K350 Attachment
(Sputter Coating/Glow Discharge)
Instruction Manual

For technical and applications advice plus our on-line shop for spares and consumable parts visit www.quorumtech.com
For further information regarding any of the other products designed and manufactured by Quorum Technologies, contact your local representative or directly to Quorum Technologies at the address above.

<table>
<thead>
<tr>
<th>Issue</th>
<th>Date</th>
<th>Details</th>
<th>Revised By</th>
</tr>
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<td>1</td>
<td>10/10/2000</td>
<td>Initial Issue for new instrument</td>
<td>DJR</td>
</tr>
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<td>2</td>
<td>10/09/2002</td>
<td>Page 1 Photo added</td>
<td>RIS</td>
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<tr>
<td>3</td>
<td>04/10/2002</td>
<td>Rear and Front Panel added</td>
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<td>4</td>
<td>06/06/2005</td>
<td>Fuse Listings Updated</td>
<td>HJR</td>
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<td>5</td>
<td>04/09/2006</td>
<td>Rear Panel changed and note added re: override plug</td>
<td>HJR</td>
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<tr>
<td>6</td>
<td>01/09/2007</td>
<td>Manual format changed to new layout, new sections and index</td>
<td>JLS</td>
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<tr>
<td>7</td>
<td>04/08/2008</td>
<td>Paragraph 3.2.2. removed, St St Electrode changed to Aluminium</td>
<td>JLS</td>
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</table>

**Disclaimer**

The components and packages described in this document are mutually compatible and guaranteed to meet or exceed the published performance specifications. No performance guarantees, however, can be given in circumstances where these component packages are used in conjunction with equipment supplied by companies other than Quorum Technologies Ltd.

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2 Health and Safety

Safety is very important when using any instrumentation. Quorum Technologies is committed to providing a safe working environment for its employees and those that use its equipment and conducts its business responsibly, and in a manner designed to protect the health and safety of its customers, employees and the public at large. It also seeks to minimise any adverse effects that its activities may have on the environment.

Quorum Technologies regularly reviews its operations to make environmental, health and safety improvements in line with UK and European Community legislation.

Quorum Technologies cannot be held responsible for any damage, injury or consequential loss arising from the use of its equipment for any other purposes, or any unauthorised modifications made to the equipment.

All service work carried out on the equipment should only be undertaken by suitably qualified personnel. Quorum Technologies is not liable for any damage, injury or consequential loss resulting from servicing by unqualified personnel. Quorum Technologies will also not be liable for damage, injury or consequential loss resulting from incorrect operation of the instrument or modification of the instrument.

2.1 Control of Substances Hazardous to Health (COSHH)

The E.C. legislation regarding the “Control of Substances Hazardous to Health” requires Quorum Technologies to monitor and assess every substance entering or leaving their premises. Consequently any returned goods of whatever nature must be accompanied by a declaration form Health and Safety Declaration form completed. (Appendix 7.2.5 for the form)

Without this declaration Quorum Technologies reserves the right not to handle the substance/item. Also in accordance with E.C. regulations we will supply on request hazard data sheets for substances used in our instruments.

2.2 WEEE Compliance

This product is required to comply with the European Union's Waste Electrical & Electronic Equipment (WEEE) Directive 2002/96/EC.

![WEEE Directive Symbol](image)

Figure 2-1: WEEE Directive Symbol

For full details of our environmental policies including WEEE please visit [http://www.quorumtech.com/environmental_policy.htm](http://www.quorumtech.com/environmental_policy.htm)
2.3 Conformity
This Equipment of this Design and manufacture and marked CE, conforms with the requirements of the European Directives EMC 89/336/EEC & LVD 73/23/EEC.

2.4 Hazard Signal Words
The standard three hazard signal words are defined as follows:

- **DANGER** - *imminently* hazardous situation or unsafe practice that, if not avoided, *will* result in death or severe injury.
- **WARNING** - *potentially* hazardous situation or unsafe practice that, if not avoided, *could* result in death or severe injury.
- **CAUTION** - *potentially* hazardous situation or unsafe practice that, if not avoided, *may* result in minor or moderate injury or damage to equipment.

