

BUREAU OF ANALYSED SAMPLES LTD  
***Certified Reference Materials***



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## INTRODUCTION

The Certified Reference Materials have been prepared under rigorous laboratory conditions and are issued by Bureau of Analysed Samples Ltd. under the auspices of an Honorary Advisory Committee and a body of approximately 150 Co-operating Analysts representing Independent Laboratories and Manufacturers and Users of the materials concerned.

### (a) CERTIFIED REFERENCE MATERIALS (CRMs)

British Chemical Standard Certified Reference Materials (BCS-CRMs) are normally analysed by at least five Analysts, and a certificate showing the individual mean values obtained by each Analyst and a summary of the methods used is supplied with each sample. Certificates issued since 1984 also give the standard deviation of the intralaboratory means, and those issued since 1994 express the level of confidence of the certified value as the 95% half width confidence interval.

EURONORM Certified Reference Materials (ECRMs) were prepared under the auspices of the European Committee for Iron and Steel Standardization (ECISS). Each one is issued with a certificate giving the names of the participating laboratories, the mean values obtained by each laboratory for each element and a statistical evaluation of the laboratory means. The certificate also includes a summary of the methods of analysis used. Before publication each certificate has been approved by the Producing Organisations, namely Bureau of Analysed Samples Ltd. (BAS) in the UK, Institut de Recherches de la Siderurgie Française (IRSID) now ArcelorMittal Maizières Research (AMMZ) / Centre Technique des Industries de la Fonderie (CTIF) in France, Stahlinstitut VDEh (VDEh), BAM Bundesanstalt für Materialforschung und prüfung and Max-Planck-Institut für Eisenforschung (MPI) in Germany and the Nordic CRM Working Group (NCRMWG) in the Nordic countries. Although BAS is no longer part of the ECRM Producers Group, there are still over 50 BAS ECRMs which will be available until their exhaustion, when they will be replaced by BCS-CRMs and/or SS-CRMs.

There are also some existing BCS-CRMs which have been accepted as interim ECRMs after examination by laboratories in the EU. These are indicated with an ECRM number alongside the existing BCS-CRM number.

Bureau of Analysed Samples Ltd. act as UK distributors for ECRMs prepared by AMMZ/IRSID/CTIF in France, BAM in Germany and Jernkontoret in Sweden, and details of these samples, most of which are held in UK stock, are given in a separate BAS 'Outside Source' Reference Materials Catalogue, copies of which will be supplied on request. Further information regarding the preparation, certification and supply of ECRMs, and the use of the statistical information given on their certificates is given in Technical Reports CEN/TR 10317:2014 and CEN/TR 10350:2013 which are available in the UK from the BSI, 389 Chiswick High Road, London W4 4AL.

All BCS-CRM and ECRM samples are supplied in the finely divided form and many of them are also available in disc form for optical emission and X-ray fluorescence spectrometry.

Spectroscopic Standard Certified Reference Materials (SS-CRMs) have been specially prepared to provide samples of uniform composition in a form suitable for use with optical emission and X-ray fluorescence spectrometers. Each sample has been analysed by at least five laboratories, and a certificate showing the individual mean values obtained by each laboratory and a summary of the methods used is supplied with each sample or set of samples.

Steel samples are usually in the form of discs cut from round bar. Cast iron samples, which are prepared in conjunction with Replicast Ltd./Castings Technology International (formerly BCIRA), are in the form of chill cast rectangular blocks.

### (b) REFERENCE MATERIALS (RMs)

British Chemical Standard Reference Materials (BCS-RMs) and Spectroscopic Reference Materials, e.g. high purity metals and ceramic materials (p.16), low alloy cast irons, high chromium irons, nickel chromium irons and austenitic (Ni-resist) irons (p. 22) and copper base alloys (p. 23) are normally analysed by only two laboratories and are not given certified status.

### (c) SPECTROSCOPIC SETTING-UP SAMPLES (SUS)

These Setting-up Samples (SUS) have been specially prepared to meet the day to day setting-up requirements of laboratories using direct reading spectrometers for production control analysis. Their use will conserve supplies of Spectroscopic Standard CRMs for calibration purposes only and will relieve spectrographers of the problem of finding suitable samples within their works for their daily setting-up requirements.

The steel samples are in the form of round bar. The cast iron samples, prepared in conjunction with Replicast Ltd./Castings Technology International (formerly BCIRA), are in the form of chill cast rectangular blocks.

## GENERAL INFORMATION

Our website, at [www.basrid.co.uk](http://www.basrid.co.uk), is continually being improved and now includes a page of downloadable certificates for all currently available BAS products.

Every endeavour is made to maintain a continuous supply of all samples in this catalogue by completing the preparation of an appropriate replacement by the time each sample becomes exhausted. When orders are received for obsolete samples the relevant replacements will normally be supplied. If for any reason such a sample is not acceptable, full credit will be allowed if it is returned carriage paid provided that the seal on the carton containing finely divided samples is unbroken.

Information regarding new samples in course of preparation will be supplied on request. When these are available for distribution a notice to this effect will be made on our website.

## QUALITY ASSURANCE

Bureau of Analysed Samples Ltd. is very pleased to advise that in November 1994 its Quality System was formally approved and recognised by the award of a Certificate of Registration to the Quality Standard BS EN ISO 9002:1994 for the production and supply of CRMs, RMs and SUS. This certificate has now been revalidated to the new Standard BS EN ISO 9001:2015. Furthermore, BAS was accredited, in June 2006, to the International Guide, ISO Guide 34 and the accreditation has since been updated to the full Standard ISO 17034:2016.

# BUREAU OF ANALYSED SAMPLES LTD.

REG. No. 307549 (ENGLAND)

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|--|--|

BRITISH CHEMICAL STANDARD AND EURONORM CERTIFIED REFERENCE MATERIALS - High Purity Irons and Unalloyed Steels

The figures are listed primarily as a guide to purchasers. In some cases provisional figures are given which may differ slightly from those given on the Certificate. Always consult the Certificate issued with the sample to obtain the accurate analysis.

CHEMICAL COMPOSITION (nominal mass content in %) - Figures in bold type certified, figures in small italic type only approximate.

High Purity Irons (Finely divided material - units of 100g: 097-1 and 097-2 also available as 38mm dia. x 30, 25 or 3mm discs - see page 17)

| ECRM No. | Description      | C                 | Si              | Mn     | P       | S       | Cr     | Mo               | Ni     | Al (Total)       | As      | B       | Co     | Cu      | N            | Nb               |
|----------|------------------|-------------------|-----------------|--------|---------|---------|--------|------------------|--------|------------------|---------|---------|--------|---------|--------------|------------------|
| 088-2    | High Purity Iron | 0.0006            | 0.0052          | 0.0809 | 0.0048  | 0.0070  | 0.0244 | <i>0.0025</i>    | 0.0275 | <i>0.0005</i>    | ...     | ...     | 0.0061 | 0.0163  | <i>0.001</i> | ...              |
| 097-1(C) | High Purity Iron | <i>&lt;0.0005</i> | <i>&lt;0.01</i> | 0.0064 | 0.0016  | 0.0022  | 0.0016 | <i>&lt;0.001</i> | 0.0025 | ...              | 0.0051  | 0.0003  | 0.0037 | 0.0020  | 0.0007       | <i>&lt;0.001</i> |
| 097-2(C) | High Purity Iron | <i>&lt;0.002</i>  | 0.00285         | 0.0120 | 0.00538 | 0.00181 | 0.0213 | 0.00370          | 0.0241 | <i>&lt;0.002</i> | 0.00281 | 0.00012 | 0.0139 | 0.00793 | 0.00294      | <i>0.0011</i>    |

| ECRM No. | Description              | Pb                | Sn                | Ti                | V                | W                    | Zr               | Bi                | Ca                | Ga            | Mg                | O            | Sb                   | Ta                | Zn                |
|----------|--------------------------|-------------------|-------------------|-------------------|------------------|----------------------|------------------|-------------------|-------------------|---------------|-------------------|--------------|----------------------|-------------------|-------------------|
| 088-2    | High Purity Iron (cont.) | ...               | ...               | ...               | 0.00029          | ...                  | ...              | ...               | 0.00072           | ...           | ...               | ...          | ...                  | ...               | ...               |
| 097-1(C) | High Purity Iron (cont.) | <i>&lt;0.0005</i> | <i>&lt;0.0025</i> | <i>&lt;0.0015</i> | <i>&lt;0.001</i> | <b><i>≤0.001</i></b> | <i>&lt;0.001</i> | <i>&lt;0.0005</i> | <i>&lt;0.0005</i> | ...           | <i>&lt;0.0005</i> | <i>0.05</i>  | <b><i>≤0.001</i></b> | <i>&lt;0.0005</i> | <i>&lt;0.0001</i> |
| 097-2(C) | High Purity Iron (cont.) | <i>&lt;0.001</i>  | 0.00043           | <i>0.0008</i>     | 0.00011          | 0.00386              | <i>&lt;0.002</i> | <i>&lt;0.0002</i> | <i>&lt;0.001</i>  | <i>0.0003</i> | <i>&lt;0.0005</i> | <i>0.005</i> | 0.00012              | 0.00015           | 0.00014           |

ECRM 097-2(C) also has the additional information: Ag: *<0.0001%*, Al(sol.): *<0.0004% & 0.0010%*, Cd: *<0.0001%*, Ge: *0.00043% & 0.00066%*, Se: *<0.0001%*, Te: *<0.0001%*.

Unalloyed Steels (Finely divided material - units of 100g: 111/1, 115 and 116 also available as 44mm dia. x 19mm discs/055-2, 057-2, 058-2, 059-2, 084-1, 085-1, 086-1, 087-1 and 090-1 also available as 38mm dia. x 30 or 25mm discs/056-2 also available as 44mm dia. x 30 or 25mm discs - see page 17)

| BCS-CRM No. | ECRM No. | Description                   | C      | Si           | Mn          | P            | S            | Cr           | Mo               | Ni           | Al (Acid Sol.) | Al (Total)       | As          | Co            | Cu           | N             | Nb                | Pb               | Sn           | Ti                | V               | Sb               | Ca                | Zn            |     |
|-------------|----------|-------------------------------|--------|--------------|-------------|--------------|--------------|--------------|------------------|--------------|----------------|------------------|-------------|---------------|--------------|---------------|-------------------|------------------|--------------|-------------------|-----------------|------------------|-------------------|---------------|-----|
| 111         | ...      | Low Carbon Steel              | 0.0258 | 0.0253       | 0.155       | 0.0033       | 0.0054       | 0.0197       | 0.0008           | 0.0387       | ...            | 0.0348           | 0.0017      | 0.0144        | 0.0171       | 0.0034        | <i>0.0005</i>     | <i>&lt;0.001</i> | 0.0015       | 0.0004            | 0.0009          | <i>&lt;0.001</i> | <i>&lt;0.0005</i> | ...           |     |
| 111/1       | ...      | Low Carbon Steel              | 0.0070 | 0.0039       | 0.1623      | 0.0045       | 0.0049       | 0.0055       | 0.0005           | 0.0161       | ...            | <i>&lt;0.002</i> | 0.0011      | 0.0053        | 0.0089       | 0.0025        | ...               | ...              | 0.0006       | 0.0004            | 0.0002          | ...              | ...               | ...           |     |
| 115         | ...      | Calcium Treated Steel         | 0.6224 | 0.2078       | 0.682       | 0.0123       | 0.00093      | 0.0198       | <i>0.003</i>     | 0.0196       | ...            | 0.0527           | ...         | <i>0.006</i>  | <i>0.009</i> | 0.0067        | ...               | <i>0.0002</i>    | <i>0.002</i> | 0.0027            | <i>0.001</i>    | ...              | 0.0058            | <i>0.0006</i> |     |
| 116         | ...      | Calcium Treated Steel         | 0.617  | 0.201        | 0.6756      | 0.0092       | 0.00176      | 0.0141       | <i>&lt;0.001</i> | 0.0155       | ...            | 0.0587           | ...         | ...           | <i>0.014</i> | 0.0069        | ...               | 0.00012          | <i>0.005</i> | 0.00171           | ...             | ...              | 0.0036            | ...           |     |
| 161/4       | ...      | 0.8% Carbon Steel             | 0.817  | 0.202        | 0.504       | 0.0105       | 0.0096       | ...          | ...              | ...          | ...            | ...              | ...         | ...           | ...          | ...           | ...               | ...              | ...          | ...               | ...             | ...              | ...               | ...           | ... |
| 232/2       | 051-1    | 0.1% Sulphur Steel            | 0.181  | <i>0.11</i>  | 1.18        | <i>0.025</i> | 0.126        | <i>0.05</i>  | ...              | <i>0.14</i>  | ...            | ...              | ...         | ...           | <i>0.15</i>  | ...           | ...               | ...              | ...          | ...               | ...             | ...              | ...               | ...           | ... |
| 237/2       | 060-1    | 0.1% Carbon Steel             | 0.122  | <i>0.17</i>  | 0.45        | <i>0.024</i> | <i>0.031</i> | <i>0.028</i> | <i>&lt;0.005</i> | <i>0.039</i> | ...            | <i>0.004</i>     | ...         | ...           | <i>0.060</i> | 0.004         | ...               | ...              | <i>0.005</i> | ...               | ...             | ...              | ...               | ...           | ... |
| 238/2       | 061-1    | 0.2% Carbon Steel             | 0.21   | 0.12         | <i>0.61</i> | <i>0.019</i> | <i>0.034</i> | ...          | ...              | <i>0.21</i>  | ...            | ...              | ...         | ...           | <i>0.10</i>  | ...           | ...               | ...              | ...          | ...               | ...             | ...              | ...               | ...           | ... |
| 270         | 054-1    | 0.09% Phosphorus Steel        | 0.22   | <i>0.05</i>  | <i>0.88</i> | 0.092        | <i>0.11</i>  | <i>0.17</i>  | <i>0.02</i>      | <i>0.14</i>  | ...            | ...              | <i>0.03</i> | ...           | <i>0.21</i>  | ...           | ...               | ...              | ...          | ...               | <i>&lt;0.01</i> | ...              | ...               | ...           | ... |
| ...         | 055-2(C) | 0.5% Carbon Steel             | 0.5199 | 0.3094       | 0.687       | 0.0102       | 0.0205       | 0.3127       | 0.0960           | 0.3121       | ...            | <i>&lt;0.01</i>  | 0.0187      | 0.0257        | 0.2089       | 0.01069       | <i>&lt;0.0005</i> | <i>&lt;0.001</i> | 0.0162       | 0.00104           | 0.00245         | 0.00376          | <i>&lt;0.005</i>  | <i>0.0011</i> |     |
| ...         | 056-2(C) | 0.8% Carbon Steel             | 0.8181 | 0.2006       | 0.5073      | 0.0103       | 0.0093       | 0.0146       | <i>0.0015</i>    | 0.0218       | 0.00024        | <i>&lt;0.001</i> | ...         | <i>0.0035</i> | 0.0129       | <i>0.0045</i> | ...               | ...              | ...          | ...               | ...             | ...              | ...               | ...           | ... |
| ...         | 057-2(C) | 0.05% Carbon Steel            | 0.0507 | <i>0.003</i> | 0.246       | 0.0120       | 0.0127       | 0.0114       | ...              | 0.0096       | <i>0.055</i>   | 0.059            | ...         | ...           | 0.0146       | 0.00230       | ...               | ...              | ...          | ...               | ...             | ...              | ...               | ...           | ... |
| ...         | 058-2(C) | 0.15% Sulphur Steel           | 0.424  | 0.1080       | 1.186       | 0.0098       | 0.1712       | 0.1211       | 0.0589           | 0.199        | ...            | ...              | 0.0095      | ...           | 0.261        | 0.0107        | ...               | ...              | ...          | ...               | ...             | ...              | ...               | ...           | ... |
| ...         | 059-2(C) | 0.7% Carbon Steel             | 0.721  | 0.188        | 0.495       | 0.0046       | 0.0084       | 0.0090       | 0.0018           | 0.0198       | 0.00020        | 0.00045          | ...         | ...           | 0.0074       | 0.0051        | ...               | ...              | ...          | ...               | ...             | ...              | ...               | ...           | ... |
| ...         | 064-1(C) | Nb/Ti Interstitial Free Steel | 0.0026 | 0.0065       | 0.1641      | 0.0091       | 0.0104       | 0.0184       | 0.00077          | 0.0115       | 0.0302         | 0.0330           | 0.0036      | 0.0027        | 0.0077       | 0.0026        | 0.0146            | 0.00018          | 0.00051      | 0.0189            | 0.00015         | ...              | ...               | ...           | ... |
| ...         | 084-1(C) | 0.4% Carbon Steel             | 0.391  | 0.265        | 0.860       | 0.018        | 0.029        | ...          | 0.033            | 0.154        | ...            | ...              | ...         | ...           | 0.267        | ...           | ...               | ...              | 0.023        | ...               | ...             | ...              | ...               | ...           | ... |
| ...         | 085-1(C) | 0.3% Sulphur Steel            | 0.067  | 0.008        | 0.977       | 0.062        | 0.336        | ...          | ...              | ...          | ...            | ...              | ...         | 0.019         | 0.291        | ...           | ...               | 0.0010           | ...          | ...               | 0.0021          | 0.0073           | ...               | 0.0025        | ... |
| ...         | 086-1(C) | 0.3% Carbon Steel             | 0.297  | 0.206        | 0.879       | 0.0238       | 0.0371       | 0.150        | ...              | 0.168        | ...            | ...              | 0.0230      | ...           | 0.320        | ...           | ...               | ...              | 0.0263       | ...               | ...             | ...              | ...               | ...           | ... |
| ...         | 087-1(C) | 0.15% Carbon Steel            | 0.1740 | 0.2631       | 0.6711      | 0.0103       | 0.0461       | 0.0781       | 0.0206           | 0.1177       | ...            | ...              | 0.0243      | 0.0148        | 0.1707       | ...           | ...               | ...              | 0.0171       | ...               | ...             | 0.0046           | ...               | ...           | ... |
| ...         | 090-1(C) | 1% Carbon Steel               | 1.054  | 0.281        | 0.226       | 0.0128       | 0.0095       | 0.121        | 0.0089           | 0.053        | ...            | ...              | ...         | ...           | ...          | 0.0146        | 0.00043           | 0.00239          | ...          | <i>&lt;0.0001</i> | 0.204           | 0.00090          | ...               | 0.00209       |     |
| ...         | 091-1    | 0.5% Carbon Steel             | 0.518  | ...          | ...         | ...          | ...          | 0.312        | 0.098            | 0.310        | ...            | ...              | ...         | ...           | 0.0111       | ...           | ...               | ...              | ...          | ...               | ...             | ...              | ...               | ...           | ... |
| ...         | 096-2(C) | Low S, Ca-Treated Steel       | 0.1050 | 0.262        | 1.320       | 0.0128       | 0.0016       | 0.0243       | 0.0020           | 0.0253       | ...            | 0.0460           | ...         | ...           | 0.0170       | ...           | 0.0252            | ...              | ...          | ...               | ...             | ...              | 0.0020            | ...           |     |

Unalloyed Steels (continued)

| BCS-CRM No. | ECRM No. | Description               | B             | Bi                 | Cd                 | Ga      | Hg                 | Se                | Te                | W      | Zr               |
|-------------|----------|---------------------------|---------------|--------------------|--------------------|---------|--------------------|-------------------|-------------------|--------|------------------|
| ...         | 055-2(C) | 0.5% Carbon Steel (cont.) | <i>0.0003</i> | <i>&lt;0.005</i>   | ...                | ...     | ...                | ...               | ...               | 0.0166 | <i>&lt;0.005</i> |
| ...         | 090-1(C) | 1% Carbon Steel (cont.)   | ...           | <i>&lt;0.00002</i> | <i>&lt;0.00002</i> | 0.00228 | <i>&lt;0.00001</i> | <i>&lt;0.0002</i> | <i>&lt;0.0002</i> | ...    | ...              |



BRITISH CHEMICAL STANDARD AND EURONORM CERTIFIED REFERENCE MATERIALS - Unalloyed Steels and High Speed Tool Steels

CHEMICAL COMPOSITION (nominal mass content in %) - Figures in bold type certified, figures in small italic type only approximate.

Unalloyed Steels (continued) (Finely divided material - units of 100g; 431/2-435/2 and 456/2-460/2, also available as 38mm dia. x 19mm discs - see page 17)

| BCS-CRM No. | Description                            | C      | Si     | Mn    | P      | S      | Cr     | Mo           | Ni     | Al (Acid Sol.) | Al (Total)  | As           | B      | Co           | Cu           | N      | Nb     | Pb            | Sn     | Ti           | V            | W            | Zr           | Sb     |
|-------------|--|--------|--------|-------|--------|--------|--------|--------------|--------|----------------|-------------|--------------|--------|--------------|--------------|--------|--------|---------------|--------|--------------|--------------|--------------|--------------|--------|
| 431/2       | Plain Carbon Steels                    | 0.0249 | 0.015  | 0.902 | 0.121  | 0.0065 | 0.049  | <i>0.004</i> | 0.040  | ...            | <i>0.01</i> | <i>0.005</i> | ...    | <i>0.006</i> | <i>0.015</i> | 0.0052 | 0.0040 | ...           | <0.001 | <i>0.005</i> | <i>0.003</i> | <i>0.004</i> | ...          | ...    |
| 432/2       |  | 0.0065 | 0.0822 | 0.712 | 0.0171 | 0.036  | 0.0166 | <i>0.002</i> | 0.0196 | ...            | <0.002      | ...          | ...    | <i>0.006</i> | <i>0.015</i> | 0.0066 | 0.0174 | ...           | ...    | ...          | <0.001       | <i>0.003</i> | ...          | ...    |
| 433/2       |  | 0.096  | 0.0071 | 1.188 | 0.011  | 0.0083 | 0.0262 | <i>0.004</i> | 0.037  | ...            | ...         | ...          | ...    | <i>0.006</i> | <i>0.025</i> | ...    | 0.0590 | ...           | ...    | ...          | <i>0.001</i> | <i>0.003</i> | ...          | ...    |
| 434/2       |  | 0.275  | 0.510  | 1.546 | 0.0611 | 0.0141 | 0.238  | <i>0.014</i> | 0.037  | ...            | ...         | ...          | ...    | <i>0.006</i> | <i>0.025</i> | 0.0104 | 0.038  | ...           | ...    | ...          | <i>0.04</i>  | <i>0.04</i>  | ...          | ...    |
| 435/2       |  | 0.489  | 0.328  | 0.390 | 0.0373 | 0.0424 | 0.184  | <i>0.018</i> | 0.133  | ...            | ...         | ...          | ...    | 0.0116       | <i>0.05</i>  | ...    | 0.134  | ...           | ...    | ...          | <i>0.005</i> | <i>0.015</i> | ...          | ...    |
| 452/1       | Carbon Steel Residual Series (Group A) | 0.323  | 0.055  | 1.30  | 0.035  | 0.017  | 0.067  | 0.054        | 0.19   | ...            | ...         | 0.015        | ...    | ...          | 0.22         | ...    | ...    | <i>0.0002</i> | 0.094  | 0.031        | ...          | 0.054        | ...          | ...    |
| 453/1       |  | 0.160  | 0.34   | 1.38  | 0.044  | 0.026  | 0.26   | 0.081        | 0.11   | ...            | ...         | 0.052        | ...    | ...          | 0.099        | ...    | ...    | <i>0.0001</i> | 0.022  | 0.073        | ...          | 0.30         | ...          | ...    |
| 456/2       | Carbon Steel Residual Series (Group B) | 0.112  | 0.297  | 0.220 | 0.0212 | 0.0221 | ...    | ...          | ...    | <0.002         | 0.0018      | ...          | 0.0015 | 0.0504       | ...          | ...    | 0.0057 | 0.0189        | ...    | ...          | 0.0221       | ...          | <i>0.013</i> | 0.0172 |
| 457/2       |  | 0.307  | 0.105  | 0.327 | 0.0098 | 0.0448 | ...    | ...          | ...    | 0.082          | 0.087       | ...          | 0.0046 | 0.0217       | ...          | ...    | 0.0174 | 0.0098        | ...    | ...          | 0.153        | ...          | 0.025        | 0.050  |
| 458/2       |  | 0.198  | 0.504  | 0.479 | 0.0281 | 0.0314 | ...    | ...          | ...    | 0.052          | 0.055       | ...          | 0.0069 | 0.198        | ...          | ...    | 0.0510 | 0.0140        | ...    | ...          | 0.105        | ...          | <i>0.062</i> | 0.089  |
| 460/2       |  | 0.383  | 0.126  | 0.616 | 0.0374 | 0.0099 | ...    | ...          | ...    | 0.0193         | 0.0240      | ...          | 0.0027 | 0.0106       | ...          | ...    | 0.068  | 0.0005        | ...    | ...          | 0.0322       | ...          | <0.0005      | 0.0006 |

Unalloyed Steels (continued) (Rod material – BCS-CRM 318A is a pair of 6.35mm dia. x 95mm rods, BCS-CRM 318B is a single 12.7mm dia. x 127mm rod)

| BCS-CRM No. | Description        | Form                    | C            | Si          | Mn          | P            | S            | Al     | O      |
|-------------|--------------------|-------------------------|--------------|-------------|-------------|--------------|--------------|--------|--------|
| 318A        | 0.01% Oxygen Steel | 6.35mm dia. x 95mm rod  | <i>0.083</i> | <i>0.12</i> | <i>0.39</i> | <i>0.018</i> | <i>0.035</i> | <0.002 | 0.0096 |
| 318B        | 0.01% Oxygen Steel | 12.7mm dia. x 127mm rod | <i>0.083</i> | <i>0.12</i> | <i>0.39</i> | <i>0.018</i> | <i>0.035</i> | <0.002 | 0.0103 |

High-Speed Steels (Finely divided material - units of 100g)

| BCS-CRM No. | ECRM No. | Description       | C    | Si   | Mn   | P     | S     | Cr   | Mo   | Ni   | Al           | Co   | Cu   | Sn    | V    | W    |
|-------------|----------|-------------------|------|------|------|-------|-------|------|------|------|--------------|------|------|-------|------|------|
| 220/2       | 254-1    | High-Speed Steels | 0.88 | 0.19 | 0.30 | 0.023 | 0.029 | 5.12 | 4.92 | 0.12 | ...          | 0.32 | 0.09 | 0.019 | 1.94 | 6.97 |
| 241/2       | 251-1    |                   | 0.84 | 0.21 | 0.27 | 0.024 | 0.025 | 5.35 | 0.53 | 0.15 | <i>0.009</i> | 5.70 | 0.08 | 0.025 | 1.59 | 19.9 |
| 481         | ...      |                   | 0.69 | 0.14 | 0.29 | 0.021 | 0.027 | 3.56 | 0.22 | ...  | ...          | 0.21 | ...  | ...   | 0.52 | 14.2 |
| 482         | ...      |                   | 0.70 | 0.13 | 0.28 | 0.021 | 0.025 | 4.09 | 0.27 | ...  | ...          | 0.24 | ...  | ...   | 0.98 | 18.1 |
| 483         | ...      |                   | 0.67 | 0.11 | 0.29 | 0.019 | 0.025 | 3.21 | 0.17 | ...  | ...          | 1.94 | ...  | ...   | 0.54 | 10.8 |
| 484         | ...      |                   | 0.85 | 0.20 | 0.21 | 0.030 | 0.024 | 5.17 | 1.07 | ...  | ...          | 10.2 | ...  | ...   | 0.93 | 22.4 |

BRITISH CHEMICAL STANDARD AND EURONORM CERTIFIED REFERENCE MATERIALS - Alloy Steels

CHEMICAL COMPOSITION (nominal mass content in %) - Figures in bold type certified, figures in small italic type only approximate.

