Technical Manual

# Vibrating Wire Piezometer

## Model 1200


Revision 2022-26-8



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**Important Note**

**Always ensure that the zero reading is taken at installation.**

**For further information, see the data reduction and installation sections of this manual.**




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## 1. Introduction:

The HMA Geotechnical Vibrating Wire Piezometer has been designed to easily measure remote fluid pressures in earthen masses.

The Vibrating Wire Piezometer functions on the principle of tensile wire vibration. As the native reading taken is a frequency measurement, water penetration, temperature variations and contact resistance do not affect the output unlike several other types of electrical instrumentation.
The piezometers can be read using a handheld vibrating wire readout unit , or a standalone datalogger.
Providing the HMA Geotechnical Vibrating Wire Piezometers are installed in accordance with the prescribed techniques, the instrument has the capacity to operate indefinitely.




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## 2. Specifications:

| Piezometer | |
|---|---|
| **Pressure Ranges (kPa)** | 350, 700, 2000, 3000, 5000 |
| **Over Range** | 1.5 x Rated Pressure |
| **Resolution** | 0.025% full scale |
| **Accuracy** | < 0.5% full scale |
| **Operating Temperature** | -20 to 60$^{o}$C |
| **Filters** | 0.5 and 20 micron |
| **Dimensions** | 19mm dia, 136mm long |
| **Weight** | 0.11kg |
| **Signal Output** | Continuous Gauge Frequency |
| **Frequency Range** | 2000 - 3500 Hz |
| **Cable** | |
| **Description** | 2 Pair Twisted 22AWG |
| **Conductor Gauge** | 22AWG |
| **Insulation Material** | PP Compound |
| **Nominal Thickness (mm)** | 0.2 |
| **Nominal OD (mm)** | 1.2 |
| **Drain Wire Gauge** | 24AWG |
| **Applicable Standards** | AS/NZS 1125, AS/NZS 3808 |
| ***Electrical Properties*** | |
| **Max. Conductor DC Resistance @ 20$^{o}$C** | 56.95 Ohms per km |
| **Voltage Test: Core to Core** | 1kV AC for 1 Minute |
| **Voltage Test: Core to Screen** | 1kV AC for 1 Minute |
| ***Mechanical Properties*** | |
| **Operating Temperature** | -15 to 90$^{o}$C |
| **Min. Bend Radius** | 63mm |
| **Approximate Mass** | 5.83kg/100m |



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## 3. Vibrating Wire Piezometer Operation

The HMA Geotechnical Vibrating Wire Piezometer provides a reliable static pressure output to be utilised in a number of applications, such as:

- Water level monitoring
- Soil deposit pressure monitoring
- Compacted fills for dams
- Mining applications (Dewatering, Pumping, Backfill)
- Slope stability
- Seepage

The piezometers are based upon the principle of vibrating wire resonance. The instrument consists of a vibrating wire element connected to a sensitive, perpendicular diaphragm. Exerting pressure, such as pore water pressure, on the diaphragm will cause it to deflect therefore altering the tension and corresponding resonant frequency of the vibrating wire.
Each time a measurement is taken, electromagnetic coils adjacent to the vibrating wire pluck the instrument wire and then measure the resonant frequency of the wire. The frequency of the wire is read by a handheld readout or a datalogger.

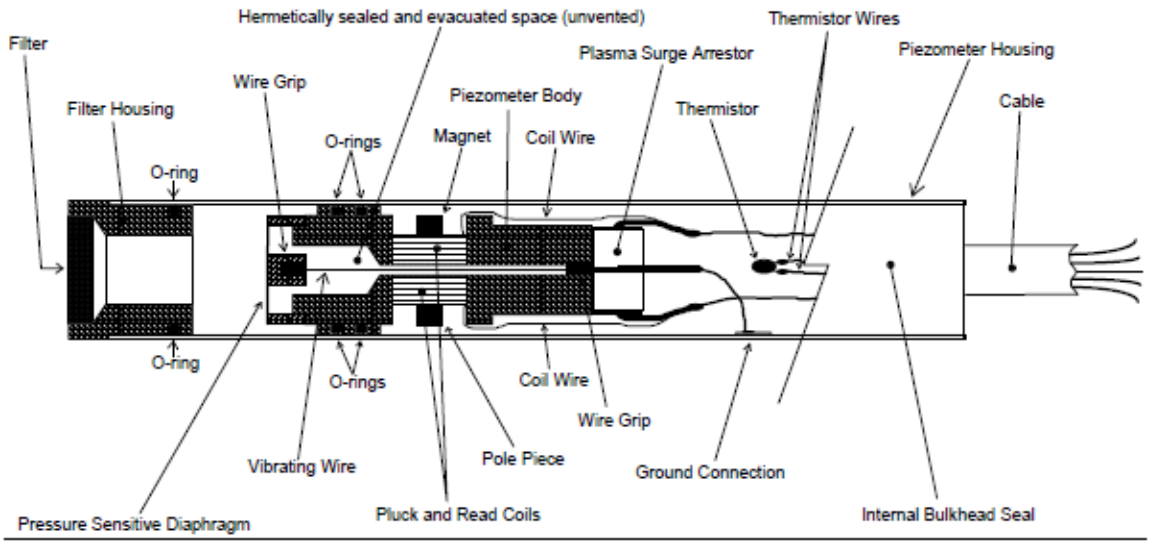


*Figure 1. Vibrating Wire Piezometer construction*

Hand held readouts and dataloggers usually return a Digits (B) reading, being the frequency squared divided by 1000 ($Hz^2 \times 10^{-3}$) as this value is directly proportional to the pressure applied to the diaphragm. By using vibration frequency as a measurement method, water penetration, lead wire resistance and contact resistances are deemed negligible. Long runs of instrumentation cable can be installed also, unlike other forms of piezometers.
The stainless steel housing of the piezometer ensures resistance to corrosive environments.

Standard filters are 20-micron pore diameter sintered stainless steel. However, a variety of filter permeabilities are available to meet different application requirements.



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# 4. Calibration and Interpreting Readings

Prior to shipment each piezometer is individually calibrated with respect to applied pressure. Although comparatively minimal, further corrective calibrations regarding changes in barometric pressure and temperature may also be necessary. It should also be noted that the manufacturers factory elevation is 110 metres above sea level, meaning that further corrections for site elevation may be required.

The site test reading of each piezometer should be checked and noted upon delivery. Theoretically once calibrated the site test reading should closely match the factory reading.

All Geotechnical Systems Vibrating Wire Piezometers have been calibrated to international standards using either pneumatic or deadweight pressure testers. Both testers are traceable to the national standards at the National Bureau of Standards (U.S.A).

Each Vibrating Wire Piezometer ships with a calibration sheet provided by HMA Geotechnical.

