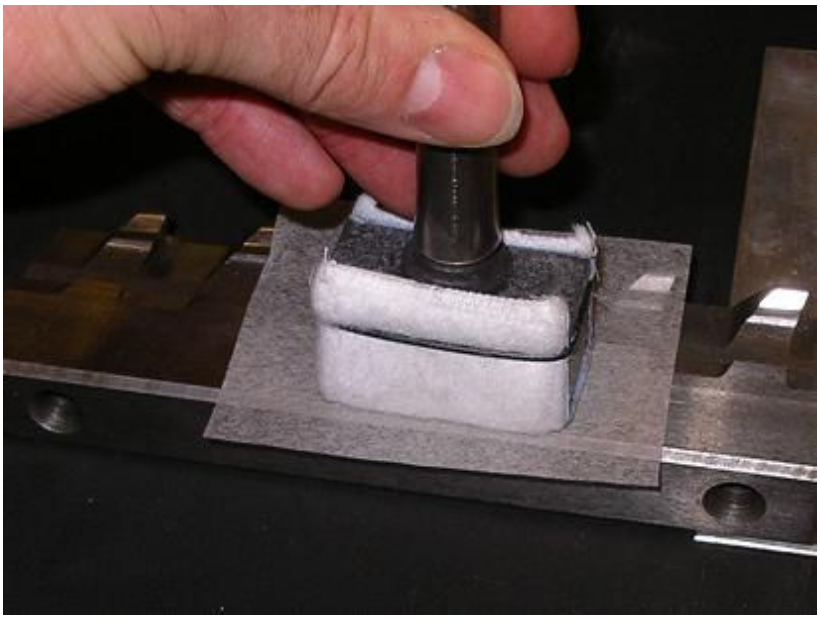
Electro-Chemical Etching
User Guide and
Accessories Catalogue



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EC DECLARATION OF CONFORMITY

DESCRIPTION OF MACHINERY: ETCHMASTER USB

SERIAL NUMBER:

- -

THIS MACHINE COMPLIES WITH THE FOLLOWING DIRECTIVES:

: The machinery Directive 98/37/EC
as implemented by The Supply of Machinery (Safety) Regulations 1992 (SI No. 3073) and The Supply of Machinery (Safety) (Amendment) Regulations 1994 (SI No. 2063).

: The EMC Directive 89/336/EEC (as amended by 92/31/EEC and 93/68/EEC)
as implemented by The Electromagnetic Compatibility Regulations 2005 (SI No. 281).

: The Low Voltage Directive 73/23/EEC (as amended by 93/68/EEC)
as implemented by The Electrical Equipment (Safety) Regulations 1994 (SI No. 3260

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THIS MACHINERY AS DESCRIBED IN THIS DECLARATION OF CONFORMITY CONFORMS IN ALL RESPECTS WITH THE ESSENTIAL HEALTH & SAFETY REQUIREMENTS STATED IN THE ABOVE LISTED DIRECTIVES, STANDARDS AND SPECIFICATIONS.

SIGNED ____________ ***TITLE: MANAGING DIRECTOR***

DATE: ....

EMPOWERED TO SIGN ON BEHALF OF THE RESPONSIBLE PERSON, MR N. ANDREW, DIRECTOR OF EDWARD PRYOR AND SON LTD. AT THE ABOVE ADDRESS.

CONTENTS

SECTION 1
Introduction

1.1 Description of Process

The process works by the electro-chemical dissolution and/or oxidation of metal from the surface being marked through a stencil impression to give the required mark.

This is achieved by sandwiching a stencil between the surface being marked (connected to the anodic polarity of the etching unit) and an electrolyte soaked pad (connected to the cathodic polarity), and passing a low voltage current between the two. When using AC cycle the Anode and Cathode are alternated around 50-60 cycles per second.

1.2 When to use ECE?

Electro-chemical marking shall be permissible only when specified by Engineering Design authority.

1.3 Sub-surface Marking (Permanent)

Sub-surface Electro-Chemical Etch marking is commonly achieved by the application of a combination etch. This is a direct current (DC) followed by oxide alternating current (AC). Power and time settings will vary for different material item combinations. Typically marking depths produced are 0,0025mm / 0.0001” minimum to 0,100mm / 0.004”.