2.5 Fail Safe
This Equipment will “fail safe” in the presence of excessive RF, Electrostatic Discharge or Mains Transients. While a loss of function could occur under extreme circumstances the Equipment's operation will be fully recoverable under normal operating conditions.
3 Description

3.1 K350 Attachment

The K350 System employs a magnetron target assembly which enhances the efficiency of the process using low voltages.

The Instrument is fitted with 60mm diameter Target x 0.1mm Thick Gold quick change target, giving optimum consumable cost performance.

**NOTE:** (When used as a Glow Discharge Unit the target is exchanged with 60mm Diameter Aluminium Electrode.)

The integrated Instrument panel and plug-in electronics, maximise 'up-time' and, with user friendly designs, ensures satisfactory multi-user discipline.

The parameters of current and time can be pre-set. The sputtering head is interlocked with a vacuum switch mounted on the sputtering head in addition to the needle valve to control argon gas flow.

3.1.1 Hydrophilisation

Freshly made Carbon support films tend to have a hydrophobic surface which inhibits the spreading of suspension of particles in negative staining solutions. However, after Glow Discharge treatment with Air, the Carbon Film is made Hydrophilic and Negatively charged, thus allowing easy spreading of aqueous suspensions. With subsequent Magnesium Acetate treatment the surface is made Hydrophilic and Positively charged.

In addition to Glow Discharge treatment using air, other Process Gases may be used to modify surface properties. For example, if alkylamine is used as a process gas, the Carbon Film surface will become Hydrophobic and positively charged. On the other hand, using Methanol as a Process Gas results in the surface becoming Hydrophobic and Negatively charged. Such treatments can facilitate the optional absorption of selected Biomolecules.
3.2 Glow Discharge Summary

<table>
<thead>
<tr>
<th>Atmosphere</th>
<th>Surface</th>
<th>Charge</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air</td>
<td>Hydrophilic</td>
<td>Negative</td>
</tr>
<tr>
<td>Air</td>
<td>Hydrophilic</td>
<td>Positive (With subsequent Magnesium Acetate treatment)</td>
</tr>
<tr>
<td>Alkylamine</td>
<td>Hydrophobic</td>
<td>Positive</td>
</tr>
<tr>
<td>Methanol</td>
<td>Hydrophobic</td>
<td>Negative</td>
</tr>
</tbody>
</table>

Table 1: Glow Discharge

3.2.1 Surface Cleaning

In many instances, surfaces need to be completely cleared of contamination films or deposits. This applies particularly to EM components where such deposits impair the maintenance of a clean vacuum system. A Glow Discharge treatment can be used to clean such components of undesirable residues.

3.3 Specifications

Specifications of the K350 Attachment Unit

<table>
<thead>
<tr>
<th>Plasma Voltage</th>
<th>0-1000V Variable DC @ 100mA.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electrode Polarity</td>
<td>+DC or –DC with Aluminium Electrode 60mm Dia</td>
</tr>
<tr>
<td>Glow Discharge Lid</td>
<td>To suit Vacuum Chamber Glass 165mm Dia x 125mm High</td>
</tr>
<tr>
<td>H.T. Vacuum Interlock</td>
<td></td>
</tr>
<tr>
<td>Needle Valve Bleed Control</td>
<td></td>
</tr>
<tr>
<td>Instrument Case</td>
<td>230mm Wide x 350mm Deep x 175mm High</td>
</tr>
<tr>
<td>Weight</td>
<td>10.0 Kg</td>
</tr>
<tr>
<td>Electrical Supply</td>
<td>230V 50 Hz 6 Amp max Supply</td>
</tr>
<tr>
<td></td>
<td>115V 60 Hz 12 Amp max Supply</td>
</tr>
</tbody>
</table>

Table 2: Specifications for the K350 Attachment Unit
4 Installation

![WARNING – MAINS LEAD](image)

This Equipment must be Earthed and fitted with the correct lead for the country of operation. This will normally be achieved from the correct mains supply socket.

It is important that this equipment is installed and operated by skilled personnel in accordance with these instructions. Failure to do so may result in damage, and impair protection provided. 'If in doubt - ask'.