## 4.1 Electrical Connection

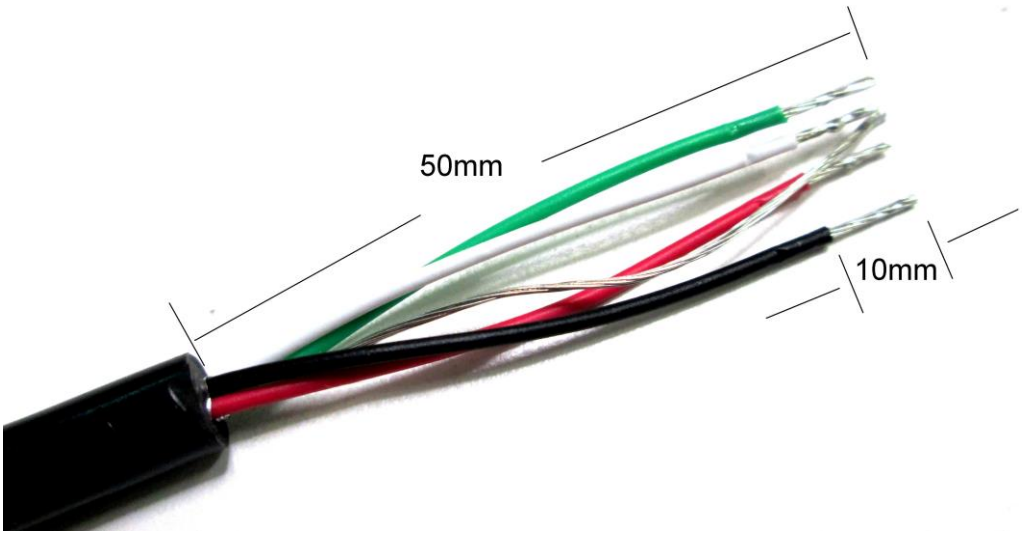


*Figure 2. Typical HMA Geotechnical Vibrating Wire Piezometer cable*

| Conductor Definitions | |
|---|---|
| **Red** | Vibrating Wire |
| **Black** | Vibrating Wire |
| **Green** | Thermistor |
| **White** | Thermistor |



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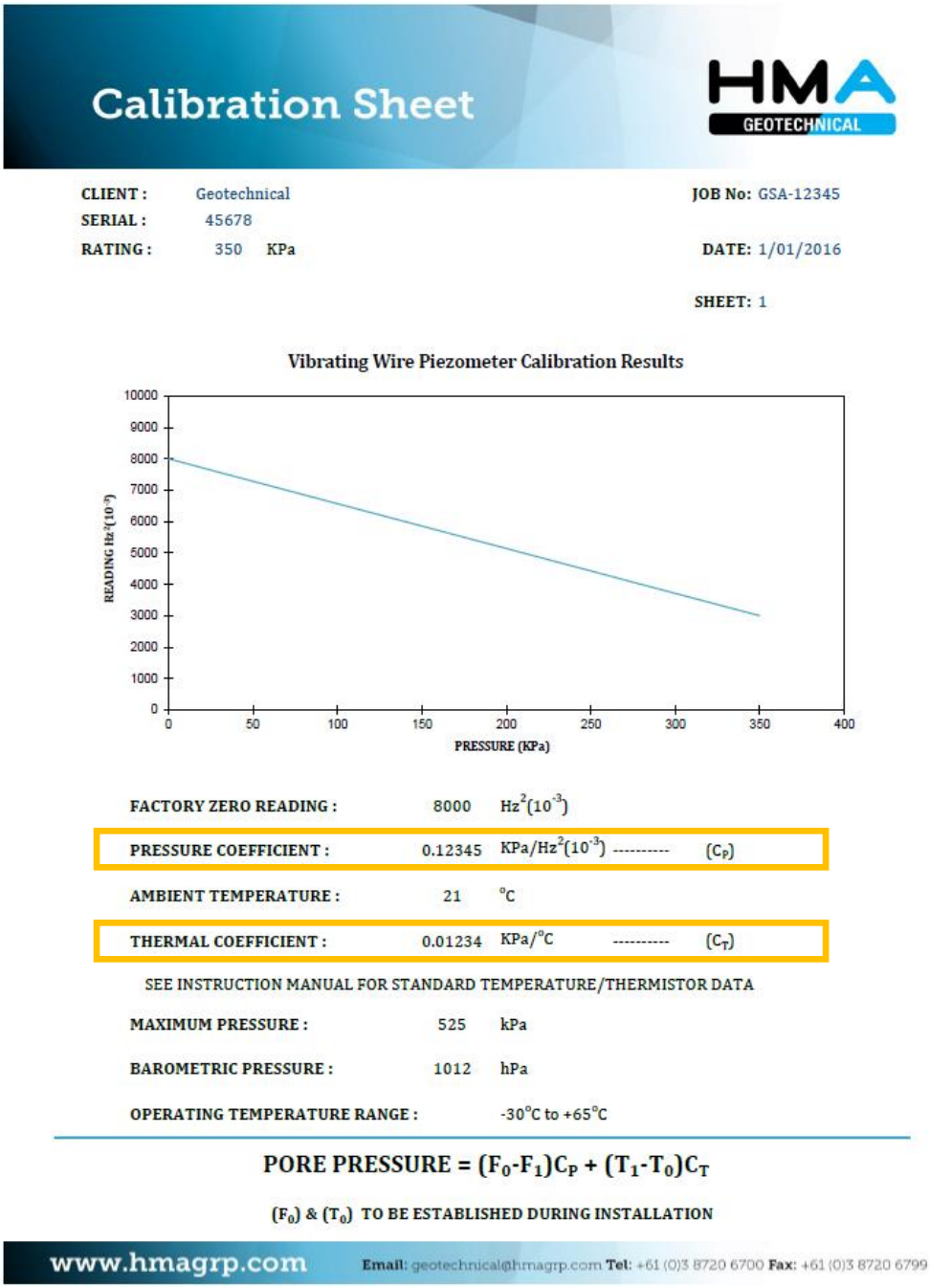
## 4.2 Calibration Sheet Interpretation

HMA Geotechnical supplied piezometers include basic information such as the client name, job number, serial number, and pressure rating at the top of the page.

These are important records to keep, please ensure these sheets are filed away safely.

You will need to refer to the calibration sheet when performing calculations to deduce the pore pressure. The key coefficients have been highlighted below that will be required when performing pressure calculations.