Low Alloy Steels (Finely divided material - units of 100g; 112-114 also available as 44mm dia. x 19mm discs; 186-1, 195-1, 219/4, 222/1, 225/2, 401/2-405/2, 407/2 and 421-424 also available in disc form for spectroscopic analysis - see page 18)

| BCS-CRM No. | ECRM No. | Description            | C      | Si    | Mn    | P      | S      | Cr     | Mo     | Ni     | Al     | As     | B      | Co     | Cu     | N      | Nb     | Pb     | Sn     | Ti     | V      | W      | Zr     | Ca      | Zn     |
|-------------|----------|------------------------|--------|-------|-------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|---------|--------|
| 112         | ...      | Low Alloy Steel        | 0.394  | 0.289 | 0.436 | 0.0043 | 0.0026 | 1.236  | 0.190  | 1.461  | 0.0148 | 0.0021 | 0.0007 | 0.0175 | 0.149  | 0.0024 | 0.0065 | <0.001 | 0.0086 | 0.0100 | 0.0088 | ...    | <0.001 | <0.0005 | ...    |
| 113         | ...      | Low Alloy Steel        | 0.837  | 0.931 | 1.207 | 0.0595 | 0.0294 | 1.248  | 0.056  | 0.0784 | 0.0151 | 0.0020 | 0.0066 | 0.0415 | 0.179  | 0.0109 | 0.0487 | <0.001 | 0.0067 | 0.0390 | 0.201  | 0.012  | 0.0029 | <0.001  | ...    |
| 114         | ...      | Low Alloy Steel        | 0.403  | 0.295 | 0.416 | 0.0044 | 0.0046 | 0.187  | 0.184  | 1.502  | 0.078  | 0.0025 | 0.0008 | 0.0171 | 0.360  | 0.0043 | 0.0042 | <0.001 | 0.041  | 0.0096 | 0.0086 | <0.001 | 0.0051 | <0.001  | ...    |
| 214/2       | 152-1    | Mn-Mo Steel            | 0.39   | 0.18  | 1.61  | 0.032  | 0.043  | 0.09   | 0.26   | 0.15   | ...    | ...    | ...    | ...    | 0.21   | ...    | ...    | ...    | ...    | ...    | <0.01  | ...    | ...    | ...     | ...    |
| 219/4       | 153-1    | Ni-Cr-Mo Steel         | 0.314  | 0.079 | 0.81  | 0.011  | 0.027  | 0.66   | 0.58   | 2.55   | 0.003  | ...    | ...    | ...    | 0.088  | ...    | ...    | ...    | 0.011  | ...    | ...    | ...    | ...    | ...     | ...    |
| 222/1       | ...      | 3.5% Ni Steel          | 0.3095 | 0.227 | 0.618 | 0.0175 | 0.0089 | 0.0535 | 0.0287 | 3.536  | ...    | ...    | <0.005 | 0.0379 | 0.150  | 0.0100 | ...    | ...    | ...    | ...    | 0.020  | ...    | ...    | ...     | ...    |
| 225/2       | 155-1    | Ni-Cr-Mo Steel         | 0.40   | 0.23  | 0.56  | 0.019  | 0.012  | 1.08   | 0.34   | 1.43   | 0.009  | 0.035  | 0.0007 | 0.018  | 0.17   | 0.012  | 0.003  | ...    | 0.017  | ...    | <0.01  | ...    | <0.01  | ...     | ...    |
| 317         | 151-1    | Low C, High Si Steel   | 0.028  | 3.49  | 0.085 | 0.015  | 0.023  | ...    | ...    | ...    | ...    | ...    | ...    | ...    | ...    | ...    | ...    | ...    | ...    | ...    | ...    | ...    | ...    | ...     | ...    |
| ...         | 186-1(C) | Silico Manganese Steel | 0.6104 | 1.719 | 0.870 | 0.0223 | 0.0354 | 0.218  | 0.0482 | 0.190  | 0.0143 | ...    | ...    | ...    | 0.281  | ...    | ...    | ...    | ...    | ...    | ...    | ...    | ...    | ...     | ...    |
| ...         | 195-1(C) | Cr-Mo-Ni Steel         | 0.756  | 0.466 | 0.571 | 0.0160 | 0.0121 | 1.566  | 0.768  | 0.327  | ...    | ...    | ...    | ...    | 0.0355 | 0.0100 | ...    | 0.0010 | 0.002  | ...    | 0.312  | ...    | ...    | 0.0017  | 0.0046 |
| 408         | ...      | Low Alloy Steel        | 0.28   | 0.24  | 0.64  | 0.043  | 0.030  | 0.090  | 0.14   | 4.58   | ...    | ...    | ...    | ...    | 0.73   | ...    | ...    | ...    | ...    | ...    | 0.063  | ...    | ...    | ...     | ...    |
| 404/1       | ...      | Low Alloy Steels       | 0.74   | 0.87  | 0.31  | 0.057  | 0.024  | 0.48   | 0.31   | 0.40   | ...    | ...    | ...    | ...    | 0.34   | ...    | ...    | ...    | ...    | ...    | 0.11   | ...    | ...    | ...     | ...    |
| 405/1       | ...      |                        | 0.032  | 1.71  | 1.28  | 0.018  | 0.069  | 0.15   | 0.002  | 0.22   | ...    | ...    | ...    | ...    | 0.013  | ...    | ...    | ...    | ...    | ...    | 0.28   | ...    | ...    | ...     | ...    |
| 407/1       | ...      |                        | 0.47   | 0.59  | 0.047 | 0.030  | 0.010  | 2.95   | 0.78   | 0.59   | ...    | ...    | ...    | ...    | 0.57   | ...    | ...    | ...    | ...    | ...    | 0.18   | ...    | ...    | ...     | ...    |
| 409/1       | ...      |                        | 0.082  | 1.46  | 0.44  | 0.025  | 0.021  | 0.94   | 0.65   | 3.06   | ...    | ...    | ...    | 0.014  | 0.048  | ...    | ...    | ...    | ...    | ...    | 0.09   | ...    | ...    | ...     | ...    |
| 401/2       | ...      | Low Alloy Steels       | 0.935  | 0.602 | 1.197 | 0.0265 | 0.0078 | 0.138  | 0.495  | 0.019  | 0.074  | ...    | ...    | 0.0042 | 0.101  | 0.0159 | ...    | ...    | ...    | ...    | 0.496  | ...    | ...    | ...     | ...    |
| 402/2       | ...      |                        | 1.311  | 0.111 | 0.228 | 0.0161 | 0.0138 | 0.652  | 0.140  | 0.808  | 0.161  | ...    | ...    | ...    | 0.302  | 0.0069 | ...    | ...    | ...    | ...    | 0.194  | ...    | ...    | ...     | ...    |
| 403/2       | ...      |                        | 0.750  | 0.209 | 1.677 | 0.055  | 0.0381 | 0.463  | 0.088  | 0.223  | 0.0485 | ...    | ...    | ...    | 0.221  | 0.010  | ...    | ...    | ...    | ...    | 0.341  | ...    | ...    | ...     | ...    |
| 404/2       | ...      |                        | 0.696  | 1.121 | 0.532 | 0.0479 | 0.0228 | 0.774  | 0.307  | 0.393  | 0.017  | ...    | ...    | ...    | 0.427  | 0.0089 | ...    | ...    | ...    | ...    | 0.107  | ...    | ...    | ...     | ...    |
| 405/2       | ...      |                        | 0.044  | 0.947 | 0.903 | 0.0095 | 0.058  | 0.206  | 0.025  | 0.102  | 0.330  | ...    | ...    | 0.009  | 0.022  | 0.011  | ...    | ...    | ...    | ...    | 0.411  | ...    | ...    | ...     | ...    |
| 407/2       | ...      |                        | 0.490  | 0.66  | 0.195 | 0.038  | 0.0105 | 3.03   | 0.83   | 0.527  | 0.040  | ...    | ...    | 0.0068 | 0.397  | 0.011  | ...    | ...    | ...    | ...    | 0.19   | ...    | ...    | ...     | ...    |
| 409/2       | ...      |                        | 0.086  | 1.18  | 0.559 | 0.0141 | 0.0179 | 1.318  | 0.599  | 3.02   | 0.094  | ...    | ...    | ...    | 0.205  | 0.0108 | ...    | ...    | ...    | ...    | 0.008  | ...    | ...    | ...     | ...    |
| 421         | ...      | Low Tungsten Steels    | 0.049  | 0.07  | 0.11  | 0.012  | 0.027  | ...    | 0.028  | ...    | ...    | ...    | ...    | ...    | ...    | ...    | ...    | ...    | ...    | ...    | <0.02  | 0.52   | ...    | ...     | ...    |
| 422         | ...      |                        | 0.036  | 0.06  | 0.09  | 0.015  | 0.025  | ...    | 0.033  | ...    | ...    | ...    | ...    | ...    | ...    | ...    | ...    | ...    | ...    | ...    | <0.02  | 1.28   | ...    | ...     | ...    |
| 423         | ...      |                        | 0.030  | 0.05  | 0.07  | 0.017  | 0.027  | ...    | 0.027  | ...    | ...    | ...    | ...    | ...    | ...    | ...    | ...    | ...    | ...    | ...    | <0.02  | 2.06   | ...    | ...     | ...    |
| 424         | ...      |                        | 0.024  | 0.05  | 0.09  | 0.02   | 0.024  | ...    | 0.036  | ...    | ...    | ...    | ...    | ...    | ...    | ...    | ...    | ...    | ...    | ...    | <0.02  | 3.02   | ...    | ...     | ...    |

BRITISH CHEMICAL STANDARD AND EURONORM CERTIFIED REFERENCE MATERIALS - Highly Alloyed Steels

CHEMICAL COMPOSITION (nominal mass content in %) - Figures in bold type certified, figures in small italic type only approximate.

Highly Alloyed Steels (Finely divided material - units of 100g: 272-1, 276-2, 285-2, 287-1, 292-1, 295-1, 296-1, 340 (SS70), 461/1-468/1, 466/2, 469-473, 475 and 479 also available in disc form for spectroscopic analysis - see pages 19 & 20)

| BCS-CRM No. | ECRM No. | Description                   | C      | Si     | Mn     | P      | S      | Cr     | Mo           | Ni          | Al             | As           | B               | Co           | Cu          | N            | Nb           | Pb              | Sn             | Ti             | V              | Mg            | Sb           | Others                  |                       |
|-------------|----------|-------------------------------|--------|--------|--------|--------|--------|--------|--------------|-------------|----------------|--------------|-----------------|--------------|-------------|--------------|--------------|-----------------|----------------|----------------|----------------|---------------|--------------|-------------------------|-----------------------|
| ...         | 272-1(C) | 12% Chromium Steel            | 0.2815 | 0.420  | 0.600  | 0.0156 | 0.0197 | 11.927 | 0.0030       | 0.244       | 0.0046         | 0.0116       | 0.0018          | 0.0145       | 0.0192      | 0.0508       | 0.0028       | <i>0.0004</i>   | <i>0.0008</i>  | 0.00096        | 0.0167         | <i>0.0002</i> | 0.0007       | 0.00090 Ca<br>0.0031 Zn |                       |
| ...         | 276-2(C) | 5% Cr-Mo-V Steel              | 0.399  | 1.034  | 0.365  | 0.0093 | 0.0189 | 4.975  | 1.134        | 0.203       | ...            | ...          | ...             | ...          | 0.183       | 0.0116       | ...          | ...             | 0.0133         | ...            | 0.296          | ...           | ...          | ...                     |                       |
| ...         | 281-1    | 18/9 Stainless Steel & Ti     | 0.048  | 0.929  | 0.786  | 0.012  | 0.016  | 18.17  | ...          | 9.37        | 0.015          | <i>0.015</i> | 0.0012          | 0.023        | 0.076       | 0.023        | ...          | 0.0005          | 0.009          | 0.216          | ...            | ...           | ...          | ...                     | ...                   |
| ...         | 285-2(C) | Maraging Steel                | 0.0018 | 0.0117 | 0.0168 | 0.0053 | 0.0025 | 0.0236 | 4.99         | 18.07       | 0.1067         | ...          | 0.0009          | 7.76         | 0.0094      | 0.0007       | ...          | ...             | <i>0.001</i>   | 0.520          | ...            | ...           | ...          | ...                     | 0.0050 Zr             |
| ...         | 287-1(C) | High B Stainless Steel        | 0.0164 | 0.569  | 1.478  | 0.0267 | 0.0014 | 18.61  | 0.247        | 10.35       | ...            | ...          | 0.924           | 0.148        | 0.203       | 0.0194       | ...          | ...             | ...            | ...            | ...            | ...           | ...          | ...                     | ...                   |
| ...         | 292-1(C) | Nb-Stabilised Stainless Steel | 0.0367 | 0.402  | 1.744  | 0.0175 | 0.0055 | 18.00  | 0.0464       | 10.09       | <i>0.002</i>   | <i>0.008</i> | <i>0.0003</i>   | 0.0255       | 0.0391      | 0.0640       | 0.571        | ...             | ...            | ...            | ...            | ...           | ...          | ...                     | <i>0.007</i> Ta       |
| ...         | 295-1(C) | 4% Mo-Cr-Ni Steel             | 0.0166 | 0.418  | 1.758  | 0.0167 | 0.0003 | 19.51  | 3.996        | 24.40       | 0.0203         | 0.0041       | 0.0018          | 0.0450       | 1.481       | 0.0615       | ...          | ...             | 0.0025         | ...            | 0.0456         | <i>0.0003</i> | 0.0007       | 48.36 Fe                |                       |
| ...         | 296-1(C) | Jethete Steel                 | 0.1166 | 0.242  | 0.676  | 0.0178 | 0.0026 | 11.82  | 1.700        | 2.790       | 0.0275         | 0.0139       | <i>0.0003</i>   | 0.0218       | 0.1498      | 0.0214       | ...          | 0.00016         | 0.0131         | ...            | 0.363          | ...           | ...          | ...                     | ...                   |
| 332         | ...      | Austenitic Stainless Steel    | 0.063  | 0.44   | 0.80   | 0.015  | 0.020  | 12.78  | ...          | 12.47       | ...            | ...          | ...             | <i>0.037</i> | <i>0.10</i> | ...          | ...          | ...             | ...            | ...            | <i>0.02</i>    | ...           | ...          | ...                     | ...                   |
| 339         | ...      | Ferritic Stainless Steels     | 0.29   | 0.36   | 0.41   | 0.022  | 0.022  | 12.39  | ...          | 0.37        | ...            | ...          | ...             | ...          | <i>0.08</i> | ...          | ...          | ...             | ...            | ...            | ...            | ...           | ...          | ...                     | ...                   |
| 340         | ...      |                               | 0.18   | 0.35   | 0.38   | 0.024  | 0.020  | 16.36  | ...          | 0.40        | ...            | ...          | ...             | ...          | <i>0.06</i> | ...          | ...          | ...             | ...            | ...            | ...            | ...           | ...          | ...                     | ...                   |
| 341         | ...      |                               | 0.103  | 0.31   | 0.43   | 0.016  | 0.024  | 24.01  | ...          | 0.56        | ...            | ...          | ...             | ...          | <i>0.10</i> | ...          | ...          | ...             | ...            | ...            | ...            | ...           | ...          | ...                     | ...                   |
| 342         | ...      |                               | 0.18   | 0.92   | 0.91   | 0.030  | 0.026  | 16.13  | 0.69         | 2.16        | ...            | ...          | ...             | ...          | <i>0.08</i> | ...          | ...          | ...             | ...            | ...            | ...            | ...           | ...          | ...                     | ...                   |
| 463         | ...      | Austenitic Stainless Steels   | 0.088  | 0.51   | 0.77   | 0.015  | 0.017  | 18.29  | ...          | 9.65        | ...            | ...          | <i>0.0004</i>   | ...          | ...         | ...          | ...          | ...             | ...            | ...            | ...            | ...           | ...          | ...                     | ...                   |
| 461/1       | ...      |                               | 0.0103 | 0.374  | 0.686  | 0.0053 | 0.0051 | 14.727 | 0.0138       | 6.124       | <i>0.002</i>   | <i>0.004</i> | ...             | <i>0.004</i> | 0.0091      | ...          | ...          | <i>0.005</i>    | ...            | ...            | ...            | ...           | ...          | ...                     | ...                   |
| 462/1       | ...      |                               | 0.0345 | 0.463  | 0.722  | 0.0053 | 0.0041 | 11.888 | 0.0304       | 12.85       | ...            | ...          | ...             | ...          | 0.0112      | ...          | ...          | ...             | ...            | ...            | ...            | ...           | ...          | ...                     | ...                   |
| 463/1       | ...      |                               | 0.019  | 0.270  | 1.400  | 0.025  | 0.019  | 18.46  | 0.265        | 10.20       | ...            | ...          | ...             | 0.0022       | 0.116       | 0.276        | 0.063        | ...             | ...            | ...            | < <i>0.005</i> | <i>0.04</i>   | ...          | ...                     | ...                   |
| 464/1       | ...      |                               | 0.086  | 0.57   | 0.791  | 0.020  | 0.028  | 25.39  | ...          | 20.05       | ...            | <i>0.003</i> | ...             | 0.054        | ...         | ...          | ...          | 0.0004          | ...            | ...            | ...            | ...           | ...          | ...                     | ...                   |
| 465/1       | ...      |                               | 0.066  | 0.405  | 1.380  | 0.021  | 0.012  | 17.31  | 0.092        | 9.24        | 0.026          | ...          | 0.0006          | 0.053        | 0.098       | 0.010        | ...          | < <i>0.001</i>  | ...            | 0.40           | 0.102          | ...           | ...          | ...                     | ...                   |
| 466/2       | ...      |                               | 0.0141 | 0.480  | 1.311  | 0.0105 | 0.0069 | 17.84  | 2.776        | 10.20       | <i>0.002</i>   | 0.0020       | 0.0039          | 0.0184       | 0.0278      | 0.0508       | <i>0.001</i> | < <i>0.0001</i> | < <i>0.001</i> | <i>0.002</i>   | 0.0346         | ...           | ...          | ...                     | ...                   |
| 467/1       | ...      |                               | 0.082  | 0.52   | 0.788  | 0.018  | 0.019  | 18.09  | ...          | 9.21        | ...            | 0.004        | ...             | ...          | ...         | ...          | 0.99         | 0.004           | ...            | ...            | ...            | ...           | ...          | ...                     | 0.0017 Ta             |
| 468/1       | ...      | 0.143                         | 1.41   | 1.70   | 0.014  | 0.020  | 17.96  | ...    | 8.90         | ...         | ...            | ...          | ...             | 0.018        | ...         | ...          | ...          | ...             | ...            | ...            | ...            | ...           | ...          | ...                     |                       |
| 469         | ...      | Ferritic Stainless Steels     | 0.279  | 0.421  | 0.598  | 0.015  | 0.020  | 11.93  | ...          | 0.246       | ...            | ...          | ...             | <i>0.01</i>  | <i>0.02</i> | ...          | ...          | ...             | ...            | ...            | <i>0.02</i>    | ...           | ...          | ...                     | ...                   |
| 470         | ...      |                               | 0.153  | 0.335  | 0.235  | 0.024  | 0.035  | 17.68  | ...          | 0.369       | ...            | ...          | ...             | ...          | <i>0.02</i> | <i>0.02</i>  | ...          | ...             | ...            | ...            | <i>0.02</i>    | ...           | ...          | ...                     | ...                   |
| 471         | ...      |                               | 0.095  | 0.326  | 0.417  | 0.018  | 0.023  | 23.85  | ...          | 0.96        | ...            | ...          | ...             | ...          | <i>0.02</i> | <i>0.02</i>  | ...          | ...             | ...            | ...            | <i>0.03</i>    | ...           | ...          | ...                     | ...                   |
| 472         | ...      |                               | 0.227  | 1.05   | 1.02   | 0.032  | 0.029  | 15.82  | 0.661        | 1.95        | ...            | ...          | ...             | ...          | <i>0.02</i> | <i>0.02</i>  | ...          | ...             | ...            | ...            | <i>0.02</i>    | ...           | ...          | ...                     | ...                   |
| 473         | ...      |                               | 0.172  | 0.604  | 0.494  | 0.019  | 0.030  | 9.06   | 0.95         | <i>0.06</i> | ...            | ...          | ...             | ...          | <i>0.01</i> | <i>0.03</i>  | ...          | ...             | ...            | ...            | <i>0.02</i>    | ...           | ...          | ...                     | ...                   |
| 474         | ...      | Stainless Steels              | 0.022  | 0.17   | 1.70   | 0.008  | 0.020  | 19.06  | 3.55         | 14.74       | <i>0.006</i>   | 0.030        | ...             | <i>0.02</i>  | 0.35        | ...          | ...          | ...             | ...            | ...            | 0.30           | ...           | ...          | ...                     | ...                   |
| 475         | ...      |                               | 0.050  | 0.21   | 0.89   | 0.037  | 0.008  | 14.14  | 1.59         | 5.66        | 0.013          | ...          | ...             | ...          | 0.22        | 1.94         | ...          | 0.22            | ...            | 0.015          | ...            | ...           | ...          | ...                     | ...                   |
| 476         | ...      | Mo-Stabilised Stainless Steel | 0.0171 | 0.323  | 1.755  | 0.0302 | 0.0234 | 16.88  | 2.049        | 10.17       | < <i>0.005</i> | 0.0053       | ...             | 0.1628       | 0.3026      | 0.0794       | 0.0107       | < <i>0.002</i>  | 0.0059         | < <i>0.005</i> | 0.0663         | ...           | <i>0.001</i> | ...                     | 0.0419 W<br>0.0028 Ca |
| 479         | ...      | Nb-Stabilised Stainless Steel | 0.0529 | 0.553  | 0.680  | 0.0029 | 0.0030 | 19.922 | <i>0.003</i> | 24.87       | <i>0.013</i>   | <i>0.002</i> | < <i>0.0005</i> | <i>0.002</i> | 0.0052      | 0.0057       | 0.625        | < <i>0.001</i>  | < <i>0.002</i> | 0.0306         | 0.0052         | ...           | ...          | ...                     | < <i>0.005</i> Ta     |
| 290/2       | 253-1    | High Manganese Steels         | 1.15   | 0.34   | 12.5   | 0.042  | 0.019  | 0.16   | <i>0.031</i> | 0.29        | ...            | ...          | ...             | <i>0.35</i>  | <i>0.17</i> | <i>0.013</i> | ...          | ...             | ...            | ...            | <i>0.02</i>    | ...           | ...          | ...                     | ...                   |
| 491         | ...      |                               | 0.92   | 0.90   | 16.10  | 0.026  | 0.012  | 1.45   | 0.60         | 0.046       | 0.042          | ...          | ...             | ...          | <i>0.04</i> | ...          | ...          | ...             | ...            | ...            | <i>0.06</i>    | ...           | ...          | ...                     | ...                   |
| 494         | ...      |                               | 1.24   | 0.26   | 13.56  | 0.040  | 0.005  | 0.56   | 0.079        | 0.69        | 0.004          | ...          | ...             | ...          | <i>0.43</i> | <i>0.19</i>  | ...          | ...             | ...            | ...            | <i>0.02</i>    | ...           | ...          | ...                     | ...                   |
| 495         | ...      |                               | 0.82   | 0.46   | 13.56  | 0.036  | 0.014  | 1.93   | 0.035        | 1.05        | 0.103          | ...          | ...             | ...          | <i>0.09</i> | ...          | ...          | ...             | ...            | ...            | <i>0.02</i>    | ...           | ...          | ...                     | ...                   |
| 495/1       | ...      |                               | 0.81   | 0.58   | 13.13  | 0.054  | 0.026  | 1.93   | 0.109        | 1.13        | 0.170          | ...          | ...             | ...          | ...         | ...          | ...          | ...             | ...            | ...            | <i>0.02</i>    | ...           | ...          | ...                     | ...                   |

BRITISH CHEMICAL STANDARD AND EURONORM CERTIFIED REFERENCE MATERIALS - Special Alloys, Cast Irons and Ferro-Alloys

CHEMICAL COMPOSITION (nominal mass content in %) - Figures in bold type certified, figures in small italic type only approximate.

Special Alloys (Finely divided material - units of 100g)

| BCS-CRM No. | ECRM No. | Description             | C      | Si    | Mn          | S      | Ni          | Al         | Co          | Cu          | Nb          | Ti    | Ta           |
|-------------|----------|-------------------------|--------|-------|-------------|--------|-------------|------------|-------------|-------------|-------------|-------|--------------|
| 383         | ...      | Alcomax III             | 0.025  | ...   | <i>0.07</i> | 0.202  | <i>13.2</i> | <i>7.7</i> | <i>24.4</i> | <i>2.63</i> | <i>0.51</i> | ...   | ...          |
| 398         | ...      | Alnico HC               | 0.025  | 0.11  | 0.065       | 0.19   | 16.59       | 9.98       | 14.92       | 6.09        | 0.13        | 0.765 | ...          |
| ...         | 376-1    | 24% Cobalt Magnet Alloy | 0.0256 | 0.313 | 0.046       | 0.0040 | 13.37       | 8.12       | 23.70       | 2.94        | 0.309       | 0.158 | <i>0.016</i> |

Cast Irons (Finely divided material - units of 100g)

| BCS-CRM No. | ECRM No. | Description               | C           | Graphite    | Si    | Mn           | P      | S      | Cr           | Mo           | Ni          | Al     | As           | Cu          | N             | Sn    | Ti           | V            | Mg     |
|-------------|----------|---------------------------|-------------|-------------|-------|--------------|--------|--------|--------------|--------------|-------------|--------|--------------|-------------|---------------|-------|--------------|--------------|--------|
| ...         | 451-2    | Austenitic Cast Iron      | 2.059       | ...         | 2.092 | 1.079        | 0.0593 | 0.0315 | 1.097        | ...          | 14.01       | ...    | ...          | 6.26        | ...           | ...   | ...          | ...          | ...    |
| 206/3       | 453-1    | High Si and P Iron        | <i>2.44</i> | <i>2.37</i> | 3.17  | 0.72         | 1.63   | 0.049  | 0.053        | ...          | 0.068       | ...    | 0.019        | 0.10        | ...           | ...   | <i>0.040</i> | 0.050        | ...    |
| 236/3       | 454-1    | Hematite Iron             | <i>2.53</i> | <i>1.96</i> | 2.00  | 1.16         | 0.046  | 0.068  | ...          | ...          | <i>0.21</i> | ...    | <i>0.025</i> | <i>0.07</i> | ...           | ...   | 0.052        | ...          | ...    |
| ...         | 481-1    | Nodular Iron              | 3.907       | ...         | 2.288 | 0.448        | 0.0192 | 0.0040 | 0.063        | 0.0110       | 1.190       | 0.0229 | 0.0096       | 0.150       | ...           | ...   | ...          | ...          | 0.0507 |
| ...         | 482-2    | Low Alloy Cast Iron       | 2.599       | ...         | 1.815 | 0.728        | 0.0974 | 0.0491 | 0.675        | 0.454        | 2.284       | ...    | ...          | 1.231       | ...           | ...   | ...          | ...          | ...    |
| ...         | 483-1    | High Duty Iron            | 2.463       | 1.65        | 1.755 | 0.596        | 0.615  | 0.103  | 0.039        | ...          | ...         | ...    | ...          | ...         | ...           | 0.130 | ...          | ...          | ...    |
| ...         | 484-1    | Whiteheart Malleable Iron | 3.203       | ...         | 0.717 | 0.395        | 0.121  | 0.230  | 0.155        | ...          | ...         | ...    | ...          | ...         | ...           | ...   | ...          | ...          | ...    |
| ...         | 486-1    | Foundry Iron              | 2.212       | ...         | 2.429 | 0.841        | 0.996  | 0.0233 | 0.104        | ...          | 0.0571      | ...    | ...          | 0.548       | ...           | 0.074 | ...          | 0.0197       | ...    |
| ...         | 489-1    | White Iron                | 2.860       | ...         | 1.524 | <i>0.510</i> | 0.815  | 0.155  | ...          | ...          | ...         | ...    | ...          | 0.274       | <i>0.0056</i> | ...   | ...          | ...          | ...    |
| 527         | ...      | Blast Furnace Iron        | 3.873       | ...         | 1.000 | 0.316        | 0.1269 | 0.0366 | <i>0.087</i> | <i>0.006</i> | 0.0229      | ...    | ...          | 0.0104      | ...           | ...   | 0.0187       | <i>0.010</i> | ...    |