1.4 Surface Marking (Semi Permanent) (Titanium only)

This forms a dark oxide film on the surface of the item with little or no depth. This type of mark is generally less durable than Sub-surface Electro-Chemical Etching marking. Due to this, Surface Electro-Chemical Etching shall be subject to Engineering Design Authority. The process is achieved by the application of AC current only. Power and time settings will vary for different material / item cominations.

1.5 Components - Condition

Components must be clean and free from corrosion or scale.
The area to be marked must be free from insulating surface treatments - paint, anodizing etc.

SECTION 2
Equipment

2.1 EtchMasterUSBTM Digital Etching Unit

- Controls Current Voltage and Duration.
- Supports etch, oxide and etch/oxide sequences.
- AC/DC.
- 6-30 Volts.
- 0-10 Amps.
- 0-30 Seconds.
- PC or stand alone operation.
- Stores settings (10 pre-programmed) infinite via PC.
- Visible and audible cycle complete.
- Foot switch actuation.
- Spark suppression.

Options

- Auto actuation output.
- Peristaltic pump output for auto fluid delivery.

2.2 Thermal Stencil Printer.

- 300 dpi Thermal Printer
- Stencil Cutter Attachment
- Media Feed Attachment
- Media Cover.

2.3 Stencil material

Stencil material and stencil generation are critical to producing repeatable quality of coded identification. There are 4 common types of stencil material currently available, the method commonly used in Rolls-Royce plc for Data Matrix are:

2.3.1 Thermal transfer printed stencil - disposable

This type of stencil material is similar to Die-impression paper, with a permeable fabric and a non-permeable laminate. The main difference being that the laminate is only microns thick. The laminate is thermally removed from the stencil using a thermal printer leaving the image on the permeable fabric. The process is generally reliable and produces a good quality mark. The stencils are normally used once and then disposed of. Slight variations in print quality are mainly due to the weave of the permeable fabric structure. Can be used more than once, generally up to 5 times with a combined etch and 10 times when used with AC oxide mark only.

2.3.2 Photographic Stencil.

This type of stencil material is normally more durable than thermal transfer stencils. It is most suited to fixed data marks.

