



**The Good Delivery Rules for Gold and Silver Bars
Specifications for Good Delivery Bars and Application Procedures for Listing**

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Preamble and Amendments

This edition of the Good Delivery Rules contains the following substantive amendments relative to the September 2014 version.

6.2 Annual Maintenance Fees: This section describes the revised annual fees for maintaining a refiner's Good Delivery listing and the discounts on membership fees for refiners which are LBMA Members or Associates.

7.4 General Description of Good Delivery Bars – Undercut: The description of the previous method of calculating undercut has been removed. The earlier method involved deducting the dimension of the bottom edge of the bar from the dimension of the top edge and dividing the result by the top edge dimension multiplied by one hundred to obtain the percentage undercut. This method is no longer used.

A summary of the main changes in the Rules since the first Gold List was issued in 1934 can be found at [http://www.lbma.org.uk/assets/market/gdl/GD Rule Changes - 1934 to date 20140912.pdf](http://www.lbma.org.uk/assets/market/gdl/GD_Rule_Changes_-_1934_to_date_20140912.pdf).

The LBMA recognises that in some instances Good Delivery refiners may need to comply with national standards regarding the production of gold and silver bars. In order to recognise such needs, the LBMA has tried, wherever possible, not to be too prescriptive in formulating these Rules and it is for this reason that some items in the Rules appear as non-mandatory recommendations which are intended to be merely guidance as to best practice.

1. Introduction

The list of acceptable refiners of gold and silver bars in the London bullion market, the "LBMA Good Delivery List", has been developed and is maintained by The London Bullion Market Association ("the LBMA") in order to facilitate the international distribution and acceptability on technical grounds of standard bars produced by those refiners:

- (a) who meet the criteria for inclusion in the list; and
- (b) whose bars have passed the testing procedures laid down by the LBMA.

Standard bars are bars of approximately 400 fine troy ounces for gold and approximately 1,000 troy ounces for silver. Bars are listed at the discretion of the Management Committee of the LBMA, which reserves the right to make any investigations that it deems appropriate into an applicant for listing.

An entry on the List relates to one refinery at one specific location. Separate applications are required if an applicant wishes to register bars produced in refineries situated at different locations.

If a company on the List wishes to change the location of its refinery or the dimensions of, or registered marks on, its standard bars, then it must inform the LBMA in advance, providing all appropriate details. Any change in a company's standard bars will trigger a requirement for the new bars to comply fully with the specifications on markings and dimensions described in sections 7 to 9.

If a company on the List is subject to a substantive change in its ownership or the technology used in refining, it must inform the LBMA accordingly. The LBMA reserves the right in such circumstances to ask the company to submit a new application.

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2. Criteria

The LBMA is unlikely to give favourable consideration to an application for listing unless the following criteria are met:

- (a) the applicant has been in existence for at least five years and has been involved in refining the metal for which it is applying for at least three years prior to the application;
- (b) the applicant has an established annual refined production (which need not be in the form of standard bars) of at least 10 tonnes in the case of gold and 50 tonnes in the case of silver;
- (c) the applicant has a tangible net worth equivalent to at least 15 million pounds sterling or such figure as the LBMA may from time to time determine;
- (d) the applicant's ownership, financial standing and reputation would allow it to satisfy the KYC (Know Your Customer) tests practised in the London bullion market; and
- (e) in the case of gold applications, the applicant must implement the LBMA Responsible Gold Guidance prior to accreditation (see Section 12).

The LBMA reserves the right to reject any application and is under no obligation to disclose the reason(s) for its decision.

The LBMA believes that the long-term viability of a refinery as well as its ability to meet the required standards of the Good Delivery List depend on it having a certain volume of production as well as a minimum tangible net worth. If a refinery suffers a substantial and sustained fall in refined production or tangible net worth relative to the quantities mentioned in paragraphs (b) and (c) above, it must inform the LBMA of the reasons for the fall and, if appropriate, the likely future development.

3. Procedure for Submission of an Application

An applicant company wishing to apply for Good Delivery status for its refinery must submit an application to the LBMA Executive using the application form given in Annex A. If an applicant company feels that it is in need of a significant degree of assistance in preparing its application it may wish to contact one of the Facilitators listed in Annex L. In such circumstances the applicant should approach a Facilitator directly to negotiate terms and fees for the provision of any assistance to be provided.

Applicants for gold accreditation must implement the LBMA Responsible Gold Guidance (see Section 12) and pass an audit prior to accreditation. Applicants can submit an application to initiate the process in advance of passing such an audit, but full accreditation will not be granted until a satisfactory Responsible Gold audit report has been provided to the LBMA.

The application must be accompanied by a number of documents (which are described in detail in Annex A). These should give a clear description of the ownership, operating history and financial position of the refinery, together with details of the Good Delivery bars produced. The documents include a letter attesting to the applicant's standing from the central bank of the country in which the refinery is located. If, however, the applicant's central bank is unwilling, as a matter of principle, to provide such a letter, then, by agreement with the LBMA, a letter of support from a suitable alternative organisation may be provided instead. Suitable organisations may include government ministries, industry trade associations or well-known commercial banks that are acquainted with the applicant's business and activities.

These documents are required firstly, to provide a general description of the operations at the refinery and the standing of the applicant company; and secondly, to ascertain the ownership structure and in particular to meet the compliance requirements for the setting up of a customer account for the applicant to facilitate the subsequent steps in the assaying of samples and the provision of bars for testing.

The Application Form also includes declarations relating to the applicant's willingness to (a) respond to any complaints from the market about the quality of its bars and (b) have the quality of its refining tested from time to time by the LBMA (by means of the Proactive Monitoring system, which is described in Annex I).

Documents must be provided in English. In the case of documents originally published in the applicant's local language, an English translation must be provided. Where copies of official

documents are to be provided, the LBMA may require such documents to be notarised by a public official.

The LBMA Executive will treat the production data and the contents of the video mentioned in Annex A as confidential. This information will normally only be examined by the LBMA Chief Executive and its technical consultant and, if necessary, by members of the Physical Committee. In no circumstances will the contents of the video be shown to the LBMA's referees.

See attached Annex J for an example of what the LBMA considers to be an acceptable technical line drawing of a bar and is required to be submitted with an application. Annex A describes the format of the drawing and also of the photographs of the bars that should be provided.

It should be noted that the application fee of £2,000 per metal + VAT at the applicable rate, must be paid at the time of the application, either in the form of an accompanying cheque in favour of The London Bullion Market Association or by direct bank transfer to the LBMA bank account including all bank charges. Details of the LBMA's bank account are given in Annex A. The LBMA will issue a corresponding receipt when the payment has been received (or if required, an invoice in advance). The application fee is non-refundable in the event that an application is unsuccessful, irrespective of the stage reached. Details of the other charges involved are given in Section 6.

The LBMA Executive will normally acknowledge receipt of the application within one working day. As soon as possible after receipt of the application, the LBMA Executive will decide on whether the application should be accepted for technical assessment. The LBMA Executive will normally consult members of the Physical Committee concerning the application and may, on matters relating to the tangible net worth of the applicant, consult the LBMA's accountants.

The LBMA reserves the right, where this is considered necessary, to arrange a short inspection visit before accepting an application for technical appraisal. The costs of the inspection visit, including business class flights, local subsistence and travel, must be paid for by the applicant. If, having considered all the information submitted, the Physical Committee agrees that the application meets all the relevant criteria and should therefore be processed further, the applicant will be so advised and will be required to undertake the following procedures for:

- (a) the examination of its assaying capability, and
- (b) the examination and testing of its bars.

Throughout the application process, the LBMA will act as the intermediary between the applicant and the referees (see list in Annex C) that will be used in the technical assessment stages. The LBMA will also keep accounts in respect of the charges for the two stages of the technical assessment and the bars that the applicant supplies for testing and any other costs involved. The applicant will not be informed of the identities of the referees carrying out the technical assessment and the referees will only be informed of the identity of the applicant when the application has been successfully completed and the applicant advised of the result.

4. Technical Assessment Procedure

4.1 Testing the applicant's assaying capability

The first stage of the testing procedure involves the applicant assaying reference samples provided by the LBMA. The reference samples have been manufactured by the LBMA's panel of referees and cross-checked assayed by at least two other referees. The reference assay values are calculated by the LBMA based on the assays performed on the samples by at least three of the referees.