Ferro-Alloys (Finely divided material - units of 100g)

| BCS-CRM No. | ECRM No. | Description            | C            | Si           | Mn           | P            | S            | Cr          | Mo           | Ni    | Al (Acid Sol.) | Al (Total)  | B           | Co           | Cu     | N            | Nb          | Sn           | Ti           | V            | W     | Ta    | Fe           |
|-------------|----------|------------------------|--------------|--------------|--------------|--------------|--------------|-------------|--------------|-------|----------------|-------------|-------------|--------------|--------|--------------|-------------|--------------|--------------|--------------|-------|-------|--------------|
| 203/6       | ...      | Low C Ferro-Chromium   | 0.0270       | 0.381        | 0.153        | 0.0195       | 0.004        | 71.01       | ...          | 0.218 | ...            | ...         | ...         | 0.0442       | ...    | <i>0.029</i> | ...         | ...          | <i>0.003</i> | 0.0729       | ...   | ...   | ...          |
| 204/6       | ...      | High C Ferro-Chromium  | 8.57         | 0.715        | 0.225        | 0.0164       | 0.0190       | 68.77       | ...          | 0.289 | ...            | ...         | ...         | 0.0359       | ...    | <i>0.023</i> | ...         | ...          | 0.0565       | 0.094        | ...   | ...   | ...          |
| 208/3       | ...      | High C Ferro-Manganese | 6.834        | 0.603        | <i>77.91</i> | 0.137        | 0.006        | ...         | ...          | ...   | ...            | ...         | ...         | ...          | ...    | ...          | ...         | ...          | ...          | ...          | ...   | ...   | <i>13.82</i> |
| 231/5       | ...      | Ferro-Molybdenum       | <i>0.209</i> | 1.663        | <i>0.84</i>  | 0.0289       | <i>0.043</i> | <i>0.78</i> | 61.70        | ...   | ...            | ...         | <i>0.19</i> | ...          | 0.270  | ...          | <i>0.83</i> | <i>0.004</i> | ...          | ...          | ...   | ...   | <i>32.0</i>  |
| 231/6       | ...      | Ferro-Molybdenum       | <i>0.058</i> | 0.722        | <i>0.21</i>  | 0.0211       | <i>0.031</i> | <i>0.21</i> | 71.41        | ...   | ...            | ...         | ...         | ...          | 0.2230 | ...          | <i>0.14</i> | <i>0.003</i> | ...          | ...          | ...   | ...   | <i>26.3</i>  |
| 242/2       | 555-1    | Ferro-Tungsten         | 0.025        | 1.75         | ...          | <i>0.02</i>  | <i>0.018</i> | ...         | ...          | ...   | ...            | 0.14        | ...         | ...          | ...    | ...          | ...         | 0.034        | ...          | ...          | 79.9  | ...   | <i>15.2</i>  |
| ...         | 576-1    | Ferro-Niobium (40% Nb) | 0.201        | 1.79         | ...          | ...          | ...          | ...         | ...          | ...   | ...            | 2.53        | ...         | ...          | ...    | ...          | 43.90       | 0.195        | 1.32         | ...          | ...   | 0.306 | ...          |
| ...         | 577-1    | Ferro-Vanadium         | 0.089        | 1.79         | 0.158        | 0.035        | 0.034        | ...         | ...          | 0.053 | <i>0.21</i>    | 0.414       | ...         | ...          | 0.054  | ...          | ...         | ...          | ...          | 50.16        | ...   | ...   | ...          |
| ...         | 578-1    | Ferro-Molybdenum       | 0.016        | 0.208        | ...          | 0.024        | 0.065        | ...         | 72.23        | ...   | ...            | ...         | ...         | ...          | 0.136  | ...          | ...         | ...          | ...          | ...          | ...   | ...   | ...          |
| ...         | 579-1    | Ferro-Niobium (60% Nb) | 0.037        | 1.03         | ...          | 0.064        | 0.021        | ...         | ...          | ...   | ...            | 1.86        | ...         | 0.0051       | ...    | ...          | 62.87       | 0.344        | 0.567        | ...          | ...   | 3.85  | ...          |
| ...         | 580-1    | Low C Ferro-Chromium   | 0.019        | 0.306        | ...          | 0.011        | ...          | 72.18       | ...          | ...   | ...            | ...         | ...         | 0.047        | ...    | 0.035        | ...         | ...          | ...          | 0.083        | ...   | ...   | ...          |
| ...         | 583-1    | Ferro-Manganese        | 0.333        | 0.396        | 86.42        | 0.146        | <i>0.007</i> | ...         | ...          | ...   | ...            | ...         | ...         | ...          | ...    | <i>0.041</i> | ...         | ...          | ...          | ...          | ...   | ...   | <i>12.3</i>  |
| ...         | 584-1    | Ferro-Titanium         | 0.044        | 1.80         | 1.13         | 0.032        | 0.030        | ...         | ...          | ...   | <i>6.0</i>     | 7.19        | ...         | ...          | ...    | ...          | ...         | ...          | 37.17        | ...          | ...   | ...   | ...          |
| ...         | 587-1    | Ferro-Boron            | 0.738        | <i>0.129</i> | 0.272        | <i>0.020</i> | <i>0.001</i> | <i>0.10</i> | <i>0.005</i> | ...   | ...            | 0.047       | 18.7        | <i>0.010</i> | ...    | ...          | ...         | ...          | <i>0.04</i>  | <i>0.004</i> | ...   | ...   | ...          |
| ...         | 590-1    | Ferro-Tungsten         | 0.0250       | 1.05         | 0.136        | ...          | <i>0.07</i>  | ...         | 0.101        | ...   | ...            | <i>0.37</i> | ...         | ...          | 0.0484 | ...          | ...         | 0.045        | ...          | ...          | 79.55 | ...   | <i>17.9</i>  |

BRITISH CHEMICAL STANDARD CERTIFIED REFERENCE MATERIALS - Aluminium, Magnesium, Copper, Lead & Tin Base Alloys

CHEMICAL COMPOSITION (nominal mass content in %) - Figures in bold type certified, figures in small italic type only approximate.

Aluminium and Magnesium Base Alloys (Finely divided material - units of 100g)

| BCS-CRM No. | Description             | Si     | Fe    | Cu    | Mn    | Mg    | Cr     | Zn    | Ti    | Pb    | Sn     | Ni     | Sb   | Zr    | Be     | Total Rare Earths | Al    |
|-------------|-------------------------|--------|-------|-------|-------|-------|--------|-------|-------|-------|--------|--------|------|-------|--------|-------------------|-------|
| 181/3       | 2.5% Cu Aluminium Alloy | 0.30   | 0.72  | 2.48  | 1.10  | 1.57  | 0.04   | 2.52  | 0.058 | 0.101 | ...    | 2.00   | ...  | ...   | ...    | ...               | Bal.  |
| 182/3       | 11% Si Aluminium Alloy  | 11.03  | 0.51  | 0.037 | 0.26  | 0.068 | ...    | 0.128 | 0.107 | 0.056 | 0.027  | 0.047  | ...  | ...   | ...    | ...               | Bal.  |
| 216/3       | 5% Cu Aluminium Alloy   | 0.74   | 0.77  | 5.45  | 0.76  | 0.76  | 0.108  | 0.214 | 0.20  | 0.052 | 0.052  | 0.24   | 0.01 | 0.084 | ...    | ...               | Bal.  |
| 262/1       | 10% Mg Aluminium Alloy  | 0.16   | 0.20  | 0.039 | 0.084 | 10.74 | 0.002  | 0.084 | 0.005 | 0.05  | 0.04   | 0.071  | ...  | ...   | <0.01  | ...               | Bal.  |
| 263/2       | 5% Mg Aluminium Alloy   | 0.14   | 0.26  | 0.019 | 0.36  | 4.67  | 0.074  | 0.056 | 0.022 | ...   | ...    | ...    | ...  | ...   | <0.001 | ...               | Bal.  |
| 268/1       | 5% Si Aluminium Alloy   | 5.49   | 0.47  | 1.35  | 0.24  | 0.49  | ...    | 0.028 | 0.008 | 0.028 | 0.031  | 0.16   | ...  | ...   | ...    | ...               | Bal.  |
| 300/1       | 6% Zn Aluminium Alloy   | 0.14   | 0.24  | 1.27  | 0.33  | 2.74  | 0.13   | 5.87  | 0.09  | ...   | ...    | ...    | ...  | 0.18  | ...    | ...               | Bal.  |
| 343         | Wrought Aluminium Alloy | 0.52   | 0.39  | 0.28  | 0.69  | 0.70  | 0.14   | 0.028 | 0.024 | ...   | ...    | ...    | ...  | ...   | ...    | ...               | Bal.  |
| 349         | 3.5% Cu Aluminium Alloy | 1.19   | 0.154 | 3.40  | 0.111 | 0.024 | <0.001 | 0.298 | 0.034 | 0.077 | 0.074  | ...    | ...  | ...   | <0.001 | ...               | Bal.  |
| 380/1       | 2% Si Aluminium Alloy   | 1.93   | 1.24  | 0.91  | 0.094 | 0.24  | <0.001 | 0.025 | 0.024 | 0.014 | ...    | 0.94   | ...  | ...   | ...    | ...               | Bal.  |
| 307         | Magnesium Alloy (ZRE 1) | <0.001 | 0.002 | 0.005 | 0.006 | Bal.  | ...    | 2.08  | ...   | ...   | <0.001 | <0.001 | ...  | 0.56  | ...    | 2.84              | 0.008 |
| 316         | 8% Al Magnesium Alloy   | 0.054  | 0.009 | 0.040 | 0.28  | Bal.  | ...    | 0.68  | ...   | 0.024 | 0.005  | 0.004  | ...  | ...   | ...    | ...               | 8.01  |
| 505         | Aluminium-Silicon Alloy | 12.8   | 0.30  | 0.05  | 0.52  | 0.05  | ...    | 0.24  | 0.03  | 0.09  | 0.17   | 0.20   | ...  | ...   | ...    | ...               | Bal.  |

Copper Base Alloys (Finely divided material - units of 100g)

| BCS-CRM No. | Description                  | Cu    | Sn    | Zn    | Pb    | P     | Ni    | Fe     | Al     | Mn     | Sb     | As     | Si     | Bi    | Mg    | S     | C    | Cd    |
|-------------|------------------------------|-------|-------|-------|-------|-------|-------|--------|--------|--------|--------|--------|--------|-------|-------|-------|------|-------|
| 179/2       | High Tensile Brass (Cast)    | 58.5  | 0.70  | 35.8  | 0.35  | ...   | 0.56  | 1.02   | 2.22   | 0.86   | ...    | 0.008  | 0.044  | ...   | ...   | ...   | ...  | 0.003 |
| 180/2       | Copper Nickel                | 68.12 | ...   | ...   | 0.003 | ...   | 30.35 | 0.68   | ...    | 0.75   | ...    | ...    | 0.018  | ...   | ...   | 0.006 | 0.04 | ...   |
| 183/4       | Leaded Gunmetal              | 84.08 | 7.27  | 3.47  | 3.15  | 0.090 | 1.30  | 0.056  | <0.002 | 0.01   | 0.23   | 0.13   | 0.01   | 0.005 | ...   | 0.11  | ...  | ...   |
| 207/2       | Gunmetal                     | 87.35 | 9.74  | 1.60  | 0.70  | 0.018 | 0.28  | 0.029  | 0.013  | ...    | 0.10   | 0.066  | 0.016  | 0.04  | ...   | ...   | ...  | ...   |
| 304/1       | Copper-Aluminium             | 80.23 | 0.03  | 0.31  | 0.010 | ...   | 4.82  | 4.64   | 9.71   | 0.12   | ...    | ...    | 0.08   | ...   | <0.01 | ...   | ...  | ...   |
| 344         | 70/30 Brass                  | 68.98 | ...   | 30.98 | ...   | ...   | ...   | ...    | ...    | ...    | ...    | ...    | ...    | ...   | ...   | ...   | ...  | ...   |
| 364         | Leaded Bronze                | 80.7  | 9.36  | 0.13  | 9.24  | 0.057 | 0.28  | <0.005 | <0.002 | ...    | 0.18   | 0.07   | <0.005 | <0.01 | ...   | 0.06  | ...  | ...   |
| 374         | Phosphor Bronze              | 89.5  | 9.80  | 0.006 | 0.064 | 0.59  | 0.014 | <0.005 | <0.005 | ...    | 0.01   | ...    | <0.005 | 0.007 | ...   | 0.012 | ...  | ...   |
| 385         | Leaded Brass                 | 58.7  | 0.27  | 38.5  | 2.24  | ...   | 0.13  | 0.15   | <0.005 | <0.005 | <0.01  | ...    | ...    | ...   | ...   | ...   | ...  | ...   |
| 390         | High Tensile Brass (Wrought) | 57.1  | 0.34  | 38.6  | 1.04  | ...   | 0.033 | 0.83   | 0.83   | 1.30   | ...    | ...    | 0.023  | ...   | ...   | ...   | ...  | 0.011 |
| 399         | Phos. Deoxidised Copper      | 99.93 | 0.003 | 0.003 | 0.002 | 0.045 | 0.002 | 0.006  | ...    | ...    | <0.001 | <0.001 | ...    | 0.001 | ...   | ...   | ...  | 0.003 |

Lead and Tin Base Alloys (Finely divided material - units of 100g)

| BCS-CRM No. | Description           | Pb   | Sn   | Sb    | Cu    | As   | Bi    | Cd     | Fe    | Ni     | Zn     | Al     | Ag    | Au    | In    |
|-------------|-----------------------|------|------|-------|-------|------|-------|--------|-------|--------|--------|--------|-------|-------|-------|
| 177/2       | Lead Base White Metal | 84.5 | 5.07 | 10.1  | 0.12  | 0.05 | 0.028 | ...    | ...   | 0.007  | ...    | ...    | 0.008 | ...   | ...   |
| 178/2       | Tin Base White Metal  | 3.18 | 82.2 | 9.45  | 4.58  | 0.15 | 0.11  | 0.14   | 0.024 | 0.17   | 0.040  | 0.005  | 0.02  | ...   | ...   |
| 347         | Electronic Flowsolder | Bal. | 62.6 | 0.191 | 0.169 | 0.02 | 0.080 | 0.0040 | 0.002 | 0.0072 | 0.0015 | <0.001 | 0.099 | 0.037 | 0.006 |

BRITISH CHEMICAL STANDARD CERTIFIED REFERENCE MATERIALS - Nickel & Titanium Base Alloys, Chromium Metal, Cements, Fluorspar & Bauxites

CHEMICAL COMPOSITION - Figures in bold type certified, figures in small italic type only approximate.

Nickel Base Alloys (Finely divided material - units of 100g - 345, 346 (346A), 350, 351/1, 363/1 & 387/1 also available in disc form for spectroscopic analysis - see page 21)

MAJOR ELEMENTS - nominal mass content in %

| BCS-CRM No. | Description        | C           | Si    | Mn     | P      | S            | Cr          | Mo       | Ni    | Al         | B      | Co        | Cu     | N      | Nb           | Ti          | V        | W      | Zr     | Fe    |
|-------------|--------------------|-------------|-------|--------|--------|--------------|-------------|----------|-------|------------|--------|-----------|--------|--------|--------------|-------------|----------|--------|--------|-------|
| 310/1       | Nimonic '90' Alloy | 0.068       | 0.46  | 0.35   | ...    | ...          | 19.43       | ...      | 58.6  | 1.06       | ...    | 17.0      | ...    | ...    | ...          | 2.43        | ...      | ...    | ...    | 0.25  |
| 345         | IN 100 Alloy       | 0.153       | ...   | ...    | ...    | ...          | 9.95        | 3.01     | Bal.  | 5.58       | 0.019  | 14.71     | ...    | ...    | ...          | 4.74        | 1.00     | ...    | 0.044  | ...   |
| 346         | IN 100 Alloy       | <i>0.15</i> | ...   | ...    | ...    | ...          | <i>10</i>   | <i>3</i> | Bal.  | <i>5.5</i> | ...    | <i>15</i> | ...    | ...    | ...          | <i>5</i>    | <i>1</i> | ...    | ...    | ...   |
| 350         | IN 713 Alloy       | 0.138       | 0.110 | 0.019  | ...    | ...          | 13.43       | 4.29     | 70.8  | 5.97       | 0.013  | 0.338     | ...    | ...    | 2.17         | 0.87        | ...      | 0.094  | 0.072  | 1.50  |
| 351/1       | IN 718 Alloy       | 0.0255      | 0.080 | 0.0562 | 0.0045 | 0.00037      | 19.14       | 3.04     | 53.35 | 0.554      | 0.0035 | 0.145     | 0.0222 | 0.0077 | 5.31         | 0.938       | 0.0181   | 0.0209 | 0.0017 | 17.20 |
| 363/1       | Monel Alloy 400    | 0.140       | 0.028 | 1.26   | ...    | <i>0.002</i> | <i>0.05</i> | ...      | 64.7  | 0.027      | ...    | 0.032     | 31.90  | ...    | ...          | <i>0.03</i> | ...      | ...    | ...    | 1.86  |
| 371         | Commercial Nickel  | 0.30        | 0.34  | ...    | ...    | 0.013        | ...         | ...      | Bal.  | ...        | ...    | 0.39      | ...    | ...    | ...          | ...         | ...      | ...    | ...    | ...   |
| 387/1       | Nimonic 901 Alloy  | 0.033       | 0.06  | 0.025  | 0.0033 | 0.0028       | 11.35       | 5.83     | 41.2  | 0.24       | 0.017  | 0.020     | 0.0076 | ...    | <i>0.006</i> | 3.00        | ...      | ...    | ...    | 38.4  |

Nickel Base Alloys (continued)

TRACE ELEMENTS - nominal mass content in µg/g

| BCS-CRM No. | Description       | Pb         | Bi   | Ag          | Se   | Te   | Tl   | Sb  | Ta  | As   | Cd   | Ga   | Sn  | Zn   | Mg  | Ca  | In  |
|-------------|-------------------|------------|------|-------------|------|------|------|-----|-----|------|------|------|-----|------|-----|-----|-----|
| 345         | IN 100 Alloy      | 0.21       | <0.2 | <0.2        | <0.5 | <0.2 | <0.2 | <2  | ... | 2    | <0.1 | 8.2  | 5.6 | <0.5 | 5.5 | <5  | ... |
| 346         | IN 100 Alloy      | 21.0       | 10.4 | 35.0        | 9.1  | 11.7 | 1.8  | 47  | ... | 50.3 | 0.42 | 50.6 | 91  | 28.9 | 147 | 39  | 19  |
| 351/1       | IN 718 Alloy      | <1         | <1   | <1          | <1   | <1   | <1   | 2.4 | 33  | <10  | <0.1 | <20  | 3.3 | <10  | 16  | <10 | ... |
| 371         | Commercial Nickel | ...        | ...  | ...         | ...  | ...  | ...  | ... | ... | ...  | ...  | ...  | ... | ...  | 600 | ... | ... |
| 387/1       | Nimonic 901 Alloy | <i>0.3</i> | <1.0 | <i>≤0.2</i> | ...  | ...  | ...  | 3   | ... | ...  | ...  | ...  | ... | ...  | ... | ... | ... |

Titanium Base Alloys (Finely divided material - units of 50g)

nominal mass content in %

| BCS-CRM No. | Description    | Al   | V    | Fe    | Cu     | Ni     | Cr     | Mo     | N      | Sn            | Si            | W             | C             | H             | O             | B             | Zr            | Y             |
|-------------|----------------|------|------|-------|--------|--------|--------|--------|--------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|
| 356         | Titanium Alloy | 6.25 | 4.05 | 0.124 | 0.0055 | 0.0070 | 0.0112 | 0.0020 | 0.0103 | <i>0.0155</i> | <i>0.0200</i> | <i>0.0010</i> | <i>0.0085</i> | <i>0.0019</i> | <i>0.2000</i> | <0.0005       | <0.0005       | ...           |
| 357         | Titanium Alloy | 5.46 | 3.53 | 0.202 | 0.0537 | 0.0511 | 0.0521 | 0.053  | 0.0148 | <i>0.0620</i> | <i>0.0500</i> | <0.001        | <i>0.0072</i> | <i>0.0012</i> | <i>0.2500</i> | <i>0.0013</i> | <i>0.0455</i> | <i>0.0046</i> |

Chromium Metal (Finely divided material - units of 100g)

nominal mass content in %

| BCS-CRM No. | Description    | C      | Si     | S      | N      | Fe    | O     | Al (Total)   |
|-------------|----------------|--------|--------|--------|--------|-------|-------|--------------|
| 361         | Chromium Metal | 0.0039 | 0.0449 | 0.0043 | 0.0079 | 0.092 | 0.101 | <i>0.083</i> |

Chrome Ore (Finely divided material - units of 100g)

| BCS-CRM No. | Description | FeO*  | SiO <sub>2</sub> | Al <sub>2</sub> O <sub>3</sub> | Cr <sub>2</sub> O <sub>3</sub> | TiO <sub>2</sub> | CaO  | MgO  | MnO   | P      | Na <sub>2</sub> O | K <sub>2</sub> O | Cr (VI)       |
|-------------|-------------|-------|------------------|--------------------------------|--------------------------------|------------------|------|------|-------|--------|-------------------|------------------|---------------|
| 308/1       | Chrome Ore  | 26.58 | 1.194            | 15.10                          | 44.91                          | 0.74             | 0.65 | 9.15 | 0.230 | <0.006 | <0.015            | <0.0054          | <i>0.0006</i> |

\*Total Iron expressed as FeO

Cements (Finely divided material - units of 100g)

nominal mass content in %

| BCS-CRM No. | Description                        | SiO <sub>2</sub> | Al <sub>2</sub> O <sub>3</sub> | TiO <sub>2</sub> | Fe <sub>2</sub> O <sub>3</sub> | Cr <sub>2</sub> O <sub>3</sub> | Mn <sub>2</sub> O <sub>3</sub> | CaO  | MgO  | Na <sub>2</sub> O (Acid Sol) | K <sub>2</sub> O (Acid Sol) | P <sub>2</sub> O <sub>5</sub> | SO <sub>3</sub> | SrO  | Cl           |
|-------------|------------------------------------|------------------|--------------------------------|------------------|--------------------------------|--------------------------------|--------------------------------|------|------|------------------------------|-----------------------------|-------------------------------|-----------------|------|--------------|
| 353         | Sulphate-Resisting Portland Cement | 20.5             | 3.77                           | 0.16             | 4.82                           | <i>0.02</i>                    | 0.23                           | 64.8 | 2.42 | 0.10                         | 0.49                        | 0.077                         | 2.25            | 0.23 | <i>0.01</i>  |
| 354         | White Portland Cement              | 21.8             | 4.85                           | <i>0.04</i>      | 0.30                           | <i>0.003</i>                   | 0.057                          | 70.0 | 0.42 | 0.10                         | 0.11                        | 0.12                          | 2.25            | 0.11 | <i>0.005</i> |

Fluorspar & Bauxites (Finely divided material - units of 100g)

nominal mass content in %

| BCS-CRM No. | Description      | Fe <sub>2</sub> O <sub>3</sub> | SiO <sub>2</sub> | Al <sub>2</sub> O <sub>3</sub> | CaF <sub>2</sub> | TiO <sub>2</sub> | CaO    | MgO    | P <sub>2</sub> O <sub>5</sub> | BaO  | Na <sub>2</sub> O | K <sub>2</sub> O | S    | CO <sub>2</sub> | Cr            | Cu            | Mn            | Ni            | Pb            | Sr            | Zn            | L.O.I.      |
|-------------|------------------|--------------------------------|------------------|--------------------------------|------------------|------------------|--------|--------|-------------------------------|------|-------------------|------------------|------|-----------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|-------------|
| 392         | Fluorspar        | ...                            | 0.67             | ...                            | 97.2             | ...              | 0.52   | ...    | ...                           | 0.37 | ...               | ...              | 0.12 | 0.48            | ...           | ...           | ...           | ...           | 0.18          | ...           | ...           | ...         |
| 394/1       | Calcined Bauxite | 1.372                          | 6.47             | 88.88                          | ...              | 2.967            | 0.0173 | 0.0047 | 0.0574                        | ...  | <0.01             | <0.01            | ...  | ...             | ...           | ...           | ...           | ...           | ...           | ...           | ...           | <i>0.05</i> |
| 395         | Bauxite          | 16.3                           | 1.24             | 52.4                           | ...              | 1.93             | 0.05   | 0.02   | ...                           | ...  | <i>0.02</i>       | <i>0.02</i>      | ...  | ...             | <i>0.0453</i> | <i>0.0021</i> | <i>0.0042</i> | <i>0.0034</i> | <i>0.0028</i> | <i>0.0023</i> | <i>0.0043</i> | 27.8        |

BRITISH CHEMICAL STANDARD AND EURONORM CERTIFIED REFERENCE MATERIALS - Non-Metallic Materials

CHEMICAL COMPOSITION (nominal mass content in %) - Figures in bold type certified, figures in small italic type only approximate.