4.1 Preliminary Checks

Remove Instrument from packing and place on appropriate operational position. Carry out visual inspection for any signs of transit damage. Remove Accessories Pack, and check contents against K350 Accessories Pack shipping list. Ensure that all areas of the Instrument are free of loose packaging material.

4.2 Connections

Connections should only be made in accordance with instructions. Refer To: Fig 4-1 and Table 3.
UNDER NO CIRCUMSTANCES SHOULD ANY OTHER CONNECTIONS OR OUTLETS/INLETS BE USED FOR ANY OTHER EQUIPMENT OR SERVICES.

### WARNING – EARTH CONNECTOR

This Equipment is normally supplied from 3 pin supply including Earth. If only 2 pin supply is available a separate Earth must be fitted. The supplementary Earth stud can be used to facilitate this requirement.

<table>
<thead>
<tr>
<th>TITLE</th>
<th>FUNCTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rocker Switch</td>
<td>Main power on to Instrument incorporating neon indicator</td>
</tr>
<tr>
<td>Power In</td>
<td>Main power inlet socket.</td>
</tr>
<tr>
<td>Needle Valve (Located On Head)</td>
<td>Argon process gas inlet supply from low pressure regulator used to control vacuum for sputtering.</td>
</tr>
<tr>
<td>Coating Output</td>
<td>HT output to cathode (target) head.</td>
</tr>
<tr>
<td>Interlock</td>
<td>Inhibits HT sputtering supply until vacuum has been achieved.</td>
</tr>
<tr>
<td>Fuse 1</td>
<td>Electronics power supply fuse.</td>
</tr>
<tr>
<td>Fuse 2</td>
<td>Output fuse HT sputter supply.</td>
</tr>
<tr>
<td>Control Cable</td>
<td>Enables signal from freestanding FTM or override plug</td>
</tr>
</tbody>
</table>

Table 3: K350 Rear Panel Functions

For fuse ratings and voltages refer to: Section 6.3.

*For 'stand alone' operation of the instrument without the FTM, the 5 Pin DIN override plug supplied should be fitted to the control cable socket in the rear panel of the Coater. The Coater will now operate in the normal manner in isolation.*

Carry out process gas connections to needle valve with tubing and connectors provided.

Ensure the two-part ferule is located correctly with taper towards valve. Tighten lock nut to ensure leak-free connection.

Argon gas is recommended at a nominal pressure of 4 p.s.i.

The electrical input to the Instrument is made with the power lead provided. The Instrument connection is standard, and the lead is fitted with the appropriate plug for the country of operation. Ensure the plugs are firmly located. Check the voltage label on the Instrument, this is found at the end of the Instruction manual.

Ensure that the HT connector to the lid is screwed firmly in place, and also screwed in firmly to the rear panel connection. Ensure interlock connector is firmly in place. Check the sputtering head is correctly located on the vacuum chamber.
5 Operation

5.1 Display

The diagram below shows the layout of the instrument front panel showing the LCD and the data entry keys.

![Figure 5-1: K350 Front Panel](image)

<table>
<thead>
<tr>
<th>TITLE</th>
<th>FUNCTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Start</td>
<td>Non-latching, self maintaining switch (manual initiate.)</td>
</tr>
<tr>
<td>Stop</td>
<td>Non-latching, self maintaining. Switches sputtering manually.</td>
</tr>
<tr>
<td>Polarity</td>
<td>The polarity switch enables H.T. voltage polarity to be changed for use when Etching/Glow Discharge mode. An interlock prevents this being changed whilst sputtering.</td>
</tr>
<tr>
<td>Deposition Control</td>
<td>Controls deposition current in milliamps (mA). Normal operation at approx. 20mA.</td>
</tr>
<tr>
<td>Timer Control</td>
<td>Sets time between 1 minute to 4 minutes normal operation at 2 minutes. Switches off sputtering automatically at end of time period.</td>
</tr>
<tr>
<td>Needle Valve Control</td>
<td>Controls flow of gas “bleed” during process.</td>
</tr>
<tr>
<td>Polarity Select</td>
<td>Selects cathode negative or positive (for sputtering cathode is always selected negative for etching is always selected positive, for Glow Discharge it may be negative or positive depending on the application, but negative is the more common mode to make coatings hydrophilic.</td>
</tr>
</tbody>
</table>

Table 4: K350 Front Panel Controls
5.2  **Sputtering Sequence**

The sequence of events for a typical coating run when used for sputtering. Assuming the Instrument has been set up as Instructions under Section 4.