The reference samples will comprise

- for gold, twenty four samples of approximately 5 grams each within the approximate range 995.0 to 999.9 parts per thousand and
- for silver, ten samples of approximately 30 grams each within the approximate range 999.0 to 999.9 parts per thousand.

To initiate the testing phase, the LBMA will request the applicant to pay the Stage 1 fee shown in the Table in section 6. This covers the costs of the reference samples, including the value of the contained gold and/or silver and the LBMA's administrative costs. However, the costs incurred

by the LBMA of shipping the samples to the applicant will be charged to the applicant in addition to the fees shown. In order to ensure safe delivery of the samples to the applicant's refinery, the LBMA will, in general, use the services of a security transport company to ship the samples.

When the payment for the Stage 1 fee has been received by the LBMA, the reference samples, each identified by a code number, will be sent to the applicant by the LBMA.

The applicant is required to assay the samples and send a report of its results by email and fax to the Chief Executive of the LBMA. Once the samples have been received by the refinery, the report must be submitted:

- within ten local business days in the case of gold; and
- within five local business days in the case of silver.

Failure to submit the report within this time-frame may result in the application being rejected with the forfeiture of the fees paid.

The assay report should list the reference numbers and show the assay determined for each sample to five significant figures and the applicant's interpretation of the assays to four significant figures, according to the rules shown below.

For the purpose of rounding five-figure assays to four figures, the following principle should be observed (except in the three cases shown below). If the fifth significant figure is a six or greater, then the fourth significant figure should be rounded up by one.

- The first exception is that assays of 999.86 to 999.89 should not be rounded up to 999.9 and should be reported as 999.8.
- Similarly assays of 994.96 to 994.99 should not be rounded up to 995.0 and should be reported as 994.9. Thus bars within this range would be below the minimum assay for acceptability.
- Finally, an assay of 999.96 or above should not be rounded up and should be reported as 999.9.

The assay report should also state which method of assaying has been used. It should be noted that the LBMA's referees normally use direct determinations of the assay contents of their gold samples (i.e. corrected fire assay) though in the case of higher purity alloys with assays of 999.5 and above, they may also use spectrographic analysis. Applicants may use alternative methods of assaying if they are confident that they are accurate over the whole range of Good Delivery gold alloys. In the case of the assaying of silver, where spectrographic methods are generally used, oxygen and nitrogen should be ignored when deducting the sum of the impurities from 1000 (in other words, these gases should be treated as silver). Refiners who use spectrographic methods to determine the assay value should submit a full elemental analysis using an Excel spreadsheet for each sample. Annex M shows the residual elements that LBMA referees will look for in carrying out spectrographic analyses of gold and silver.

All applicants, including those whose standard production is at the 999.9 level, must be able to demonstrate their capability to assay across the range permitted for Good Delivery bars, i.e. approximately 995.0 to 999.9 for gold and 999.0 to 999.9 for silver.

In order to pass the assay test on the samples, the criteria shown below should be met. These are shown in terms of fineness (parts per thousand).

- (a) assays of 999.5 and above should agree to ± 0.05 ; for example, the assay determined on a sample with a reference value of 999.84 would have to fall within the range 999.79 to 999.89;
- (b) assays of less than 999.5 should agree within ± 0.15 ; for example, the assay determined on a sample with a reference value of 996.73 would have to fall within the range 996.58 to 996.88.

However, it will be deemed acceptable if there are not more than a total of three divergences in the case of gold and two divergences in the case of silver from paragraphs (a) and (b) above, provided that all such divergences are no greater than ± 0.25 and that there is no significant bias in the set of results. The final decision by the LBMA on whether an applicant has passed the assay

test will be based on an examination of all assay results. In marginal cases, the LBMA may request to see the detailed results of all the trials carried out.

When determining the assay of sample bars using spectrographic methods, the applicant is responsible for identifying all impurity elements contained therein which will determine the final assay. The LBMA does not prescribe detailed procedures or criteria for assaying bars using spectrographic methods but Annex M lists the elements that LBMA Referees will typically determine.

4.2 Submission and testing of sample bars

If the test of the applicant's assaying ability is satisfactory, the applicant will be requested by the LBMA to pay the Stage 2 charges shown in section 6 and then to submit eleven gold and/or silver bars to the LBMA's duty and VAT-free warehouse in London ("the nominated vault"). These bars must conform generally to the specifications and standards laid down by the LBMA (see Sections 7 to 9 below).

Weight lists accompanying bars (whether for commercial shipments or for bars submitted by applicants) must be provided in a machine-readable electronic form, such as an Excel spreadsheet or a file using comma-separated variables. Bar weights must be shown in troy ounces. Metric weights may be shown on the weight list but if so, they must also be converted to and shown in troy ounces by using the methods shown in Annex H.

There are special requirements for bars submitted for testing

- (a) One of the bars should be stamped with the identifying stamp of the refinery and other marks as listed in sections 8 and 9 below.
- (b) The remaining ten bars should only be stamped with an identifying code provided by the LBMA (such as LBMA14-1-) plus a number from 1 to 10. The code will be supplied to the applicant by the LBMA.
- (c) Although the permitted weight ranges for commercial shipments of gold and silver bars are quite wide (see Sections 8 and 9 below), the sample bars submitted by the applicant for examination and testing purposes should, unless specifically agreed by the LBMA, be within the weight range of 395 to 405 troy ounces for gold and 900 to 1050 troy ounces for silver.
- (d) Annex H shows the format for both commercial weight lists and the different arrangement of the weight lists accompanying the eleven bars submitted by an applicant for accreditation. In the latter case the weight list should show:
 - for **gold**, the bar number, brand, gross weight, fineness (to five significant figures and the equivalent rounded to four significant figures) and fine weight in troy ounces; and,
 - for **silver**, the bar number, brand, gross weight, and fineness (to five significant figures and the equivalent rounded to four significant figures)

Usually the bars must be received by the LBMA's nominated vault within four weeks of the applicant being requested to submit them. Failure to submit the bars within this time-frame may, in the absence of specific agreement by the LBMA, result in an application being terminated with the forfeiture of the fees paid.

The applicant is required to insure the bars on a vault-to-vault basis and is recommended to use one of the LBMA carriers in the United Kingdom (see list at Annex E), for transporting the bars from the point of entry into the United Kingdom to the nominated vault. All transportation and insurance costs are payable by the applicant.

The LBMA's nominated vault will check-weigh the sample bars against the accompanying weight list. A representative of the LBMA will check the bars against the photograph and scale technical drawing submitted with the application (see Annex A) and, together with two representatives of the clearing vaults, will then carry out an initial visual examination of the bars. If found to be satisfactory, five of the unmarked sample bars will then be sent for testing to each of two referees appointed by the LBMA.

The two referees will independently examine the bars. The first phase of testing involves visual inspection, weighing and assaying of cut and / or drill samples taken from each of the bars. The referees will then perform full melt assays on four of the five bars, holding one bar each in reserve.

In addition to these tests, the referees will carry out a full spectrographic analysis on a cut sample of the remaining un-melted bar, in order to determine the levels of impurities and thence to give an opinion on whether any of these are present in amounts that would be considered deleterious. The LBMA does not set maximum acceptable levels for impurities but seeks to ensure that they are within appropriate limits and the referees' reports will include their evaluation of the impurities found in this regard.

5. Results

An applicant must satisfy the Physical Committee that it has met all the above criteria and testing requirements before it can be included in the list of acceptable refiners.

When the Physical Committee has approved an application for listing, the LBMA Executive will inform the applicant. The Executive will arrange for the applicant's details to be included on the Good Delivery List and will prepare and send to the applicant a certificate marking its acceptance onto the List.