Calibration Sheet

CLIENT : Geotechnical
SERIAL : 45678
RATING : 350 KPa

JOB No: GSA-12345
DATE: 1/01/2016
SHEET: 1

Vibrating Wire Piezometer Calibration Results



| | | | | |
|---|---|---|---|---|
| FACTORY ZERO READING : | 8000 | $Hz^2(10^{-3})$ | | |
| PRESSURE COEFFICIENT : | 0.12345 | $KPa/Hz^2(10^{-3})$ | ---------- | ($C_P$) |
| AMBIENT TEMPERATURE : | 21 | °C | | |
| THERMAL COEFFICIENT : | 0.01234 | KPa/°C | ---------- | ($C_T$) |

SEE INSTRUCTION MANUAL FOR STANDARD TEMPERATURE/THERMISTOR DATA

| | | |
|---|---|---|
| MAXIMUM PRESSURE : | 525 | kPa |
| BAROMETRIC PRESSURE : | 1012 | hPa |
| OPERATING TEMPERATURE RANGE : | | -30°C to +65°C |

$$\text{PORE PRESSURE} = (F_0-F_1)C_P + (T_1-T_0)C_T$$

($F_0$) & ($T_0$) TO BE ESTABLISHED DURING INSTALLATION

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*Figure 3. Typical HMA Geotechnical calibration sheet*

## 4.3 Data Reduction

To calculate the pore water pressure being applied to the piezometer the following formula should be used:

$$P = (F_0 - F_1)C_P + (T_1 - T_0)C_T$$

| | | | |
|---|---|---|---|
| Where | $P$ | = | Pressure (Dependant on pressure coefficient, usually kPa) |
| | $F_0$ | = | Zero reading prior to installation ***taken at site*** ($Hz^2 \times 10^{-3}$) |
| | $F_1$ | = | Current piezometer reading ($Hz^2 \times 10^{-3}$) |
| | $C_P$ | = | Pressure coefficient (kPa / $Hz^2 \times 10^{-3}$) |
| | $C_T$ | = | Temperature Coefficient (kPa / $^oC$) |
| | $T_1$ | = | Current temperature reading ($^oC$) |
| | $T_0$ | = | Zero temperature reading prior to installation ***taken at site*** ($^oC$) |

Refer to "Standard Thermistor Resistance/Temperature tables" table to determine the temperature from the resistance reading from the vibrating wire piezometer's internal thermistor.

**Note: The zero reading must be taken on site and is detailed in the installation section of this manual.**

Do not use the factory reading unless there is no other option. While it is possible to use this value in the event that a zero reading has not been taken prior to installation on site, data will not reflect the true pressure experienced by the transducer.



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## 4.4 Pressure Head/Water Level Calculation

The pressure head is calculated by dividing the kilopascals value taken from a Vibrating Wire Piezometer by the specific weight of water.
Table 1 indicates appropriate values with an example given below.

| Degrees Celsius | Specific Weight (kN/m3) |
|---|---|
| **0** | 9.805 |
| **5** | 9.807 |
| **10** | 9.804 |
| **15** | 9.798 |
| **20** | 9.789 |
| **25** | 9.777 |
| **30** | 9.765 |
| **40** | 9.731 |
| **50** | 9.69 |
| **60** | 9.642 |
| **70** | 9.589 |
| **80** | 9.53 |
| **90** | 9.467 |
| **100** | 9.399 |

*Table 1. Temperature vs Specific Weight*

**Example 1**
A Piezometer is reading 140kPa at 20 degrees Celsius. The pressure head is found by dividing 140kPa by 9.789.

*140kPa/9.789 = 14.3m Pressure Head*

## 4.5 Barometric Compensation

In some instances, it will be necessary to compensate for barometric pressure changes.
If a Vibrating Wire Piezometer is installed in an open borehole, small fluctuating pressure changes may be due to the barometric pressure. This can be overcome by using lower pressure vented piezometers, which utilise a different style of cable inclusive of a vent tube from the instrument to the top of the hole. The vent tube is terminated with a desiccant chamber to prevent moisture ingress. HMA Geotechnical can supply these piezometers when requested.



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# 5. Installation Procedure

## 5.1 Installation in Standpipes

To install the piezometer in open standpipes the transducer is normally lowered to the surface of the water and slightly immersed to allow the unit to come to thermal equilibrium (approximately 5 minutes). A zero reading is taken and the piezometer can then be lowered to the desired position in the standpipe.

In situations where packers are used in standpipes the same sequence as above should be noted and special care should be taken to avoid cutting the cable jacket with the packer since this could introduce a possible pressure leakage path or short circuit the instrument.

## 5.2 Installation in Boreholes (traditional sand layer method)

HMA Geotechnical piezometers can be installed in boreholes in either cased or uncased holes. Careful attention must be paid to borehole sealing techniques if pore pressures in a particular zone are to be monitored.

Boreholes should be drilled either without drilling mud or with a material that degrades rapidly with time, such as Revert. The hole should extend from 150 to 300mm below the proposed piezometer location and should be washed clean of drill cuttings.
The bottom of the borehole should then be back filled with clean sand to a point 150mm below the desired piezometer tip location.

The piezometer can then be installed, as delivered, or preferably encapsulated in a filter cloth bag containing clean, saturated sand.

It is then lowered to the surface of the water and slightly immersed to allow the unit to come to thermal equilibrium (approximately 5 minutes). A zero reading is taken and the piezometer can then be lowered to the desired position in the borehole.

While holding the instrument in position (a mark on the cable is helpful) clean sand should be placed around the piezometer and to a point 150mm above it.

Immediately above the collection zone the borehole should be sealed with either alternating layers of bentonite and sand back fill tamped in place for approximately 300mm followed by common back fill or by an impermeable bentonite – cement grout mix.

If multiple piezometers are to be used in a single hole, the bentonite-sand plugs should be tamped in place below and above the upper piezometers and also at intervals between the piezometer zones. When designing and using tamping tools, special care should be taken to ensure that the piezometer cable jackets are not cut during installation.

<u>It should be noted that as the vibrating wire piezometer is basically a no flow instrument, collection zones of appreciable size are not required and the piezometer can in fact, be placed directly into most materials provided that the fines are not able to migrate through the filter.</u>



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### 5.3 Installation in Boreholes (direct grout method)

HMA Geotechnical piezometers can be installed in boreholes in either cased or uncased holes. Careful attention must be paid to borehole sealing techniques if pore pressures in a particular zone are to be monitored.

Boreholes should be drilled either without drilling mud or with a material that degrades rapidly with time, such as Revert. The hole should extend from 150 to 300mm below the proposed piezometer location and should be washed clean of drill cuttings

Typically a number of piezometers will be installed within the same borehole when using the direct grout method. Piezometers are typically installed in deep boreholes (up to 800m) using this technique.

Due to the long cable lengths and the associated self weight induced strain on the piezometer cables it is advisable to use catenary cable to support the piezometer cables down the borehole. The piezometer cables are fixed to the catenary cable using cable ties at intervals of 1 to 2 metres.