SECTION 3
Electrolyte and Cleaner

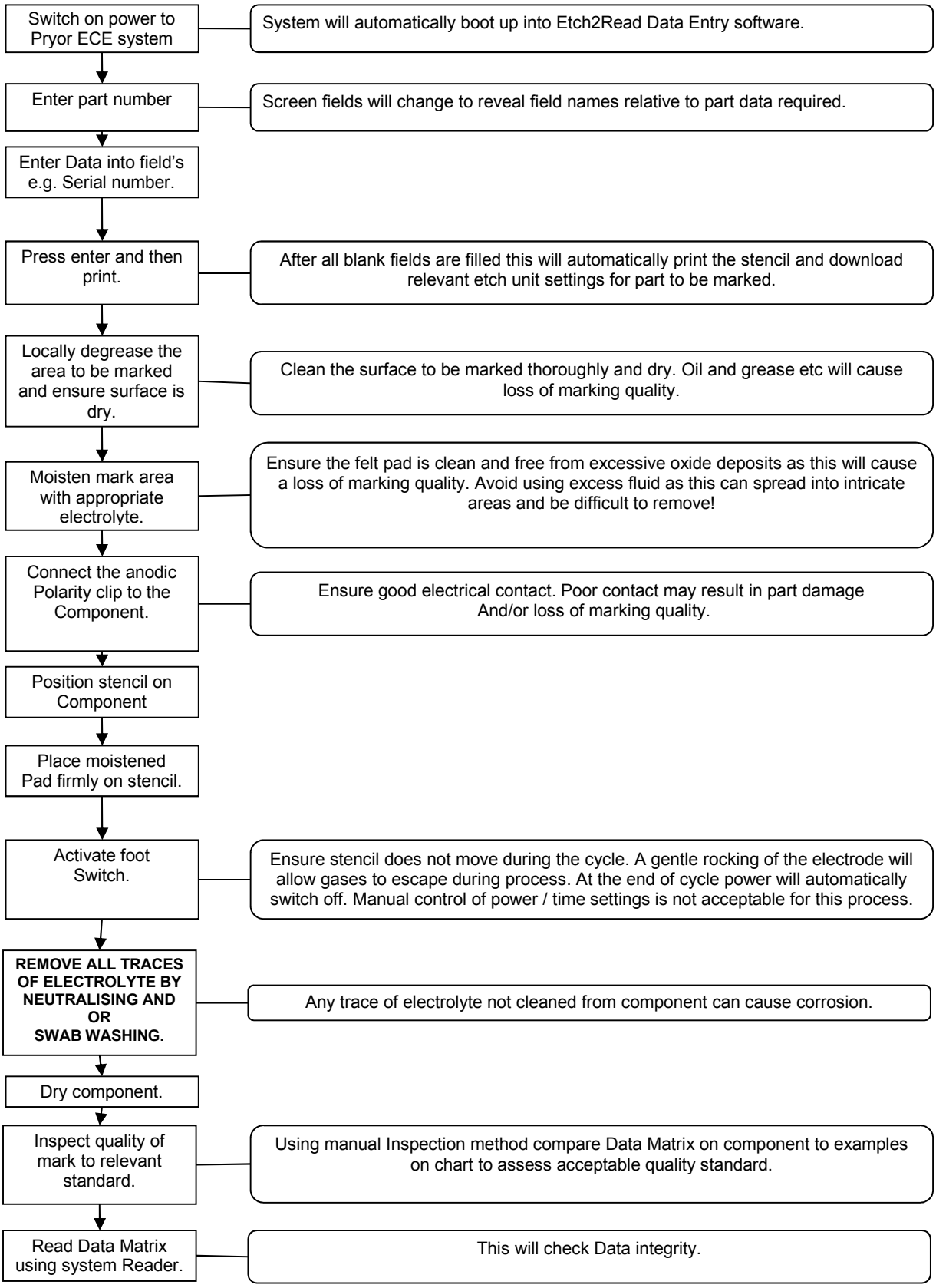
3.1 Electrolyte Solutions

A large number of electrolyte solutions exist, the compositions of which may vary according to component material type. However as they are all designed to produce some form of chemical attack of the material, it is vitally important that all traces of electrolyte are washed/removed/neutralized from the entire component immediately after the marking process is complete. It is also vitally important to note that when applying or removing the electrolyte, that the electrolyte and washing solution shall not be allowed to flow into any openings or cracks between parts. The type/composition and use of the electrolyte fluid shall be the responsibility of the Engineering Design authority.

3.2 Material Settings table

Material	Electrolyte	Etch Power (DC)	Etch Time (sec)	Oxide Power (AC)	Oxide Time (sec)	Comments
TCA Titanium	PAE5	0	0	2	0.5	Wipe surface with marking head prior to applying stencil. Use damp pad and high marking pressure.
17-7 Stainless steel	PAE5	4	2	4	6	Wipe surface with marking head prior to applying stencil. Use gentle rocking motion during cycle.
ERY Stainless steel	PAE5	4	2	4	6	Wipe surface with marking head prior to applying stencil. Use gentle rocking motion during cycle.
TAK Titanium	PAE3	0	0	2	0.5	Wipe surface with marking head prior to applying stencil. Use damp pad and high marking pressure keeping electrode still.
EBM Stainless steel	PAE5	4	2	4	6	Wipe surface with marking head prior to applying stencil. Use gentle rocking motion during cycle.

3.3 Process Flowchart



SECTION 4
Neutralising

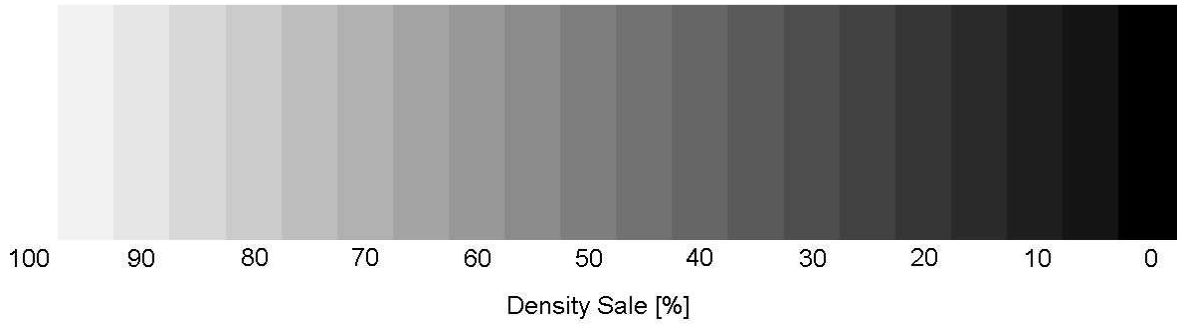
Neutralising is extremely important and should be thorough enough to **REMOVE ALL TRACES OF ELECTROLYTE** from the component; any trace of electrolyte left on the material could potentially result in corrosion over a period of time. After neutralising dry area with clean wipe.