6. Charges and Accounting

6.1 Application Fees

Fees are levied by the LBMA for a Good Delivery application to cover the costs of the LBMA and the work of the referees. Such fees may be reviewed by the LBMA at any time but not retrospectively once an application has commenced. Currently the total fee, excluding VAT, amounts to £25,540 for gold and £19,100 for silver. The fees are payable in three tranches:

Fees Payable by Good Delivery Applicants (in £ sterling – subject to VAT where indicated)

Fees (all fees are payable to the LBMA)	Gold	Silver
On Application (plus VAT at the applicable rate)	2,000	2,000
Stage 1: Assay Test (not normally subject to VAT)	10,440	4,000
Stage 2: Testing of Applicant's bars (not normally subject to VAT)	13,100	13,100
Total	25,540	19,100

The above-mentioned fees are payable in advance at each stage. The fees shown for Stage 1 cover the cost of the samples (including their metal content) provided to the applicant but not the cost of shipping incurred by the LBMA (which will be charged in addition to the fees shown). In the event of an applicant not progressing to the next stage, for whatever reason, no part of the fees already paid is refundable. But in such situations, no fees are payable for the next stage.

Once the tests have been completed, the after-melting weight and fine troy ounce content for gold or troy ounce content for silver of the sample bars supplied by the applicant will be notified to the applicant by the LBMA. By separate arrangement with the LBMA, the gold or silver may be sold and the proceeds credited to the applicant. Alternatively, an equivalent weight of gold or silver can be made available to the applicant (subject to the settlement of all outstanding fees) on a loco London basis by book transfer through the London bullion market clearing mechanism.

Concerning the 11th bar, which will have been retained in the nominated vault in London, it should be noted that this is not considered to be LGD even if the applicant has been accredited. Similar arrangements for selling the metal content may be made or alternatively, the applicant can arrange to collect it from the vault.

6.2 Annual Maintenance Fee

In order to maintain its accreditation, each refiner on the Good Delivery List must pay an annual maintenance fee to the LBMA (of £8,000 per metal or £12,000 if a refiner is listed for both gold and silver). Refiners which are either Members or Associates will receive a discount of 50% on

the respective membership fees of £8,000 per year for Membership and £5,000 per year for Associateship. All the above amounts are subject to UK Value Added Tax where applicable.

7. General Specifications for Good Delivery Bars

The LBMA's recommended specifications for Good Delivery bars are shown below. Detailed requirements for gold and silver Good Delivery Bars are given in the Sections 8 and 9 respectively. The LBMA considers that the appearance of bars is important, firstly because of the technical reasons described below and secondly because the maintenance of high standards of surface finish indicates a good level of quality control in general. A poor bar appearance might, on the other hand, suggest that standards of refining or assaying are less than desired. The decision on whether a bar meets the physical standards of the London bullion market is the responsibility of each vault's vault manager, who has complete discretion in relation to the bars which should be accepted. The LBMA facilitates a consistent approach to such decision-making by arranging regular meetings of the vault managers and by providing guidance to allow them to distinguish between, on the one hand, minor imperfections, and on the other, serious defects which require the bar to be rejected.

7.1 Changes to Bar Dimensions or Marks

A refiner intending to change either the marks on the bars or the bar dimensions must give the LBMA at least one month's notice of the change and provide a technical drawing of the proposed new bar and the date on which it is intended to be introduced. When the drawing has been approved and the bar has gone into production, the refiner must send to the LBMA electronic images of the new bar in plan and perspective views. See Annex A for a description of the required drawing and photographs.

The bar dimensions shown in sections 8 and 9 are mandatory for new refiners. For refiners already listed whose bars were produced prior to January 2008 and are outwith these dimensions, their bars will continue to be acceptable. However, if a refiner wishes to change either the dimensions or marks on the bars, it must ensure that the new bars have dimensions within the ranges specified. If a refiner is only intending to change the marks without changing the dimensions, the LBMA will allow it a grace period of 6 months to change the dimensions so that existing moulds can be used while new moulds are obtained.

7.2 Quality Control

If bars are delivered into the London market and the recipient vault is of the opinion that the bars do not conform to the above requirements, the recipient vault may ask the LBMA to appoint independent inspectors to examine the bars and express an opinion as to whether the bars are acceptable for Good Delivery purposes. For the avoidance of doubt, any proposed recipient of bars has, irrespective of any view expressed by an inspector on the condition of a bar, the absolute right to refuse to accept delivery of a bar if its vault manager considers that the bar does not meet the Good Delivery standards as set out in these Rules.

7.3 Non-Good Delivery Bars

If bars are produced in the general form of Good Delivery bars, but due to their intended use (for example bars produced for and delivered directly to an industrial customer for use as a raw material) they do not meet the Good Delivery specifications (for example, inferior appearance or sub-standard bar marks) then the Good Delivery refiner must stamp the bars NGD (meaning Non Good Delivery) in close proximity to the LBMA-approved manufacturer's mark.

7.4 General Description of Good Delivery Bars

Weighing: Bars should be weighed in accordance with the procedure laid down by the LBMA (see Annex G "Weighing, Packing and Delivery Procedures for Gold and Silver Bars")

Casting Method: Bars must be produced in graphite or cast iron moulds, either by the conventional method of pouring molten metal into them or alternatively, by melting grain in an induction tunnel system. Silver bars may also be produced using continuous casting. Existing GD refiners wishing to convert to the use of the above-mentioned non-conventional methods of bar production must submit a proposal to the LBMA for consideration prior to implementation. The

LBMA may then request that two bars cast using the induction tunnel system must be sent to London for visual inspection. Once the bar inspection is complete the bars may then be sent to the Referees for further analysis to ensure that the bars meet the specifications in the Good Delivery Rules. The refiner must pay for the LBMA's costs in the examination and testing of the bars.

Shape: Bars must be ingot-shaped (i.e., having a trapezoidal cross section, both along the length and across the width of the bar) with sufficient undercut to facilitate handling but without resulting in the width of the bottom surface being so narrow that the bar cannot be safely stacked. Bars cast in open moulds should be produced at a single pouring. Bars must be easy and safe to handle. Refiners must also ensure that their bars will stack safely when considering the dimensions of their proposed GD bar. Proper stacking and handling of a bar will be taken into consideration during bar inspections. It is important that the edges of the bars must not be sharp, so as to avoid the risk of injury during handling.

Undercut: The undercut refers to the degree of slope on the side and ends of the bar and is represented by the angle of deviation from the vertical of the side and end surfaces.

Appearance: Bars must be of good appearance. Faults that must be avoided, especially on the top surface of a bar, are irregularities such as surface cavities, cracks, holes or blisters (debris and water can accumulate in such irregularities which can affect the weight of the bar and, accumulated water can cause an explosion when the bars are melted) and excessive shrinkage (i.e. the concavity of the top face of the bar and any concentric cooling rings must not be such that it makes it difficult to either apply or read the bar marks or in the case of concavity bars become unstable when stacked on top of each other). The sides and bottom (smaller) surface should be flat and reasonably smooth (which does not imply the need for a mirror-like finish) and free from cavities, lumps and excessive layering. Layering is considered to be excessive if it can result in dust or dirt being trapped and thus affecting the recorded weight of a bar. In the case of new production of gold bars, hammering is not acceptable, as are any attempts to conceal defects i.e. burnishing. In some cases the use of a ball pein hammer to flatten a sharp protrusion may be considered acceptable. In the case of new production of silver bars, it is recognised that a small degree of hammering or other surface treatment is sometimes required but such hammering should not affect the markings or shape of the bar.

Marks: Gold bars must be marked on the larger of the two main surfaces (the cast surface at the top of the mould) using conventional (pressure) stamping or dot matrix (pneumatic punching) provided always that if pneumatic punching is used, the marks must be no less clear and at least as durable as if conventional stamping had been used. Silver bars may alternatively be marked on the end of the bar if marked using a dot matrix method so that the marks can be read from the top edge downwards (see attached Annex K). Existing Good Delivery Refiners intending to change to dot matrix marking should notify the LBMA and send a new drawing and photo in advance together with the date from which the new marking method will be used. Failure to provide this graphical material in advance may result in bars being rejected on arrival at a London vault. For refiners whose bar dimensions are currently not compliant with the LBMA's recommended sizes, changing from pressure to dot-matrix marking will trigger a requirement for bars to be brought within the recommended dimension range. Refiners must apply a consistent font to all digits of the assay mark.