The grout tremie tubes also need to be attached to the catenary wire. It is important to know at what lifts the grout will be placed as well as how many grout tubes are required. It is also important not to over pressurise the piezometers during installation as this may permanently damage the piezometers.
Please note the piezometers have an over range 1.5x that of the specified pressure range. *However, the piezometer is only calibrated to is specified pressure range and not the over range.*

The porous filter is removed from the piezometer tip and the annulus is fully filled with silicon greasing making sure that all air bubbles are removed. A rubber diaphragm (can use cut finger tip from a rubber glove) is then placed and fixed firmly, over the silicon grease filled annulus, to the stainless steel housing of the piezometer. The piezometer can then be installed down (silicon greased filled annulus pointing down the borehole.

It is then lowered (with catenary cable attached) to the surface of the water slightly immersed to allow the unit to come to thermal equilibrium (approximately 5 minutes). A zero reading is taken and the piezometer can then be lowered to the desired position in the borehole.

In general when installing piezometers using the direct grout method, grout mix that is similar to the parameters of the surrounding soil. Typically throughout the entire depth of the piezometer borehole, the surrounding soil will not always be consistent with respect strength and permeability. However, the use of several types of grout mixes within the same borehole to mirror the strength and permeability of the surrounding soil may not be cost effective nor practical. Unless it is necessary to do so, identify one type of grout mix (see Table 2) that would be applicable to the entire length of the piezometer borehole.

When mixing grout the emphasis should be on controlling the water-to-cement ratio as this determines the strength characteristics of the mix. When initially mixing the grout start by **mixing the cement with the water first**. The most effective way of mixing the cement and water is to use a drill rig pump to circulate the mix in a grout mixing tub.

The exact amount of bentonite needed will vary somewhat. Use Table 2 as a guide that shows two possible grout mixes for strengths of 350 kPa and 30 kPa.



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| | 350 kPa Grout for Medium to Hard Soils (Rock) : Ratio by weight | 30 kPa Grout for Soft Soils : Ratio by weight |
|---|---|---|
| **Water** | 2.5 | 6.6 |
| **Cement** | 1 | 1 |
| **Bentonite Powder** | 0.3 | 0.4 |
| Note : | The 28–day compressive strength of t his mix is about 350 kPa, similar to very stiff/hard clay. The modulus is about 70 MPa. | The 28–day strength of this mix is about 30 kPa , similar to very soft clay. |

*Table 2. Grout ratio by weight*

Initially add the measured amount of clean water to the grout mixing tub and then gradually add the cement in the correct weight ratio. Mix the cement thoroughly into the water, and then slowly add the bentonite powder so that clumps do not form. Keep adding the bentonite powder until the watery mix turns to a slimy consistency. Continue mixing for approximately five to 10 minutes to allow the grout to thicken. Add more bentonite as required (see Table 2) until it is a smooth cream like consistency.

When pumping grout (unless the tremie pipe is to be left in place), withdraw the tremie pipe after each batch, by an amount corresponding to the grout level in the borehole.

For more details on grouting, refer to "Piezometers in Fully Grouted Boreholes" by Mikkelson and Green, FMGM proceedings Oslo 2003. Copies are available from HMA Geotechnical.

Once the piezometers are all in position the grout can be pumped down the first (deepest) grout tube. As mentioned earlier it is important not to over pressurise the piezometers with the grout during installation. Please note that typically the specific gravity of a bentonite/cement grout is about 1.6. Once the first lift of grout has been placed it should be left to cure overnight.

The procedure can be repeated for the other piezometers in the same borehole. It is good practice to continually check the piezometer readings during the grouting process.

Once the cables have been all grouted in and the grout has cured the piezometers can now be read.



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## 5.4 Installation in Fills and Embankments

HMA Geotechnical piezometers are normally supplied with direct burial cable suitable for placement in fills such as highway embankments and dams, both in the core and in the surrounding materials, each installation must be treated separately.

In installations in non-cohesive fill materials the piezometer may be placed directly in the fill or, if large aggregate sizes are present, in a saturated sand pocket in the fill. The cable should be similarly protected from the large aggregate.

In fills such as impervious dam cores where sub-atmospheric pore water pressures need to be measured as opposed to the pore air pressure, a ceramic tip with a high air entry value is required and should be carefully placed in direct contact with the compacted fill material.

If only the pore air pressure is required then the low air entry tip is acceptable. It should be noted that the low air entry tip measures the air pressure when there is a difference between pore air pressure and pore water pressure, the difference between the two pressures is due to the capillary suction of the soil. The general consensus is that it is normally of no consequence to embankment stability. As a general rule the low air entry tip suitable for most routine measurements and, in fine cohesive soils, sand pockets should not be used around the piezometer tip.

The zero reading should be taken when the instrument has been installed.



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## 6. Instrument Troubleshooting

To ensure that the vibrating wire piezometers are functioning properly it is advised that the instrument be checked periodically. As the transducers are sealed they cannot be opened for inspection, hence for inaccurate readings the flow chart below should be employed.

