the data, and extrapolated back to the stress axis. The curve can be constructed by the investigator by hand, or fitted according to some common fitting equation which allows for the presence of a yield stress, like that of Bingham or Herschel Bulkley etc. (Refer to Tim’s Top Tips - How to measure Flow and Viscosity Curves Rheo327)

- The stress intercept is designated the yield stress.

3.4 Results

The results of a flow curve extrapolation to determine yield stress is shown in Figure 5.

![Figure 5: Data from yield stress (\(\tau_0\)) analysis using the flow curve extrapolation technique](image)

Figure 5: Data from yield stress (\(\tau_0\)) analysis using the flow curve extrapolation technique

3.5 Benefits of the flow curve extrapolation technique

- Uses information often already generated
  Often information on the interdependence of shear rate and shear stress is already in existence from previous analyses.

- Small sample volumes are required
  The measuring gap is usually small, in particular for cone and plate or plate and plate geometries.

- Intuitive interpretation of the data
  The meaning of the extrapolation is easily understood.

- Simple measurement
  The measurement is quite simple to execute but data processing is not always straightforward.

- Slip
  Slip can be overcome by using profiled cup and bob or plate and plate sensor systems.

- Temperature control
  For cone and plate, plate and plate and cup and bob geometries temperature control is not difficult.

- Sensor system insertion
  Using computer control, the measuring gap is always closed to the same point, at the same speed, making the measurement very repeatable.

3.6 Potential problems with the flow curve extrapolation technique

- Can be time consuming
  Compared with the vane technique, this technique can be time consuming. It can be necessary to refine different curve fits to find the best one.

- Reliability
  This technique involves extrapolation of known data into an area where behaviour is unknown. This is a dangerous practice as the shape of the flow curve is not known with any certainty outside the area in which a measurement has been performed.

- Accuracy
  Depending on the curve fit, the quality of the data, and the quantity of data, in particular at low shear rates, the prediction of the intercept is unreliable at best.

- Sample loading
  Closing the measuring gap can alter (sometimes irreversibly) the structure of the material. Because of the shape of the sensors and the small size of the measuring gap it is usually impossible to avoid this using any measuring geometry other than the vane.

- Not enough data points
  If insufficient data are collected there is a danger that any curve fit to the known data will be of poor quality, leading to inaccurate prediction of the yield stress.

- Agglomerates
  Agglomerates or particles (more than 1/3 of the measuring gap size, or 1/10 of the gap size for highly loaded materials) often occur in mineral slurries and pastes, these can interfere
with gap closure for most geometries and may cause an apparently excessive shear stress during the flow curve measurement because of solid particle(s) bridging the measuring gap.

- **Settling or time dependent slurries**
  Time dependent slurries change their properties with time.

**Summary**

Table 1 summarises the possibilities for measuring yield stress using the techniques discussed. Each of the techniques is ranked between 0 and 5 for each of the potential issues and solutions, where:

5 = Excellent  
4 = Good  
3 = Adequate  
2 = Possible  
1 = Difficult  
0 = Not Possible

Determining the most suitable type of measurement or instrument is not simply a matter of adding up the ranking for each. Rather, identify which measurement technique, variable etc is most relevant and appropriate for your application/product.

* Depending on the test, these parameters may be viewed alternatively as either a strength or as a weakness

**Table 1: Assessment of strengths/weaknesses for each technique**

<table>
<thead>
<tr>
<th>Technique:</th>
<th>Vane</th>
<th>Stress Ramp</th>
<th>Flow Curve Extrapolation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Measurement</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rapid</td>
<td>5</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Easy</td>
<td>4</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Accurate</td>
<td>4</td>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td>Direct determination of yield stress from measurement</td>
<td>5</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>Small sample volume</td>
<td>2</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Temperature control</td>
<td>2</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td><strong>Measuring system</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rheometer or viscometer</td>
<td>Both</td>
<td>Rheometer</td>
<td>Both</td>
</tr>
<tr>
<td>Cost</td>
<td>5</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Large variety of sensors</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Measures materials with large particles &amp; agglomerates</td>
<td>4</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Structural disruption on loading avoidable</td>
<td>5</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td><strong>Number of Participants</strong></td>
<td></td>
<td></td>
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<tr>
<td>Single operator</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td><strong>Results</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intuitively comprehended</td>
<td>4</td>
<td>4</td>
<td>3</td>
</tr>
</tbody>
</table>

To repeatably measure the maximum yield stress, the material should be allowed to equilibrate. Settling slurries have the opposite problem. If possible they should be measured as quickly as possible, before appreciable settlement has taken place.
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Other Notes Available in the Tim’s Tips - Rheology Solutions for the Mining Industries Series are:

- How to Measure Flow and Viscosity Curves (Rheo327)
- How to Measure Thixotropy (Rheo329)

Other Information Available for the Mining Industries include:

- Rheology Solutions for Mining Industries Information Kit
- Applications Laboratory and Contract Testing Capabilities Statement for Mining Industries
- Technical Literature for Mining Industries

Focused on providing our customers with materials characterisation solutions through knowledge, experience and support.
Mining Dictionary

Industry Term: Beach.
Definition: Deposition of waste solids materials (transported as a slurry or a paste) from which the liquid fraction flows.
Governing Properties: Beach slope is dictated by the viscosity and yield stress of the slurry or paste. Shear viscosity and yield stress, measured on a CR (Controlled Rate) Viscometer using a flow curve (viscosity) and the vane technique (yield point).

Industry Term: Bingham.
Definition: A flow curve exhibiting a linear relationship between shear rate and shear stress, with a positive intercept on the stress axis. The curve is of the form
\[ \tau = \tau_0 + \eta \gamma \]
Governing Properties: Measured using a flow curve generated on CS rheometer or a CR viscometer.
Rheology Solutions Instrument: HAAKE ViscoTester 550, HAAKE RotoVisco, HAAKE RheoStress, HAAKE MARS.

Industry Term: Controlled Deformation.
Definition: Mode of operation for a rheometer or viscometer. Controls the deformation of the sample.
Governing Properties: CD mode is usually available using a CS rheometer or a CR viscometer.
Rheology Solutions Instrument: HAAKE ViscoTester 550, HAAKE RotoVisco, HAAKE RheoStress, HAAKE MARS.

Industry Term: Controlled Rate.
Definition: Mode of operation for a rheometer or viscometer. Controls the shear rate imposed on the sample.
Governing Properties: CR mode is usually available using a CS rheometer or a CR viscometer.
Rheology Solutions Instrument: HAAKE ViscoTester 550, HAAKE RotoVisco, HAAKE RheoStress, HAAKE MARS.

Industry Term: Controlled Stress (Stress Controlled Technique).
Definition: Mode of operation for a rheometer or viscometer. Controls the shear stress imposed on the sample.
Governing Properties: CS mode is usually available using a CS rheometer but not on a CR viscometer.
Rheology Solutions Instrument: HAAKE RheoStress, HAAKE MARS.

Industry Term: Deformation.
Definition: The movement of an element of a material, usually as a result of some applied force.
The rate of deformation (shear rate) due to an applied force is dependent on the resistance of the material – it’s viscosity in the case of a liquid, or rigidity in the case of a solid.
Rheology Solutions Instrument: HAAKE ViscoTester 550, HAAKE RotoVisco, HAAKE RheoStress, HAAKE MARS, Marimex ViscoScope.
**Industry Term:** Flow Curve.
**Definition:** A flow curve is a plot showing the relationship between shear rate and shear stress. Measured using a CS rheometer or a CR viscometer. Rheology Solutions Instrument: HAAKE ViscoTester 550, HAAKE RotoVisco, HAAKE RheoStress, HAAKE MARS.

**Industry Term:** Herschel Bulkley.
**Definition:** A flow curve exhibiting a shear thinning relationship between shear rate and shear stress, with a positive intercept on the stress axis. The curve is of the form:

$$\tau = \tau_0 + K \dot{\gamma}^n$$

**Governing Properties:** Measured using a flow curve generated on a CS rheometer or a CR viscometer.
**Rheology Solutions Instrument:** HAAKE ViscoTester 550, HAAKE RotoVisco, HAAKE RheoStress, HAAKE MARS.

**Industry Term:** Rheology.
**Definition:** The flow and deformation of matter.
**Governing Properties:** N/A
**Rheology Solutions Instrument:** HAAKE ViscoTester 550, HAAKE RotoVisco, HAAKE RheoStress, HAAKE MARS.

**Industry Term:** Rheometer.
**Definition:** An instrument designed for the measurement of viscous and viscoelastic flow properties at specified temperature and atmospheric conditions, by measuring the force required to move one layer over another without turbulence.

**Governing Properties:** Rheometers often have air bearings, making them highly sensitive to small variations in load or displacement and can operate in rotation or oscillation for Controlled Rate or Controlled Stress modes. Some rheometers have mechanical bearings, but in general they do not have the required sensitivity to make good use of CS mode in these cases and cannot run oscillatory measurements well (or at all).
**Rheology Solutions Instrument:** HAAKE RheoStress, HAAKE MARS.