**NOTE:** - Ensure Polarity Switch is selected to negative. Do not change polarity during operation.

1. The suggested parameters which should be satisfactory for general applications are as listed.
   
   (a) Needle valve (bleed) adjustment set to give $1 \times 10^{-1}$ mbar with process at nominal 4 p.s.i. 
   (b) Deposition current at 20mA  
   (c) Deposition time 2 minutes.
   (d) Typical coating 15nm (150 Angstroms).

2. Start.
   
   (a) The vacuum chamber should have stable vacuum of $1 \times 10^{-1}$ mbar.
   (b) Coat will operate at deposition current of 20mA.

3. At end of Cycle
   
   (a) Timer will switch off coating automatically.
   (b) Close Needle Valve of K350.
   (c) Operate vent-stop on main Instrument, and purge to allow specimens to be removed.

**CAUTION**

Always switch off mains power to K350 before removing the sputtering head, when changing target, or when not in use.
5.3 Glow Discharge Sequence

When used as glow discharge option incorporated in K350.

When used in glow discharge mode either for surface treatment of carbon films or etching of surfaces, if a gold target was previously fitted for sputter coating, this should be exchanged for the stainless steel target provided to avoid contamination or sputtering occurring when not required.

The Polarity of the Head can be switched from Positive to Negative with respect to Earth, for Carbon Film Surface Treatment or Surface Etching of Metallic Specimens.

Plasma Voltage 0 - 1000V Variable DC @ 50mA.
Electrode Polarity +DC or -DC with Stainless Steel.
Electrode 60mm Dia.

The sequence of events for a typical Glow Discharge Carbon Film treatment.

**NOTE 1**: Glow Discharge is normally in air, so a process gas is not required. Negative DC is selected.

**NOTE 2**: The Glow Discharge cycle is rated for a Max 50mA for 5 minutes, with a duty cycle of 50% (Off time - 5 minutes.)

1. The suggested parameters which should be satisfactory for general applications are as listed.
   (a) Operate Pump-Start on main unit.
   (b) Needle Valve (bleed) adjustment set to give $2 \times 10^{-1}$ mbar with process at nominal 4 p.s.i. (If a process Gas is used).
   (c) Current at 20mA.
   (d) Time 2 Minutes.
   (e) Glow Discharge will operate at deposition current of 20mA.

2. At End of Cycle.
   (a) Operate vent stop on main unit
   (b) If further purging is required, the vent stop on main unit can be operated manually.
   (c) To abort a run operate stop on Glow Discharge and vent-stop on main unit.
   (d) And Vent-stop on main unit.

**NOTE**: For Glow Discharge Etching - Treatment is similar to above, but with positive DC selected, current higher at 30mA, and longer timer at 3 minutes.

**IMPORTANT DO NOT REVERSE POLARITIES DURING A CYCLE.**
5.3.1 Glow Discharge Protocols

Both Glow Discharge Carbon Film Treatment, and Glow Discharge Etching can be obtained by experience with particular specimens.

Please consult Reference Papers.

1. DUBOCHET, J. GROOM, M. and MUELLER-NEUTEBOOM,


ADVANCES IN OPTICAL and ELECTRON MICROSCOPY, Vol 8, pp 107-135.

(Available On Request)
6 Service and Maintenance

For technical and applications advice plus our on-line shop for spares and consumable parts visit www.quorumtech.com

<table>
<thead>
<tr>
<th>CAUTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ensure mains electrical power is off during any maintenance and service activities</td>
</tr>
</tbody>
</table>

6.1 Changing Target

Loosen the two small Allen screws around the circumference of the target holder using the Allen key provided with your spares kit. These locate into a 'V' groove in the target circumference, the target can then be removed. Replace with the new target, ensuring that the screws are tightened equally and firmly into the 'V' groove to ensure good electrical and mechanical connection.