The marks should include the stamp of the refiner (which, if necessary for clear identification, should include its location), the assay mark (where used), the fineness, the serial number (which must not comprise of more than eleven digits or characters) and the year of manufacture as a four digit number unless incorporated as the first four digits in the bar number. If bar numbers are to be reused each year, then it is strongly recommended that the year of production is shown as the first four digits of the bar number although a separate four digit year stamp may be used in addition. If bar numbers are not to be recycled each year then the year of production must be shown as a separate four digit number. Marks should be clear and the height of characters used should be a minimum of 12 mm.

Weight Stamps: It is strongly recommended that weights should not be stamped on Good Delivery bars, however if bars are so stamped, the unit of weight must be shown. The reason for this recommendation is that when bars are weighed in London by an LBMA approved weigher their weights, which may be different from those determined by the original refiner, will prevail, and also any adjustment to the weight of a bar caused by future handling or sampling would necessitate alteration to the mark.

8. Specifications for a Good Delivery Gold Bar

The physical settlement of a loco London gold trade is a bar conforming to the following specifications:

- Weight:** minimum gold content: 350 fine troy ounces (approximately 10.9 kilograms)
maximum gold content: 430 fine troy ounces (approximately 13.4 kilograms)
- The gross weight of a bar should be expressed in troy ounces, in multiples of 0.025, rounded down to the nearest 0.025 of a troy ounce.
- Dimensions:** the permitted dimensional ranges for a Good Delivery gold bar are as follows:
Length (Top): 250 mm +/- 40 mm Undercut: 5° to 25°
Width (Top): 70 mm +/- 15 mm Undercut: 5° to 25°
Height: 35 mm +/- 10 mm
- Fineness:** the minimum acceptable fineness is 995.0 parts per thousand fine gold.
- Marks:** Serial number (see additional comments in section 7 above)
Assay stamp of refiner
Fineness (to four significant figures)
Year of manufacture (see additional comments in section 7 above)

9. Specifications for a Good Delivery Silver Bar

The physical settlement of a loco London silver trade is a bar conforming to the following specifications:

- Weight:** minimum gross weight: 750 troy ounces (approximately 23 kilograms)
maximum gross weight: 1100 troy ounces (approximately 34 kilograms)
- However, it is recommended that ideally refiners should aim to produce bars within the following weight range;
- minimum gross weight: 900 troy ounces (approximately 28 kilograms)
maximum gross weight: 1050 troy ounces (approximately 33 kilograms)
- Bars produced prior to 1st January 2008 having a weight in the former wider range of 500 to 1250 troy ounces will continue to be acceptable for the time being though it is expected that these will eventually be phased out when the number of such bars in the London vaults has declined to nearly zero.
- The gross weight of a bar should be expressed in troy ounces in multiples of 0.10, rounded down to the nearest 0.10 of a troy ounce.
- Dimensions:** the permitted dimensional ranges for a Good Delivery silver bar are as follows:
Length (Top): 300 mm +/- 50 mm Undercut: 5° to 15°
Width (Top): 130mm +/- 20 mm Undercut: 5° to 15°
Height: 80 mm +/- 20 mm
- Fineness:** the minimum acceptable fineness is 999.0 parts per thousand silver.
- Marks:** Serial number (see additional comments in section 7 above)
Assay stamp of refiner
Fineness, expressed to either three or four significant figures
Year of manufacture (see additional comments in section 7 above)

10. Proactive Monitoring

The LBMA operates a system of monitoring the quality of the production and assaying ability of refiners on the Good Delivery List. This involves refiners providing on request a dip sample from a normal production melt which will be check-assayed by one of the LBMA's referees. Special arrangements apply to gold refiners which only produce and market "four-nines" gold.

All current Good Delivery refiners are also required to submit their production and audited financial data on an annual basis to the Executive. The minimum requirement for a company's Tangible Net Worth is £15million.

Normally refiners will be subject to full technical monitoring as described above once every three years. A newly listed refiner would not normally be monitored within the first three years of being listed. Annex I - "Proactive Monitoring Procedures and Criteria" describes the operation of the system in detail.

11. Retesting of Bars

The LBMA reserves the right when appropriate to ask refiners on the Good Delivery List to submit bars for testing if, in its opinion, a refiner is unable to demonstrate the required competence in assaying (as revealed by the proactive monitoring system) or if the appearance of a refiner's bars gives cause for concern. At its discretion, the LBMA may request a refiner to send two bars to a London vault for inspection and testing.

11.1 Testing Method

The methods of inspection and testing specified in section 4.2 of these Rules will generally be followed.

11.2 Charges

The refiner will be required to pay for the cost of insurance and shipping the bars to the London vault. If a subsequent inspection by a panel of clearing vaults or other specialists appointed by the LBMA is satisfactory, the LBMA will charge the refiner the sum of £2,000 plus VAT as applicable. However, should the vault inspection indicate the need for further testing of the bars by the LBMA's referees, then an additional charge of up to £8,000 plus VAT as applicable will be levied to cover the cost of shipping the bars to the referees and the testing of the bars by the referees.

12. LBMA Responsible Gold Guidance

Since January 2012, the LBMA requires that all LBMA Good Delivery Gold Refiners comply with the LBMA Responsible Gold Guidance (RGG), which aims to ensure that the London Market is free from metal that has financed conflict or been used for money laundering or terrorist financing. Potential applications should review the LBMA RGG for the detailed process (which is described on the LBMA Website). It should be understood that the audits under the LBMA RGG should be:

- carried out by an independent third party auditor who is also on the LBMA Recommended Service provider list; and
- submitted prior to accreditation and then thereafter the audit should be carried out every year and the report submitted to the LBMA, within three months of the close of the applicant's financial year.

13. Further Information

Any questions or requests for further information about the Good Delivery List, specifications or application procedures should be addressed to the Chief Executive of the LBMA.

Annex A – Application Form for Good Delivery Listing

GOLD/SILVER †

Name of Refinery.....

Address of Refinery

.....
.....
.....

Name of Company and address of Head Office if different from those of Refinery

.....
.....
.....
.....

Contact name, title and address to which correspondence should be addressed

.....
.....
.....
.....

Telephone No: Fax No:

E-mail:.....

† Delete as applicable.

Please complete a separate Application Form for gold and silver if both metals are applied for.

See overleaf for documents and payment to be enclosed.

Documents and other information to be enclosed

Unless otherwise specified, the documents must be in English and if provided as a translation into English, they should in each case be authenticated, in a manner acceptable to the LBMA, as being a true translation of the original document.

Unless otherwise specified, the documents must be in English and if provided as a translation into English, they should in each case be authenticated, in a manner acceptable to the LBMA, as being a true translation of the original document.

1. A letter of support from the applicant's central bank, attesting to the financial standing of the applicant. If it is not possible to obtain such a letter, the applicant should explain the reason for this and provide an equivalent letter of support from a suitable alternative organisation (to be approved in advance by the LBMA) such as a government ministry or a major, well-known, commercial bank.
2. Certificate of Incorporation (or Certificate of Trade)
3. Latest published annual report and audited financial statements for the most recently available annual accounting period. If these documents are not officially published in English, a translation of the following into English should be provided:
 - Auditor's letter approving the Accounts
 - Balance Sheet
 - Profit and Loss Account
4. Description of the structure of the Company's ownership, including:
 - List of five principal shareholders, with their addresses and shareholdings
 - List of all directors
5. History and description of the company's business and refining operations, including:
 - exact location of refining plant
 - history of refining operations at the plant
 - a general description of the main sources of feedstock
 - a brief description of the main refining processes used
 - a general description of the main customers for the refinery's main products
 - a description of the methods and equipment used for assaying gold and/or silver
6. Figures for the last three years' annual production of refined¹* gold/silver in tonnes.
7. Estimate of next two years' annual production of refined* gold/silver in tonnes.
8. Illustrations of the gold/silver Good Delivery bar as follows;
 - An electronic high quality high resolution coloured digital image in the form of a jpg file (pixel dimensions should be in the order of 2700 by 1800) showing the detailed bar marks on the face of the bar, the bar marks should be clear and in focus
 - An electronic high quality high resolution coloured digital image in the form of a jpg file (pixel dimensions should be in the order of 2700 by 1800) showing the bar in three dimensional view with the bottom surface of the bar uppermost
 - Three high quality hard copies of each of the above (**not copies reproduced on ordinary quality paper using an inkjet printer**) or alternatively three high quality colour photographs (size 18 cm x 12 cm) showing the face of the bar and three dimensional view as described above
 - a fully dimensioned, black and white scale technical drawing on A4 size paper and in PDF format. This should show the location of the marks on the main surface and a detailed view of the marks. The drawing should include the height of the characters used for the bar number, assay and year marks. The drawing