Aerospace Approved De-ionised water is normally used in the form of Pryor **DIW 1** or alternative.

SECTION 5
Data checking & integrity.

5.1 Inspection of Surface Colour - Contrast

Surface colours and mark contrast will affect the quality of component identification. In general, dark colours are applied to light surfaces and light markings applied to dark surfaces.
The minimum contrast level between the marking and its substrate as a grey density difference should be no less than 20%.



A Scale of Gray Density

In order to maximize quality, original surface discoloration should be minimized.

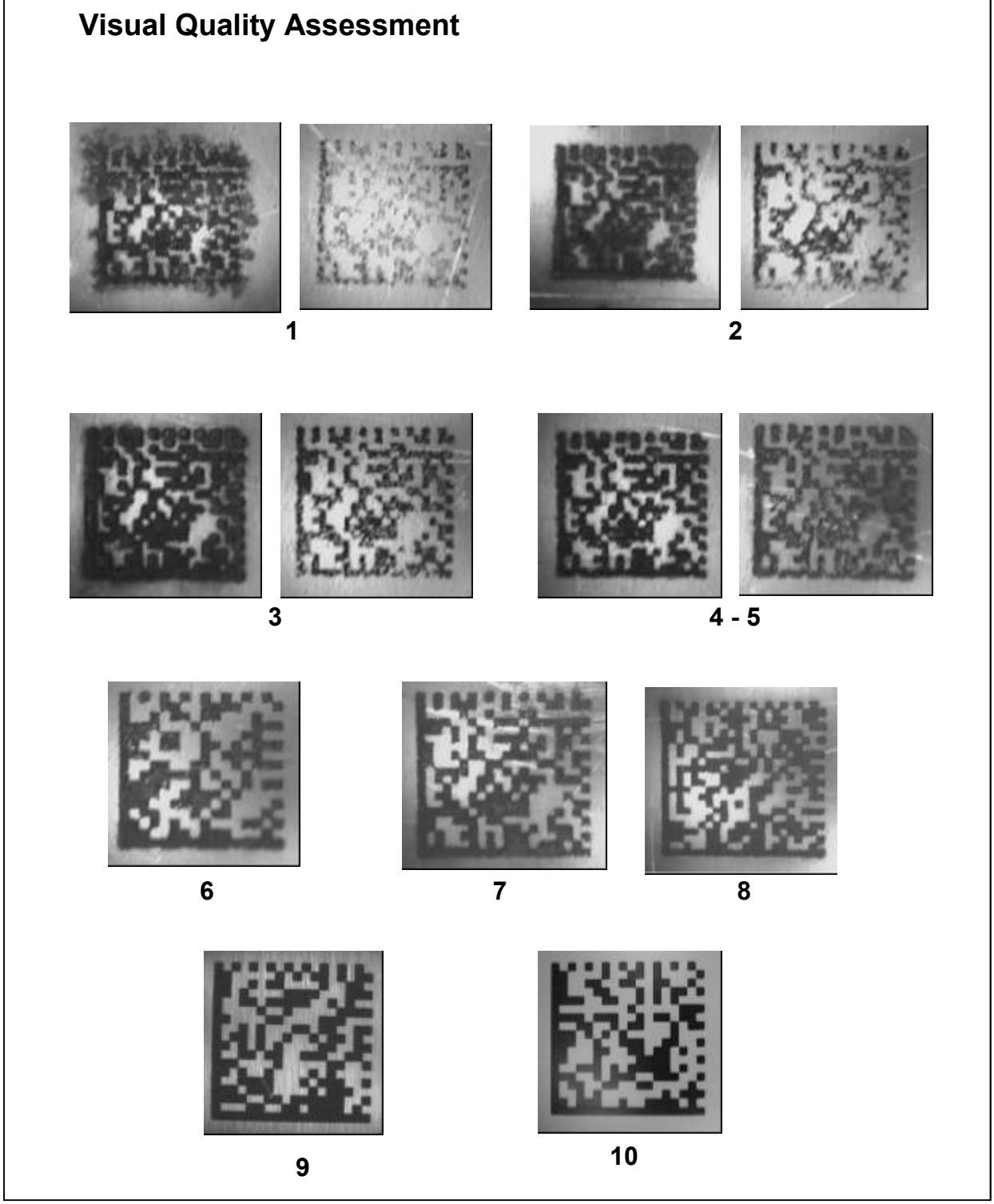
5.2 Cell Fill

The cell size fill shall be 70 - 110% of the nominal cell size. In other words, overlapping of 10% is permitted.