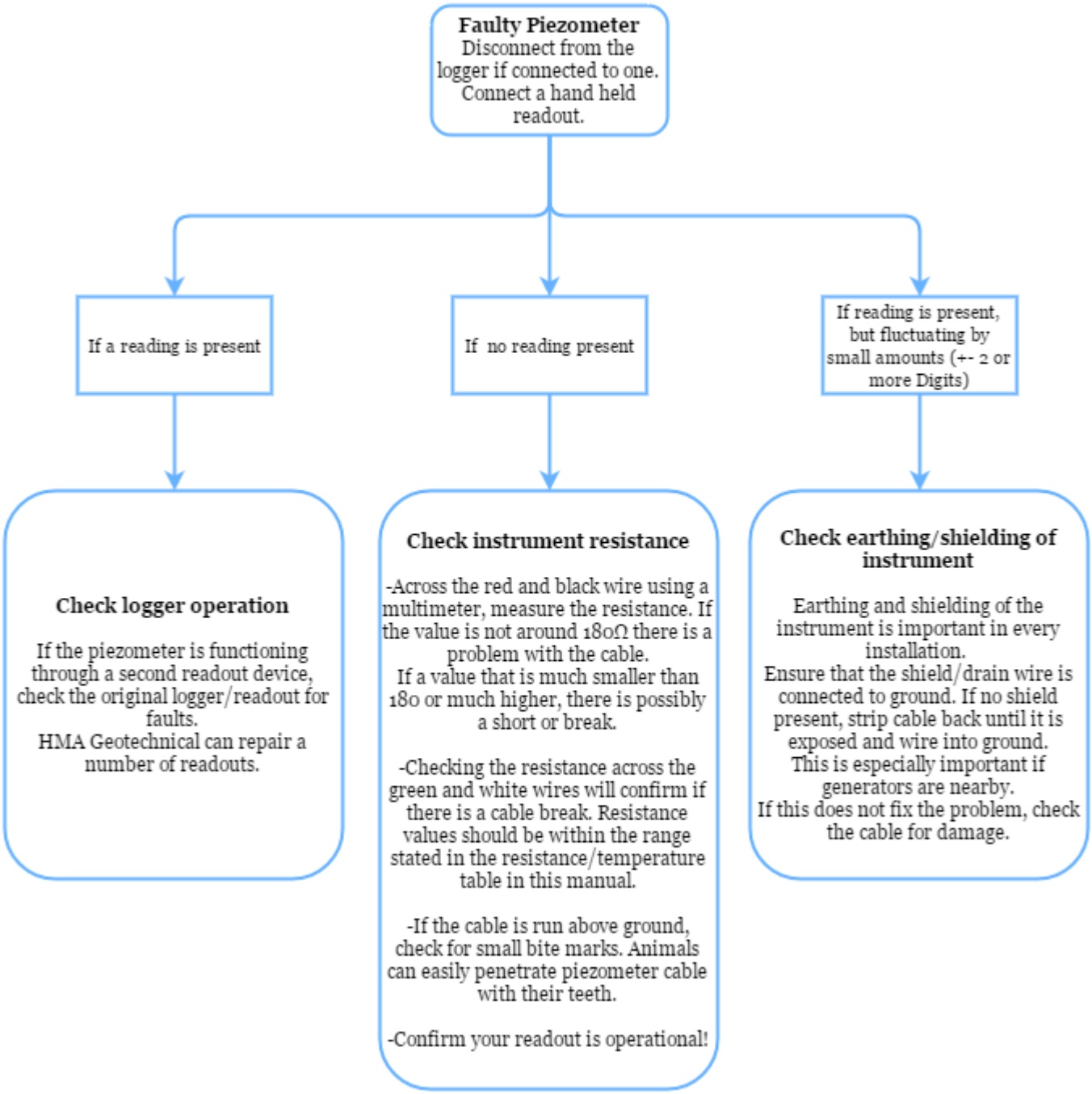


*Figure 4. Piezometer troubleshooting matrix*



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## 7. Field Installation Records Sheet

To assist with installations in the field, HMA Geotechnical provide a standard piezometer installation record sheet that allows any field operator to quickly record key data to be used by monitoring engineers at a later date.

An example is provided below, please contact HMA Geotechnical for a higher resolution copy.

HMA GEOTECHNICAL

| | |
|---|---|
| Hole Number | |
| VWP Serial No. | |

**Installation Record**

BORE LOG

DEPTHS

| | |
|---|---|
| JOB No. | |
| CLIENT | |
| INSTALLER'S NAME | |
| LOCATION | |
| START DATE | |
| FINISH DATE | |
| INSTALLATION TIME TAKEN | |

| | |
|---|---|
| HOLE DEPTH | |
| HOLE DIAMETER | |
| HOLE REF. No. | |

| | |
|---|---|
| INSTRUMENT TYPE | |
| SERIAL No. | |

WORK PERFORMED :

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ANCHOR OR INSTRUMENT DEPTHS (m) | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 |
| ZERO/BASE READINGS UNITS ( f^2 x 10-3 ) | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| FINAL READINGS UNITS ( f^2 x 10-3 ) | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 |

DETAILS OF CONDUIT, TRENCHING, BACKFILL PERFORMED :

DETAILS AND TIMES OF PLANT EQUIPMENT AND SUBCONTRACTORS USED :

DETAILS OF ANY OTHER MATERIAL USED:

NOTES AND PROBLEMS ENCOUNTERED :

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*Figure 5. Standard HMA Geotechnical piezometer installation record sheet*

## 8. Standard Temperature vs Resistance Values

Each vibrating wire piezometer is fitted internally with a thermistor that is used to thermally compensate the pressure readings taken from the vibrating wire transducer (see section 4.3 Data Reduction). In most cases the vibrating wire readout unit or datalogger that is used to read the vibrating wire piezometer will convert the resistance (Ohms) reading from the thermistor into a temperature (°C). If a vibrating wire readout or datalogger is not connected to the vibrating wire piezometer a multimeter/ohm meter can be used to read the thermistor to obtain a resistance reading. The resistance reading can then be substituted into the formula below or referenced against Table 3 to equate a corresponding temperature in °C.

Thermistor Types:

- YSI 44005, Dale #1C3001–B3, Alpha #13A3001–B3
- Honeywell 192–302LET–A01

Resistance to Temperature Equation:

$$T = \frac{1}{A+B(LnR)+C(LnR^3)} - 273.15$$

Where:

T = Temperature in °C

LnR = Natural Log of Thermistor Resistance

$A = 1.4051 \times 10^{-3}$

$B = 2.369 \times 10^{-4}$

$C = 1.019 \times 10^{-7}$

**Note:** Coefficients calculated over the –30 to +65 °C span.



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| Ohms | Temp °C | Ohms | Temp °C | Ohms | Temp °C | Ohms | Temp °C |
|---|---|---|---|---|---|---|---|
| 53100 | -30 | 4105 | 18 | 13390 | -6 | 1475 | 42 |
| 49910 | -29 | 3922 | 19 | 12700 | -5 | 1418 | 43 |
| 46940 | -28 | 3748 | 20 | 12050 | -4 | 1363 | 44 |
| 44160 | -27 | 3583 | 21 | 11440 | -3 | 1310 | 45 |
| 41560 | -26 | 3426 | 22 | 10860 | -2 | 1260 | 46 |
| 39130 | -25 | 3277 | 23 | 10310 | -1 | 1212 | 47 |
| 36860 | -24 | 3135 | 24 | 9796 | 0 | 1167 | 48 |
| 34730 | -23 | 3000 | 25 | 9310 | 1 | 1123 | 49 |
| 32740 | -22 | 2872 | 26 | 8851 | 2 | 1081 | 50 |
| 30870 | -21 | 2750 | 27 | 8417 | 3 | 1040 | 51 |
| 29130 | -20 | 2633 | 28 | 8006 | 4 | 1002 | 52 |
| 27490 | -19 | 2523 | 29 | 7618 | 5 | 965 | 53 |
| 25950 | -18 | 2417 | 30 | 7252 | 6 | 929.6 | 54 |
| 24510 | -17 | 2317 | 31 | 6905 | 7 | 895.8 | 55 |
| 23160 | -16 | 2221 | 32 | 6576 | 8 | 863.3 | 56 |
| 21890 | -15 | 2130 | 33 | 6265 | 9 | 832.2 | 57 |
| 20700 | -14 | 2042 | 34 | 5971 | 10 | 802.3 | 58 |
| 19580 | -13 | 1959 | 35 | 5692 | 11 | 773.7 | 59 |
| 18520 | -12 | 1880 | 36 | 5427 | 12 | 746.3 | 60 |
| 17530 | -11 | 1805 | 37 | 5177 | 13 | 719.9 | 61 |
| 16600 | -10 | 1733 | 38 | 4939 | 14 | 684.7 | 62 |
| 15720 | -9 | 1664 | 39 | 4714 | 15 | 670.4 | 63 |
| 14900 | -8 | 1598 | 40 | 4500 | 16 | 647.1 | 64 |
| 14120 | -7 | 1535 | 41 | 4297 | 17 | 624.7 | 65 |

*Table 3. 3kΩ Thermistor resistance*



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## 9. Definitions

**Factory Reading**
The reading taken at the factory during calibration and shown on the calibration sheet.

**Site Test Reading**
The reading taken on receipt of the equipment to prove its functionality after shipping.

**Zero Reading**
The reading taken during the installation and used for all subsequent calculations. This is the most important reading the installer must take during a field install.