Tin Ore (Finely divided material - units of 100g)

| BCS-CRM No. | Description | Sn    | Fe    | Cu    | As   | Bi    | Zn    | Pb    | S    | W    | Ni     | Si   | Ti   | Al   | Ca   | F    |
|-------------|-------------|-------|-------|-------|------|-------|-------|-------|------|------|--------|------|------|------|------|------|
| 355         | Tin Ore     | 31.42 | 17.08 | 0.085 | 0.14 | 0.015 | 0.059 | 0.012 | 0.50 | 0.35 | 0.0040 | 7.14 | 0.37 | 4.12 | 2.63 | 2.07 |

Iron Ores & Furnace Dust (Finely divided material - units of 100g)

| BCS-CRM No. | ECRM No. | Description           | Fe    | Si    | Ca           | Mg     | Al    | Ti     | Mn     | P      | S            | Na           | K           | F           | V      | Cr            | Zn            | LOI         |
|-------------|----------|-----------------------|-------|-------|--------------|--------|-------|--------|--------|--------|--------------|--------------|-------------|-------------|--------|---------------|---------------|-------------|
| 301/1       | 651-1    | Lincolnshire Iron Ore | 23.85 | 3.46  | 16.1         | 1.04   | 2.25  | 0.10   | 0.97   | 0.35   | 0.40         | 0.05         | 0.26        | ...         | ...    | ...           | ...           | 25.8        |
| 377/6       | ...      | Iron Ore Sinter       | 54.78 | 2.982 | 5.74         | 0.907  | 0.783 | 0.1001 | 0.604  | 0.0586 | <i>0.04</i>  | <i>0.10</i>  | <i>0.57</i> | <i>0.30</i> | 0.0178 | 0.0154        | 1.002         | ...         |
| 517         | ...      | Brazilian Iron Ore    | 66.30 | 0.519 | 0.033        | 0.0311 | 0.508 | 0.0332 | 0.679  | 0.0408 | 0.0090       | 0.0097       | 0.0105      | ...         | 0.0040 | ...           | 0.0047        | 1.898       |
| ...         | 676-1    | Iron Ore Sinter       | 39.76 | 6.40  | 12.78        | 1.16   | 3.40  | 0.19   | 0.83   | 0.59   | 0.12         | 0.095        | 0.43        | 0.10        | 0.070  | ...           | ...           | ...         |
| ...         | 682-2    | Iron Ore              | 66.12 | 0.833 | <i>0.007</i> | 0.0133 | 0.325 | 0.0441 | 0.0311 | 0.0529 | 0.0140       | <i>0.002</i> | ...         | ...         | 0.0015 | <i>0.0015</i> | <i>0.0014</i> | <i>3.01</i> |
| ...         | 690-1    | Haematite Iron Ore    | 66.70 | 0.881 | 0.269        | 0.815  | 0.198 | 0.229  | 0.0337 | 0.0085 | <i>0.001</i> | 0.0312       | 0.0158      | ...         | 0.1417 | 0.0113        | <i>0.002</i>  | ...         |
| ...         | 884-1    | Furnace Dust          | 31.67 | 2.101 | 5.22         | 1.848  | 0.379 | 0.0230 | 5.85   | 0.079  | <i>0.49</i>  | 0.585        | 0.979       | 0.411       | 0.0303 | 1.86          | 17.50         | <i>2.94</i> |

Iron Ores & Furnace Dust (continued)

| BCS-CRM No. | ECRM No. | Description                   | Ni            | Pb               | C           | Co               | Cu          | Ag     | As            | Ba           | Bi     | Cd             | Mo    | Sn           | Cl <sub>(sol)</sub> | Cl           | Hg                | H <sub>2</sub> O |     |
|-------------|----------|-------------------------------|---------------|------------------|-------------|------------------|-------------|--------|---------------|--------------|--------|----------------|-------|--------------|---------------------|--------------|-------------------|------------------|-----|
| 301/1       | 651-1    | Lincolnshire Iron Ore (cont.) | ...           | ...              | <i>6.0</i>  | ...              | ...         | ...    | ...           | ...          | ...    | ...            | ...   | ...          | ...                 | ...          | ...               | ...              | 5.3 |
| 377/6       | ...      | Iron Ore Sinter (cont.)       | <i>0.009</i>  | 0.1485           | ...         | <i>&lt;0.002</i> | <i>0.08</i> | ...    | ...           | <i>0.01</i>  | ...    | ...            | ...   | ...          | ...                 | ...          | ...               | ...              |     |
| 517         | ...      | Brazilian Iron Ore (cont.)    | <i>0.0003</i> | 0.0028           | 0.061       | <i>0.0003</i>    | 0.0088      | ...    | <i>0.0004</i> | <i>0.015</i> | ...    | <i>≤0.0001</i> | ...   | ...          | 0.00075             | ...          | ...               | ...              |     |
| ...         | 682-2    | Iron Ore (cont.)              | ...           | 0.0004           | ...         | <i>0.0006</i>    | 0.0005      | ...    | ...           | ...          | ...    | ...            | ...   | ...          | ...                 | ...          | <i>&lt;0.0001</i> | ...              |     |
| ...         | 690-1    | Haematite Iron Ore (cont.)    | 0.0200        | <i>&lt;0.002</i> | ...         | 0.0089           | 0.0006      | ...    | ...           | ...          | ...    | ...            | ...   | <i>0.001</i> | ...                 | <i>0.001</i> | ...               | ...              |     |
| ...         | 884-1    | Furnace Dust (cont.)          | 0.197         | 0.442            | <i>0.82</i> | 0.0046           | 0.1569      | 0.0028 | 0.0054        | ...          | 0.0280 | 0.0045         | 0.208 | 0.0186       | ...                 | 0.991        | <i>0.0002</i>     | <i>0.30</i>      |     |

Manganese Ores (Finely divided material - units of 100g)

| BCS-CRM No. | Description   | Mn    | Fe    | SiO <sub>2</sub> | Al <sub>2</sub> O <sub>3</sub> | TiO <sub>2</sub> | CaO  | MgO  | P      | Na <sub>2</sub> O | K <sub>2</sub> O | BaO    | Co     | Cu     | S            | As <sub>2</sub> O <sub>3</sub> | B            |
|-------------|---------------|-------|-------|------------------|--------------------------------|------------------|------|------|--------|-------------------|------------------|--------|--------|--------|--------------|--------------------------------|--------------|
| 176/3       | Manganese Ore | 27.69 | 0.976 | 14.31            | 2.504                          | 0.0972           | 6.83 | 4.72 | 0.0602 | 0.285             | 0.363            | 0.0157 | 0.0056 | 0.0054 | <i>0.235</i> | <i>0.049</i>                   | <i>0.009</i> |
| 176/4       | Manganese Ore | 29.13 | 0.839 | 13.09            | 2.236                          | 0.0854           | 5.59 | 5.36 | 0.0582 | 0.321             | 0.261            | 0.0135 | 0.0050 | 0.0041 | <i>0.160</i> | <i>0.051</i>                   | <i>0.011</i> |

Copper Concentrate / Zinc Concentrate (Finely divided material - units of 100g)

| BCS-CRM No. | Description        | SiO <sub>2</sub> | MgO   | CaO   | Cu    | Zn    | Pb    | S     | Fe    | Ag     | Au      | Cd     | Mn     | Ni     | Al <sub>2</sub> O <sub>3</sub> | Na <sub>2</sub> O | K <sub>2</sub> O | As               | Bi               |
|-------------|--------------------|------------------|-------|-------|-------|-------|-------|-------|-------|--------|---------|--------|--------|--------|--------------------------------|-------------------|------------------|------------------|------------------|
| 514         | Copper Concentrate | 2.97             | 0.184 | 0.263 | 25.24 | 0.268 | 0.010 | 35.89 | 31.41 | 0.0034 | 0.00193 | 0.0043 | 0.0027 | 0.0021 | <i>0.59</i>                    | <i>0.074</i>      | <i>0.070</i>     | <i>&lt;0.005</i> | <i>&lt;0.005</i> |
| 520         | Zinc Concentrate   | 1.78             | 0.266 | 0.125 | 0.568 | 52.50 | 0.820 | 31.78 | 9.88  | 0.0036 | ...     | 0.0735 | ...    | ...    | 0.334                          | ...               | ...              | 0.0228           | ...              |

| BCS-CRM No. | Description                | C            | Mo           | Cl               | Co           | Cr               | F            | Hg                | In               | P            | Sb              | Se           | Te               | Ti           | Ba               | Be                | Ge               | Sn              | Tl               |
|-------------|----------------------------|--------------|--------------|------------------|--------------|------------------|--------------|-------------------|------------------|--------------|-----------------|--------------|------------------|--------------|------------------|-------------------|------------------|-----------------|------------------|
| 514         | Copper Concentrate (cont.) | <i>0.064</i> | <i>0.058</i> | <i>&lt;0.005</i> | <i>0.010</i> | <i>&lt;0.005</i> | <i>0.005</i> | <i>&lt;0.0005</i> | <i>&lt;0.003</i> | <i>0.006</i> | <i>&lt;0.01</i> | <i>0.021</i> | <i>&lt;0.005</i> | <i>0.017</i> | <i>&lt;0.005</i> | <i>&lt;0.0005</i> | <i>&lt;0.002</i> | <i>&lt;0.01</i> | <i>&lt;0.002</i> |

Slags (Finely divided material - units of 100g)

| BCS-CRM No. | ECRM No. | Description | SiO <sub>2</sub> | TiO <sub>2</sub> | Al <sub>2</sub> O <sub>3</sub> | Fe    | FeO  | CaO   | MgO  | Cr <sub>2</sub> O <sub>3</sub> | MnO  | V <sub>2</sub> O <sub>5</sub> | P <sub>2</sub> O <sub>5</sub> (Cit. Sol.) | P <sub>2</sub> O <sub>5</sub> (Form. Sol.) | P <sub>2</sub> O <sub>5</sub> (Total) | S     | F     |
|-------------|----------|-------------|------------------|------------------|--------------------------------|-------|------|-------|------|--------------------------------|------|-------------------------------|---|--|---------------------------------------|-------|-------|
| 381         | ...      | Basic Slag  | 8.78             | 0.35             | 0.67                           | 13.3  | 3.69 | 49.0  | 1.03 | 0.33                           | 3.16 | 0.94                          | 15.2                                      | ...  | 15.7                                  | 0.19  | ...   |
| ...         | 879-1    | Basic Slag  | 8.82             | 0.535            | 0.803                          | 18.97 | ...  | 43.70 | 2.19 | 0.477                          | 4.45 | 0.738                         | 7.59                                      | 5.73                                       | 8.46                                  | 0.102 | 0.368 |

Tungsten Carbide and Silicon Carbide Refractories (Finely divided material - units of 100g)

| BCS-CRM No. | ECRM No. | Description                      | C (Total) | Si (Total) | Al (Total) | C (Free)     | Si (Free)    | Fe (Total)    | Mn              | P             | Cr              | Mo            | Ni            | B             | O            | N             | Ti            | V             | Ca            | Mg              | Na              | K               |
|-------------|----------|----------------------------------|-----------|------------|------------|--------------|--------------|---------------|-----------------|---------------|-----------------|---------------|---------------|---------------|--------------|---------------|---------------|---------------|---------------|-----------------|-----------------|-----------------|
| ...         | 783-1    | Tungsten Carbide                 | 6.188     | ...        | ...        | <i>0.04</i>  | ...          | 0.0022        | ...             | ...           | ...             | ...           | ...           | ...           | <i>0.01</i>  | ...           | ...           | ...           | ...           | ...             | ...             | ...             |
| ...         | 781-1    | Silicon Carbide Refractory       | 48.25     | 35.56      | 4.39       | <i>37.22</i> | <i>4.646</i> | <i>0.8061</i> | <i>0.0274</i>   | <i>0.0117</i> | <i>0.0240</i>   | <i>0.0264</i> | <i>0.0210</i> | <i>0.0149</i> | <i>10.5</i>  | <i>0.0282</i> | <i>0.0320</i> | <i>0.0216</i> | <i>0.0433</i> | <i>0.0421</i>   | <i>0.0308</i>   | <i>0.3765</i>   |
| 359         | ...      | Nitrogen Bearing Silicon Carbide | 23.46     | 67.6       | 0.118      | <i>0.061</i> | <i>0.325</i> | 0.175         | <i>&lt;0.01</i> | ...           | ...             | ...           | <i>0.014</i>  | ...           | <i>0.532</i> | <i>7.84</i>   | 0.022         | <i>0.027</i>  | 0.108         | <i>&lt;0.01</i> | <i>&lt;0.01</i> | <i>&lt;0.01</i> |
| 360         | ...      | Sialon Bonded Silicon Carbide    | 23.53     | 60.8       | 6.52       | <i>0.085</i> | <i>0.538</i> | <i>0.19</i>   | <i>&lt;0.01</i> | ...           | <i>&lt;0.01</i> | ...           | <i>0.013</i>  | ...           | <i>4.03</i>  | <i>4.77</i>   | 0.025         | ...           | 0.115         | <i>&lt;0.02</i> | <i>&lt;0.01</i> | <i>&lt;0.01</i> |

BRITISH CHEMICAL STANDARD CERTIFIED REFERENCE MATERIALS - Ceramic Materials and Minerals

CHEMICAL COMPOSITION (nominal mass content in %) - Figures in bold type certified, figures in small italic type only approximate.

Ceramic Materials, Minerals & Glass Sands (All finely divided material - units of 100g, except BCS-CRM 525 – units of 25g)

| BCS-CRM No. | ECRM No. | Description                             | SiO <sub>2</sub> | Al <sub>2</sub> O <sub>3</sub> | TiO <sub>2</sub> | Fe <sub>2</sub> O <sub>3</sub> | MnO         | Mn <sub>3</sub> O <sub>4</sub> | CaO         | MgO             | Na <sub>2</sub> O | K <sub>2</sub> O | BaO             | Cr <sub>2</sub> O <sub>3</sub> | PbO              | ZnO             |
|-------------|----------|---|------------------|--------------------------------|------------------|--------------------------------|-------------|--------------------------------|-------------|-----------------|-------------------|------------------|-----------------|--------------------------------|------------------|-----------------|
| 309         | ...      | Sillimanite                             | 34.1             | 61.1                           | 1.92             | 1.51                           | <i>0.03</i> | ...                            | 0.22        | 0.17            | 0.34              | 0.46             | <i>0.006</i>    | ...                            | ...              | ...             |
| 313/2       | ...      | High Purity Silica                      | 99.73            | 0.068                          | 0.0243           | 0.0229                         | 0.00032     | ...                            | 0.0160      | 0.0038          | 0.0057            | 0.0108           | 0.00067         | ...                            | ...              | <i>0.0014</i>   |
| 319/1       | ...      | Magnesia                                | 1.093            | 0.109                          | 0.0070           | 0.291                          | 0.108       | ...                            | 3.00        | 95.38           | ...               | ...              | <i>0.0038</i>   | 0.0035                         | ...              | ...             |
| 348         | ...      | Ball Clay                               | 51.1             | 31.6                           | 1.08             | 1.04                           | ...         | ...                            | 0.17        | 0.30            | 0.34              | 2.23             | <i>0.04</i>     | 0.016                          | ...              | ...             |
| 358         | ...      | Zirconia                                | 0.21             | 0.08                           | 0.20             | 0.065                          | ...         | ...                            | 1.50        | 3.42            | <i>&lt;0.01</i>   | <i>&lt;0.01</i>  | 0.10            | ...                            | ...              | ...             |
| 362*        | ...      | Mine Tailings Sample                    | 9.03             | 0.667                          | 0.047            | 0.483                          | ...         | 0.829                          | 44.21       | 0.068           | 0.084             | 0.14             | <i>2.02</i>     | <i>0.003</i>                   | 2.63             | 2.59            |
| 369         | ...      | Magnesite-Chrome                        | 2.59             | 14.7                           | 0.14             | 10.3                           | 0.11        | ...                            | 1.17        | 53.5            | 0.05              | 0.03             | <i>&lt;0.01</i> | 17.2                           | ...              | ...             |
| 370         | ...      | Magnesite-Chrome                        | 3.01             | 12.3                           | 0.13             | 7.23                           | 0.11        | ...                            | 1.54        | 61.8            | 0.06              | 0.03             | <i>&lt;0.01</i> | 13.4                           | ...              | ...             |
| 375/1       | ...      | Soda Feldspar                           | 69.26            | 17.89                          | 0.313            | 0.291                          | ...         | Mn <sub>2</sub> O <sub>3</sub> | 0.78        | 0.180           | 8.89              | 1.47             | <i>0.0106</i>   | <i>0.0018</i>                  | <i>0.0004</i>    | <i>0.0005</i>   |
| 376/1       | ...      | Potash Feldspar (SGT Feldspar 1)        | 65.77            | 18.63                          | <i>&lt;0.01</i>  | 0.085                          | ...         | <i>0.004</i>                   | 0.421       | <i>0.03</i>     | 3.00              | 11.59            | 0.0210          | <i>0.001</i>                   | 0.0090           | ...             |
| 388         | ...      | Zircon                                  | 32.7             | 0.291                          | 0.232            | 0.049                          | ...         | ...                            | <i>0.04</i> | <i>&lt;0.05</i> | <i>&lt;0.02</i>   | <i>&lt;0.03</i>  | ...             | ...                            | ...              | ...             |
| 389/1       | ...      | High Purity Magnesia                    | 0.274            | 0.104                          | 0.0051           | 0.607                          | 0.100       | ...                            | 0.880       | 97.89           | ...               | ...              | <i>0.0015</i>   | <i>0.004</i>                   | ...              | <i>0.0029</i>   |
| 393         | 752-1    | Limestone                               | 0.70             | 0.12                           | 0.009            | 0.045                          | 0.010       | ...                            | 55.4        | 0.15            | <i>0.02</i>       | 0.02             | 0.006           | ...                            | ...              | ...             |
| 396         | ...      | Low Silica Magnesite Chrome             | 1.37             | 5.73                           | 0.26             | 10.9                           | 0.17        | ...                            | 1.12        | 64.6            | <i>0.06</i>       | <i>0.03</i>      | ...             | 15.6                           | ...              | ...             |
| 512         | ...      | Dolomite (SGT Dolomite 1)               | 0.379            | 0.055                          | 0.0020           | 0.030                          | 0.0036      | ...                            | 30.61       | 21.59           | <i>0.1</i>        | <i>&lt;0.02</i>  | <i>&lt;0.02</i> | <i>&lt;0.001</i>               | <i>&lt;0.001</i> | <i>&lt;0.01</i> |
| 513         | ...      | Limestone (SGT Limestone 1)             | 0.228            | 0.108                          | <i>0.004</i>     | 0.0275                         | 0.0095      | ...                            | 55.59       | 0.182           | <i>&lt;0.3</i>    | 0.0150           | <i>0.01</i>     | 0.0012                         | 0.0009 Pb        | 0.0014 Zn       |
| 516         | ...      | Standard Glass Sand (SGT Glass Sand 10) | 98.73            | 0.513                          | 0.172            | 0.0596                         | ...         | 0.0012                         | 0.0243      | 0.0387          | 0.0195            | 0.127            | 0.0040          | 0.0081                         | 0.0127           | <i>&lt;0.01</i> |
| 525         | ...      | Low Iron Float Glass                    | 72.55            | 0.167                          | <i>0.021</i>     | 0.0166                         | ...         | 0.0012                         | 8.91        | 4.28            | 13.43             | 0.087            | 0.0041          | <i>0.0003</i>                  | <i>0.0004</i>    | ...             |
| 528         | ...      | Standard Glass Sand (SGT Glass Sand 11) | 95.62            | 2.447                          | 0.0486           | 0.1111                         | ...         | ...                            | 0.237       | 0.0887          | 0.101             | 0.875            | 0.0298          | 0.0008                         | 0.0006           | <i>0.001</i>    |
| 529         | ...      | Anorthic Feldspar                       | 56.24            | 26.84                          | <i>0.087</i>     | 0.273                          | ...         | ...                            | 9.58        | 0.045           | 5.58              | 0.42             | <i>0.093</i>    | 0.002                          | ...              | ...             |
| 531         | ...      | Low Iron Sand                           | 99.74            | 0.0327                         | 0.0160           | 0.00636                        | 0.00014     | ...                            | 0.0040      | 0.00132         | <i>0.003</i>      | 0.0039           | 0.00112         | <i>&lt;0.0002</i>              | <i>&lt;0.001</i> | ...             |
| 532         | ...      | Swedish Feldspar                        | 77.07            | 13.46                          | <i>0.019</i>     | 0.1813                         | ...         | ...                            | 0.212       | 0.159           | 4.35              | 3.80             | <i>0.015</i>    | <i>0.004</i>                   | ...              | ...             |
| ...         | 776-1    | Firebrick                               | 62.76            | 29.28                          | 1.62             | 1.43                           | ...         | ...                            | 0.310       | 0.476           | 0.488             | 2.92             | 0.122           | 0.022                          | ...              | ...             |
| ...         | 782-1    | Dolomite                                | 0.266            | 0.104                          | 0.0042           | 0.450                          | 0.081       | ...                            | 30.34       | 21.29           | ...               | 0.0260           | <i>0.0008</i>   | 0.0009                         | 0.0029           | 0.0082          |

\*Additional certified values available for Aqua Regia soluble content and pH in BCS-CRM 362: As=0.0030%, Cd=0.0200%, Cr=0.0011%, Cu=0.0056%, Ni=0.0012%, Pb=2.30%, Zn=2.03% and pH=8.14

Ceramic Materials, Minerals & Glass Sands (continued)

| BCS-CRM No. | ECRM No. | P <sub>2</sub> O <sub>5</sub> | ZrO <sub>2</sub> | S               | L.O.I.      | B <sub>2</sub> O <sub>3</sub> | HfO <sub>2</sub> | Li <sub>2</sub> O | SrO             | ThO <sub>2</sub> | U <sub>3</sub> O <sub>8</sub> | Y <sub>2</sub> O <sub>3</sub> | As               | C           | Cd               | F                | Mn               | Ni               | Sn               |
|-------------|----------|-------------------------------|------------------|-----------------|-------------|-------------------------------|------------------|-------------------|-----------------|------------------|-------------------------------|-------------------------------|------------------|-------------|------------------|------------------|------------------|------------------|------------------|
| 309         | ...      | ...                           | ...              | ...             | <i>0.1</i>  | ...                           | ...              | <i>0.01</i>       | <i>0.003</i>    | ...              | ...                           | ...                           | ...              | ...         | ...              | ...              | ...              | ...              | ...              |
| 313/2       | ...      | <i>0.0022</i>                 | ...              | ...             | <i>0.14</i> | ...                           | ...              | ...               | 0.00024         | ...              | ...                           | ...                           | ...              | ...         | ...              | ...              | ...              | ...              | ...              |
| 319/1       | ...      | <i>0.007</i>                  | <i>0.0008</i>    | ...             | ...         | <i>0.002</i>                  | ...              | ...               | <i>0.0060</i>   | ...              | ...                           | <i>0.0014</i>                 | ...              | ...         | ...              | ...              | ...              | <i>0.0075</i>    | ...              |
| 348         | ...      | 0.071                         | <i>0.03</i>      | <i>0.1</i>      | 11.8        | ...                           | ...              | ...               | ...             | ...              | ...                           | ...                           | ...              | <i>1.64</i> | ...              | ...              | ...              | ...              | ...              |
| 358         | ...      | ...                           | 92.70            | ...             | 0.08        | ...                           | 1.63             | ...               | 0.07            | <i>0.0007</i>    | <i>0.08</i>                   | ...                           | ...              | ...         | ...              | ...              | ...              | ...              | ...              |
| 362*        | ...      | <i>0.014</i>                  | ...              | 1.48            | 32.81       | ...                           | ...              | ...               | 0.034           | ...              | ...                           | ...                           | ...              | 9.9         | 0.020            | ...              | ...              | <i>0.001</i>     | ...              |
| 369         | ...      | ...                           | ...              | ...             | ...         | ...                           | ...              | 0.03              | <i>&lt;0.01</i> | ...              | ...                           | ...                           | ...              | ...         | ...              | ...              | ...              | <i>0.15</i>      | ...              |
| 370         | ...      | ...                           | ...              | ...             | ...         | ...                           | ...              | 0.03              | <i>&lt;0.01</i> | ...              | ...                           | ...                           | ...              | ...         | ...              | ...              | ...              | <i>0.08</i>      | ...              |
| 375/1       | ...      | 0.226                         | <i>0.0107</i>    | ...             | 0.72        | ...                           | <i>0.0004</i>    | ...               | <i>0.012</i>    | <i>0.0011</i>    | <i>0.0002</i>                 | <i>0.0023</i>                 | ...              | ...         | ...              | ...              | ...              | ...              | ...              |
| 376/1       | ...      | <i>0.02</i>                   | <i>&lt;0.01</i>  | ...             | 0.203       | ...                           | ...              | ...               | ...             | ...              | ...                           | ...                           | ...              | ...         | ...              | ...              | ...              | ...              | ...              |
| 388         | ...      | 0.122                         | 64.9             | ...             | <i>0.20</i> | ...                           | 1.28             | ...               | ...             | 0.019            | 0.034                         | 0.136                         | ...              | ...         | ...              | ...              | ...              | ...              | ...              |
| 389/1       | ...      | 0.0295                        | <i>0.0008</i>    | ...             | ...         | <i>0.015</i>                  | ...              | ...               | <i>0.0007</i>   | ...              | ...                           | <i>0.0029</i>                 | ...              | ...         | ...              | ...              | ...              | <i>0.0012</i>    | ...              |
| 393         | 752-1    | <i>0.005</i>                  | ...              | 0.007           | 43.4        | ...                           | ...              | 0.019             | ...             | ...              | ...                           | ...                           | ...              | ...         | ...              | <i>&lt;0.01</i>  | ...              | ...              | ...              |
| 396         | ...      | ...                           | ...              | ...             | <i>0.04</i> | 0.09                          | ...              | <i>0.05</i>       | ...             | ...              | ...                           | ...                           | ...              | ...         | ...              | ...              | ...              | ...              | ...              |
| 512         | ...      | <i>&lt;0.02</i>               | ...              | <i>&lt;0.05</i> | 46.80       | ...                           | ...              | 0.024             | ...             | ...              | ...                           | ...                           | <i>&lt;0.003</i> | 12.4        | <i>&lt;0.001</i> | <i>0.01</i>      | ...              | <i>&lt;0.001</i> | ...              |
| 513         | ...      | <i>0.005</i>                  | ...              | 0.0097          | 43.61       | ...                           | ...              | 0.0176            | 43.61           | ...              | ...                           | ...                           | <i>&lt;0.001</i> | 11.9        | <i>&lt;0.001</i> | <i>&lt;0.005</i> | ...              | <i>&lt;0.001</i> | ...              |
| 516         | ...      | <i>0.013</i>                  | <i>0.075</i>     | SO <sub>3</sub> | 0.24        | ...                           | <i>&lt;0.01</i>  | ...               | <i>&lt;0.01</i> | ...              | ...                           | ...                           | ...              | ...         | ...              | ...              | ...              | ...              | ...              |
| 525         | ...      | <i>0.004</i>                  | 0.0045           | 0.284           | 0.43        | ...                           | ...              | 0.0038            | ...             | ...              | ...                           | ...                           | ...              | ...         | ...              | ...              | ...              | ...              | ...              |
| 528         | ...      | <i>0.20</i>                   | <i>0.014</i>     | ...             | 0.271       | ...                           | ...              | ...               | ...             | ...              | ...                           | ...                           | ...              | ...         | ...              | ...              | <i>&lt;0.002</i> | ...              | <i>0.0016</i>    |
| 529         | ...      | <i>0.047</i>                  | ...              | <i>0.135</i>    | 0.550       | ...                           | ...              | 0.323             | ...             | ...              | ...                           | ...                           | ...              | ...         | ...              | ...              | ...              | 0.15             | ...              |
| 531         | ...      | 0.00082                       | <i>0.002</i>     | <i>0.0009</i>   | 0.12        | ...                           | ...              | 0.00017           | ...             | ...              | ...                           | ...                           | ...              | ...         | ...              | ...              | ...              | ...              | <i>&lt;0.001</i> |
| 532         | ...      | ...                           | ...              | ...             | 0.56        | ...                           | ...              | ...               | ...             | ...              | ...                           | ...                           | ...              | ...         | ...              | ...              | ...              | ...              | ...              |
| ...         | 776-1    | 0.062                         | <i>0.04</i>      | ...             | <i>0.3</i>  | ...                           | ...              | 0.019             | ...             | ...              | ...                           | ...                           | ...              | ...         | ...              | ...              | ...              | ...              | ...              |
| ...         | 782-1    | 0.0128                        | ...              | <i>0.016</i>    | 47.25       | <i>0.0039</i>                 | ...              | ...               | ...             | ...              | ...                           | ...                           | ...              | ...         | ...              | ...              | ...              | <i>0.0004</i>    | ...              |



BRITISH CHEMICAL STANDARD CERTIFIED REFERENCE AND REFERENCE MATERIALS - Soda Ash, High Purity Metals, Ceramic Materials and Benzoic Acids

Although the High Purity Metals, Ceramic Materials and Benzoic Acid samples below have been carefully analysed by both BAS Ltd. and an independent laboratory, they have been classified as RMs and not CRMs in order to distinguish them from BAS CRMs which are normally analysed by at least five laboratories.