5.3 Visual Appearance

To maximize quality, the process output must be controlled within acceptable visual limits

5.4 Example Method for Checking Visual Quality



- As a guide a table of this type can be used.
- Marks of quality corresponding to 6 or above are acceptable.
- Quality of 5 or less requires further process parameter adjustment before an acceptable output level is achieved.

5.5 Cell Depth

Cell depth is subject to Engineering Design requirements. The cell depth is based upon the requirements for process, environment survivability and other material considerations.

5.6 Cell Size

Nominal cell size is typically in the range of 0,20mm to 0,60mm (0.008” to 0.024”). Changes to this range should be approved by the Engineering Design authority. Refer to JES131 for further information.

5.7 Testing

To determine marking parameters, which meet the requirements of section 4, process trials shall be performed.

Process trials shall be performed for all material types. If different components from the same material are electro-chemically etched, process trials are required only on one of these components or on a representative sample.

In the course of the process trials the following parameters shall be specified:
- Type of equipment
- Power Setting - AC and / or DC
- Time required for process steps
- Electrolyte
- Stencil material

Other parameters may be required and instructed by Engineering Design Authority. The results of the process trials shall be documented in a test report. If one of the above parameters is changed, the process trials must be repeated.

5.8 Corrosion Protection

All metal parts are susceptible to corrosion. It is therefore the responsibility of the Engineering Design authority to specify adequate corrosion protection for metallic parts at all stages of manufacturing.

5.9 Quality assurance

Maintenance of the Electro-Chemical Etch marking facilities shall be in accordance with instructions from the group responsible for maintenance schedules.

SECTION 6
Helpful Hints and Tips

6.1 Mark Contrast

6.1.1 Is the contrast between the mark and the parent material low?

- Check for good connection between anode and cathode when marking.
- Ensure electrode pad is soaked with **CORRECT** electrolyte.
- When marking cycle commences rock electrode gently to allow gases to escape (not suitable for titanium marking).
- Increase AC Duration by a small amount. If deterioration of quality appears reduce power level.

6.1.2 Does mark appear to be blurred or smudged?

- Clean area to be marked thoroughly prior to marking.
- Ensure correct electrolyte is used.
- Reduce DC power or duration.

6.1.3 Handling Stencil material.

- Take care when handling stencil material as creases or tears may cause unwanted lines to be marked.

6.1.4 Stencil life.

- Thermal printed stencils can be used many times depending on application. When using an etching cycle the stencil life is reduced dramatically

6.1.5 Component Surface

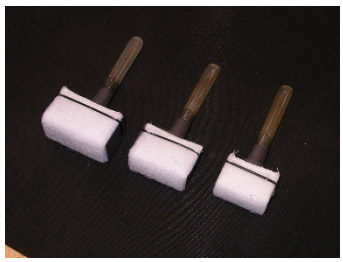
- Must be Clean and Dry.
- Machined, polished and some cast surfaces can be marked.
- Coated and painted parts cannot be marked.

SECTION 7
Accessories and Consumables

7.1 Accessories

7.1.1 Electrodes

Available in 3 standard sizes;



FLAT - size 25mm x 50mm
(P132 stock code)

FLAT - size 19mm x 44mm
(P133 stock code)

FLAT - size 16mm x 38mm
(P131 stock code)

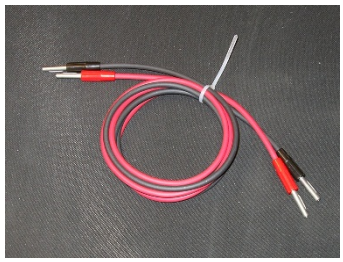
7.1.2 Handle/Connector

(For use with graphite electrodes above)
(P130 stock code)