**Pressure Coefficient**
The pressure factor obtained during factory calibration of the instrument and shown on the calibration sheet. This is a calibrated value that determines the amount of pressure (usually in kilopascals) per digit reading. Found on the calibration sheet, calculations cannot be performed without this value.

**Temperature Coefficient**
The temperature factor obtained during factory calibration of the instrument and shown on the calibration sheet. This is a calibrated value that determines the effect of temperature on the Vibrating Wire Piezometer digits reading.



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# 10. HMA Group Conditions of Supply

Accurate as of 14th May 2021. Subject to change. An up to date copy can be viewed at hmagrp.com.

1 Agreement

(a) These Conditions of Supply, any Quotation and any other document referred to in that Quotation, once accepted by you and then us (together, the "Agreement") form a legal agreement between you and us.
(b) Acceptance by you of the Agreement will constitute an offer from you to purchase the Supply from us, which will then be open for acceptance by us. Your offer can be made by doing either one or more of the following things:
(i) Signing these Conditions of Supply; or
(ii) Signing and returning the Quotation or otherwise accepting the Quotation; or
(iii) Issuing a purchase order or similar request for goods or services in response to the Quotation.
(c) Once your offer is made, we are at liberty to accept or reject your offer in our absolute discretion by:
(i) notice to you in writing; or
(ii) Performing the Supply in accordance with a purchase order issued by you.
(d) Your offer in respect of our Quotation must be accompanied by sufficient information to enable us to proceed with the order forthwith otherwise we shall be at liberty to amend the Contract Price and/or delivery period to cover any variation or delay.

2 General and Definitions

(a) Where the following words are not already defined in the Quotation or another part of this Agreement: Confidential Information means the content of this Agreement, any information of a party which is marked confidential and any information which is by its nature confidential.
Contract Price means the price payable in respect of any supply made under this Agreement, more particularly described in the Quotation. goods and/or equipment means goods and/or equipment forming part of the Supply HMA Group Member means any one or more of the following companies and
divisions:
Halley & Mellowes Pty Limited - ABN 83 000 558 627; or
HMA Geotechnical (trading as a Division of Halley & Mellowes Pty Ltd) –ABN 83 000 558 627; or
HMA Materials Handling (trading as a Division of Halley & Mellowes Pty Ltd) –ABN 83 000 558 627; or
HMA Wear Solutions Pty Limited - ABN 69 002 407 730; or
HMA Power Generation - ABN 64 008 425 214; or
Diamond Power (Australia) Pty Limited ABN 64 008 425 214; or
HMA Instrumentation Pty Limited - ABN 42 058 605 959; or
HMA Flow and Industrial Pty Limited - ABN 68 092 292 718; or
Measurement Resources Pty Limited – ABN 62 003 247 738; or
HT Engineering Pty Limited – ABN 76 103 801 574
Intellectual Property Rights means all intellectual property rights at any time protected by statute or common law, including patents, copyright and any registered intellectual property rights, registered designs, trademarks and goodwill; and any application or right to apply for registration of any of these rights. Personnel means your employees, officers, agents or contractors. PPSA means the Personal Property Securities Act 2009 (Cth) as amended from time to time. Where a particular section or term from the PPSA is used in this Agreement, it is deemed to be that section or term as amended, renumbered or replaced from time to time. Quotation means a tender, proposal or quotation submitted to you by us or a third party on our behalf in which these Conditions of Supply are either referred to or attached in full. Supply means the supply of goods and/or services by us, more particularly described in the Quotation.
us, we, our/s means the HMA Group Member or Members who authored and/or submitted the Quotation.
you or your/s means the customer or entity to whom the Quotation is addressed, or if a customer is expressly nominated in the Quotation, then that entity

3 Validity

Unless stated otherwise in the Quotation, the Contract Price and other items contained in the Quotation is/are valid for a period of thirty (30) days from the date of the Quotation and are automatically withdrawn unless accepted by you within this time and confirmed by us. Notwithstanding the above, we may withdraw the Quotation at any time prior to the commencement of this Agreement.

4 Prices

(a) The Contract Price or prices quoted are in Australian Dollars, based on the quantities quoted, current costs and exchange rates at the date of Quotation or at the specified base date (if any) and unless expressly stated to the contrary are subject to variation to cover any increase in costs and exchange rates between the date of Quotation (or the base date) and the date of any actual Supply that results in an increase in price.
(b) If any variation or modification of the Supply is received after your order is accepted by us, any such variation or modification will be charged as an additional cost to you.
(c) The Contract Price is exclusive of all taxes, imposts, duties or levies (including without limitation, goods and services tax, sales tax, value added tax, withholding tax, customs/import duty, etc).
(d) You must pay in addition to and at the same time and in the same method as the Contract Price, all taxes, imposts, duties or levies (whether Federal State or otherwise) upon the Supply, or any goods or raw material incorporated into the Supply, imposed either prior to or subsequent to the placement of the order.



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5 Packaging and Transport

Unless otherwise specified in our Quotation:

(a) delivery terms are EXW (Incoterms 2011) at place of manufacture;
(b) if we have agreed to provide any packing cases, skids, drums, etc. then all packing cases, skids, drums, etc must be returned to us at your expense and in good condition within one month of receipt, otherwise their cost will be charged to you; and
(c) where goods need packing for transportation, that packing will be suitable for transportation of the goods by road. Special packing such as fumigated cases will only be provided where quoted and ordered.
(d) You shall ensure that you or your transport company comply with the Heavy Vehicle National Laws and Regulations, National Transport Commission Load Restraint Guide and National Heavy Vehicle Regulator Chain of Responsibility obligations and the HMA Freight Handling Guideline.