CHEMICAL COMPOSITION (nominal mass content in %)

Soda Ash Certified Reference Material (Finely divided material - units of 100g)

| BCS-CRM No. | Description               | Na <sub>2</sub> CO <sub>3</sub> | NaCl  | Fe <sub>2</sub> O <sub>3</sub> | Na <sub>2</sub> SO <sub>4</sub> | Insoluble Residue |
|-------------|---------------------------|---------------------------------|-------|--------------------------------|---------------------------------|-------------------|
| 526         | Soda Ash (SGT Soda Ash 1) | 99.74                           | 0.126 | 0.0005                         | 0.008                           | <0.02             |

High Purity Metal Reference Materials (Finely divided material or blocks/bars - see below)

| BCS-RM No. | Description  | Ag     | As       | Bi      | C     | Cd      | Co     | Cu      | Fe      | Ga    | In      | Mn     | Ni      |
|------------|--|--------|----------|---------|-------|---------|--------|---------|---------|-------|---------|--------|---------|
| 192j       | High Purity Tin (100g millings or 300g blocks)       | ...    | <0.0001  | <0.0001 | 0.001 | <0.0001 | ...    | <0.0001 | <0.0005 | ...   | <0.0001 | ...    | <0.0001 |
| 194e       | High Purity Zinc (300g blocks)                       | ...    | <0.00005 | ...     | ...   | <0.0005 | ...    | <0.0005 | 0.001   | ...   | <0.0005 | ...    | ...     |
| 195g       | High Purity Aluminium (100g millings or 300g blocks) | ...    | ...      | ...     | ...   | ...     | ...    | 0.001   | 0.080   | 0.009 | ...     | 0.001  | ...     |
| 198f       | Super Pure Aluminium (100g blocks)                   | ...    | ...      | ...     | ...   | ...     | ...    | 0.005   | 0.001   | ...   | ...     | ...    | ...     |
| 210e       | High Purity Lead (500g bars)                         | 0.0001 | <0.002   | 0.0008  | ...   | <0.0001 | <0.005 | 0.0006  | 0.0005  | ...   | ...     | <0.001 | <0.001  |

High Purity Metal Reference Materials (continued)

| BCS-RM No. | Description                       | S      | Sb     | Si    | Ti    | Tl      | V     | Al     | Pb     | Sn     | Zn      | Melting Point |
|------------|-----------------------------------|--------|--------|-------|-------|---------|-------|--------|--------|--------|---------|---------------|
| 192j       | High Purity Tin (continued)       | 0.0002 | <0.001 | ...   | ...   | ...     | ...   | ...    | <0.001 | 99.996 | <0.0001 | 231.9°C       |
| 194e       | High Purity Zinc (continued)      | ...    | ...    | ...   | ...   | <0.0005 | ...   | ...    | 0.002  | <0.001 | 99.99   | 419.5°C       |
| 195g       | High Purity Aluminium (continued) | ...    | ...    | 0.035 | 0.002 | ...     | 0.004 | 99.85  | ...    | ...    | 0.015   | 659.2°C       |
| 198f       | Super Pure Aluminium (continued)  | ...    | ...    | 0.002 | ...   | ...     | ...   | 99.99  | ...    | ...    | ...     | ...           |
| 210e       | High Purity Lead (continued)      | ...    | <0.002 | ...   | ...   | 0.001   | ...   | <0.001 | 99.996 | <0.002 | <0.005  | 327.3°C       |

Ceramic Reference Materials (Finely divided material - units of 100g). These samples have been prepared jointly by Ceram Research Limited (now Lucideon) and BAS.

| BCS-RM No. | Description       | SiO <sub>2</sub> | Al <sub>2</sub> O <sub>3</sub> | TiO <sub>2</sub> | Fe <sub>2</sub> O <sub>3</sub> | CaO   | MgO   | Na <sub>2</sub> O | K <sub>2</sub> O | P <sub>2</sub> O <sub>5</sub> | BaO  | Mn <sub>2</sub> O <sub>3</sub> | SnO <sub>2</sub> | SrO  | SO <sub>3</sub> | ZrO <sub>2</sub> + HfO <sub>2</sub> | L.O.I. |
|------------|-------------------|------------------|--------------------------------|------------------|--------------------------------|-------|-------|-------------------|------------------|-------------------------------|------|--------------------------------|------------------|------|-----------------|-------------------------------------|--------|
| 201a       | Nepheline Syenite | 57.3             | 23.54                          | 0.05             | 0.12                           | 1.07  | 0.025 | 7.53              | 8.90             | 0.025                         | 0.37 | 0.007                          | ...              | 0.43 | ...             | ...                                 | 0.76   |
| 202a       | Plaster (Gypsum)  | 1.38             | 0.33                           | 0.03             | 0.10                           | 37.4  | 0.39  | <0.03             | 0.10             | <0.01                         | ...  | ...                            | ...              | 0.33 | 53              | ...                                 | 7.0    |
| 203a       | Talc              | 59.7             | 0.30                           | <0.01            | 0.22                           | 0.25  | 32.08 | 0.02              | 0.005            | 0.13                          | ...  | ...                            | ...              | ...  | ...             | ...                                 | 6.78   |
| 204a       | Zircon            | 37.6             | 0.74                           | 2.22             | 0.18                           | 0.15  | 0.012 | 0.014             | 0.017            | 0.77                          | ...  | ...                            | 1.69             | ...  | ...             | 53.8                                | 0.50   |
| 205a       | Borax Frit        | 52.16            | 5.38                           | 0.04             | 0.15                           | 12.58 | 0.62  | 8.53              | 1.04             | ...                           | 0.03 | ...                            | ...              | 0.01 | ...             | ...                                 | 0.24   |

Ceramic Reference Materials (continued)

| BCS-RM No. | Description        | B <sub>2</sub> O <sub>3</sub> | ZrO <sub>2</sub> | PbO  | ZnO  | Li <sub>2</sub> O |
|------------|--------------------|-------------------------------|------------------|------|------|-------------------|
| 205a       | Borax Frit (cont.) | 18.46                         | 0.34             | 0.05 | 0.16 | <0.01             |

Benzoic Acid Reference Materials (BCS-RM 190t supplied in units of 100 x 0.2g tablets; BCS-RM 190v supplied in units of 100g of crystals or 100 x 1.0g tablets)

| BCS-RM No. | Description  |  |
|------------|--------------|--|
| 190t       | Benzoic Acid | Purity 100.0±0.05%, Calorific Value, 26,439.7±12.2 joules per gramme based on mass (Certified by Pattinson and Stead, Middlesbrough, UK) |
| 190v       | Benzoic Acid | Purity 100.0±0.06%, Calorific Value, 26,443.2±6.6 joules per gramme based on mass (Certified by Pattinson and Stead, Middlesbrough, UK)  |

SPECTROSCOPIC STANDARD CERTIFIED REFERENCE MATERIALS - Unalloyed Steels

The figures are listed primarily as a guide to purchasers. In some cases provisional figures are given which may differ slightly from those given on the Certificate. Always consult the Certificate issued with the sample to obtain the accurate analysis.

CHEMICAL COMPOSITION (nominal mass content in %) - Figures in bold type certified, figures in small italic type only approximate.

Plain Carbon Steels (Wrought) (SS-CRM: 38mm dia. x 19mm discs, ECRM: 38mm dia. x 30 or 25mm discs except 056-2(D): 44mm dia. x 30 or 25mm discs)

| Ref No.       | Description                   | C      | Si           | Mn     | P            | S            | Cr           | Mo            | Ni     | Al (Acid Sol.) | Al (Total)     | As           | Co            | Cu           | N             | Nb              | Pb             | Sn             | V              | W             | Sb      | Others            |
|---------------|-------------------------------|--------|--------------|--------|--------------|--------------|--------------|---------------|--------|----------------|----------------|--------------|---------------|--------------|---------------|-----------------|----------------|----------------|----------------|---------------|---------|-------------------|
| SS-CRM 432/1  | Plain Carbon Steels           | 0.102  | 0.043        | 1.34   | 0.024        | 0.039        | 0.31         | <i>0.02</i>   | 0.14   | ...            | <i>0.01</i>    | ...          | ...           | <i>0.04</i>  | ...           | <0.002          | ...            | ...            | ...            | ...           | ...     | ...               |
| SS-CRM 434/1  |                               | 0.41   | 0.31         | 1.49   | 0.050        | 0.027        | 0.055        | <i>0.01</i>   | 0.044  | ...            | < <i>0.01</i>  | ...          | ...           | <i>0.05</i>  | ...           | 0.078           | ...            | ...            | ...            | ...           | ...     | ...               |
| SS-CRM 435/1  |                               | 0.52   | 0.54         | 0.41   | 0.033        | 0.031        | 0.14         | < <i>0.01</i> | 0.060  | ...            | < <i>0.01</i>  | ...          | ...           | <i>0.05</i>  | ...           | 0.039           | ...            | ...            | ...            | ...           | ...     | ...               |
| SS-CRM 431/2  | Plain Carbon Steels           | 0.0249 | 0.015        | 0.902  | 0.121        | 0.0065       | 0.049        | <i>0.004</i>  | 0.040  | ...            | <i>0.01</i>    | <i>0.005</i> | <i>0.006</i>  | <i>0.015</i> | 0.0052        | 0.0040          | ...            | < <i>0.001</i> | <i>0.003</i>   | <i>0.004</i>  | ...     | ...               |
| SS-CRM 432/2  |                               | 0.0065 | 0.0822       | 0.712  | 0.0171       | 0.036        | 0.0166       | <i>0.002</i>  | 0.0196 | ...            | < <i>0.002</i> | ...          | <i>0.006</i>  | <i>0.015</i> | 0.0066        | 0.0174          | ...            | ...            | < <i>0.001</i> | <i>0.003</i>  | ...     | ...               |
| SS-CRM 433/2  |                               | 0.096  | 0.0071       | 1.188  | 0.011        | 0.0083       | 0.0262       | <i>0.004</i>  | 0.037  | ...            | ...            | ...          | <i>0.006</i>  | <i>0.025</i> | ...           | 0.0590          | ...            | ...            | <i>0.001</i>   | <i>0.003</i>  | ...     | ...               |
| SS-CRM 434/2  |                               | 0.275  | 0.510        | 1.546  | 0.0611       | 0.0141       | 0.238        | <i>0.014</i>  | 0.037  | ...            | ...            | ...          | <i>0.006</i>  | <i>0.025</i> | 0.0104        | 0.038           | ...            | ...            | <i>0.04</i>    | <i>0.04</i>   | ...     | ...               |
| SS-CRM 435/2  |                               | 0.489  | 0.328        | 0.390  | 0.0373       | 0.0424       | 0.184        | <i>0.018</i>  | 0.133  | ...            | ...            | ...          | 0.0116        | <i>0.05</i>  | ...           | 0.134           | ...            | ...            | <i>0.005</i>   | <i>0.015</i>  | ...     | ...               |
| ECRM 055-2(D) | 0.5% Carbon Steel             | 0.5199 | 0.3094       | 0.687  | 0.0102       | 0.0205       | 0.3127       | 0.0960        | 0.3121 | ...            | < <i>0.01</i>  | 0.0187       | 0.0257        | 0.2089       | 0.01069       | < <i>0.0002</i> | < <i>0.001</i> | 0.0162         | 0.00245        | 0.0166        | 0.00376 | < <i>0.005</i> Ca |
| ECRM 056-2(D) | 0.8% Carbon Steel             | 0.8181 | 0.2006       | 0.5073 | 0.0103       | 0.0093       | 0.0146       | <i>0.0015</i> | 0.0218 | 0.00024        | < <i>0.001</i> | ...          | <i>0.0035</i> | 0.0129       | <i>0.0045</i> | ...             | ...            | ...            | ...            | ...           | ...     | ...               |
| ECRM 057-2(D) | 0.05% Carbon Steel            | 0.0507 | <i>0.003</i> | 0.246  | 0.0120       | 0.0127       | 0.0114       | ...           | 0.0096 | <i>0.055</i>   | 0.059          | ...          | ...           | 0.0146       | 0.0023        | ...             | ...            | ...            | ...            | ...           | ...     | ...               |
| ECRM 058-2(D) | 0.15% Sulphur Steel           | 0.424  | 0.1080       | 1.186* | 0.0098       | 0.1712*      | 0.1211       | 0.0589        | 0.199  | ...            | ...            | 0.0095       | ...           | 0.261        | 0.0107        | ...             | ...            | ...            | ...            | ...           | ...     | ...               |
| ECRM 059-2(D) | 0.7% Carbon Steel             | 0.721  | 0.188        | 0.495  | 0.0046       | 0.0084       | 0.0090       | 0.0018        | 0.0198 | 0.00020        | 0.00045        | ...          | ...           | 0.0074       | 0.0051        | ...             | ...            | ...            | ...            | ...           | ...     | ...               |
| ECRM 064-2(D) | Nb/Ti Interstitial Free Steel | 0.0026 | 0.0065       | 0.1641 | <i>0.011</i> | <i>0.012</i> | <i>0.024</i> | 0.00077       | 0.0115 | ...            | <i>0.05</i>    | 0.0036       | 0.0027        | 0.0077       | 0.0026        | 0.0146          | 0.00018        | 0.00051        | 0.00015        | <i>0.0002</i> | ...     | ...               |
| ECRM 084-1(D) | 0.4% Carbon Steel             | 0.391  | 0.265        | 0.860  | 0.018        | 0.029        | ...          | 0.033         | 0.154  | ...            | ...            | ...          | ...           | 0.267        | ...           | ...             | ...            | 0.023          | ...            | ...           | ...     | ...               |
| ECRM 085-1(D) | 0.3% Sulphur Steel            | 0.067  | 0.008        | 0.977* | 0.062        | 0.336*       | ...          | ...           | ...    | ...            | ...            | ...          | 0.019         | 0.291        | ...           | ...             | 0.0010         | ...            | 0.0021         | ...           | 0.0073  | 0.0025 Zn         |
| ECRM 086-1(D) | 0.3% Carbon Steel             | 0.297  | 0.206        | 0.879  | 0.0238       | 0.0371       | 0.150        | ...           | 0.168  | ...            | ...            | 0.0230       | ...           | 0.320        | ...           | ...             | ...            | 0.0263         | ...            | ...           | ...     | ...               |
| ECRM 087-1(D) | 0.15% Carbon Steel            | 0.1740 | 0.2631       | 0.6711 | 0.0103       | 0.0461       | 0.0781       | 0.0206        | 0.1177 | ...            | ...            | 0.0243       | 0.0148        | 0.1707       | ...           | ...             | ...            | 0.0171         | ...            | ...           | 0.0046  | ...               |
| ECRM 090-1(D) | 1% Carbon Steel               | 1.054  | 0.281        | 0.226  | 0.0128       | 0.0095       | 0.121        | 0.0089        | 0.053  | ...            | ...            | ...          | ...           | ...          | 0.0146        | 0.00043         | 0.00239        | ...            | 0.204          | ...           | 0.00090 | ...               |

\*The metallurgical conditions of ECRMs 058-2(D) and 085-1(D) render them unsuitable for the determination of Mn and S by Optical Emission Spectrometry.

Plain Carbon Steels (Wrought) (continued)

| Ref No.       | Description               | Bi             | Cd      | Ga      | Hg       | Se      | Te      | Ti      | Zn            |
|---------------|---------------------------|----------------|---------|---------|----------|---------|---------|---------|---------------|
| ECRM 055-2(D) | 0.5% Carbon Steel (cont.) | < <i>0.005</i> | ...     | ...     | ...      | ...     | ...     | 0.00104 | <i>0.0011</i> |
| ECRM 090-1(D) | 1% Carbon Steel (cont.)   | <0.0000        | <0.0000 | 0.00228 | <0.00001 | <0.0002 | <0.0002 | <0.0001 | 0.00209       |

Carbon Steels Residual Series (Wrought) (38mm dia. x 19mm discs)

| Ref No.      | Description                  | C           | Si          | Mn          | P            | S            | Cr             | Mo         | Ni     | Al (Total) | As    | Cu     | Pb     | Sn     | Ti              | W      | Sb           |
|--------------|------------------------------|-------------|-------------|-------------|--------------|--------------|----------------|------------|--------|------------|-------|--------|--------|--------|-----------------|--------|--------------|
| SS-CRM 53    | Carbon Steel                 | <i>0.25</i> | <i>0.37</i> | <i>0.29</i> | <i>0.020</i> | <i>0.009</i> | 0.22           | 0.100      | 0.172  | ...        | 0.058 | ...    | ...    | 0.025  | 0.018           | 0.25   | <i>0.004</i> |
| SS-CRM 55    | Residual Series              | <i>0.19</i> | <i>0.25</i> | <i>0.42</i> | <i>0.018</i> | <i>0.010</i> | 0.22           | 0.16       | 0.23   | 0.028      | 0.013 | ...    | ...    | 0.046  | 0.013           | 0.12   | 0.002        |
| Ref No.      | Description                  | C           | Si          | Mn          | P            | S            | Al (Acid Sol.) | Al (Total) | B      | Co         | Cu    | Nb     | Pb     | V      | Zr              | Sb     |              |
| SS-CRM 56    | Carbon Steel Residual Series | <i>0.23</i> | <i>0.36</i> | 0.32        | <i>0.019</i> | <i>0.009</i> | <i>0.003</i>   | 0.005      | 0.001  | 0.023      | 0.36  | ...    | 0.014  | 0.057  | ...             | 0.005  |              |
| SS-CRM 456/2 |                              | 0.112       | 0.297       | 0.220       | 0.0212       | 0.0221       | < <i>0.002</i> | 0.0018     | 0.0015 | 0.0504     | ...   | 0.0057 | 0.0189 | 0.0221 | <i>0.013</i>    | 0.0172 |              |
| SS-CRM 457/2 |                              | 0.307       | 0.105       | 0.327       | 0.0098       | 0.0448       | 0.082          | 0.087      | 0.0046 | 0.0217     | ...   | 0.0174 | 0.0098 | 0.153  | 0.025           | 0.050  |              |
| SS-CRM 458/2 |                              | 0.198       | 0.504       | 0.479       | 0.0281       | 0.0314       | 0.052          | 0.055      | 0.0069 | 0.198      | ...   | 0.0510 | 0.0140 | 0.105  | <i>0.062</i>    | 0.089  |              |
| SS-CRM 459/2 |                              | 0.467       | 0.640       | 0.909       | 0.0482       | 0.0481       | 0.0134         | 0.0154     | 0.0110 | 0.0890     | ...   | 0.0102 | 0.0044 | 0.0585 | 0.074           | 0.0121 |              |
| SS-CRM 460/2 |                              | 0.383       | 0.126       | 0.616       | 0.0374       | 0.0099       | 0.0193         | 0.0240     | 0.0027 | 0.0106     | ...   | 0.068  | 0.0005 | 0.0322 | < <i>0.0005</i> | 0.0006 |              |

Many of the above samples are also available in the finely divided form - see pages 7 and 8.

SPECTROSCOPIC STANDARD CERTIFIED REFERENCE MATERIALS - High Purity Iron, Unalloyed and Low Alloy Steels

CHEMICAL COMPOSITION (nominal mass content in %) - Figures in bold type certified, figures in small italic type only approximate.

High Purity Irons (Wrought) (38mm dia. x 30, 25 or 3mm discs)

| ECRM No. | Description      | C       | Si      | Mn     | P       | S       | Cr     | Mo      | Ni     | Al (Total) | As      | B       | Co     | Cu      | N       | Nb     |
|----------|------------------|---------|---------|--------|---------|---------|--------|---------|--------|------------|---------|---------|--------|---------|---------|--------|
| 097-1(D) | High Purity Iron | 0.00025 | <0.01   | 0.0064 | 0.0016  | 0.0022  | 0.0016 | <0.001  | 0.0025 | ...        | 0.0051  | 0.0003  | 0.0037 | 0.0020  | 0.0007  | <0.001 |
| 097-2(D) | High Purity Iron | <0.002  | 0.00285 | 0.0120 | 0.00538 | 0.00181 | 0.0213 | 0.00370 | 0.0241 | <0.002     | 0.00281 | 0.00012 | 0.0139 | 0.00793 | 0.00294 | 0.0011 |

| ECRM No. | Description              | Pb      | Sn      | Ti      | V       | W             | Zr     | Bi      | Ca      | Ga     | Mg      | O     | Sb            | Ta      | Zn      |
|----------|--------------------------|---------|---------|---------|---------|---------------|--------|---------|---------|--------|---------|-------|---------------|---------|---------|
| 097-1(D) | High Purity Iron (cont.) | <0.0005 | <0.0025 | <0.0015 | <0.001  | <b>≤0.001</b> | <0.001 | <0.0005 | <0.0005 | ...    | <0.0005 | 0.05  | <b>≤0.001</b> | <0.0005 | <0.0001 |
| 097-2(D) | High Purity Iron (cont.) | <0.001  | 0.00043 | 0.0008  | 0.00011 | 0.00386       | <0.002 | <0.0002 | <0.001  | 0.0003 | <0.0005 | 0.005 | 0.00012       | 0.00015 | 0.00014 |

ECRM 097-2(D) also has the additional information: Ag: <0.0001%, Al(sol.): <0.0004% & 0.0010%, Cd: <0.0001%, Ge: 0.00043% & 0.00066%, Se: <0.0001%, Te: <0.0001%.

Low Alloy Steels (Wrought) (SS-CRM 111/1-116: 44mm dia. x 19mm discs. Other SS-CRM: 38mm dia. x 19mm discs. ECRM: 38mm dia. x 30 or 25mm discs)

| Ref. No.      | Description            | C      | Si     | Mn     | P      | S       | Cr     | Mo     | Ni     | Al     | As     | B       | Co     | Cu     | N      | Nb     | Pb      | Sn     | Ti      | V      | W      | Zr     | Ca      | Zn     |     |
|---------------|------------------------|--------|--------|--------|--------|---------|--------|--------|--------|--------|--------|---------|--------|--------|--------|--------|---------|--------|---------|--------|--------|--------|---------|--------|-----|
| SS-CRM 111/1  | Low Carbon Steel       | 0.0070 | 0.0039 | 0.1623 | 0.0045 | 0.0049  | 0.0055 | 0.0005 | 0.0161 | <0.002 | 0.0011 | ...     | 0.0053 | 0.0089 | 0.0025 | ...    | ...     | 0.0006 | 0.0004  | 0.0002 | ...    | ...    | ...     | ...    |     |
| SS-CRM 112    | Low Alloy Steels       | 0.394  | 0.289  | 0.436  | 0.0043 | 0.0026  | 1.236  | 0.190  | 1.461  | 0.0148 | 0.0021 | 0.0007  | 0.0175 | 0.149  | 0.0024 | 0.0065 | <0.001  | 0.0086 | 0.0100  | 0.0088 | ...    | <0.001 | <0.0005 | ...    |     |
| SS-CRM 113    |                        | 0.837  | 0.931  | 1.207  | 0.0595 | 0.0294  | 1.248  | 0.056  | 0.0784 | 0.0151 | 0.0020 | 0.0066  | 0.0415 | 0.179  | 0.0109 | 0.0487 | <0.001  | 0.0067 | 0.0390  | 0.201  | 0.012  | 0.0029 | <0.001  | ...    |     |
| SS-CRM 114    |                        | 0.403  | 0.295  | 0.416  | 0.0044 | 0.0046  | 0.187  | 0.184  | 1.502  | 0.078  | 0.0025 | 0.0008  | 0.0171 | 0.360  | 0.0043 | 0.0042 | <0.001  | 0.041  | 0.0096  | 0.0086 | <0.001 | 0.0051 | <0.001  | ...    |     |
| SS-CRM 115    |                        | 0.6224 | 0.2078 | 0.682  | 0.0123 | 0.00093 | 0.0198 | 0.003  | 0.0196 | 0.0527 | ...    | <0.0001 | 0.006  | 0.009  | 0.0067 | ...    | 0.0002  | 0.002  | 0.0027  | 0.001  | ...    | ...    | 0.0058  | 0.0006 |     |
| SS-CRM 116    | Calcium Treated Steels | 0.617  | 0.201  | 0.6756 | 0.0092 | 0.00176 | 0.0141 | <0.001 | 0.0155 | 0.0587 | ...    | ...     | ...    | 0.014  | 0.0069 | ...    | 0.00012 | 0.005  | 0.00171 | ...    | ...    | ...    | 0.0036  | ...    |     |
| ...           |                        |        |        |        |        |         |        |        |        |        |        |         |        |        |        |        |         |        |         |        |        |        |         |        |     |
| SS-CRM 219/4  | Ni-Cr-Mo Steel         | 0.314  | 0.079  | 0.81   | 0.011  | 0.027   | 0.66   | 0.58   | 2.55   | 0.003  | ...    | ...     | ...    | 0.088  | ...    | ...    | ...     | 0.011  | ...     | ...    | ...    | ...    | ...     | ...    |     |
| SS-CRM 222/1  | 3.5% Ni Steel          | 0.3095 | 0.227  | 0.618  | 0.0175 | 0.0089  | 0.0535 | 0.0287 | 3.536  | ...    | ...    | <0.005  | 0.0379 | 0.150  | 0.0100 | ...    | ...     | ...    | ...     | 0.020  | ...    | ...    | ...     | ...    |     |
| SS-CRM 225/2  | Ni-Cr-Mo Steel         | 0.40   | 0.23   | 0.56   | 0.019  | 0.012   | 1.08   | 0.34   | 1.43   | 0.009  | 0.035  | 0.0007  | 0.018  | 0.17   | 0.012  | 0.003  | ...     | 0.017  | ...     | <0.01  | ...    | <0.01  | ...     | ...    |     |
|               |                        |        |        |        |        |         |        |        |        |        |        |         |        |        |        |        |         |        |         |        |        |        |         |        |     |
| SS-CRM 401/2  | Low Alloy Steels       | 0.935  | 0.602  | 1.197  | 0.0265 | 0.0078  | 0.138  | 0.495  | 0.019  | 0.074  | ...    | ...     | 0.0042 | 0.101  | 0.0159 | ...    | ...     | ...    | ...     | 0.496  | ...    | ...    | ...     | ...    |     |
| SS-CRM 402/2  |                        | 1.311  | 0.111  | 0.228  | 0.0161 | 0.0138  | 0.652  | 0.140  | 0.808  | 0.161  | ...    | ...     | ...    | 0.302  | 0.0069 | ...    | ...     | ...    | ...     | ...    | 0.194  | ...    | ...     | ...    | ... |
| SS-CRM 403/2  |                        | 0.750  | 0.209  | 1.677  | 0.055  | 0.0381  | 0.463  | 0.088  | 0.223  | 0.0485 | ...    | ...     | ...    | 0.221  | 0.010  | ...    | ...     | ...    | ...     | ...    | 0.341  | ...    | ...     | ...    | ... |
| SS-CRM 404/2  |                        | 0.696  | 1.121  | 0.532  | 0.0479 | 0.0228  | 0.774  | 0.307  | 0.393  | 0.017  | ...    | ...     | ...    | 0.427  | 0.0089 | ...    | ...     | ...    | ...     | ...    | 0.107  | ...    | ...     | ...    | ... |
| SS-CRM 405/2  |                        | 0.044  | 0.947  | 0.903  | 0.0095 | 0.058   | 0.206  | 0.025  | 0.102  | 0.330  | ...    | ...     | 0.009  | 0.022  | 0.011  | ...    | ...     | ...    | ...     | ...    | 0.411  | ...    | ...     | ...    | ... |
| SS-CRM 407/2  |                        | 0.490  | 0.66   | 0.195  | 0.038  | 0.0105  | 3.03   | 0.83   | 0.527  | 0.040  | ...    | ...     | 0.0068 | 0.397  | 0.011  | ...    | ...     | ...    | ...     | ...    | 0.19   | ...    | ...     | ...    | ... |
|               |                        |        |        |        |        |         |        |        |        |        |        |         |        |        |        |        |         |        |         |        |        |        |         |        |     |
| SS-CRM 421    | Low Tungsten Steels    | 0.049  | 0.07   | 0.11   | 0.012  | 0.027   | ...    | 0.028  | ...    | ...    | ...    | ...     | ...    | ...    | ...    | ...    | ...     | ...    | ...     | <0.02  | 0.52   | ...    | ...     | ...    |     |
| SS-CRM 422    |                        | 0.036  | 0.06   | 0.09   | 0.015  | 0.025   | ...    | 0.033  | ...    | ...    | ...    | ...     | ...    | ...    | ...    | ...    | ...     | ...    | ...     | ...    | <0.02  | 1.28   | ...     | ...    | ... |
| SS-CRM 423    |                        | 0.030  | 0.05   | 0.07   | 0.017  | 0.027   | ...    | 0.027  | ...    | ...    | ...    | ...     | ...    | ...    | ...    | ...    | ...     | ...    | ...     | ...    | <0.02  | 2.06   | ...     | ...    | ... |
| SS-CRM 424    |                        | 0.024  | 0.05   | 0.09   | 0.02   | 0.024   | ...    | 0.036  | ...    | ...    | ...    | ...     | ...    | ...    | ...    | ...    | ...     | ...    | ...     | ...    | <0.02  | 3.02   | ...     | ...    | ... |
| ECRM 186-1(D) | Silico-Manganese Steel | 0.6104 | 1.719  | 0.870  | 0.0223 | 0.0354  | 0.218  | 0.0482 | 0.190  | 0.0143 | ...    | ...     | ...    | 0.281  | ...    | ...    | ...     | ...    | ...     | ...    | ...    | ...    | ...     | ...    |     |
| ECRM 195-1(D) | Cr-Mo-Ni Steel         | 0.73   | 0.466  | 0.571  | 0.0160 | 0.0121  | 1.566  | 0.768  | 0.327  | ...    | ...    | ...     | ...    | 0.0355 | 0.0100 | ...    | 0.0010  | 0.002  | ...     | 0.312  | ...    | ...    | 0.0017  | 0.0046 |     |

Most of these samples are also available in the finely divided form - see page 7 and 9

SPECTROSCOPIC STANDARD CERTIFIED REFERENCE MATERIALS - Highly Alloyed Steels and Plain Carbon and Low Alloy Cast Steels

CHEMICAL COMPOSITION (nominal mass content in %) - Figures in bold type certified, figures in small italic type only approximate.