7.1.3 Convex (Rocker Pad)

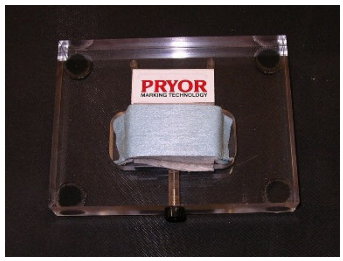
size 50mm x 100 mm
(P134 stock code)
(requires two wire cord set)

7.1.4 Two Wire Cord Set



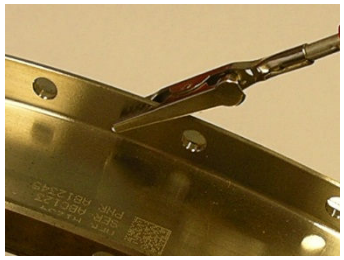
(as a spare) (MATC125 Stock code)

7.1.5 Bench Fixture



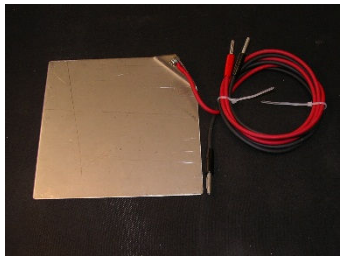
(Requires two wire cord set above)

7.1.6 Spring Clamp With 1 M Lead.



7.1.7 Steel Bench Fixture.

(150mm x 150mm with leads)
(stock code MCBF102)



7.2 Felt Pads

SIZE- 16mm x 38mm
(pack of 25) (P231 stock code)

SIZE- 25mm x 50mm
(pack of 25) (P232 stock code)

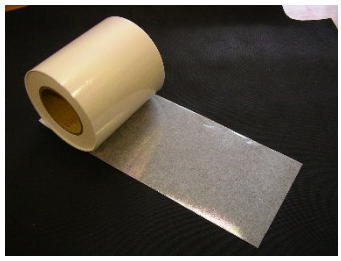
SIZE- 44mm x 19mm
(pack of 25) (P233 stock code)

SIZE- 32mm x 50mm
(pack of 5 for bench fixture)
(P230A stock code)

SIZE- 50mm x 100mm
(pack of 3 for Convex rocker pad)
(P234 stock code)

7.3 Stencil Material

Thermal
Size - 100mm x 100 metre roll.



7.4 Electrolyte

Generally available in 1 Litre Bottles. For larger quantities please apply.

Metals and Alloys to be marked	Electrolyte(s)
ALUMINIUM AND ALUMINIUM ALLOYS	AL.1
BRASS	NM.3 / PSC.4
CARBIDES	PSC.2 / PSC.4
CHROMIUM PLATE	PSC.1 / PSC.4 / NC.7
INCONEL	PSC.1 / PSC.4 / NC.7
MONEL METALS	PSC.2 / PSC.4 / NC.7
NICKEL AND ALLOYS	PSC.2 / PSC.4 / NC.7
NIMONIC ALLOYS	NM.3
NON-FERROUS METALS	PSC.2 / PSC.4 / NC.7
PHOSPHOR BRONZE	NM.3 / PSC.4
STEEL (BLACK OXIDE COATED)	PSC.6
STEEL (LOW CARBON)	PSC.2 / PSC.4 / PSC.5 / 224
STEEL (MILD)	PSC.4 / PSC.5 / 224 / 336
STEEL (SAND BLASTED)	336 / PSC.2
STEEL (STAINLESS)	PSC.1 / PSC.2 / PSC.4 / PSC.5
STEEL (STEAM TEMPERED HIGH SPEED)	448 PSC.1 / PSC.2
TIN PLATE	PSC.2
TITANIUM	PSC.7
TOOL STEELS	PSC.1 / PSC.2 / NC.7
ZINC/ZINC ALLOYS	PSC.1
ZINC (ELECTROPLATED)	PSC.2
DE-WATERING INHIBITOR	TYPE C CLEANER
OIL BASED INHIBITOR	TYPE B CLEANER
AEROSPACE	
PAE 1 PAE 3 PAE 5 DIW 1 (Neutraliser for PAE Range)	See table in section 3.2 for settings and recommendations.

SECTION 8
Where to get help

8.1 Contact Information

Janice Roberts, Customer Support Team Leader

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Fax: **+44(0) 114 276 6890**
Email: **support@pryormarking.com**