Regularly inspect electrical power cords and plugs for general condition.

6.2 Service

Routine service should not be necessary. In the event of non-operation, carry out the following checks.

**IMPORTANT**: Depending on nature of problem, disconnect power cord before carrying out any servicing activities.

1. Check power to instrument: neon on rear should be illuminated.
2. Check fuses: Refer To: Section 6.3
3. Check chamber seating for vacuum leaks.
4. Check operating conditions of instrument controls.
5. Check Allen screws to target and connections.
6. Check correct conditions have been set.
7. Check all connections.

In the event of all checks proving negative, please contact Emitech, or your local distributor.

An advance delivery modular exchange service scheme is operated for the complete single module control electronics.

This can be customer installed in accordance with Instructions provided.
6.3 **Fuse Listings**

Fuse listing for 230 Volt K350

<table>
<thead>
<tr>
<th>TITLE</th>
<th>RATING</th>
<th>FUNCTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fuse 1</td>
<td>T800mA Ceramic</td>
<td>Unit Power</td>
</tr>
<tr>
<td>Fuse 2</td>
<td>T630mA Ceramic</td>
<td>H.T. Sputter Output</td>
</tr>
</tbody>
</table>

Table 5:- Fuse Listing for the 230 Volt K350

Fuse listing for 115 Volt K350

<table>
<thead>
<tr>
<th>TITLE</th>
<th>RATING</th>
<th>FUNCTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fuse 1</td>
<td>T2A Ceramic</td>
<td>Unit Power</td>
</tr>
<tr>
<td>Fuse 2</td>
<td>T1A Ceramic</td>
<td>H.T. Sputter Output</td>
</tr>
</tbody>
</table>

Table 6:- Fuse Listing for the 115 Volt K350

Fuse Standard CSA C22.2/UL 198G *

Replacement fuses can be supplied by QUORUM TECHNOLOGIES, or the approved distributor.**

** If an approved distributor is not known - please contact Quorum Technologies direct for details.
7 Appendices

7.1 World Wide Electrical Supplies

<table>
<thead>
<tr>
<th>COUNTRY</th>
<th>VOLTAGE</th>
<th>FREQUENCY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Australia</td>
<td>240V</td>
<td>50Hz</td>
</tr>
<tr>
<td>Brazil</td>
<td>115V/230V</td>
<td>60Hz</td>
</tr>
<tr>
<td>Canada</td>
<td>115V</td>
<td>60Hz</td>
</tr>
<tr>
<td>Finland</td>
<td>230V</td>
<td>50Hz</td>
</tr>
<tr>
<td>France</td>
<td>230V</td>
<td>50Hz</td>
</tr>
<tr>
<td>Germany</td>
<td>230V</td>
<td>50Hz</td>
</tr>
<tr>
<td>India</td>
<td>230V</td>
<td>50Hz</td>
</tr>
<tr>
<td>Ireland</td>
<td>230V</td>
<td>50Hz</td>
</tr>
<tr>
<td>Israel</td>
<td>230V</td>
<td>50Hz</td>
</tr>
<tr>
<td>Italy</td>
<td>230V</td>
<td>50Hz</td>
</tr>
<tr>
<td>Korea (South)</td>
<td>230V</td>
<td>60Hz</td>
</tr>
<tr>
<td>Japan</td>
<td>115V</td>
<td>50 / 60Hz</td>
</tr>
<tr>
<td>Netherlands</td>
<td>230V</td>
<td>50Hz</td>
</tr>
<tr>
<td>Norway</td>
<td>230V</td>
<td>50Hz</td>
</tr>
<tr>
<td>Pakistan</td>
<td>230V</td>
<td>50Hz</td>
</tr>
<tr>
<td>Portugal</td>
<td>230V</td>
<td>50Hz</td>
</tr>
<tr>
<td>Scandinavia</td>
<td>230V</td>
<td>50Hz</td>
</tr>
<tr>
<td>Singapore</td>
<td>230V</td>
<td>50Hz</td>
</tr>
<tr>
<td>Spain</td>
<td>230V</td>
<td>50Hz</td>
</tr>
<tr>
<td>Taiwan</td>
<td>115V</td>
<td>60Hz</td>
</tr>
<tr>
<td>Turkey</td>
<td>230V</td>
<td>50Hz</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>230V</td>
<td>50Hz</td>
</tr>
<tr>
<td>United States of America</td>
<td>115V</td>
<td>60Hz</td>
</tr>
</tbody>
</table>