Highly Alloyed Steels (Wrought) (38mm dia. x 30 or 25mm discs)

| Ref. No.      | Description                   | C      | Si     | Mn     | P      | S      | Cr     | Mo     | Ni    | Al           | As           | B             | Co     | Cu     | N      | Nb     | Pb            | Sn            | Ti      | V      | Zr     | Sb      | Fe    | Others                  |
|---------------|-------------------------------|--------|--------|--------|--------|--------|--------|--------|-------|--------------|--------------|---------------|--------|--------|--------|--------|---------------|---------------|---------|--------|--------|---------|-------|-------------------------|
| ECRM 272-1(D) | 12% Chromium Steel            | 0.2815 | 0.420  | 0.600  | 0.0156 | 0.0197 | 11.927 | 0.0030 | 0.244 | 0.0046       | 0.0116       | 0.0018        | 0.0145 | 0.0192 | 0.0508 | 0.0028 | <i>0.0004</i> | <i>0.0008</i> | 0.00096 | 0.0167 | ...    | 0.00070 | ...   | 0.00090 Ca<br>0.0031 Zn |
| ECRM 276-2(D) | 5% Cr-Mo-V Steel              | 0.399  | 1.034  | 0.365  | 0.0093 | 0.0189 | 4.975  | 1.134  | 0.203 | ...          | ...          | ...           | ...    | 0.183  | 0.0116 | ...    | ...           | 0.0133        | ...     | 0.296  | ...    | ...     | ...   | ...                     |
| ECRM 285-2(D) | Maraging Steel                | 0.0018 | 0.0117 | 0.0168 | 0.0053 | 0.0025 | 0.0236 | 4.99   | 18.07 | 0.1067       | ...          | 0.0009        | 7.76   | 0.0094 | 0.0007 | ...    | ...           | <i>0.0011</i> | 0.520   | ...    | 0.0050 | ...     | ...   | ...                     |
| ECRM 287-1(D) | High B Stainless Steel        | 0.0164 | 0.569  | 1.478  | 0.0267 | 0.0014 | 18.61  | 0.247  | 10.35 | ...          | ...          | 0.924         | 0.148  | 0.203  | 0.0194 | ...    | ...           | ...           | ...     | ...    | ...    | ...     | ...   | ...                     |
| ECRM 292-1(D) | Nb-Stabilised Stainless Steel | 0.0367 | 0.402  | 1.744  | 0.0175 | 0.0055 | 18.00  | 0.0464 | 10.09 | <i>0.002</i> | <i>0.008</i> | <i>0.0003</i> | 0.0255 | 0.0391 | 0.0640 | 0.571  | ...           | ...           | ...     | ...    | ...    | ...     | ...   | { 0.001 Ta<br>0.0006 Ca |
| ECRM 295-1(D) | 4% Mo-Cr-Ni Steel             | 0.0166 | 0.418  | 1.758  | 0.0167 | 0.0003 | 19.51  | 3.996  | 24.40 | 0.0203       | 0.0041       | 0.0018        | 0.0450 | 1.481  | 0.0615 | ...    | ...           | 0.0025        | ...     | 0.0456 | ...    | 0.0007  | 48.36 | 0.0003 Mg               |
| ECRM 296-1(D) | Jethete Steel                 | 0.1166 | 0.242  | 0.676  | 0.0178 | 0.0026 | 11.82  | 1.700  | 2.790 | 0.0275       | 0.0139       | <i>0.0003</i> | 0.0218 | 0.1498 | 0.0214 | ...    | 0.00016       | 0.0131        | ...     | 0.363  | ...    | ...     | ...   | ...                     |

These samples are also available in the finely divided form - see page 10

Austenitic Stainless Steels (Wrought) (38mm dia. x 19mm discs)

| Ref. No.     | Description                 | C      | Si    | Mn    | P      | S      | Cr     | Mo           | Ni    | Al           | As           | B       | Co           | Cu     | N      | Nb           | Pb            | Sn     | Ti           | V           | W      | Ta     | Ca     | Zr     |
|--------------|-----------------------------|--------|-------|-------|--------|--------|--------|--------------|-------|--------------|--------------|---------|--------------|--------|--------|--------------|---------------|--------|--------------|-------------|--------|--------|--------|--------|
| SS-CRM 462   | Austenitic Stainless Steels | 0.092  | 0.46  | 0.74  | 0.010  | 0.018  | 12.37  | ...          | 12.53 | ...          | 0.007        | ...     | ...          | ...    | ...    | ...          | 0.0005        | ...    | ...          | ...         | ...    | ...    | ...    | ...    |
| SS-CRM 461/1 |                             | 0.0103 | 0.374 | 0.686 | 0.0053 | 0.0051 | 14.727 | 0.0138       | 6.124 | <i>0.002</i> | <i>0.004</i> | ...     | <i>0.004</i> | 0.0091 | ...    | ...          | <i>0.0005</i> | ...    | ...          | ...         | ...    | ...    | ...    | ...    |
| SS-CRM 462/1 |                             | 0.0345 | 0.463 | 0.722 | 0.0053 | 0.0041 | 11.888 | 0.0304       | 12.85 | ...          | ...          | ...     | ...          | 0.0112 | ...    | ...          | ...           | ...    | ...          | ...         | ...    | ...    | ...    | ...    |
| SS-CRM 463/1 |                             | 0.019  | 0.270 | 1.400 | 0.025  | 0.019  | 18.46  | 0.265        | 10.20 | ...          | ...          | 0.0022  | 0.116        | 0.276  | 0.063  | ...          | ...           | ...    | ≤0.005       | <i>0.04</i> | ...    | ...    | ...    | ...    |
| SS-CRM 464/1 |                             | 0.086  | 0.57  | 0.791 | 0.020  | 0.028  | 25.39  | ...          | 20.05 | ...          | <i>0.003</i> | ...     | 0.054        | ...    | ...    | ...          | 0.0004        | ...    | ...          | ...         | ...    | ...    | ...    | ...    |
| SS-CRM 465/1 |                             | 0.066  | 0.405 | 1.380 | 0.021  | 0.012  | 17.31  | 0.092        | 9.24  | 0.026        | ...          | 0.0006  | 0.053        | 0.098  | 0.010  | ...          | <0.001        | ...    | 0.40         | 0.102       | ...    | ...    | ...    | ...    |
| SS-CRM 466/2 |                             | 0.0141 | 0.480 | 1.311 | 0.0105 | 0.0069 | 17.84  | 2.776        | 10.20 | <i>0.002</i> | 0.0020       | 0.0039  | 0.0184       | 0.0278 | 0.0508 | <i>0.001</i> | <0.0001       | <0.001 | <i>0.002</i> | 0.0346      | ...    | ...    | ...    | ...    |
| SS-CRM 467/1 |                             | 0.082  | 0.52  | 0.788 | 0.018  | 0.019  | 18.09  | ...          | 9.21  | ...          | 0.004        | ...     | ...          | ...    | ...    | 0.99         | 0.004         | ...    | ...          | ...         | ...    | 0.0017 | ...    | ...    |
| SS-CRM 468/1 |                             | 0.143  | 1.41  | 1.70  | 0.014  | 0.020  | 17.96  | ...          | 8.90  | ...          | ...          | ...     | 0.018        | ...    | ...    | ...          | ...           | ...    | ...          | ...         | ...    | ...    | ...    | ...    |
| SS-CRM 475   |                             | 0.050  | 0.21  | 0.89  | 0.037  | 0.008  | 14.14  | 1.59         | 5.66  | 0.013        | ...          | ...     | 0.22         | 1.94   | ...    | 0.22         | ...           | 0.015  | ...          | ...         | ...    | ...    | ...    | ...    |
| SS-CRM 476   |                             | 0.0171 | 0.323 | 1.755 | 0.0302 | 0.0234 | 16.88  | 2.049        | 10.17 | <0.005       | 0.0053       | ...     | 0.1628       | 0.3026 | 0.0794 | 0.0107       | <0.002        | 0.0059 | <0.005       | 0.0663      | 0.0419 | <0.001 | 0.0028 | <0.003 |
| SS-CRM 479   |                             | 0.0529 | 0.553 | 0.680 | 0.0029 | 0.0030 | 19.922 | <i>0.003</i> | 24.87 | <i>0.013</i> | <i>0.002</i> | <0.0005 | <i>0.002</i> | 0.0052 | 0.0057 | 0.625        | <0.001        | <0.002 | 0.0306       | 0.0052      | ...    | <0.005 | ...    | ...    |

These samples are also available in the finely divided form - see page 10

Low Alloy Cast Steel (44mm dia. x 12mm discs)

| Ref. No.     | Description          | C    | Si   | Mn   | S           | Cr   | Mo   | Ni   | Cu          | V    |
|--------------|----------------------|------|------|------|-------------|------|------|------|-------------|------|
| SS-CRM 615/1 | Low Alloy Cast Steel | 0.30 | 0.17 | 1.68 | <i>0.02</i> | 0.49 | 0.21 | 4.01 | <i>0.05</i> | 0.10 |

Plain Carbon Cast Steels (44mm dia. x 19mm discs)

| Ref No.      | Description           | C     | Si    | Mn    | P     | S     | Al (Total) | Al (Acid Sol.) | Cr          | Mo           | Ni          | Co           | Cu          | V            | Zr          |
|--------------|-----------------------|-------|-------|-------|-------|-------|------------|----------------|-------------|--------------|-------------|--------------|-------------|--------------|-------------|
| SS-CRM 602/2 | Low Alloy Cast Steels | 0.94  | 0.057 | 0.66  | 0.023 | 0.031 | 0.096      | <i>0.094</i>   | <i>0.03</i> | <i>0.004</i> | <i>0.02</i> | <i>0.007</i> | <i>0.06</i> | <i>0.001</i> | <0.005      |
| SS-CRM 603/2 |                       | 0.79  | 0.97  | 0.236 | 0.020 | 0.056 | 0.076      | <i>0.075</i>   | <i>0.04</i> | <i>0.004</i> | <i>0.03</i> | <i>0.01</i>  | <i>0.05</i> | <i>0.001</i> | <0.005      |
| SS-CRM 604/2 |                       | 0.199 | 0.75  | 1.91  | 0.016 | 0.072 | 0.008      | <i>0.005</i>   | <i>0.06</i> | <i>0.02</i>  | <i>0.09</i> | <i>0.01</i>  | <i>0.07</i> | <i>0.001</i> | <0.005      |
| SS-CRM 605/2 |                       | 0.400 | 0.54  | 0.345 | 0.054 | 0.015 | 0.027      | <i>0.026</i>   | <i>0.06</i> | <i>0.01</i>  | <i>0.05</i> | <i>0.008</i> | <i>0.06</i> | <i>0.001</i> | <i>0.12</i> |

SPECTROSCOPIC STANDARD CERTIFIED REFERENCE MATERIALS - Highly Alloyed Steels

CHEMICAL COMPOSITION (nominal mass content in %) - Figures in bold type certified, figures in small italic type only approximate.

Ferritic Stainless Steels (Wrought) (SS-CRM 469-473: 38mm dia. x 19mm discs, SS-CRM 70: 44mm dia. x 13mm disc)

| Ref. No.   | Description               | C     | Si    | Mn    | P     | S     | Cr    | Mo    | Ni    | Co   | Cu   | V    |
|------------|---------------------------|-------|-------|-------|-------|-------|-------|-------|-------|------|------|------|
| SS-CRM 70  | Ferritic Stainless Steels | 0.18  | 0.35  | 0.38  | 0.024 | 0.020 | 16.36 | ...   | 0.40  | ...  | 0.02 | ...  |
| SS-CRM 469 |                           | 0.279 | 0.421 | 0.598 | 0.015 | 0.020 | 11.93 | ...   | 0.246 | 0.01 | 0.02 | 0.02 |
| SS-CRM 470 |                           | 0.153 | 0.335 | 0.235 | 0.024 | 0.035 | 17.68 | ...   | 0.369 | 0.02 | 0.02 | 0.02 |
| SS-CRM 471 |                           | 0.095 | 0.326 | 0.417 | 0.018 | 0.023 | 23.85 | ...   | 0.96  | 0.02 | 0.02 | 0.03 |
| SS-CRM 472 |                           | 0.227 | 1.05  | 1.02  | 0.032 | 0.029 | 15.82 | 0.661 | 1.95  | 0.02 | 0.02 | 0.02 |
| SS-CRM 473 |                           | 0.172 | 0.604 | 0.494 | 0.019 | 0.030 | 9.06  | 0.95  | 0.06  | 0.01 | 0.03 | 0.02 |

Samples 469 to 473 are also available in the finely divided form - see page 10

High-Speed Steels (Wrought) (38mm dia. x 19mm discs)

| Ref No.      | Description       | C     | Si   | Mn   | P     | S     | Cr   | Mo   | Ni   | Al (Total) | As    | Co   | Sn    | V    | W     |
|--------------|-------------------|-------|------|------|-------|-------|------|------|------|------------|-------|------|-------|------|-------|
| SS-CRM 482/1 | High-Speed Steels | 0.675 | 0.14 | 0.26 | 0.027 | 0.027 | 3.95 | 0.40 | 0.16 | ...        | ...   | 0.29 | ...   | 1.04 | 17.83 |
| SS-CRM 483/1 |                   | 0.650 | 0.16 | 0.22 | 0.023 | 0.023 | 2.90 | 0.18 | 0.08 | ...        | ...   | 2.06 | ...   | 0.22 | 9.28  |
| SS-CRM 485/1 |                   | 0.94  | 0.30 | 0.41 | 0.043 | 0.039 | 4.02 | 0.66 | 0.14 | 0.006      | 0.022 | 4.97 | 0.019 | 1.02 | 17.79 |
| SS-CRM 486/1 |                   | 0.74  | 0.27 | 0.21 | 0.029 | 0.021 | 4.54 | 5.20 | 0.06 | <0.005     | 0.016 | 0.08 | 0.014 | 1.82 | 5.80  |
| SS-CRM 487/1 |                   | 1.02  | 0.18 | 0.26 | 0.022 | 0.029 | 3.91 | 9.41 | 0.14 | 0.006      | 0.012 | 7.95 | 0.006 | 1.14 | 1.80  |

High Manganese Steels (Cast) (48mm x 42mm x 12mm blocks). These samples have been prepared jointly by Replicast Ltd./Castings Technology International (formerly BCIRA) and BAS.

| Ref Nos.     | Description           | C     | Si    | Mn    | P      | S      | Cr    | Mo    | Ni   | Al (Total) | Co     | Cu     | N      | V     | As    | Ti     |
|--------------|-----------------------|-------|-------|-------|--------|--------|-------|-------|------|------------|--------|--------|--------|-------|-------|--------|
| SS-CRM 492/3 | High Manganese Steels | 1.18  | 0.299 | 8.33  | 0.0318 | 0.0093 | 1.076 | 1.318 | 4.17 | 0.131      | 0.0048 | 0.0211 | 0.0225 | 0.004 | 0.002 | 0.0024 |
| SS-CRM 493/3 |                       | 0.819 | 0.861 | 11.15 | 0.12   | 0.009  | 0.259 | 1.04  | 3.24 | 0.035      | ...    | 0.017  | 0.025  | 0.025 | ...   | ...    |

SPECTROSCOPIC STANDARD CERTIFIED REFERENCE MATERIALS - Cast Irons and Nickel Base Alloys

CHEMICAL COMPOSITION - Figures in bold type certified, figures in small italic type only approximate.

Cast Irons (All are 48mm x 42mm x 12mm chill cast blocks except SCRM 675 which is a 40mm x 37mm x 10mm chill cast block.)

These samples are prepared jointly by Replicast Ltd./Castings Technology International (formerly BCIRA) and BAS. nominal mass content in %

| Ref. No.    | Description                       | C     | Si    | Mn    | P      | S      | Cr          | Mo               | Ni           | Al               | As     | Co           | Cu           | Sn               | Ti           | V            | Ce           | Mg               | Zn               |
|-------------|-----------------------------------|-------|-------|-------|--------|--------|-------------|------------------|--------------|------------------|--------|--------------|--------------|------------------|--------------|--------------|--------------|------------------|------------------|
| SCRM 652/4  | Malleable Irons                   | 2.34  | 0.878 | 1.19  | 0.071  | 0.129  | <i>1</i>    | ...              | ...          | ...              | ...    | ...          | ...          | ...              | ...          | ...          | ...          | ...              | ...              |
| SCRM 655/4  |                                   | 1.90  | 2.110 | 0.44  | 0.180  | 0.076  | <i>1</i>    | ...              | ...          | ...              | ...    | ...          | ...          | ...              | ...          | ...          | ...          | ...              | ...              |
| SCRM 656/9  | Low Phosphorus Engineering Irons  | 2.537 | 2.504 | 0.820 | 0.060  | 0.108  | <i>0.03</i> | ...              | <i>0.03</i>  | ...              | ...    | ...          | ...          | ...              | ...          | ...          | ...          | ...              | ...              |
| SCRM 657/9  |                                   | 3.157 | 3.209 | 0.112 | 0.101  | 0.0401 | ...         | ...              | ...          | ...              | ...    | ...          | ...          | ...              | ...          | ...          | ...          | ...              | ...              |
| SCRM 658/12 |                                   | 3.336 | 2.033 | 0.555 | 0.243  | 0.0768 | <i>0.01</i> | <i>&lt;0.001</i> | <i>0.004</i> | <i>&lt;0.001</i> | ...    | <i>0.001</i> | <i>0.004</i> | <i>&lt;0.001</i> | <i>0.02</i>  | <i>0.006</i> | <i>0.003</i> | <i>&lt;0.001</i> | ...              |
| SCRM 659/9  |                                   | 4.174 | 1.361 | 1.010 | 0.0215 | 0.0372 | ...         | ...              | ...          | ...              | ...    | ...          | ...          | ...              | ...          | ...          | ...          | ...              | ...              |
| SCRM 660/10 |                                   | 3.522 | 1.719 | 0.398 | 0.143  | 0.1089 | ...         | ...              | ...          | ...              | ...    | ...          | ...          | ...              | ...          | ...          | ...          | ...              | ...              |
| SCRM 661/4  | High Phosphorus Engineering Irons | 2.56  | 2.96  | 0.30  | 0.84   | 0.068  | <i>1</i>    | ...              | ...          | ...              | ...    | ...          | ...          | ...              | ...          | ...          | ...          | ...              | ...              |
| SCRM 662/4  |                                   | 2.95  | 2.33  | 0.76  | 0.30   | 0.087  | <i>1</i>    | ...              | ...          | ...              | ...    | ...          | ...          | ...              | ...          | ...          | ...          | ...              | ...              |
| SCRM 665/4  |                                   | 3.25  | 1.66  | 0.24  | 1.09   | 0.053  | <i>1</i>    | ...              | ...          | ...              | ...    | ...          | ...          | ...              | ...          | ...          | ...          | ...              | ...              |
| SCRM 666/12 | Ductile (Nodular) Irons           | 3.599 | 1.763 | 0.106 | ...    | ...    | 0.102       | 0.0979           | 1.709        | ...              | ...    | ...          | 0.0581       | ...              | 0.1069       | 0.0486       | <i>0.006</i> | 0.0838           | ...              |
| SCRM 667/13 |                                   | 3.04  | 2.866 | 0.222 | ...    | ...    | 0.294       | <i>0.006</i>     | 1.303        | ...              | ...    | ...          | 0.497        | ...              | <i>0.007</i> | 0.103        | 0.110        | 0.070            | ...              |
| SCRM 668/13 |                                   | 3.724 | 1.400 | 0.712 | ...    | ...    | 0.962       | 0.0193           | 0.097        | ...              | ...    | ...          | 0.751        | ...              | 0.091        | 0.193        | 0.0245       | 0.0116           | ...              |
| SCRM 669/14 |                                   | 2.955 | 2.201 | 0.523 | ...    | ...    | 0.214       | 0.0550           | 0.473        | ...              | ...    | ...          | 0.194        | ...              | 0.0499       | 0.532        | 0.0415       | 0.0224           | ...              |
| SCRM 670/21 |                                   | 3.694 | 2.273 | 0.332 | ...    | 0.0154 | 0.495       | 0.0112           | 0.894        | ...              | ...    | ...          | 0.902        | ...              | 0.1090       | 0.0234       | 0.0108       | 0.0403           | ...              |
| SCRM 671/1  | Blast Furnace Irons               | 3.165 | 0.868 | 0.811 | 0.108  | 0.0503 | 0.0609      | 0.0259           | 0.0627       | 0.030            | ...    | 0.098        | ...          | 0.0103           | 0.0407       | 0.0122       | ...          | ...              | <i>&lt;0.002</i> |
| SCRM 672/1  |                                   | 4.322 | 0.143 | 0.474 | 0.198  | 0.036  | 0.0186      | 0.117            | 0.083        | 0.0102           | 0.0079 | 0.139        | 0.100        | 0.0047           | 0.0373       | 0.0988       | ...          | ...              | <i>0.008</i>     |
| SCRM 673/1  |                                   | 2.455 | 1.702 | 0.123 | 0.317  | 0.0112 | 0.0423      | 0.0092           | 0.103        | 0.0287           | ...    | 0.053        | ...          | 0.0206           | 0.0718       | 0.052        | ...          | ...              | <i>&lt;0.001</i> |
| SCRM 674/1  |                                   | 3.71  | 0.484 | 1.437 | 0.0180 | 0.078  | 0.0296      | 0.0497           | 0.161        | 0.0061           | ...    | 0.0066       | ...          | 0.0164           | 0.0131       | 0.0125       | ...          | ...              | ...              |
| SCRM 675    |                                   | 1.916 | 1.300 | 1.798 | 0.0453 | 0.0724 | 0.0794      | 0.0342           | 0.205        | 0.0072           | 0.0342 | 0.0230       | 0.0117       | 0.0062           | 0.0070       | 0.179        | ...          | ...              | 0.0006           |

Nickel Base Alloys (38, 41 or 50mm dia. x 13 or 19mm discs)

MAJOR ELEMENTS - nominal mass content in %

| Ref. No.     | Description                 | C            | Si    | Mn     | P            | S            | Cr          | Mo       | Ni        | Al         | B      | Co        | Cu     | N      | Nb           | Ti          | V        | W      | Zr     | Fe    |
|--------------|-----------------------------|--------------|-------|--------|--------------|--------------|-------------|----------|-----------|------------|--------|-----------|--------|--------|--------------|-------------|----------|--------|--------|-------|
| SS-CRM 345   | IN 100 Alloy (cast)         | 0.153        | ...   | ...    | ...          | ...          | 9.95        | 3.01     | Bal.      | 5.58       | 0.019  | 14.71     | ...    | ...    | ...          | <i>5</i>    | 1.00     | ...    | 0.044  | ...   |
| SS-CRM 346A  | IN 100 Alloy (cast)         | <i>0.15</i>  | ...   | ...    | ...          | ...          | <i>10</i>   | <i>3</i> | <i>60</i> | <i>5.5</i> | ...    | <i>15</i> | ...    | ...    | ...          | <i>5</i>    | <i>1</i> | ...    | ...    | ...   |
| SS-CRM 350   | IN 713 Alloy (cast)         | 0.138        | 0.110 | 0.019  | ...          | ...          | 13.43       | 4.29     | 70.8      | 5.97       | 0.013  | 0.338     | ...    | ...    | 2.17         | 0.87        | ...      | 0.094  | 0.072  | 1.50  |
| SS-CRM 351   | IN 718 Alloy (wrought)      | <i>0.025</i> | 0.14  | 0.037  | <i>0.006</i> | 0.0006       | 18.12       | 3.06     | 53.1      | 0.55       | 0.0051 | 0.136     | 0.016  | ...    | 5.20         | 1.06        | ...      | ...    | ...    | 18.26 |
| SS-CRM 351/1 | IN 718 Alloy (wrought)      | 0.0255       | 0.080 | 0.0562 | 0.0045       | 0.00037      | 19.14       | 3.04     | 53.35     | 0.554      | 0.0035 | 0.145     | 0.0222 | 0.0077 | 5.31         | 0.938       | 0.0181   | 0.0209 | 0.0017 | 17.20 |
| SS-CRM 363/1 | Monel Alloy 400 (wrought)   | 0.140        | 0.028 | 1.26   | ...          | <i>0.002</i> | <i>0.05</i> | ...      | 64.7      | 0.027      | ...    | 0.032     | 31.90  | ...    | ...          | <i>0.03</i> | ...      | ...    | ...    | 1.86  |
| SS-CRM 387/1 | Nimonic 901 Alloy (wrought) | 0.033        | 0.06  | 0.025  | 0.0033       | 0.0028       | 11.35       | 5.83     | 41.2      | 0.24       | 0.017  | 0.020     | 0.0076 | ...    | <i>0.006</i> | 3.00        | ...      | ...    | ...    | 38.4  |

Nickel Base Alloys (continued)

TRACE ELEMENTS - nominal mass content in µg/g

| Ref. No.     | Description                    | Pb         | Bi   | Ag          | Se   | Te   | Tl   | Sb  | Ta  | As       | Cd   | Ga   | Sn  | Zn   | Mg  | Ca        | In        |
|--------------|--------------------------------|------------|------|-------------|------|------|------|-----|-----|----------|------|------|-----|------|-----|-----------|-----------|
| SS-CRM 345   | IN 100 Alloy (cont.)           | 0.21       | <0.2 | <0.2        | <0.5 | <0.2 | <0.2 | <2  | ... | <i>2</i> | <0.1 | 8.2  | 5.6 | <0.5 | 5.5 | <5        | ...       |
| SS-CRM 346A  | IN 100 Alloy (cont.)           | 22.2       | 10.3 | 42.5        | 5.7  | 9.3  | 1.9  | 45  | ... | 50.4     | 0.37 | 49.6 | 93  | 28.8 | 130 | <i>22</i> | <i>20</i> |
| SS-CRM 351/1 | IN 718 Alloy (wrought) (cont.) | <1         | <1   | <1          | <1   | <1   | <1   | 2.4 | 33  | <10      | <0.1 | <20  | 3.3 | <10  | 16  | <10       | ...       |
| SS-CRM 387/1 | Nimonic 901 Alloy (cont.)      | <i>0.3</i> | <1.0 | <i>≤0.2</i> | ...  | ...  | ...  | 3   | ... | ...      | ...  | ...  | ... | ...  | ... | ...       | ...       |

SPECTROSCOPIC REFERENCE MATERIALS - Cast Irons

These samples are intended for the calibration of optical emission and XRF instruments with respect to the alloying and trace elements below. Although they have been carefully analysed by both BAS Ltd. and an independent laboratory, they have been classified as RMs and not CRMs in order to distinguish them from BAS CRMs which are normally analysed by at least five laboratories.

CHEMICAL COMPOSITION (nominal mass content in %)

Cast Iron Reference Materials (All are 40mm x 37mm x 10mm chill cast blocks except LARM 5/1, CRRM 3/2, CRRM 4/2, CRRM 5/2, NIRM 2/1, NIRM 5/1, NIRM 6/1, NIRM 8/2, SIMO 1/5 and SIMO 2/3 which are 48mm x 42mm x 12mm chill cast blocks).