6 Delivery/Installation Dates

(a) Any dates given in our Quotation for delivery or installation are estimates only and while we shall use reasonable commercial endeavours to meet such dates you acknowledge and agree that no liability shall attach to us for any loss or damage, (whether direct or consequential), arising out of any such delay in delivery or
(b) If due to any cause beyond our control including but not limited to acts of God, storm, flood, war or insurrection, industrial disputes, or due to the unavailability of materials on reasonable commercial terms, we are unable to deliver or install, either within the times quoted to you (or in the absence of any specified time, within a reasonable time), or at all, the Agreement shall be voidable at the option of either party with no right by the other party to claim any damages beyond liability for payment of any completed (or partially completed) Supply.

7 Payment

(a) Where we have approved credit to you (and subject to the terms of any such credit approval), unless otherwise specified in writing by us, the terms of payment are in full by EFT, cash or bank cheque 30 days from the date of our invoice.
(b) Notwithstanding any other provisions herein contained or any other agreement with you (and without prejudice to any other rights we may have at law, in the event of any account remaining unpaid by you after the due date of payment:

i. we shall be entitled, at our option and without notice to you to suspend any work or refuse delivery of any goods; and
ii. you will be liable to pay interest on any amount outstanding until that amount is paid in full. Interest will be calculated on the rate that is 2% above our then current financial institution's overdraft rate for $100,000, calculated daily and compounding monthly.

8 Title and Risk

(a) The risk in any goods which are supplied by us to you will pass:

i. In the case of supply of goods only, immediately upon delivery to you, your Personnel or a nominated carrier for transportation to you, or to some other place or site nominated by you or upon pick up by you or your agent; or.
ii. in the case of supply and installation of any goods, immediately upon the delivery of the goods to work site.

(b) Such delivery shall in every case be deemed to be delivered to you and accepted by you whether or not you are present at the time of delivery to sign a receipt for such goods.
(c) You must:

i. effect and maintain with a reputable insurance company insurance for the goods, at your cost, against all risks as it thinks appropriate;
ii. note our interest on the insurance policy; and
iii. produce a certificate of currency of the insurance effected by you under this clause 8(b) to us, upon request.

(d) Risk in the goods will remain with you at all times unless we retake possession of the goods in accordance with clause 8(g)(ii).
(e) Title in the goods supplied by us to you will not pass to you and will remain our absolute property until such time as we have been paid all monies due and owing to us by you in relation to any account.
(f) Until such time as we have been paid all monies due and owing to us by you in relation to any account:

i. You take custody of the goods and retain them as our fiduciary agent and bailee.
ii. You may resell but only as a fiduciary agent of our. Any right to bind us to any liability to any third party by contract or otherwise is however expressly negated.
Any such resale is to be at arms length and on market terms and pending resale or utilization in any manufacturing process is to be kept separate from your own, properly stored, protected and insured.
iii. You will receive all proceeds whether tangible or intangible, direct or indirect of any dealing with the goods on trust for us and will keep such proceeds in a separate account until the liability to us shall have been discharged.
iv. We are to have power to appropriate payments to such goods and accounts as we thinks fit notwithstanding any appropriation by you to the contrary.
v. In the event that you use the goods in some manufacturing process of your own or some third party, then you shall hold such part of the proceeds of such manufacturing process as relates to the goods on trust for us. Such part shall be deemed to equal in dollar terms the amount owing by you to us at the time of the receipt of such proceeds.
vi. You may not assign, factor or otherwise deal with your right to receive payment from any person in respect of a sale of any goods, or any item manufactured using any goods, without our written consent.

(g) If you have breached this Agreement, you authorise us, at any time, to enter onto any premises upon which our goods are stored with liability for trespass or damage to enable us to:

i. inspect the goods; and/or
ii. reclaim the goods.

(h) if you sell, dispose of or otherwise deal with goods or any part thereof before full payment has been received by us, you must advise us in writing, at such times as we may request, specifying full details of the goods sold, disposed of, utilized or otherwise dealt with.



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(i) You agree that the provisions of this clause 8 apply despite any arrangement under which we grant credit to you.

9 Security and PPSA

(a) To the extent permitted by law, and for better securing payment of the Contract Price plus any costs or charges, you hereby charge all of your real and personal present and after-acquired property in favour of us.
(b) You acknowledge and agree that this Agreement constitutes a security agreement in relation to our security interest in all present and after-acquired goods in accordance with the PPSA. Conditions of Supply 14th May 2021
(c) You also acknowledge and agree that the PPSA applies to our separate security interests set out in clause 8 and at 9(a) above.
(d) To the extent permitted by law, the following provisions of the PPSA do not apply, and for the purposes of s115 of the PPSA are contracted out of this Agreement:

i. sections 95 (notice of removal of accession), to the extent that it requires us to give a notice to you, 96 (retain of accession) and 125 (obligation to dispose of or retain collateral);
ii. section 130 (notice of disposal), to the extent that it requires us to give a notice to you;
iii. section 132(3)(d) (contents of statement of account after disposal);
iv. section 132(4) (statement of account if no disposal);
v. section 135 (notice of retention);
vi. section 142 (redemption of collateral);
vii. section 143 (reinstatement of security agreement).

(e) For the purposes of section 14(6) of the PPSA, you (and we) agree that any payments received from you pursuant to or in any way connected with this Agreement, will be applied in the following order of priority:

i. Firstly, if there are any debts or obligations outstanding to us which are not secured by clause 8 or this clause 9, then to those debts or obligations, in the order they arose;
ii. Secondly, if there are debts or obligations outstanding to us which are secured, but are not classified as purchase money security interests (for the purposes of the PPSA), then to those debts or obligations, in the order they arose or were incurred; and
iii. Lastly, to any obligations or debts secured by purchase money security interests (as defined by the PPSA).

(f) You consent to:

i. and agree to execute any other document or instrument required to give effect to the security interests created by this Agreement; and
ii. the registration with the relevant authority or public register of any security interest created by this Agreement or any other document required to give effect to a security interest created by this Agreement.

(g) You must pay all costs of and incidental to the preparation, execution and registration of any instrument which is executed for the purposes of giving effect to this clause and must also pay all costs incidental to the withdrawal, discharge or release of such instrument.

10 Storage

In the event of us receiving no instructions as to delivering, or not receiving sufficient instructions to enable us to despatch the goods or equipment to you within 14 days after the date of notification that they are ready for despatch, you must take delivery or arrange for storage. If you do not take delivery or arrange for storage, we shall be entitled to deliver the goods or equipment at your place of business or on site or elsewhere on your behalf and all charges for storage, insurance or for demurrage shall be payable by you. In such case delivery shall be deemed to have been made and payment will be due

11 Cancellation

Orders, once accepted by us, can only be countermanded or cancelled with our written consent provided always that you must indemnify us against any and all costs and losses incurred as a result.