¹ * 'Refined' refers to metal which has gone through a refining process, such as electrolysis, Miller Process or Aqua Regia refining.

must also include the radius measurements for any rounded corners or edges. Where bottom edges have rounded edges, the width and length measurements must be measured to the theoretical sharp edges. (see Annex J as an example)

- a detailed description of the applicant's logo appearing on the bars explaining what the individual characters and / or symbols represent
 - a statement confirming whether bar numbers are re-cycled each year and an explanation of what the individual digits within the bar number represent.
9. Short DVD film (of approximately 10 minutes) showing the premises, equipment and refining operations used in the refinery. This should show in detail the process of casting large bars (including the pouring of the metal, the removal of the bar, a view of the top surface of the as-cast bar and any subsequent surface treatment). The footage of the assaying laboratory should show the equipment used for both instrumental and manual methods. The commentary or sub-titles must describe clearly in English the images that are being shown.
 10. Sterling cheque for £2,000 per metal, plus VAT (as applicable) in favour of the London Bullion Market Association or confirmation of the payment direct to the LBMA's bank account.
 11. For Gold Applicants, a letter on company headed paper confirming that the applicant has read and understood the content of the LBMA's Responsible Gold Guidance (which can be found on the LBMA website) and that it will arrange for a third party audit of its compliance prior to accreditation being granted.

DECLARATION

(To be signed by a Director/Authorised Officer of the Applicant, as appropriate.)

To: The London Bullion Market Association

We confirm that we have read the LBMA paper on The Rules for Good Delivery Gold and Silver Bars which sets out the specifications and procedures applied by the LBMA for the examination of the assaying capability and the testing of bars of Applicants for Good Delivery status. We also agree that this procedure should be applied to assess our melting and assaying capability and that, in order to be included by the LBMA in the list of Acceptable Refiners, we must satisfy the Management Committee of the LBMA that we have met the criteria and requirements of the tests laid down in the Procedures.

We agree to pay the initial application fee of the LBMA with this application, and those fees subsequently payable during the course of the testing procedures whether or not our application is successful.

We agree that if accepted onto the Good Delivery List, we will respond appropriately to any complaints from the market about the quality of our bars.

We agree that if accepted onto the Good Delivery List, we will submit to regular proactive monitoring.

Please declare (a) or (b)

- (a) We are not a Member or Associate of the LBMA and agree to the payment of an annual monitoring fee in respect of continuing membership of the Good Delivery List
- (b) As a Member/Associate of the LBMA, we understand that the annual Good Delivery List monitoring fee will be included as part of the annual charge for Membership/Associateship

For and on behalf of:

.....

(Name of Applicant Company)

Signature of Director/Authorised Officer.....

Name in BLOCK letters

Date.....

This application, together with all supporting documents, should be sent to:

The Chief Executive
The London Bullion Market Association
1-2 Royal Exchange Buildings
London EC3V 3LF
United Kingdom

LBMA Bank Account Details:
HSBC Bank plc, 28 Borough High Street, London, SE1 1YB
Account Name: London Bullion Market Association
Current Account Number: 72017180
Sort Code: 40-06-21
IBAN Code GB87MIDL40062172017180
BIC Code MIDLGB22

Annex B – LBMA Vaults

The term “LBMA Vault” refers to a Market Making Member of the LBMA which also provides bullion vaulting and clearing services to third parties. It should be noted that the LBMA does not approve physical vaults which may be used by the market.

Annex F lists the companies which have been approved as weighers by the LBMA.

Inclusion in this list does not constitute or imply any representation or warranty by the LBMA as to creditworthiness or as to the services or goods supplied or quality or compliance with any specification relating thereto. No liability for direct or consequential loss, howsoever caused, whether by negligence or otherwise, whether by use of this list or reliance thereon, is accepted by the LBMA.

Company	Address
HSBC Bank USA NA London Branch	8 Canada Square London E14 5HQ
JP Morgan Chase Bank	25 Bank Street Canary Wharf London, E14 5JP
The Bank of Nova Scotia – Scotia Mocatta	201 Bishopsgate, 6th Floor London EC2M 3NS
UBS AG	100 Liverpool Street London EC2M 2RH

Annex C – Approved Good Delivery Referees

The following companies have been appointed as Referees to the LBMA Good Delivery system.

Inclusion in this list does not constitute or imply any representation or warranty by the LBMA as to creditworthiness or as to the services or goods supplied or quality or compliance with any specification relating thereto. No liability for direct or consequential loss, howsoever caused, whether by negligence or otherwise, whether by use of this list or reliance thereon, is accepted by the LBMA.

Company

Argor-Heraeus SA

Metalor Technologies SA

PAMP SA

Rand Refinery Limited

Tanaka Kikinzoku Kogyo K.K.

Annex D – Approved Good Delivery Supervisors

The following companies have been appointed as Supervisors to the LBMA Good Delivery system. The role of Supervisors in the Good Delivery system is to witness dip sampling operations for Proactive Monitoring and to report on these to the LBMA.

Inclusion in this list does not constitute or imply any representation or warranty by the LBMA as to creditworthiness or as to the services or goods supplied or quality or compliance with any specification relating thereto. No liability for direct or consequential loss, howsoever caused, whether by negligence or otherwise, whether by use of this list or reliance thereon, is accepted by the LBMA.

Company	Address	Contact Details
ALS Inspection (Formerly Stewart Group Inspection and Analysis)	Caddick Road Knowsley Business Park Prescot L34 9HP United Kingdom	T: +44 (0) 151 632 9248 F: +44 (0) 151 548 0714 Email: david.pownall@alsglobal.com Email: paul.scales@alsglobal.com
Alex Stewart International	20 Sefton Business Park, Aintree, Liverpool, Merseyside, L30 1RD United Kingdom	T: +44 (0) 151 525 1499 F: +44 (0) 1708 472 914 Email: andy.smith@alexstewartinternational.com aemans@alexstewartinternational.com (Audrey Emans)
Inspectorate International Limited	2 Perry Road Witham Essex CM8 3TU United Kingdom	T: +44 (0) 1376 536 800 F: +44 (0) 1376 520 819 Email: paul.alston@uk.bureauveritas.com

Annex E – List of Security Transport Companies**List of Security Transport Companies that are Members of the LBMA**

Inclusion in this list does not constitute or imply any representation or warranty by the LBMA as to creditworthiness or as to the services or goods supplied or quality or compliance with any specification relating thereto. No liability for direct or consequential loss, howsoever caused, whether by negligence or otherwise, whether by use of this list or reliance thereon, is accepted by the LBMA.

Company	Contact Details
Brink's Ltd	Tel: +44 (0) 20 8818 0659 Fax: +44 (0) 20 8818 0692 Contact name: Mr Tony Evanson Email: tony.evanson@brinksglobal.com
G4S International	T: +44 (0) 20 7933 9220 F: +44 (0) 20 7283 9258 Contact name: Mr Stefan Dingeldein Email: Stefan.dingeldein@g4si.com
Malca-Amit Commodities Ltd	T: +44 (0) 20 8814 9850 F: +44 (0) 20 8814 9855 Contact name: Mr Allan Finn Email: allan.finn@malca-amit.com
Loomis International Ltd (Formerly Viamat)	Tel: +44 (0) 1932 230130 Fax: +44 (0) 1932 230231 Contact name: Mr Graham Tuck Email: zzz_mb_londonoperations@int.loomis.com

Annex F – Approved Weighers of Gold and Silver Bars

The following is a list of weighers of gold and silver bars whose weighing facilities, procedures and capability meet the standards required by the LBMA.

It should be noted that the LBMA does not approve vaults and that inclusion in the Approved Weighers List relates solely to the weighing by the entities listed of large gold and silver bars according to the standards laid down by the LBMA.

Inclusion in this list does not constitute or imply any representation or warranty by the LBMA as to creditworthiness or as to the services or goods supplied or quality or compliance with any specification relating thereto. No liability for direct or consequential loss, howsoever caused, whether by negligence or otherwise, whether by use of this list or reliance thereon, is accepted by the LBMA.