Table 7: Electrical supplies World Wide
7.2 **Return of Goods**
Safety information for the return of Preparation Equipment and Accessories.

7.2.1 **General Introduction:**
The employer (user) is responsible for the health and safety of his employees. This also applies to all those persons who come into contact with the Preparation Equipment and Accessories either at the user’s or manufacturer’s premises during repair of service. The contamination of Preparation Equipment and Accessories has to be declared and the Health and Safety Declaration form completed. (Appendix -7.2.5 for the form)

7.2.2 **Health and Safety Declaration**
Those persons carrying out repair or service have to be informed of the condition of the components. This is the purpose of the ‘Declaration of Contamination of Preparation Equipment and Accessories’.

7.2.3 **Despatch**
When returning equipment the procedures set out in the Operating Instructions must be followed. For example:
- Drain the vacuum pumps.
- Neutralise the flushing with gas.
- Remove filter elements.
- Seal all outlets.
- Pack glass components safely.
- Pack loose attachments securely for example stages.
- Seal in heavy duty polythene or a bag,
- Despatch in suitable transport container.

7.2.4 **Return Address:**
F. A. O.: The Service Manager,
QUORUM TECHNOLOGIES LTD,
Units 1 & 3 Eden Business Centre
South Stour Avenue,
ASHFORD,
Kent. TN23 7RS
7.2.5 Declaration of Contamination Form

Declaration of Contamination of Preparation Equipment and Accessories.
The repair and/or service of Preparation Equipment and Accessories can only be carried out if a correctly completed declaration has been submitted. Non-completion will result in delay. The manufacturer reserves the right to refuse acceptance of consignments submitted for repair or maintenance work where the declaration has been omitted. This declaration may only be completed and signed by authorised and qualified staff.

1. Description of component
   - Equipment type/model: ____________________________
   - Code No.:        ____________________________
   - Serial No.:       ____________________________
   - Invoice No. (if known)     ____________________
   - Delivery Date.: (if known)_____________________

2. Reason for return:
__________________________________________
__________________________________________
__________________________________________
__________________________________________
__________________________________________

3. Equipment condition
   - Has the equipment been used? Yes/No
   - What type of operating medium was used?
   - Is the equipment free from potentially harmful substances? Yes/No
     (If Yes go to Section 5)
     (If No go to Section 4)

   - Toxic                                        Yes/No
   - Corrosive                                    Yes/No
   - Explosive*                                   Yes/No
   - Microbiological*                             Yes/No
   - Radioactive*                                 Yes/No
   - Other harmful substances        Yes/No

* We will not accept any Equipment/Accessories which have been radioactively, explosively, or microbiologically contaminated without written evidence that such Equipment/Accessories have been decontaminated in the prescribed manner.

Please list all harmful substances, gases and dangerous by-products, which have come into contact with the Preparation Equipment and Accessories.

<table>
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<tr>
<th>Trade name</th>
<th>Chemical name and symbol</th>
<th>Danger class</th>
<th>Precautions associated with substance.</th>
<th>First aid measures in the event of an accident.</th>
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5. Legally Binding Declaration.
I hereby declare that the information supplied on this form is complete and accurate. The despatch will be in accordance with the appropriate regulations covering Packaging, Transportation and Labelling of Dangerous Substances.

Name of Organisation: __________________________________________________________________
Address: _____________________________________ ________________________________________
                      _____________________________________ ________________________________________
Tel.:        _____________________________  Fax.:   ______________________
Name:    _____________________________  Job Title:               ______________________
Date:      _____________________________  Company Stamp:  ______________________

Table 8: Declaration of Contamination Form
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