12 Technical Data

All descriptions, specifications, drawings and particulars of weights and dimensions submitted with the Quotation are approximate only, intended merely to present a general idea of the goods or services. After acceptance by you of our tender or quotation all relevant technical information may be supplied by us on request providing always that we have the right to withhold any confidential information or trade secret. Such technical data however must not under any circumstances be shown to any third party not a party to this agreement or necessary for its performance unless our written consent is obtained.

13 Variation

(a) We reserve the right to make, at our discretion, any necessary substitutions of materials and equipment to effect the Supply.
(b) As our policy is one of continued product improvement the specification of the goods and equipment to be supplied is subject to change without notice.

14 Assignment

We reserve the right to assign any or all of our rights and obligations under this Agreement. You must not assign your rights under this Agreement without our prior written consent.

15 Tests

Our goods are carefully inspected before despatch. If special tests or tests in your presence or the presence of your representatives are required, these tests, unless otherwise agreed, must be made at our works and will be at your additional expense, and in the event of any



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delay on your part in attending such tests after seven days notice that we are ready, the tests may proceed in your absence and shall be deemed to have been made in your presence.

16 Performance

Any performance figures given by us are based on information supplied to us by the manufacturers or distributors of various goods or equipment. We shall be under no liability for damages for failure to attain such figures unless we have specifically guaranteed them in writing subject always to recognised tolerances applicable to them and any variances based on differing inputs, loads, installation or usage requirements being applied to them.

17 Intellectual Property

(a) Any pre-existing Intellectual Property Rights owned by us before the commencement of this Agreement, will remain vested in us.
(b) Any pre-existing Intellectual Property Rights owned by you before the commencement of this Agreement, will remain vested in you.
(c) Subject to any Intellectual Property Rights existing in any third party materials, all Intellectual Property Rights, created by us on or after the commencement of this Agreement will remain vested in us notwithstanding those rights were created pursuant to or for use in the supply of goods or services under this Agreement.

18 Warranty and Limitation of Liability

(a) In relation to the goods we manufacture, to the fullest extent permitted by law, our liability is limited to making good by replacement or repair defects which, under proper use, appear thereon and arise solely from faulty design, material or workmanship within a period of six calendar months after the original goods or equipment have been first despatched, at the termination of which period all liability on our part ceases. For the avoidance of doubt, we are not liable for defects arising out of:

i. A failure by you or your Personnel to properly store any goods or equipment;
ii. A failure by you or your Personnel to use or operate any goods or equipment in strict accordance with any manuals, guidelines or directions given by us, or in the absence of such manuals, guidelines or directions, then in strict accordance with applicable industry standards;
iii. Defects caused by the continued use or operation of the goods or equipment after you or your Personnel have become aware of ought to have become aware of a defect in the goods or equipment;
iv. Defects caused or contributed to by any design, materials or workmanship provided by you or your Personnel; or
v. Any part of the goods or equipment reasonably considered as consumables, intended to be consumed or used up on a regular basis including but not limited to items such as grinding media and ceramic wear items.

(b) In the case of goods or equipment not of our manufacture, you are entitled only to such benefits as given under any manufacturer's warranty in respect thereof which we are able to assign to you.
(c) Except where expressly prohibited by statute, save as set out sub-clauses (a), (b) and (f) of this clause 16 all expenses or implied warranties relating to quality or fitness for any purpose of the goods is hereby expressly excluded to the fullest extent permitted by law.
(d) Such defects referred to in sub-clauses (a) and (b) of this clause 16 must be notified to us at the address above as soon as any defect is noticed and you must prove to our satisfaction that the goods or equipment in question were manufactured or supplied by us.
(e) Where goods are manufactured by us or supplied to you to your description or specification we shall be under no liability to replace or repair defects arising from faulty design, or for any other claims whatsoever except faulty workmanship or material.
(f) In the event that any Supply is a supply of goods or services to a consumer as defined in AUSTRALIAN COMPETITION AND CONSUMER ACT 2010 (as amended or replaced) ("the Act") nothing contained in this Agreement excludes or modifies any condition, warranty, right or remedy which pursuant to the Act applies to the Agreement or is conferred upon you provided that to the extent the Act permits us to limit such liability then our liability for such breach shall be limited at our absolute discretion to any one of the following:

i. the cost of replacing the goods; or
ii. cost of acquiring equivalent goods; or
iii. the cost of repairing the goods; or
iv. in the case of services, the supplying of the services again; or
v. The payment for the cost of having the services supplied again.

(g) The foregoing shall be our sole and exclusive liability to you arising from our dealings with you.
(h) Under no circumstances whatsoever shall we be liable to you for special, incidental or consequential damages including but not limited to damage or loss resulting from inability to use the goods, loss of anticipated profits, loss by reason of plant shut down, non-operation or increased expense of operation, service interruption, loss of production, cost of purchased or replacement power, claims of customers, cost of money, loss of capital or revenue, or for any special, incidental or consequential damages, whether similar to dissimilar of any nature arising from any cause whatsoever, whether based in contract, tort (including negligence), strict liability or any other theory of law and whether or not we have been given notice of the possibility of any such damages or losses occurring.

19 Dispute

If a dispute arises out of or relates to this contract, or the breach, termination, validity or subject matter thereof, the parties agree to endeavour to settle the dispute with good faith negotiations between the respective General Managers of both parties before having recourse to litigation.



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20 Entire Agreement

These terms and conditions constitute the entire agreement regarding the Supply and shall only be varied, modified or rescinded by written agreement and approved by us and shall expressly exclude and nullify any differing terms and conditions purported to be incorporated into the Agreement in any document produced by or on your behalf.

21 Applicable Law and Jurisdiction

This contract is entered into in New South Wales under the laws of that State and is subject to the exclusive jurisdiction of the courts of New South Wales for the adjudication of any disputes arising here from.

22 Confidentiality

We are supplying you with goods, operations manuals and other support documents which are subject of copyright and other statutory and common law protection. After you have purchased the goods and materials from us, you are not permitted to disclose to any other person or company, or to use for any purpose other than for that you have disclosed to us, any of the documentation, engineering, design and manufacturing details; operations manuals or any other information in any way related to the goods and other materials supplied to you pursuant to this Agreement. Further, you must keep confidential any other Confidential Information supplied by us to you. If you fail to comply with the preceding paragraph, you will cause damage to us, and we will be entitled to seek compensation from you. However you acknowledge that compensation may be inadequate on its own, and that we may be entitled to seek injunctive relief, in addition to compensation. This condition continues even after you have paid for and taken delivery of the goods and other materials. This condition does not apply to information already publicly available other than due to a breach of this condition by you (or by any person obtaining this information from you), or if you are compelled to disclose the information to a Court or similar body.

23 Minimum Order Value

Our minimum order value is AUD $150 per order.

End of Conditions



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