These samples have been prepared jointly by Replicast Ltd./Castings Technology International (formerly BCIRA) and BAS

| Ref No.  | Description                          | C     | Si    | Mn    | P      | S       | Cr    | Mo    | Ni    | Al<br>(Total) | As    | B      | Co    | Cu    | Nb   | Pb     | Sn    | Ti    | V      | Bi     | Ce     | Mg    |
|----------|--------------------------------------|-------|-------|-------|--------|---------|-------|-------|-------|---------------|-------|--------|-------|-------|------|--------|-------|-------|--------|--------|--------|-------|
| LARM 1   | Low Alloy Cast Irons                 | (3.0) | (2.0) | (0.3) | (0.05) | (<0.01) | 0.50  | 0.002 | 0.49  | 0.002         | ...   | 0.006  | ...   | 2.49  | ...  | 0.0003 | ...   | 0.14  | 0.11   | 0.011  | 0.005  | ...   |
| LARM 2   |                                      | (3.0) | (2.0) | (0.3) | (0.05) | (<0.01) | 2.50  | 0.22  | 0.030 | 0.066         | 0.044 | ...    | ...   | 0.021 | ...  | 0.007  | 0.22  | 0.33  | 0.0028 | <0.001 | 0.008  | ...   |
| LARM 3   |                                      | (3.0) | (2.0) | (0.3) | (0.05) | (<0.01) | 0.045 | 0.008 | 1.80  | 0.042         | 0.092 | 0.003  | ...   | 1.20  | ...  | 0.0006 | ...   | 0.015 | 0.55   | 0.022  | <0.008 | ...   |
| LARM 4   |                                      | (3.0) | (2.0) | (0.3) | (0.05) | (<0.01) | 1.19  | 1.00  | 0.028 | 0.014         | ...   | ...    | ...   | 0.26  | ...  | 0.018  | 0.11  | 0.17  | 0.014  | <0.001 | 0.008  | ...   |
| LARM 5/1 |                                      | 2.98  | 2.02  | 0.33  | 0.049  | 0.012   | ...   | 0.58  | 2.56  | ...           | ...   | 0.0016 | ...   | ...   | ...  | <0.001 | 0.023 | ...   | 0.23   | 0.0012 | ...    | ...   |
| CRRM 1/1 | High Chromium Cast Irons             | 1.83  | 1.53  | 1.45  | 0.132  | 0.099   | 11.18 | 3.05  | 2.03  | 0.117         | ...   | ...    | ...   | 2.01  | ...  | ...    | ...   | 0.096 | 0.040  | ...    | ...    | ...   |
| CRRM 2/1 |                                      | 1.92  | 1.18  | 1.11  | 0.097  | 0.079   | 14.13 | 2.44  | 1.61  | 0.054         | ...   | ...    | ...   | 1.59  | ...  | ...    | ...   | 0.070 | 0.063  | ...    | ...    | ...   |
| CRRM 3/2 |                                      | 2.37  | 1.21  | 0.92  | 0.073  | 0.087   | 18.78 | 1.58  | 1.35  | 0.102         | ...   | ...    | ...   | 1.09  | ...  | ...    | ...   | 0.015 | 0.042  | ...    | ...    | ...   |
| CRRM 4/2 |                                      | 2.93  | 0.45  | 0.58  | 0.049  | 0.042   | 21.93 | 1.15  | 0.58  | <0.005        | ...   | ...    | ...   | 0.53  | ...  | ...    | ...   | 0.008 | 0.11   | ...    | ...    | ...   |
| CRRM 5/2 |                                      | 3.43  | 0.20  | 0.30  | 0.029  | 0.018   | 30.35 | 0.63  | 0.36  | 0.15          | ...   | ...    | ...   | 0.22  | ...  | ...    | ...   | 0.009 | 0.11   | ...    | ...    | ...   |
| NCRM 1   | Nickel Chromium Cast Irons           | 3.05  | 0.95  | 1.21  | 0.300  | 0.156   | 0.55  | 1.02  | 0.57  | ...           | ...   | ...    | ...   | 2.17  | ...  | ...    | ...   | ...   | ...    | ...    | ...    | ...   |
| NCRM 2   |                                      | 2.97  | 1.82  | 0.95  | 0.068  | 0.119   | 1.99  | 0.36  | 2.10  | ...           | ...   | ...    | ...   | 1.67  | ...  | ...    | ...   | ...   | ...    | ...    | ...    | ...   |
| NCRM 3   |                                      | 3.24  | 0.29  | 0.67  | 0.125  | 0.090   | 3.95  | 0.78  | 3.64  | ...           | ...   | ...    | ...   | 1.21  | ...  | ...    | ...   | ...   | ...    | ...    | ...    | ...   |
| NCRM 4   |                                      | 2.66  | 2.13  | 0.40  | 0.203  | 0.012   | 7.94  | 0.57  | 5.34  | ...           | ...   | ...    | ...   | 0.68  | ...  | ...    | ...   | ...   | ...    | ...    | ...    | ...   |
| NCRM 5   |                                      | 3.70  | 1.15  | 0.27  | 0.025  | 0.015   | 10.44 | 0.10  | 6.74  | ...           | ...   | ...    | ...   | 0.204 | ...  | ...    | ...   | ...   | ...    | ...    | ...    | ...   |
| NIRM 1   | Austenitic (Ni-Resist)<br>Cast Irons | 2.05  | 3.15  | 6.72  | 0.055  | 0.005   | 0.246 | ...   | 11.80 | ...           | ...   | ...    | ...   | 0.20  | ...  | ...    | ...   | ...   | ...    | ...    | 0.018  | 0.021 |
| NIRM 2/1 |                                      | 2.81  | 1.50  | 2.08  | 0.129  | 0.010   | 1.48  | ...   | 13.95 | ...           | ...   | ...    | ...   | 5.98  | ...  | ...    | ...   | ...   | ...    | ...    | 0.015  | 0.050 |
| NIRM 3   |                                      | 2.51  | 2.21  | 0.51  | 0.208  | 0.096   | 2.43  | ...   | 17.8  | ...           | ...   | ...    | ...   | 1.00  | 0.09 | ...    | ...   | ...   | ...    | ...    | 0.007  | ...   |
| NIRM 4   |                                      | 1.97  | 3.03  | 2.37  | 0.051  | 0.008   | 3.56  | ...   | 20.2  | ...           | ...   | ...    | ...   | 0.52  | 0.37 | ...    | ...   | ...   | ...    | ...    | 0.011  | 0.014 |
| NIRM 5/1 |                                      | 2.95  | 1.50  | 1.01  | 0.103  | 0.005   | 0.51  | ...   | 21.7  | ...           | ...   | ...    | ...   | 0.21  | 0.15 | ...    | ...   | ...   | ...    | ...    | 0.016  | 0.055 |
| NIRM 6/1 |                                      | 2.53  | 2.68  | 4.07  | 0.225  | 0.049   | 1.02  | 0.51  | 26.9  | ...           | ...   | ...    | ...   | 0.11  | ...  | ...    | ...   | ...   | ...    | ...    | 0.006  | ...   |
| NIRM 7   |                                      | 2.05  | 3.05  | 0.71  | 0.058  | 0.020   | 3.53  | 0.99  | 32.9  | ...           | ...   | ...    | ...   | 0.52  | ...  | ...    | ...   | ...   | ...    | ...    | 0.005  | 0.019 |
| NIRM 8/2 |                                      | 1.45  | 5.61  | 1.58  | 0.105  | 0.014   | 2.47  | 0.77  | 35.3  | ...           | ...   | ...    | ...   | 0.23  | ...  | ...    | ...   | ...   | ...    | ...    | 0.013  | 0.033 |
| SIMO 1/5 | Silicon Molybdenum<br>Cast Irons     | 2.72  | 3.94  | 0.330 | 0.031  | 0.014   | 0.889 | 0.738 | 0.035 | 0.029         | 0.001 | ...    | 0.004 | 0.005 | ...  | ...    | 0.052 | 0.008 | 0.004  | ...    | ...    | 0.034 |
| SIMO 2/3 |                                      | 2.20  | 4.78  | 0.463 | 0.035  | 0.010   | 0.903 | 0.486 | 0.011 | 0.026         | 0.001 | ...    | 0.005 | 0.007 | ...  | ...    | 0.052 | 0.010 | 0.005  | ...    | 0.001  | 0.024 |

SPECTROSCOPIC STANDARD REFERENCE MATERIALS - Copper Base Alloys

These samples are intended for the calibration of optical emission and XRF instruments with respect to the alloying and trace elements below. Although they have been carefully analysed by both BAS Ltd. and an independent laboratory, they have been classified as RMs and not CRMs in order to distinguish them from BAS CRMs which are normally analysed by at least five laboratories.

Note that most CURM samples are now available in the finely divided (chip) form as well as in disc form  
 CHEMICAL COMPOSITION (nominal mass content in %)

Copper Base Alloy Reference Materials (Approx. 50mm dia. x 12 or 10mm discs, except CURM H30.24 which is approx. 35mm dia. x 12mm)

| Ref. No.     | Description                      | Cu     | Sn     | Pb      | Zn     | Ni      | P      | Fe     | Si     | Mn      | As     | Sb      | Bi      | Al      | S      | Mg      | Cr      | Cd      | Co      | Ag     | Te     |
|--------------|----------------------------------|--------|--------|---------|--------|---------|--------|--------|--------|---------|--------|---------|---------|---------|--------|---------|---------|---------|---------|--------|--------|
| CURM 09.01-4 | Phosphorus<br>Deoxidised Coppers | 99.82  | <0.001 | <0.0005 | 0.0008 | <0.0005 | 0.151  | 0.0019 | <0.001 | <0.0005 | <0.001 | <0.0005 | <0.0005 | <0.0005 | ...    | ...     | ...     | ...     | <0.0005 | 0.011  | <0.001 |
| CURM 09.02-4 |                                  | 99.90  | <0.001 | <0.001  | <0.001 | <0.0005 | 0.078  | 0.0042 | <0.002 | <0.0005 | <0.001 | <0.0005 | <0.0005 | <0.0005 | ...    | ...     | ...     | ...     | <0.0005 | 0.0055 | <0.001 |
| CURM 09.03-4 |                                  | 99.92  | <0.001 | <0.0005 | <0.001 | <0.0005 | 0.056  | 0.0033 | <0.001 | <0.0005 | <0.001 | <0.0005 | <0.0005 | <0.0005 | ...    | ...     | ...     | ...     | <0.0005 | 0.012  | <0.001 |
| CURM 30.05-4 | Main Elements in Brasses         | 69.48  | <0.001 | <0.002  | 30.53  | <0.0005 | ...    | <0.003 | <0.001 | <0.0005 | <0.001 | <0.005  | <0.003  | <0.001  | ...    | ...     | ...     | ...     | ...     | ...    | ...    |
| CURM 30.09-4 |                                  | 89.53  | <0.001 | <0.001  | 10.45  | <0.0003 | ...    | 0.0005 | <0.001 | <0.0003 | <0.001 | <0.001  | <0.001  | <0.001  | ...    | ...     | ...     | ...     | ...     | ...    | ...    |
| CURM 30.11-4 |                                  | 59.86  | <0.002 | 0.005   | 38.17  | 1.70    | ...    | 0.002  | <0.001 | 0.23    | <0.001 | <0.001  | <0.002  | <0.001  | ...    | ...     | ...     | ...     | ...     | ...    | ...    |
| CURM 30.15-4 |                                  | 60.66  | <0.002 | <0.005  | 38.88  | <0.001  | ...    | 0.50   | <0.005 | <0.001  | <0.005 | <0.001  | <0.001  | <0.001  | ...    | ...     | ...     | ...     | ...     | ...    | ...    |
| CURM 30.16-4 |                                  | 60.53  | <0.002 | <0.005  | 38.33  | <0.001  | ...    | 1.14   | <0.005 | <0.001  | <0.005 | <0.001  | <0.001  | <0.001  | ...    | ...     | ...     | ...     | ...     | ...    | ...    |
| CURM 30.18-4 |                                  | 63.66  | 0.58   | <0.005  | 32.33  | <0.001  | ...    | 0.006  | 0.13   | <0.001  | <0.005 | <0.001  | <0.001  | <0.001  | 3.28   | ...     | ...     | ...     | ...     | ...    | ...    |
| CURM 30.20-4 |                                  | 61.46  | 0.40   | <0.002  | 35.71  | <0.001  | ...    | <0.005 | 0.17   | <0.001  | <0.001 | <0.002  | <0.002  | 2.32    | ...    | ...     | ...     | ...     | ...     | ...    | ...    |
| CURM 30.21-4 |                                  | 56.23  | 2.01   | 0.004   | 40.08  | <0.001  | ...    | 0.003  | 0.213  | <0.001  | <0.001 | <0.002  | ...     | 1.44    | ...    | ...     | ...     | ...     | ...     | ...    | ...    |
| CURM H 30.24 | 58.87                            | <0.001 | 3.02   | 37.92   | <0.001 | ...     | 0.005  | <0.001 | <0.001 | <0.001  | <0.001 | <0.001  | <0.001  | ...     | ...    | ...     | ...     | ...     | ...     | ...    |        |
| CURM 42.21-2 | Admiralty &<br>Naval Brasses     | 66.78  | 0.60   | 0.259   | 31.61  | 0.120   | 0.087  | 0.119  | 0.15   | <0.001  | <0.003 | 0.25    | 0.013   | 0.003   | 0.034  | ...     | ...     | ...     | ...     | ...    | ...    |
| CURM 42.23-2 |                                  | 74.36  | 1.63   | 0.575   | 22.13  | 0.168   | 0.128  | 0.354  | 0.015  | 0.019   | 0.168  | 0.356   | 0.034   | 0.008   | 0.045  | ...     | ...     | ...     | ...     | ...    | ...    |
| CURM 42.24-2 |                                  | 62.45  | 2.25   | 0.91    | 33.75  | 0.025   | 0.226  | 0.066  | 0.093  | 0.065   | 0.065  | 0.060   | 0.054   | 0.067   | 0.012  | ...     | ...     | ...     | ...     | ...    | ...    |
| CURM 42.25-2 |                                  | 57.78  | 2.72   | 0.0023  | 39.20  | <0.001  | 0.050  | 0.003  | <0.001 | 0.169   | 0.118  | <0.001  | <0.001  | 0.021   | 0.005  | ...     | ...     | ...     | ...     | ...    | ...    |
| CURM 43.01-4 | Aluminium Brasses                | 74.36  | 0.116  | <0.002  | 22.44  | 0.121   | ...    | 0.008  | 0.063  | 0.064   | 0.118  | <0.001  | <0.002  | 2.75    | ...    | ...     | ...     | ...     | ...     | ...    | ...    |
| CURM 43.02-4 |                                  | 76.21  | 0.060  | 0.064   | 20.82  | 0.068   | ...    | 0.128  | 0.038  | 0.035   | 0.083  | <0.001  | <0.001  | 2.40    | ...    | ...     | ...     | ...     | ...     | ...    | ...    |
| CURM 48.01-1 | Cartridge Brasses                | 66.98  | <0.002 | 0.106   | 32.6   | 0.134   | 0.016  | 0.049  | 0.041  | <0.001  | 0.067  | 0.047   | 0.038   | <0.001  | <0.001 | 0.0008  | <0.0005 | <0.0003 | ...     | ...    | ...    |
| CURM 48.02-1 |                                  | 67.16  | 0.035  | 0.084   | 32.58  | <0.001  | 0.012  | 0.053  | 0.010  | 0.067   | 0.025  | 0.037   | 0.004   | 0.013   | 0.007  | <0.0005 | 0.004   | <0.0005 | ...     | ...    | ...    |
| CURM 48.04-1 |                                  | 72.68  | 0.018  | 0.043   | 26.99  | 0.096   | 0.006  | 0.008  | 0.004  | 0.012   | 0.034  | 0.026   | 0.014   | <0.001  | 0.011  | 0.0005  | <0.002  | <0.0003 | ...     | ...    | ...    |
| CURM 48.05-1 |                                  | 68.69  | 0.083  | <0.003  | 31.0   | 0.117   | 0.007  | 0.066  | 0.026  | 0.016   | <0.001 | <0.0005 | <0.0005 | <0.002  | 0.013  | <0.0005 | <0.0005 | <0.0003 | ...     | ...    | ...    |
| CURM 50.01-5 | Leaded Bronzes                   | 75.38  | 9.01   | 11.13   | 0.91   | 1.93    | 0.069  | 0.074  | <0.001 | <0.001  | 0.19   | 0.50    | 0.024   | <0.0005 | 0.188  | ...     | ...     | ...     | ...     | ...    | ...    |
| CURM 50.02-4 |                                  | 78.84  | 10.34  | 10.67   | 0.006  | <0.0005 | 0.046  | <0.001 | <0.002 | <0.0005 | <0.002 | <0.0005 | <0.0005 | <0.001  | <0.001 | ...     | ...     | ...     | ...     | ...    | ...    |
| CURM 50.02-5 |                                  | 77.89  | 10.31  | 11.28   | 0.128  | 0.005   | 0.041  | 0.055  | 0.021  | 0.003   | <0.001 | <0.005  | <0.0005 | <0.001  | <0.001 | ...     | ...     | ...     | ...     | ...    | ...    |
| CURM 50.03-4 |                                  | 77.42  | 8.41   | 8.86    | 1.72   | 2.89    | 0.159  | 0.018  | 0.005  | 0.037   | 0.11   | 0.24    | 0.051   | 0.005   | 0.064  | ...     | ...     | ...     | ...     | ...    | ...    |
| CURM 50.04-4 |                                  | 76.11  | 11.30  | 9.94    | 0.66   | 1.10    | 0.032  | 0.10   | 0.011  | 0.028   | 0.06   | 0.50    | 0.10    | 0.014   | 0.14   | ...     | ...     | ...     | ...     | ...    | ...    |
| CURM 51.11-4 | Aluminium Bronzes                | 93.95  | 0.027  | 0.33    | 0.111  | 0.012   | 0.035  | 0.060  | 0.159  | <0.001  | <0.001 | ...     | ...     | 5.27    | ...    | ...     | ...     | ...     | ...     | ...    | ...    |
| CURM 51.12-4 |                                  | 88.29  | 0.196  | 0.219   | 0.45   | 0.112   | <0.001 | 2.87   | 0.005  | 1.33    | 0.111  | ...     | ...     | 6.36    | ...    | ...     | ...     | ...     | ...     | ...    | ...    |
| CURM 51.13-4 |                                  | 88.79  | 0.270  | 0.104   | 0.335  | 0.057   | 0.022  | 1.81   | 0.174  | 0.898   | 0.215  | ...     | ...     | 7.30    | ...    | ...     | ...     | ...     | ...     | ...    | ...    |
| CURM 51.14-4 |                                  | 88.57  | 0.113  | 0.003   | 0.656  | 0.219   | 0.012  | 0.72   | 0.286  | 0.55    | 0.44   | ...     | ...     | 8.42    | ...    | ...     | ...     | ...     | ...     | ...    | ...    |
| CURM 52.52-5 |                                  | 79.26  | 0.044  | 0.074   | 0.094  | 3.56    | ...    | 6.02   | 0.011  | 0.145   | ...    | ...     | ...     | 10.69   | ...    | 0.007   | 0.004   | ...     | ...     | ...    | ...    |
| CURM 52.54-4 |                                  | 81.59  | 0.135  | 0.086   | 0.39   | 5.40    | ...    | 3.31   | 0.022  | 1.20    | ...    | ...     | ...     | 7.85    | ...    | <0.005  | <0.005  | ...     | ...     | ...    | ...    |
| CURM 54.01-4 | Phosphor Bronzes                 | 95.42  | 3.17   | 0.307   | 0.346  | 0.348   | 0.053  | 0.028  | 0.039  | 0.158   | 0.044  | 0.070   | ...     | 0.040   | 0.023  | 0.008   | ...     | ...     | ...     | ...    | ...    |
| CURM 54.02-4 |                                  | 92.87  | 5.53   | 0.663   | 0.410  | 0.109   | 0.107  | 0.102  | 0.012  | 0.101   | 0.023  | 0.026   | ...     | 0.020   | 0.030  | 0.0020  | ...     | ...     | ...     | ...    | ...    |
| CURM 62.12-4 | Cupro-Nickel                     | 89.42  | 0.111  | 0.053   | 0.180  | 7.94    | ...    | 0.45   | 0.109  | 1.59    | ...    | ...     | ...     | ...     | 0.034  | 0.002   | ...     | ...     | 0.081   | ...    | ...    |
| CURM 71.33-8 | Leaded Gunmetals                 | 83.60  | 4.96   | 6.84    | 3.60   | 0.938   | <0.001 | 0.018  | <0.005 | <0.0005 | <0.001 | <0.002  | <0.002  | <0.001  | <0.001 | ...     | <0.0005 | ...     | ...     | <0.002 | ...    |
| CURM 71.34-8 |                                  | 86.74  | 8.19   | 2.48    | 1.54   | <0.005  | 0.019  | 0.29   | 0.03   | 0.05    | 0.18   | 0.072   | 0.031   | 0.008   | 0.18   | ...     | 0.04    | ...     | ...     | 0.023  | ...    |



## SPECTROSCOPIC REFERENCE MATERIALS – Lead Base Alloys

These samples are intended for the calibration of optical emission and XRF instruments with respect to the alloying and trace elements below. Although they have been carefully analysed by both BAS Ltd. and an independent laboratory, they have been classified as RMs and not CRMs in order to distinguish them from BAS CRMs which are normally analysed by at least five laboratories.

CHEMICAL COMPOSITION (nominal mass content in %)

Lead Base Alloy Reference Materials (Approx. 50mm x 50mm x 20mm chill cast blocks, also available as finely divided material – units of 100g). These samples have been prepared jointly by Castings Technology International (formerly BCIRA) and BAS

| Ref No.       | Description    | Cu      | Sn   | Zn    | Ni      | Cd     | As      | Sb      | Bi     | Ca    | Ag     | Al     | Pb  |
|---------------|----------------|---------|------|-------|---------|--------|---------|---------|--------|-------|--------|--------|-----|
| PBRM L21.01-2 | Battery Alloys | 0.0003  | 0.11 | 0.002 | <0.0005 | 0.0003 | <0.0005 | 0.0006  | <0.001 | 0.051 | <0.001 | 0.012  | Bal |
| PBRM L21.02-2 |                | 0.002   | 0.28 | 0.004 | <0.0005 | 0.0010 | 0.0003  | 0.0013  | 0.013  | 0.020 | 0.007  | 0.004  | Bal |
| PBRM L21.03-2 |                | <0.0005 | 0.38 | 0.002 | <0.0005 | 0.003  | <0.0005 | <0.0005 | 0.023  | 0.089 | 0.010  | 0.011  | Bal |
| PBRM L21.04-2 |                | 0.005   | 0.47 | 0.007 | <0.0005 | 0.003  | 0.0002  | 0.0003  | 0.027  | 0.084 | 0.017  | <0.001 | Bal |

## SETTING-UP SAMPLES FOR DIRECT READING SPECTROGRAPHS

These samples have been thoroughly examined both spectrographically and chemically to confirm the homogeneity of the bulk samples. Their compositions have NOT, however, been accurately determined since it is not intended that they should be used as Spectroscopic Standard CRMs or as RMs. An Information Sheet is supplied with each sample giving the approximate composition.

Carbon, Low Alloy and Stainless Steels (Wrought) (Approx. 44mm dia. x 25, 75 or 150mm lengths)

| Ref. No. | Description            | Approximate Chemical Compositions (mass content in %) |      |      |        |        |      |      |      |       |       |        |      |      |      |        |        |        |        |        |        |       |           |
|----------|------------------------|---|------|------|--------|--------|------|------|------|-------|-------|--------|------|------|------|--------|--------|--------|--------|--------|--------|-------|-----------|
|          |                        | C   | Si   | Mn   | P      | S      | Cr   | Mo   | Ni   | Al    | As    | B      | Co   | Cu   | N    | Nb     | Sn     | Ti     | V      | W      | Zr     | Ca    | Others    |
| SUS A/11 | Low Carbon Steel       | 0.02  | 0.01 | 0.15 | <0.005 | 0.005  | 0.02 | 0.01 | 0.05 | 0.07  | ...   | ...    | 0.01 | 0.01 | ...  | <0.005 | <0.005 | <0.001 | <0.005 | <0.005 | ...    | ...   | ...       |
| SUS D/11 | Low Alloy Steel        | 0.80  | 0.80 | 0.40 | 0.01   | 0.03   | 3.0  | 1.3  | 0.10 | 0.19  | ...   | <0.001 | 0.29 | 0.11 | 0.01 | 0.05   | 0.01   | 0.10   | 0.12   | 0.16   | ...    | ...   | ...       |
| SUS F/6  | Duplex Stainless Steel | 0.02  | 0.53 | 0.61 | 0.02   | <0.005 | 25.8 | 3.4  | 7.2  | 0.005 | 0.005 | 0.002  | 0.05 | 0.63 | 0.25 | 0.005  | <0.005 | <0.005 | 0.06   | 0.63   | ...    | ...   | 60.7 Fe   |
| SUS G/8  | Stainless Steel        | 0.02  | 0.32 | 1.7  | 0.03   | 0.02   | 16.8 | 2.1  | 10.0 | 0.003 | ...   | ...    | 0.15 | 0.30 | 0.08 | 0.01   | 0.006  | <0.005 | 0.08   | 0.04   | <0.005 | 0.003 | <0.001 Ta |

Cast Irons (Approx. 60mm x 35mm x 18mm chill cast blocks.) These samples have been prepared jointly by Replicast Ltd./Castings Technology International (formerly BCIRA) and BAS

| Ref. No. | Description            | Approximate Chemical Compositions (mass content in %) |      |      |      |       |      |        |      |        |        |        |       |        |        |      |        |      |        |      |
|----------|------------------------|---|------|------|------|-------|------|--------|------|--------|--------|--------|-------|--------|--------|------|--------|------|--------|------|
|          |                        | C   | Si   | Mn   | P    | S     | Cr   | Mo     | Ni   | Al     | As     | B      | Cu    | Sn     | Ti     | V    | Bi     | Mg   | Sb     | Ce   |
| SUS 1/19 | Low Phosphorus Iron    | 3.1   | 2.8  | 0.44 | 0.05 | 0.07  | 0.50 | 0.33   | 0.19 | 0.02   | ...    | ...    | 0.47  | 0.05   | <0.005 | 0.04 | ...    | ...  | ...    | ...  |
| SUS 2/49 | Medium Phosphorus Iron | 3.6   | 1.8  | 0.73 | 0.17 | 0.12  | 0.07 | 0.11   | 0.49 | 0.01   | ...    | ...    | 0.23  | 0.10   | 0.06   | 0.53 | ...    | ...  | ...    | ...  |
| SUS 3/21 | High Phosphorus Iron   | 3.4   | 2.2  | 0.90 | 1.0  | 0.10  | 0.25 | <0.005 | 0.01 | <0.005 | ...    | ...    | 0.01  | <0.005 | 0.11   | 0.27 | ...    | ...  | ...    | ...  |
| SUS 4/28 | Ductile (Nodular) Iron | 3.2   | 2.7  | 0.15 | ...  | 0.02  | 0.08 | ...    | 0.11 | 0.02   | <0.005 | ...    | 0.79  | <0.005 | 0.06   | 0.50 | ...    | 0.03 | <0.005 | ...  |
| SUS 5/56 | Ductile (Nodular) Iron | 3.8   | 2.0  | 0.59 | ...  | 0.018 | 0.01 | ...    | 1.00 | 0.04   | 0.001  | ...    | 0.003 | 0.07   | 0.009  | 0.52 | ...    | 0.10 | 0.02   | 0.03 |
| SUS 6/6  | Malleable Iron         | 2.5   | 1.8  | 0.65 | 0.05 | 0.12  | 0.10 | ...    | ...  | <0.005 | ...    | <0.001 | 0.02  | 0.05   | 0.02   | 0.02 | 0.01   | ...  | ...    | ...  |
| SUS 7/8  | Malleable Iron         | 2.8   | 0.94 | 0.29 | 0.09 | 0.18  | 0.07 | ...    | ...  | 0.02   | ...    | 0.004  | 0.21  | <0.01  | ...    | 0.06 | <0.001 | ...  | ...    | ...  |

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Certificates may be reprinted from time to time to accommodate updated text or statistical treatment. In certain cases, where chemical analyses carried out after issuance of the original certificate lead to **additional or revised certified data, the "Date of Latest Certificate" below is stated in bold.** If the certificate in your possession is not the current one, we shall gladly supply this to you on request.