Company	Address
Bank of England (Gold only)	Threadneedle Street London EC2R 8AH
Brink's Ltd	<i>Available on request</i>
ICBC Standard Bank Plc	20 Gresham Street London EC2V 7JE
G4S Cash Solutions (UK) Ltd	<i>Available on request</i>
HSBC Bank USA London Branch	Level 4 8 Canada Square London E14 5HQ
Malca-Amit Commodities Ltd	<i>Available on request</i>
JP Morgan Chase	25 Bank Street, Canary Wharf, London, E14 5JP
Loomis International Ltd (Formerly Viamat)	<i>Available on request</i>

Annex G – Weighing, Packing and Delivery Procedures

1. Weighing procedures

(a) Gold

Bars are weighed on either a beam balance or an electronic balance.

Beam Balance

Bars are weighed on a beam balance using brass or stainless steel weights of various sizes that are regularly inspected by the Inspector of Trading Standards. It is also acceptable to use an equal-arm magnetically damped precision balance or a modification unit to add magnetic damping to an existing beam balance.

If brass weights are used it is expected as a minimum requirement that a 400 troy ounce stainless steel weight is regularly used to cross-verify the accuracy of the 400 troy ounce brass weight. It is increasingly being recognised in the market that brass weights are susceptible to wear and tear and are not as accurate on an ongoing basis as stainless steel weights. The LBMA therefore recommends that, for the weighing of gold, all weights up to 50 ounces and the 400 ounce weight should be of stainless steel in preference to brass.

It is the practice of the LBMA and the London market to weigh gold bars in multiples of 0.025 of a troy ounce and therefore this is the smallest weight used.

For a gold bar to ‘turn the scale’ it is necessary for the bar to cause the indicator needle on the beam balance to move a minimum of two divisions in favour of the bar when the correct weight is placed on the scales.

A division on a gold beam balance corresponds to 0.001 of a troy ounce. A gold bar must therefore weigh at least 0.002 of a troy ounce over the stated multiple of 0.025 for a bar to be said to ‘turn the scale’.

If a bar does not ‘turn the scale’ then the weight is reduced by 0.025 of a troy ounce.

While it is recognised that other procedures for weighing exist, the above procedure will be used in determining the weight of gold bars delivered into the London market.

Electronic Balance

Where an electronic balance is used for weighing gold bars it should comply with the following criteria.

1. Capable of weighing Good Delivery gold bars, as defined by the LBMA, in the weight range 350 oz tr* (10.886 kg) to 430 oz tr (13.375 kg). The weighing range shall not be reduced by the weight of the impact protection boss mentioned below; i.e. tare range shall be 100% of the weighing range
2. The scales shall be capable of being CE marked in accordance with all applicable European Council Directives
3. Verification scale interval (e) \leq 0.1 g
4. Readability (d) \leq 0.01 g
5. Uncertainty of calibration measurement less than 0.05 g
6. The readability division (d) values must be capable of being presented on a digital electronic output device (e.g., RS232C, USB) after legal verification of the scales
7. Capable of displaying the converted metric weight into oz tr in digital intervals no larger than 0.0005 oz tr
8. The conversion factor shall be 1 oz tr = 31.1034768 g which is the accepted legal metrology factor
9. The Accuracy Class (according to European Council Directive 2009/23/EC) shall be Class I
10. The scales shall be capable of being adjusted and calibrated by users by the application of a 400 oz tr stainless steel Class F1 weight. The weight’s value shall be able to be input digitally in kg

11. The scales shall have internal calibration masses to enable automatic or semi-automatic adjustments/calibrations
 12. It shall be possible to adjust the notional value of the internal masses by input of the measured value in kg from a calibration certificate of stainless steel weight. The nominal value of the weight will be 400 oz tr.
 13. It shall be possible to switch off/on the automated function of the internal masses
 14. The scales shall have a flat-topped impact protection boss, approximately 80mm in diameter, onto which gold bars can be placed for weighing
 15. The impact protection boss shall be the only part of the scales exposed to the live weighing activity
 16. The scales' weighing parts shall be protected against the influences of drafts
 17. The scales shall be capable of verification at least within the range 15 to 25 degrees Centigrade
 18. It shall be possible to separate the scale indicator/keyboard from the weighing platform so that vibrations are not transmitted to the platform when the keyboard is used
 19. The scales shall be provided with an internal, legal-for-trade alibi memory for saving the weight (kg), date, time, serial or batch number and transaction number
 20. Scales to be compliant with European standard EN 45501 and OIML International Recommendation R76
 21. The scales' weighing mechanism shall be rugged and capable of withstanding weighing of multiple tons of bars every working day
 22. Average stabilisation time for each weighing 1.0 seconds
 23. Average response time 1.5 seconds
 24. Electrical power requirement shall be 230VAC or 115VAC +15%, -20%
 25. Ingress Protection to IP20
 26. Warm-up time after connection to power ≤ 2 hours
- * oz tr is the legal metrology abbreviation for troy ounce

(b) Silver

Bars are weighed on an electronic balance.

Electronic balance

Electronic balances used for weighing silver bars should comply with the following criteria.

1. capable of weighing silver from 500 ounces to 1,250 troy ounces;
2. European Union Verification interval no greater than 0.1 troy ounce;
3. readability less than 0.1 troy ounce;
4. internal calibration weight which can be activated automatically or via keyboard – calibration should be undertaken on a daily basis;
5. maximum eccentricity error not greater than 0.02 troy ounce;
6. maximum linearity deviation not greater than 0.02 troy ounce;
7. repeatability not greater than 0.02 troy ounce;
8. uncertainty of calibration measurement less than 0.05 troy ounce;
9. capable of Weights and Measures Verification for weighing silver (i.e. a Class I or II balance/scale having a National or EU Type approval certificate);

An electronic balance should remain powered continuously. If for any reason the balance has been disconnected from the mains or switched off, it should not be used until it has been powered for at least one hour.

Electronic balances used for weighing silver generally show the weight in troy ounces to two decimal places. Because of the uncertainty in the second decimal digit, the recorded weight will be reduced to the next lower 0.1 troy ounce division if the second decimal is less than 5. Thus a

bar showing a weight of 1000.95 on the scale would be recorded as 1000.9 troy ounces) whereas a bar showing as 1000.94 would be recorded as 1000.8. See annex H for examples of how the London weight is determined.

2. Delivery and Packing

The LBMA recommends the following good market practice for delivery and packing.

Gold and Silver

A buyer or other party taking delivery of metal may not, in the absence of express contrary agreement with the party making the delivery, stipulate any particular brand when taking delivery.

If a tendered brand meets the specifications for Good Delivery but does not suit the requirements of the party looking to take delivery, then, in the absence of express contrary agreement with the party making delivery, the party looking to take delivery will be responsible for meeting the cost of melting and/or refining.

Bars not conforming to the specifications set out in Sections 7, 8 and 9 of these rules may be sold or delivered on the market, but the party delivering such bars will be responsible for meeting the cost of making them Good Delivery.

All physical metal delivered into, or within, the London market should be packed in a safe manner on a suitable pallet, normally constructed of sturdy wood that is in a good, safe condition. Such pallets should have the following dimensions, length 700mm, width 600mm height 150mm and the wood should be at least 25mm±3mm thick and a gap of at least 100 mm is also required to allow standard fork lifting equipment to move the loaded pallet. Each pallet should be capable of carrying one ton (the recommended maximum per pallet) and the pallets should be capable of being stacked six pallets high. All pallets should be heat treated, fumigated and carry a mark to prove this without which the pallets could be rejected by customs. Plastic pallets and pallets constructed from dry, brittle or poor quality timber are not considered suitable. Bars should be adequately strapped so that if being moved and brought to a sudden halt or subjected to a sudden change of direction the bars will not topple with the forward or sideways generated momentum. It is preferable that the bars are protected with bubble wrap, corrugated cardboard or similar material, to prevent bars rubbing together when in transit. It is not necessary to wrap bars individually.