**Industry Term:** Shear Stress.
**Definition:** This is the force per unit area imposed on an element of fluid.
**Governing Properties:** The shear stress is dependent on the geometry of the fluid element and can be measured by a CR viscometer and may be imposed by a CS rheometer.
**Rheology Solutions Instrument:** HAAKE ViscoTester 550, HAAKE RotoVisco, HAAKE RheoStress, HAAKE MARS.

**Industry Term:** Thixotropy.
**Definition:** Thixotropic fluids show shear thinning behaviour combined with a time dependency. The viscosity of a thixotropic fluid drops when subjected to a constant shear rate for a period of time. The viscosity of thixotropic fluids often recovers substantially over a period of time after the shearing forces have been removed.

**Governing Properties:** Thixotropy depends on the rate of structural recovery in the material. It can be measured using a flow curve on a CR or CS instrument, or by measuring the recovery of the moduli after shearing on a CS rheometer.
**Rheology Solutions Instrument:** HAAKE ViscoTester 550, HAAKE RotoVisco, HAAKE RheoStress, HAAKE MARS.
### Industry Term: Vane Technique.
**Definition:** A test for measuring yield stresses using a special ‘star’ shaped rotor. Usually depends on the solids loading in the slurry or suspension and the interaction between them. The presence of viscosity modifiers in the slurry can also affect yield point. Measured using the vane technique and a CR viscometer.

**Rheology Solutions Instrument:** HAAKE ViscoTester 550, HAAKE RotoVisco.

### Industry Term: Viscometer.
**Definition:** An instrument for measuring the viscosity of a liquid, at specified temperature and atmospheric conditions, by measuring the force required to move one layer over another without turbulence; also referred to as a viscometer.

**Governing Properties:** Viscometers usually have mechanical bearings in their motor and generally operate in rotational mode only.

**Rheology Solutions Instrument:** HAAKE ViscoTester 550, HAAKE RotoVisco.

### Industry Term: Viscosity.
**Definition:** The resistance to flow of a fluid.

**Governing Properties:** Viscosity is the shear stress divided by the shear rate. These are measured on a CR viscometer or CS rheometer using a flow curve.

**Rheology Solutions Instrument:** HAAKE ViscoTester VT550, HAAKE RotoVisco, HAAKE RheoStress, HAAKE MARS.

### Industry Term: Yield Stress.
**Definition:** The minimum shear stress required to initiate flow in a fluid.

**Governing Properties:** Governed by the structural properties of the material at rest, measured by extrapolation using a flow curve, or using the vane technique, both on a CR or CS instrument. It can also be measured using a CS rheometer by a stress ramp.

**Rheology Solutions Instrument:** HAAKE ViscoTester 550, HAAKE RotoVisco, HAAKE RheoStress, HAAKE MARS.

### Notes:
- ViscoTester 550 and RotoVisco are controlled rate viscometers, RheoStress is a controlled stress rheometer, MARS is a modular R&D Controlled Stress Rheometer, all of which are HAAKE brand names of Thermo Fisher Scientific (Karlsruhe, Germany) GmbH.
- ViscoScope torsional motion viscometer is a brand name of Marimex Industries Corporation.

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Tim’s Top Tips – Rheology Solutions for the Mining Industries

How To Measure Yield Stress For Mining Slurries

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Company ............................................................... Department ...........................................
Address ...................................................................................................................................
Suburb ............................................................... State .......... Postcode ...........................
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☐ HAAKE VT550 – Controlled Rate Viscometer ☐ HAAKE Temperature Control Range – Refrigerated Circulators
☐ HAAKE RotoVisco – Controlled Rate Viscometer ☐ HAAKE Temperature Control Range – Heating Circulators
☐ HAAKE RheoStress – Controlled Stress Rheometer ☐ HAAKE RheoStress RS600 – Modular Controlled Stress Rheometer
☐ Marimex ViscoScope – In Line Process Viscometer ☐ HAAKE MARS – Modular R&D Controlled Stress Rheometer
☐ Rheology Solutions for Mining Industries Kit ☐ Contract Testing
☐ Technical Literature for Mining Industries ☐ Other (Please specify)

Comments: ...........................................................................................................................................

Please return your completed form to Rheology Solutions Pty Ltd by fax to 03 5367 6477 or post to Rheology Solutions Pty Ltd. PO Box 754 Bacchus Marsh, Victoria 3340 or send an email to info@rheologysolutions.com

Focused on providing our customers with materials characterisation solutions through knowledge, experience and support.

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For all your rheology and service needs please contact:

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Email: info@rheologysolutions.com
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