| BRITISH CHEMICAL STANDARD CRMs |                         | Date of Latest Certificate | Page |
|--------------------------------|-------------------------|----------------------------|------|
| Ref. No.                       | Description             |                            |      |
| BCS-CRM 111                    | Low Carbon Steel        | Mar 14                     | 7    |
| BCS-CRM 111/1                  | Low Carbon Steel        | Jan 18                     | 7    |
| BCS-CRM 112                    | Low Alloy Steel         | Mar 14                     | 9    |
| BCS-CRM 113                    | Low Alloy Steel         | Mar 14                     | 9    |
| BCS-CRM 114                    | Low Alloy Steel         | Mar 14                     | 9    |
| BCS-CRM 115                    | Calcium Treated Steel   | Jun 16                     | 7    |
| BCS-CRM 116                    | Calcium Treated Steel   | Sep 17                     | 7    |
| BCS-CRM 161/4                  | 0.8% Carbon Steel       | Sep 15                     | 7    |
| BCS-CRM 176/3                  | Manganese Ore           | Sep 15                     | 14   |
| BCS-CRM 176/4                  | Manganese Ore           | Sep 15                     | 14   |
| BCS-CRM 177/2                  | Lead Base White Metal   | Aug 12                     | 12   |
| BCS-CRM 178/2                  | Tin Base White Metal    | Aug 12                     | 12   |
| BCS-CRM 179/2                  | High Tensile Brass      | Aug 12                     | 12   |
| BCS-CRM 180/2                  | Copper-Nickel           | Aug 12                     | 12   |
| BCS-CRM 181/3                  | 2.5% Cu Aluminium Alloy | Jun 13                     | 12   |
| BCS-CRM 182/3                  | 11% Si Aluminium Alloy  | Aug 15                     | 12   |
| BCS-CRM 183/4                  | Leaded Gunmetal         | Jun 13                     | 12   |
| BCS-CRM 203/6                  | Low C Ferro-Chromium    | Feb 19                     | 11   |
| BCS-CRM 204/6                  | High C Ferro-Chromium   | Sep 17                     | 11   |
| BCS-CRM 206/3 (ECRM 453-1)     | High Si and P Cast Iron | May 11                     | 11   |
| BCS-CRM 207/2                  | Gunmetal                | Sep 12                     | 12   |
| BCS-CRM 208/3                  | High C Ferro-Manganese  | Nov 19                     | 11   |
| BCS-CRM 214/2 (ECRM 152-1)     | Mn-Mo Steel             | Jun 19                     | 9    |
| BCS-CRM 216/3                  | 5% Cu Aluminium Alloy   | Oct 12                     | 12   |
| BCS-CRM 219/4 (ECRM 153-1)     | Ni-Cr-Mo Steel          | Feb 03                     | 9    |
| BCS-CRM 220/2 (ECRM 254-1)     | High Speed Steel        | Sep 10                     | 8    |
| BCS-CRM 222/1                  | 3.5% Ni Steel           | Dec 16                     | 9    |
| BCS-CRM 225/2 (ECRM 155-1)     | Ni-Cr-Mo Steel          | Dec 10                     | 9    |
| BCS-CRM 231/5                  | Ferro-Molybdenum        | Jan 16                     | 11   |
| BCS-CRM 231/6                  | Ferro-Molybdenum        | Jan 16                     | 11   |
| BCS-CRM 232/2 (ECRM 051-1)     | 0.1% Sulphur Steel      | Oct 10                     | 7    |
| BCS-CRM 236/3 (ECRM 454-1)     | Hematite Iron           | May 11                     | 11   |
| BCS-CRM 237/2 (ECRM 060-1)     | 0.1% Carbon Steel       | Oct 10                     | 7    |
| BCS-CRM 238/2 (ECRM 061-1)     | 0.2% Carbon Steel       | Oct 10                     | 7    |
| BCS-CRM 241/2 (ECRM 251-1)     | High Speed Steel        | Nov 10                     | 8    |
| BCS-CRM 242/2 (ECRM 555-1)     | Ferro-Tungsten          | Jun 11                     | 11   |
| BCS-CRM 262/1                  | 10% Mg Aluminium Alloy  | Jul 13                     | 12   |
| BCS-CRM 263/2                  | 5% Mg Aluminium Alloy   | Jul 13                     | 12   |
| BCS-CRM 268/1                  | 5% Si Aluminium Alloy   | Jul 13                     | 12   |
| BCS-CRM 270 (ECRM 054-1)       | 0.09% Phosphorus Steel  | Nov 10                     | 7    |
| BCS-CRM 290/2 (ECRM 253-1)     | 13% Manganese Steel     | Jun 11                     | 10   |
| BCS-CRM 300/1                  | 6% Zn Aluminium Alloy   | Jul 13                     | 12   |
| BCS-CRM 301/1 (ECRM 651-1)     | Lincolnshire Iron Ore   | Aug 11                     | 14   |

|                          |                                    |        |    |
|--------------------------|------------------------------------|--------|----|
| BCS-CRM 304/1            | Copper Aluminium                   | Dec 08 | 12 |
| BCS-CRM 307              | Ce-Zn-Zr Magnesium Alloy           | Apr 13 | 12 |
| BCS-CRM 308/1            | Chrome Ore                         | Sep 15 | 13 |
| BCS-CRM 309              | Sillimanite                        | May 12 | 15 |
| BCS-CRM 310/1            | Nimonic 90                         | Aug 15 | 13 |
| BCS-CRM 313/2            | High Purity Silica                 | Sep 13 | 15 |
| BCS-CRM 316              | 8% Al Magnesium Alloy              | Jun 12 | 12 |
| BCS-CRM 317 (ECRM 151-1) | Low C High Si Steel                | Sep 11 | 9  |
| BCS-CRM 318A             | 0.01% O Steel                      | Jul 18 | 8  |
| BCS-CRM 318B             | 0.01% O Steel                      | Jul 18 | 8  |
| BCS-CRM 319/1            | Magnesia                           | Mar 09 | 15 |
| BCS-CRM 332              | Austenitic Stainless Steel         | May 13 | 10 |
| BCS-CRM 339              | Ferritic Stainless Steel           | Aug 13 | 10 |
| BCS-CRM 340              | Ferritic Stainless Steel           | Aug 13 | 10 |
| BCS-CRM 341              | Ferritic Stainless Steel           | Aug 13 | 10 |
| BCS-CRM 342              | Ferritic Stainless Steel           | Aug 13 | 10 |
| BCS-CRM 343              | Wrought Aluminium Alloy            | Jul 13 | 12 |
| BCS-CRM 344              | 70/30 Brass                        | Jan 16 | 12 |
| BCS-CRM 345              | Nickel Alloy IN100                 | May 12 | 13 |
| BCS-CRM 346              | Nickel Alloy IN100                 | Oct 19 | 13 |
| BCS-CRM 347              | Electronic Fluxsolder              | Aug 15 | 12 |
| BCS-CRM 348              | Ball Clay                          | Jun 11 | 15 |
| BCS-CRM 349              | 3.5% Cu Aluminium                  | Jan 16 | 12 |
| BCS-CRM 350              | Nickel Alloy IN713                 | Oct 19 | 13 |
| BCS-CRM 351/1            | Nickel Alloy IN718                 | May 15 | 13 |
| BCS-CRM 353              | Sulphate Resisting Portland Cement | Oct 11 | 13 |
| BCS-CRM 354              | White Portland Cement              | Oct 11 | 13 |
| BCS-CRM 355              | Tin Ore                            | May 12 | 14 |
| BCS-CRM 356              | Titanium Alloy                     | Jan 94 | 13 |
| BCS-CRM 357              | Titanium Alloy                     | Jan 94 | 13 |
| BCS-CRM 358              | Zirconia                           | Aug 15 | 15 |
| BCS-CRM 359              | Nitrogen Bearing Silicon Carbide   | Oct 18 | 14 |
| BCS-CRM 360              | Sialon Bonded Silicon Carbide      | Oct 18 | 14 |
| BCS-CRM 361              | Chromium Metal                     | May 09 | 13 |
| BCS-CRM 362              | Mine Tailings Sample               | Sep 10 | 15 |
| BCS-CRM 363/1            | Monel Alloy 400                    | Apr 16 | 13 |
| BCS-CRM 364              | Leaded Bronze                      | Aug 15 | 12 |
| BCS-CRM 369              | Magnesite Chrome                   | Aug 15 | 15 |
| BCS-CRM 370              | Magnesite Chrome                   | Aug 15 | 15 |
| BCS-CRM 371              | Commercial Nickel                  | Aug 15 | 13 |
| BCS-CRM 374              | Phosphor Bronze                    | Aug 15 | 12 |
| BCS-CRM 375/1            | Soda Feldspar                      | Nov 04 | 15 |
| BCS-CRM 376/1            | Potash Feldspar                    | May 09 | 15 |
| BCS-CRM 377/6            | Iron Ore Sinter                    | Sep 15 | 14 |
| BCS-CRM 380/1            | 2% Si Aluminium Alloy              | Jan 16 | 12 |
| BCS-CRM 381              | Basic Slag                         | Oct 12 | 14 |

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| BCS-CRM 383                        | Alcomax III                            | Jan 16 | 11 |
| BCS-CRM 385                        | Leaded Brass                           | Oct 14 | 12 |
| BCS-CRM 387/1                      | Nimonic 901 Alloy                      | Apr 16 | 13 |
| BCS-CRM 388                        | Zircon                                 | Aug 15 | 15 |
| BCS-CRM 389/1                      | High Purity Magnesia                   | Jun 13 | 15 |
| BCS-CRM 390                        | High Tensile Brass                     | Oct 14 | 12 |
| BCS-CRM 392                        | Fluorspar                              | May 12 | 13 |
| BCS-CRM 393 (ECRM 752-1)           | Limestone                              | Dec 10 | 15 |
| BCS-CRM 394/1                      | Calcined Bauxite                       | Sep 15 | 13 |
| BCS-CRM 395                        | Bauxite                                | May 12 | 13 |
| BCS-CRM 396                        | Low Silica Magnesite Chrome            | Jun 13 | 15 |
| BCS-CRM 398                        | Alnico H C                             | Sep 17 | 11 |
| BCS-CRM 399                        | Phosphorus Deoxidised Copper           | Jan 16 | 12 |
| BCS-CRM 408                        | Low Alloy Steel                        | Jan 10 | 9  |
| BCS-CRM 404/1, 405/1               | Low Alloy Steels                       | Dec 09 | 9  |
| BCS-CRM 401/2                      | Low Alloy Steel                        | Feb 19 | 9  |
| BCS-CRM 402/2, 404/2, 405/2        | Low Alloy Steels                       | Dec 05 | 9  |
| BCS-CRM 403/2                      | Low Alloy Steel                        | Jun 15 | 9  |
| BCS-CRM 407/1, 409/1               | Low Alloy Steels                       | Dec 09 | 9  |
| BCS-CRM 407/2, 409/2               | Low Alloy Steels                       | Feb 06 | 9  |
| BCS-CRM 421-424                    | Low Tungsten Steels                    | Jul 16 | 9  |
| BCS-CRM 431/2-435/2                | Plain Carbon Steels                    | Sep 18 | 8  |
| BCS-CRM 452/1, 453/1               | Carbon Steels - Residual Series (Gp A) | Aug 10 | 8  |
| BCS-CRM 456/2, 457/2, 458/2, 460/2 | Carbon Steels - Residual Series (Gp B) | Jun 19 | 8  |
| BCS-CRM 463                        | Austenitic Stainless Steel             | May 16 | 10 |
| BCS-CRM 461/1, 462/1               | Austenitic Stainless Steels            | Jun 19 | 10 |
| BCS-CRM 463/1-465/1                | Austenitic Stainless Steels            | Jun 10 | 10 |
| BCS-CRM 466/2                      | Austenitic Stainless Steel             | Jul 19 | 10 |
| BCS-CRM 467/1, 468/1               | Austenitic Stainless Steels            | Jun 10 | 10 |
| BCS-CRM 469-473                    | Ferritic Stainless Steels              | Sep 10 | 10 |
| BCS-CRM 474, 475                   | Stainless Steels                       | Sep 10 | 10 |
| BCS-CRM 476                        | Mo-stabilized Stainless Steel          | Jul 19 | 10 |
| BCS-CRM 479                        | Nb-stabilized Stainless Steel          | May 15 | 10 |
| BCS-CRM 481-484                    | High Speed Steels                      | Sep 17 | 8  |
| BCS-CRM 491, 494, 495              | High Manganese Steels                  | Nov 16 | 10 |
| BCS-CRM 495/1                      | High Manganese Steel                   | Nov 16 | 10 |
| BCS-CRM 505                        | Aluminium-Silicon Alloy                | Jun 18 | 12 |
| BCS-CRM 512                        | Dolomite                               | Jul 15 | 15 |
| BCS-CRM 513                        | Limestone                              | Jun 15 | 15 |
| BCS-CRM 514                        | Copper Concentrate                     | Sep 15 | 14 |
| BCS-CRM 516                        | Standard Glass Sand                    | May 09 | 15 |
| BCS-CRM 517                        | Brazilian Iron Ore                     | Dec 09 | 14 |
| BCS-CRM 520                        | Zinc Concentrate                       | Mar 19 | 14 |
| BCS-CRM 525                        | Low Iron Float Glass                   | Jul 17 | 15 |
| BCS-CRM 526                        | Soda Ash                               | Sep 15 | 16 |
| BCS-CRM 527                        | Blast Furnace Iron                     | Sep 15 | 11 |
| BCS-CRM 528                        | Standard Glass Sand                    | Sep 15 | 15 |
| BCS-CRM 529                        | Anorthic Feldspar                      | Jul 19 | 15 |
| BCS-CRM 531                        | Low Iron Sand                          | Oct 15 | 15 |
| BCS-CRM 532                        | Swedish Feldspar                       | Jul 19 | 15 |

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| Ref No.       | Description                   |                            |      |
| ECRM 055-2(C) | 0.5% Carbon Steel             | Sep 13                     | 7    |
| ECRM 056-2(C) | 0.8% Carbon Steel             | May 09                     | 7    |
| ECRM 057-2(C) | 0.05% Carbon Steel            | Mar 99                     | 7    |
| ECRM 058-2(C) | 0.15% Sulphur Steel           | Aug 02                     | 7    |
| ECRM 059-2(C) | 0.7% Carbon Steel             | Nov 02                     | 7    |
| ECRM 064-1(C) | Nb/Ti Interstitial Free Steel | Nov 02                     | 7    |
| ECRM 084-1(C) | 0.4% Carbon Steel             | Feb 00                     | 7    |
| ECRM 085-1(C) | 0.3% Sulphur Steel            | Feb 03                     | 7    |
| ECRM 086-1(C) | 0.3% Carbon Steel             | Jan 01                     | 7    |
| ECRM 087-1(C) | 0.15% Carbon Steel            | Aug 07                     | 7    |
| ECRM 088-2    | High Purity Iron              | Jan 01                     | 7    |
| ECRM 090-1(C) | 1% Carbon Steel               | May 00                     | 7    |
| ECRM 091-1    | 0.5% Carbon Steel             | Feb 05                     | 7    |
| ECRM 096-2(C) | Low S, Ca-Treated Steel       | Mar 99                     | 7    |
| ECRM 097-1(C) | High Purity Iron              | Feb 98                     | 7    |
| ECRM 097-2(C) | High Purity Iron              | Jan 13                     | 7    |
| ECRM 186-1(C) | Silico Manganese Steel        | Jul 08                     | 9    |
| ECRM 195-1(C) | Cr-Mo-Ni Steel                | Mar 92                     | 9    |
| ECRM 272-1(C) | 12% Chromium Steel            | Jul 05                     | 10   |
| ECRM 276-2(C) | 5% Cr-Mo-V Steel              | Feb 93                     | 10   |
| ECRM 281-1    | 18/9 Stainless Steel + Ti     | Oct 16                     | 10   |
| ECRM 285-2(C) | Maraging Steel                | May 97                     | 10   |
| ECRM 287-1(C) | High Boron Stainless Steel    | Jul 04                     | 10   |
| ECRM 292-1(C) | Nb Stabilized Stainless Steel | Nov 90                     | 10   |
| ECRM 295-1(C) | 4% Mo-Cr-Ni Steel             | Mar 95                     | 10   |
| ECRM 296-1(C) | Jethete Steel                 | Mar 97                     | 10   |
| ECRM 376-1    | 24% Co Magnet Alloy           | Nov 90                     | 11   |
| ECRM 451-2    | Austenitic Cast Iron          | Jan 99                     | 11   |
| ECRM 481-1    | Nodular Iron                  | Sep 10                     | 11   |
| ECRM 482-2    | Low Alloy Cast Iron           | Jan 19                     | 11   |
| ECRM 483-1    | High Duty Cast Iron           | Sep 03                     | 11   |
| ECRM 484-1    | Whiteheart Malleable Iron     | Mar 14                     | 11   |
| ECRM 486-1    | Foundry Iron                  | Mar 04                     | 11   |
| ECRM 489-1    | White Iron                    | Dec 91                     | 11   |
| ECRM 576-1    | Ferro-Niobium                 | Jul 14                     | 11   |
| ECRM 577-1    | Ferro-Vanadium                | Jul 14                     | 11   |
| ECRM 578-1    | Ferro-Molybdenum              | Mar 16                     | 11   |
| ECRM 579-1    | Ferro-Niobium                 | Jul 14                     | 11   |
| ECRM 580-1    | Ferro-Chromium                | Mar 16                     | 11   |
| ECRM 583-1    | Ferro-Manganese               | Mar 16                     | 11   |
| ECRM 584-1    | Ferro-Titanium                | Mar 16                     | 11   |
| ECRM 587-1    | Ferro-Boron                   | Mar 16                     | 11   |

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| ECRM 590-1 | Ferro-Tungsten             | Mar 91 | 11 |
| ECRM 676-1 | Iron Ore Sinter            | Mar 16 | 14 |
| ECRM 682-2 | Iron Ore                   | Apr 09 | 14 |
| ECRM 690-1 | Haematite Iron Ore         | Feb 13 | 14 |
| ECRM 776-1 | Firebrick                  | Aug 16 | 15 |
| ECRM 781-1 | Silicon Carbide Refractory | Mar 93 | 14 |
| ECRM 782-1 | Dolomite                   | Jul 96 | 15 |
| ECRM 783-1 | Tungsten Carbide           | Jul 05 | 14 |
| ECRM 879-1 | Basic Slag                 | Aug 16 | 14 |
| ECRM 884-1 | Furnace Dust               | Mar 11 | 14 |

| SPECTROSCOPIC STANDARD CRMs |  |                            |      |
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| SS-CRM 53,55,56             | Carbon Steels – Residual Series        | Jan 10                     | 17   |
| SS-CRM 70                   | Ferritic Stainless Steel               | Aug 13                     | 20   |
| SS-CRM 111/1                | Low Carbon Steel                       | Jan 18                     | 18   |
| SS-CRM 112-114              | Low Alloy Steels                       | Mar 14                     | 18   |
| SS-CRM 115                  | Calcium Treated Steel                  | Jun 16                     | 18   |
| SS-CRM 116                  | Calcium Treated Steel                  | Sep 17                     | 18   |
| SS-CRM 219/4                | Ni-Cr-Mo Steel                         | Apr 14                     | 18   |
| SS-CRM 222/1                | 3.5% Ni Steel                          | Dec 16                     | 18   |
| SS-CRM 225/2                | Ni-Cr-Mo Steel                         | Mar 14                     | 18   |
| SS-CRM 345                  | Nickel Alloy IN100                     | May 12                     | 21   |
| SS-CRM 346A                 | Nickel Alloy IN100                     | Oct 19                     | 21   |
| SS-CRM 350                  | Nickel Alloy IN713                     | Oct 19                     | 21   |
| SS-CRM 351                  | Nickel Alloy IN718                     | Nov 05                     | 21   |
| SS-CRM 351/1                | Nickel Alloy IN718                     | May 15                     | 21   |
| SS-CRM 363/1                | Monel Alloy 400                        | Apr 16                     | 21   |
| SS-CRM 387/1                | Nimonic 901 Alloy                      | Apr 16                     | 21   |
| SS-CRM 401/2                | Low Alloy Steel                        | Feb 19                     | 18   |
| SS-CRM 402/2, 404/2, 405/2  | Low Alloy Steels                       | Dec 05                     | 18   |
| SS-CRM 403/2                | Low Alloy Steel                        | Jun 15                     | 18   |
| SS-CRM 407/2                | Low Alloy Steel                        | Feb 06                     | 18   |
| SS-CRM 421-424              | Low Tungsten Steels                    | Jul 16                     | 18   |
| SS-CRM 432/1,434/1,435/1    | Plain Carbon Steels                    | Apr 16                     | 17   |
| SS-CRM 431/2-435/2          | Plain Carbon Steels                    | Sep 18                     | 17   |
| SS-CRM 456/2-460/2          | Carbon Steels - Residual Series (Gp B) | Jun 19                     | 17   |
| SS-CRM 462                  | Austenitic Stainless Steel             | May 16                     | 19   |
| SS-CRM 461/1, 462/1         | Austenitic Stainless Steels            | Jun 19                     | 19   |
| SS-CRM 463/1-465/1          | Austenitic Stainless Steels            | Jun 10                     | 19   |
| SS-CRM 466/2                | Austenitic Stainless Steel             | Jul 19                     | 19   |
| SS-CRM 467/1, 468/1         | Austenitic Stainless Steels            | Jun 10                     | 19   |
| SS-CRM 469-473              | Ferritic Stainless Steels              | Sep 10                     | 20   |
| SS-CRM 475                  | Stainless Steel                        | Sep 10                     | 19   |

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| SS-CRM 476                      | Mo-stabilized Stainless Steel     | Jul 19 | 19 |
| SS-CRM 479                      | Nb-stabilized Stainless Steel     | May 15 | 19 |
| SS-CRM 482/1-487/1 (less 484/1) | High-Speed Steels                 | Nov 13 | 20 |
| SS-CRM 492/3, 493/3             | High Manganese Steel (Cast)       | Jul 15 | 20 |
| SS-CRM 602/2-605/2              | Plain Carbon Cast Steels          | Jul 16 | 19 |
| SS-CRM 615/1                    | Low Alloy Cast Steel              | May 16 | 19 |
| ECRM 055-2(D)                   | 0.5% Carbon Steel                 | Sep 13 | 17 |
| ECRM 056-2(D)                   | 0.8% Carbon Steel                 | May 09 | 17 |
| ECRM 057-2(D)                   | 0.05% Carbon Steel                | Mar 99 | 17 |
| ECRM 058-2(D)                   | 0.15% Sulphur Steel               | Aug 02 | 17 |
| ECRM 059-2(D)                   | 0.7% Carbon Steel                 | Nov 02 | 17 |
| ECRM 064-2(D)                   | Nb/Ti Interstitial Free Steel     | Jul 13 | 17 |
| ECRM 084-1(D)                   | 0.4% Carbon Steel                 | Feb 00 | 17 |
| ECRM 085-1(D)                   | 0.3% Sulphur Steel                | Feb 03 | 17 |
| ECRM 086-1(D)                   | 0.7% Carbon Steel                 | Jan 01 | 17 |
| ECRM 087-1(D)                   | 0.15% Carbon Steel                | Aug 07 | 17 |
| ECRM 090-1(D)                   | 1% Carbon Steel                   | May 00 | 17 |
| ECRM 097-1(D)                   | High Purity Iron                  | Feb 98 | 18 |
| ECRM 097-2(D)                   | High Purity Iron                  | Jan 13 | 18 |
| ECRM 186-1(D)                   | Silico Manganese Steel            | Jul 08 | 18 |
| ECRM 195-1(D)                   | Cr-Mo-Ni Steel                    | Mar 92 | 18 |
| ECRM 272-1(D)                   | 12% Chromium Steel                | Jul 05 | 19 |
| ECRM 276-2(D)                   | 5% Cr-Mo-V Steel                  | Feb 93 | 19 |
| ECRM 285-2(D)                   | Maraging Steel                    | May 97 | 19 |
| ECRM 287-1(D)                   | High Boron Stainless Steel        | Jul 04 | 19 |
| ECRM 292-1(D)                   | Nb-Stabilized Stainless Steel     | Nov 90 | 19 |
| ECRM 295-1(D)                   | 4% Mo-Cr-Ni Steel                 | Mar 95 | 19 |
| ECRM 296-1(D)                   | Jethete Steel                     | Mar 97 | 19 |
| SCRM 652/4, 655/4               | Malleable Irons                   | Oct 17 | 21 |
| SCRM 656/9                      | Low Phosphorus Engineering Iron   | Oct 16 | 21 |
| SCRM 657/9                      | Low Phosphorus Engineering Iron   | Feb 19 | 21 |
| SCRM 658/12                     | Low Phosphorus Engineering Iron   | Dec 19 | 21 |
| SCRM 659/9                      | Low Phosphorus Engineering Iron   | Jun 14 | 21 |
| SCRM 660/10                     | Low Phosphorus Engineering Iron   | Nov 14 | 21 |
| SCRM 661/4, 662/4, 665/4        | High Phosphorus Engineering Irons | Oct 17 | 21 |
| SCRM 666/12                     | Ductile (Nodular) Iron            | Jun 13 | 21 |
| SCRM 667/13                     | Ductile (Nodular) Iron            | Jan 14 | 21 |
| SCRM 668/13                     | Ductile (Nodular) Iron            | Dec 15 | 21 |
| SCRM 669/14                     | Ductile (Nodular) Iron            | Aug 15 | 21 |
| SCRM 670/21                     | Ductile (Nodular) Iron            | Jun 19 | 21 |
| SCRM 671/1                      | Blast Furnace Iron                | Sep 16 | 21 |
| SCRM 672/1                      | Blast Furnace Iron                | Jan 12 | 21 |
| SCRM 673/1                      | Blast Furnace Iron                | Sep 16 | 21 |
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| SCRM 675                        | Blast Furnace Iron                | Jan 05 | 21 |

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| BCS-RM 190t                              | Benzoic Acid                        | Aug 04  | 16   |
| BCS-RM 190v                              | Benzoic Acid                        | Jul 14  | 16   |
| BCS-RM 192j                              | High Purity Tin (300g blocks)       | Jun 18  | 16   |
| BCS-RM 192j                              | High Purity Tin (millings)          | Jun 18  | 16   |
| BCS-RM 194e                              | High Purity Zinc (300g blocks)      | Jun 18  | 16   |
| BCS-RM 195g                              | High Purity Aluminium (300g blocks) | Jun 18  | 16   |
| BCS-RM 195g                              | High Purity Aluminium (millings)    | Jun 18  | 16   |
| BCS-RM 198f                              | Super Pure Aluminium (100g blocks)  | Jun 18  | 16   |
| BCS-RM 201a                              | Nepheline Syenite                   | Jul 18  | 16   |
| BCS-RM 202a                              | Plaster (Gypsum)                    | Jul 18  | 16   |
| BCS-RM 203a                              | Talc                                | Jul 18  | 16   |
| BCS-RM 204a                              | Zircon                              | Jul 18  | 16   |
| BCS-RM 205a                              | Borax Frit                          | Sep 18  | 16   |
| BCS-RM 210e                              | High Purity Lead (500g bars)        | Jun 18  | 16   |
| LARM 1-4                                 | Low Alloy Cast Irons                | Dec 17  | 22   |
| LARM 5/1                                 | Low Alloy Cast Iron                 | Aug 15  | 22   |
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| CRRM 5/2                                 | High Chromium Iron                  | Jul 19  | 22   |
| NCRM 1-5                                 | Nickel Chromium Irons               | Jul 18  | 22   |
| NIRM 1, 3, 4 & 7                         | Austenitic (Ni-Resist) Irons        | Jun 18  | 22   |
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| PBRM L21.01-2-L21.04-2                   | Lead Base Battery Alloys            | Mar 18  | 24   |
| SIMO 1/5                                 | Silicon Molybdenum Cast Iron        | Jan 19  | 22   |
| SIMO 2/3                                 | Silicon Molybdenum Cast Iron        | Aug 17  | 22   |
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| SUS D/11                                 | Low Alloy Steel                     | Aug 97  | 24   |
| SUS F/6                                  | Duplex Stainless Steel              | Feb 14  | 24   |
| SUS G/8                                  | Stainless Steel                     | Mar 18  | 24   |
| SUS 1/19                                 | Low Phosphorus Iron                 | Mar 08  | 24   |
| SUS 2/49                                 | Medium Phosphorus Iron              | Jul 19  | 24   |
| SUS 3/21                                 | High Phosphorus Iron                | Oct 14  | 24   |
| SUS 4/28                                 | Ductile (Nodular) Iron              | Jun 18  | 24   |
| SUS 5/56                                 | Ductile (Nodular) Iron              | Nov 18  | 24   |
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| CURM 09.03-4                      | Phosphorus Deoxidised Copper | Sep 03                         | 23   |
| CURM 30.05-4                      | Main Elements in Brass       | Jul 09                         | 23   |
| CURM 30.09-4                      | Main Elements in Brass       | Sep 03                         | 23   |
| CURM 30.11-4                      | Main Elements in Brass       | Sep 03                         | 23   |
| CURM 30.15-4                      | Main Elements in Brass       | Sep 03                         | 23   |
| CURM 30.16-4                      | Main Elements in Brass       | Sep 03                         | 23   |
| CURM 30.18-4                      | Main Elements in Brass       | Sep 03                         | 23   |
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| CURM 42.21-2                      | Admiralty & Naval Brass      | Jul 09                         | 23   |
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| CURM 42.25-2                      | Admiralty & Naval Brass      | Jul 09                         | 23   |
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| CURM 48.01-1                      | Cartridge Brass              | Sep 03                         | 23   |
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| CURM 50.01-5                      | Leaded Bronze                | Feb 18                         | 23   |
| CURM 50.02-4                      | Leaded Bronze                | Sep 03                         | 23   |
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| CURM 51.11-4                      | Aluminium Bronze             | Sep 03                         | 23   |
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| CURM 51.14-4                      | Aluminium Bronze             | Sep 03                         | 23   |
| CURM 52.52-5                      | Aluminium Bronze             | Mar 09                         | 23   |
| CURM 52.54-4                      | Aluminium Bronze             | Nov 08                         | 23   |
| CURM 54.01-4                      | Phosphor Bronze              | Sep 03                         | 23   |
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| CURM 71.33-8                      | Leaded Gunmetal              | Jul 09                         | 23   |
| CURM 71.34-8                      | Leaded Gunmetal              | Jul 19                         | 23   |

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