Gold bars should, if packed individually or two bars to a box, be packed in wooden, plastic or fibre boxes and strapped to a pallet whilst in transit. Each box should have a unique reference number. Alternatively gold bars may be packed, maximum 40 bars (approximately 500 kilos) on a pallet having been placed in a plastic box (sometimes referred to as a “tote”). The box should be nailed to the base of the pallet with the lid having holes to accommodate metal pull-tight seals at each corner to seal the box. Suitable metal or nylon banding should be used to band the box itself.

With silver no more than 20 tonnes should be loaded in any single container.

In all cases, the packing of Good Delivery bars should be kept to a sensible minimum in order to prevent time-consuming unpacking of deliveries.

Bars should ideally be packed in the order in which they appear on the relevant weight list.

Weight lists (in the approved format described in Annex H) must be machine readable (eg in the form of an Excel spreadsheet or a .csv file). Weight lists should be dated and indicate whether the metal has been weighed by an approved LBMA weigher.

A copy of the weight list should be attached to the bars. The inclusion of such a list should be taken as confirmation that the bars have been weighed in accordance with the London Weighing Procedures.

If the bars have not been weighed by an LBMA approved weigher, the party taking delivery may charge the party delivering the bars for weighing at a rate to be mutually agreed.

A London vault-holder shall have the absolute right to decide who is permitted access to its premises to collect or deliver bullion bars. A party arranging to deliver or collect bars from a London vault should advise the vault-holder of the vehicle registration and driver's identity. The

party giving up control of the bars shall be entitled to a receipt in respect thereof in the absence of express written agreement to the contrary.

If the above criteria are not met the London vault-holder shall be entitled to reject or refuse delivery, any costs associated therewith being for the other party's account.

3. LBMA Approved Weighers

The LBMA has drawn up and maintains a list of Approved Weighers, (see Annex F).

If a weighing dispute should arise, it will be referred by the Physical Committee to an LBMA approved weigher not associated with the dispute who will express a non-binding view as to who is responsible for any weight difference.

4. Further information

Any questions or requests for further information about the weighing, packing and delivery procedures for gold and silver bars should be addressed to the Chief Executive of the LBMA.

Annex H – Weight Lists

This Annex shows the form of weight lists that should accompany shipments of GD bars to London vaults. The form of listing used for bars which are being submitted as part of an application for GD accreditation differs from that used for commercial shipments as shown below.

It is important that weight lists show the correct number of decimal places for the weights and assays.

Commercial Weight Lists

GOLD

Serial Number	Brand Code	Gross weight (troy ounces ⁽¹⁾)	Assay	Fine Weight (troy ounces ⁽¹⁾)
123456	ABC	401.125	995.8	399.440

SILVER

Serial Number	Brand Code	Gross Weight (troy ounces ⁽¹⁾)	Assay ⁽²⁾
234567	XYZ	1,164.9	999.0

Weight lists accompanying bars (whether for commercial shipments or for bars submitted by applicants) must be provided in a machine-readable electronic form, such as an Excel spreadsheet or a file using comma-separated variables.

Notes Applying to both Gold and Silver:

- (1) In cases where the refinery weighs in kilograms, the weight list must show how the troy ounce equivalents are calculated using the method of conversion to gross and fine troy ounces shown overleaf. This uses the standard LBMA conversion factor of 1 troy ounce = 0.0311034768 kg.
- (2) In the case of commercial shipments of silver bars, the fineness marked on the bar and shown on the weight list should be in the same format (for example, whether 999.0, 999 or 999.9).

If the weight is measured in troy ounces, it is not necessary to show the kilogram equivalent. However, if the company weighs in kilograms, the weight list should show how kilogram weights have been converted to troy ounces using the method of conversion on the following pages using the standard LBMA conversion factor of 1 troy ounce = 0.0311034768 kg. The spreadsheet for making these conversions can be found in the Good Delivery section of the LBMA website.

Application Weight Lists

For Good Delivery Applications, the weight list should show both the four and five figure assay values of the bars. This is to allow comparison to be made between the assays determined by the applicant and the LBMA's referees.

The fully marked bar submitted by silver applicants should show the fineness as it would appear on commercial bars as described above (eg, 999.0, 999 or 999.9).

The fineness on gold bars with assays even marginally below 999.9 or 99.50 must not be rounded up. Similarly for silver bars at the 999.0 level.

Good Delivery applicants who initially weigh their bars in kilograms should submit a weight list which is based on the templates shown in the following pages of this Annex (in other words showing how the equivalent troy ounce weight has been calculated).

Vault Weights versus Refinery Weights

The algorithms shown on the following pages show how to convert metric to troy ounce weights and also how a troy ounce dead-weight should be converted to a final London weight. However, in cases where the refiner's weight differs from that determined by the vault, the latter will be used for recording the troy ounce weight of the bar.

Annex H (continued)– Sample Weight Lists and Conversions to troy ounces

The following tables show how to calculate the gross troy ounce (GTO) weight based on a metric weight and in the case of gold, also the rounded fine troy ounce (FTO). The table below also shows how to convert an electronic troy ounce deadweight (eg in column (3)) to London GTO and FTO weights.

Gold

Brand	Bar No.	Col(1)	Col(2)	Col(3)	Col(4)	Col(5)	Col(6)	GTO Col(7)	Col(8)	Col(9)	Col(10)	Col(11)	FTO Col(12)	
		Metric Weight	Initial Conversion	Col (2) truncated to 0.001	Col (3)-0.002 for turning the scale	Col (4)/ 0.025	Col (5) truncated	Col(4) truncated to 0.025	Assay	Col(7)*Col(8) Unrounded fine weight	Col (9) Truncated to 3 decimals	Col(9)-col(10) *1,000,000 Rounding factor	Rounded Fine Weight	Notes
		kg	tr oz	tr oz	tr oz	0.025 tr oz	0.025 tr oz	tr oz		tr oz	tr oz		tr oz	
XYZ	1	12.4360	399.8267	399.826	399.824	15992.96	15992	399.800	0.9958	398.120840	398.120	840	398.120	The initial conversion is truncated to 399.826 so deducting 0.002 gives a value of 399.824 in col (4) so the bar is marked down to 399.800.
XYZ	2	12.4423	400.0292	400.029	400.027	16001.08	16001	400.025	0.9958	398.344895	398.344	895	398.344	The figure in col(9) is not rounded up to 398.345 as the rounding factor <900
XYZ	3	12.4345	399.7786	399.778	399.776	15991.04	15991	399.775	0.9958	398.095945	398.095	945	398.096	The figure in col(9) is rounded up to 398.096 because the rounding factor is >900

Notes:

1. If the weight is initially measured in troy ounces, it is not necessary to show columns (1) and (2). A deadweight in troy ounces to three decimal places could be placed in column (3).
2. When the original weight is measured in kilograms, the figure in column (2) is calculated by dividing the kilogram weight in column (1) by the conversion factor 1 troy ounce = 0.0311034768 kg.
4. The figure in column (3) is derived from column (2) by truncating to the nearest 0.001 troy ounce.
5. The figure in column (4) is derived by subtracting 0.002 troy ounces from the figure in column (3). See Section 1(a) of Annex G on weighing procedures.
6. The figure in column (6) is derived by truncating the figure in column (5) down to the nearest 0.025 troy ounces.
7. The figure in column (7) is derived by multiplying the figure in column (6) by 0.025. It is thus gives the London gross troy ounce (GTO) weight of the bar.
8. The unrounded fine weight in column (9) is calculated as the product of columns (7) and (8). The assay in column (8) must be shown to 4 decimal places.
9. If the rounding factor shown in column (11) is 900 or more, the truncated fine weight – shown in column (10) - is increased by 0.001 to give the rounded fine troy ounce (FTO) weight in column (12). The factor in column (11) is derived from the 4th, 5th and 6th decimal digits of the figure in column (9).

Good Delivery Rules

Annex H – Sample conversion of metric to troy ounce weights for GD bars

Silver

		Col(1)	Col(2)	Col(3)	Col(4)	Col(5)	Col(6)	
Brand	Bar No.	Metric	Initial Conversion	Col(2) rounded to nearest 0.01	Col (3) truncated to nearest 0.1	(Col(3)-Col(4))*100 (Rounding factor)	Gross troy ounce (GTO) weight	Notes
		kg	troy ounce	troy ounce	troy ounce	0.01 tr oz	troy ounce	
XYZ	1	33.1159	1064.70091	1064.70	1064.7	0	1064.6	Gross Weight is truncated down to 1064.6
XYZ	2	33.1161	1064.70734	1064.71	1064.7	1	1064.6	Although the initial rounding up gives 1064.71, the Gross Weight is reduced by 0.1 to 1064.6 because the rounding factor<5
XYZ	3	33.1172	1064.74270	1064.74	1064.7	4	1064.6	The initial rounding gives 1064.74, and the Gross Weight is reduced by 0.1 because the rounding factor<5
XYZ	4	33.1173	1064.74592	1064.75	1064.7	5	1064.7	The initial conversion to 1064.74592 is rounded up to 1064.75 and the bar is not marked down to 1064.6 as the rounding factor >=5.

The table above shows how to convert an exact weight of a silver bar in kilograms to gross troy ounces. It also shows how an electronic balance deadweight in troy ounces (in column 3) would be converted to a London GTO weight.

Notes:

1. If the weight is measured in troy ounces, it is not necessary to show the kilogram equivalent.
2. When the original weight is measured in kilograms, the figure in column (2) is calculated by dividing the kilogram weight by the conversion factor 1 troy ounce = 0.0311034768 kilograms.
4. The figure in column (3) is derived from column (2) by rounding it to the nearest 0.01 troy ounce using the normal rule of rounding up if the third decimal before any rounding is 5 or greater.
5. The figure in column (4) is derived by truncating the figure in column (3) to the nearest 0.01 troy ounce.
6. The figure in column (5) is the difference between the figures in columns (3) and (4) multiplied by 100.
7. The rounding factor shown in column (5) is used to determine if the figure in column (4) should be reduced by 0.1, namely if the rounding factor is less than 5.

Annex I – Proactive Monitoring – Procedures and Criteria

1. Introduction

Proactive Monitoring (“PAM”) of refiners on the LBMA Good Delivery (“GD”) List was introduced in January, 2004. Since then, all refiners that have been accredited for at least three years have been subjected to full monitoring on one or more occasions. The system of monitoring is designed mainly to provide reassurance to purchasers about the quality they can expect from GD bars.

With effect from 1st January, 2012, all current Good Delivery refiners are required to submit their refined production and audited financial data on an annual basis to the Executive. The minimum requirement for a company’s Tangible Net Worth was increased to £15million on 1st January, 2012. Existing Good Delivery refiners which do not meet the criterion will be allowed a period of two years (namely until 31st December 2013) to bring their tangible net worth up to the new level.

The main method of monitoring requires the refiner to submit a dip sample for testing by one of the LBMA’s GD referees. The referees are all GD refiners of both gold and silver, who have previously demonstrated to the LBMA’s satisfaction a very high level of accuracy in the assaying of gold and silver. They also manufactured sets of reference samples which are free from detectable inhomogeneity and whose assay values were established to high levels of accuracy by means of an extensive programme of cross-checking. All GD refiners (including referees) will be monitored once every three years.

2. Notice to Refiners about Monitoring

The LBMA Chief Executive will send a letter to the LBMA contact at the refiner concerned (with a copy via email) informing it that proactive monitoring of its gold and/or silver production is to take place within a period of one month. The LBMA is willing to be flexible on the time allowed for arranging the monitoring operation, if for example this is affected by holiday periods or other enforced shutdowns.

The monitoring operation will normally begin with the taking of a dip sample from a production melt, this operation being witnessed by a representative of an LBMA-approved Supervisor (see the list in Annex D). Refiners that are on both the gold and silver Lists will be required to undergo monitoring for both metals at the same time (for instance, with the procedures described below being carried out on the same or successive days).

There are special arrangements for the monitoring of gold refiners whose production technology involves only “four-nines” gold. As described in Section 2.3 below, the monitoring of these refiners may involve them testing a set of six reference samples provided by the LBMA.

3. Dip Sampling

3.1 Appointment of Supervisor

A refiner being monitored by the dip sampling method should, in the first place, appoint a supervisor from the LBMA-approved list to witness and report to the LBMA about the sampling operation. The list includes the internationally recognized assaying and inspection companies which are within the LBMA Membership. These companies have local representatives or laboratories around the world.

The costs and expenses of the supervisor must be paid by the refiner. The supervising company will charge a fixed fee (currently US\$1,250) for each dip sampling operation monitored, unless specifically agreed otherwise, plus travelling and subsistence expenses incurred by its representative. Thus, the expenses chargeable by the supervising companies will depend on the locations of their representative offices relative to that of the refiner.

3.2 Witnessing of Dip Sample

The melt from which the dip sample is taken should have a fineness in the range of 999 or above for silver and between 995.0 and a maximum of 999.0 for gold.

The sample should be taken from a normal production melt and the operations leading up to the actual casting of the sample must be witnessed by the supervisor. The refiner should be confident about what the melt contains and that it is homogeneous before taking the dip sample. The dip sample should be taken at the final stage of production, that is, just before casting.

The purpose of taking the dip sample is to provide sufficient homogeneous material to provide the samples to be assayed by the refiner and the LBMA's referees, together with enough spare samples in case of various eventualities (such as a sample being lost in the post).

The actual method of taking and casting the dip sample can be either of the following.

(1) The refiner may use a standard LBMA mould (which will be brought to the refinery by the supervisor). This consists of a two-part cast iron mould which produces a casting with dimensions of

- for silver: 60 mm in width, 6 mm in thickness and 100 mm in height;
- for gold: 60 mm in width, 6 mm in thickness and 50 mm in height.

The refinery should have a guillotine or shear available which can be used to crop 5 mm from each edge. In the case of silver, the cropped casting should then be cut into 8 pieces of approximately 25 x 22.5 mm each (giving a sample weight of around 35 grams). In the case of gold, the guillotine should be used to cut off eight samples of approximately 10 grams each.

(2) The refiner can use its normal method of dip sampling, provided that this will produce the necessary samples for fire assay (in the case of gold) and, in the case of silver, for spectrographic analysis, including by spark OES which requires a plate type sample of dimensions approximately 25 x 25 mm).

The supervisor will report to the LBMA using a standardised format including information on:

- the use to which the refined metal will be put,
- the raw materials used,
- the processes leading up to the sample being taken,
- the method of dip sampling employed and,
- in the case of bars which are to be numbered, the numbers of the bars produced.

3.3 Treatment of the Dip Samples

Two of the eight samples will be sealed and sent by the supervisor to the LBMA. One will be left with the refiner for assaying and five will be sealed by the supervisor and left with the refiner as reserves.

Refiner Assay

The sample left with the refiner by the supervisor should be assayed by corrected fire assay in the case of gold and by an appropriate spectrographic method of analysis in the case of silver. The number of individual fire assay trials to be carried out is not specified by the LBMA but is instead left to the refiner, according to its normal practice. For gold fire assays, the report should include the individual trial results expressed to five significant figures of fineness and the mean of the trial results, also to five figures. The assay results should be presented in an Excel spreadsheet and submitted by email to the LBMA Executive within four working days after the dip sampling.

The method of assaying must be stated in the report (including the type of spectrographic testing used for silver). In the case of the assaying of silver by spectrographic methods, oxygen and nitrogen should be ignored when deducting the sum of the impurities from 1000 (in other words, these gases should be treated as silver).

When determining the assay of dip samples using spectrographic methods, the applicant is responsible for identifying all impurity elements contained therein which will determine the final assay. The LBMA does not prescribe detailed procedures or criteria for assaying by means of spectrographic methods but Annex M lists the elements that LBMA Referees will typically determine.

The report on a silver dip sample should include the elemental analysis as well as the silver assay obtained by difference for all trials.

The LBMA Chief Executive will treat the information provided by the refiner in strict confidence. In particular, no information which could be used to identify the refiner will be provided to the referee(s) that will assay the dip sample. However, at the conclusion of the Proactive Monitoring the assays of the refiner and referee will be sent (anonymously, via the Executive) to each other.

Referee Assay

On receipt of the two samples by the LBMA, both samples will be sent according to a rota to two of the LBMA's referees who will be asked to assay the sample they receive to five significant figures. It should be noted that the referees will not be aware of the identity of the refiner that provided the samples. For gold, the referee will carry out at least 6 trials by means of corrected fire assay and will include the results in the report sent to the LBMA. In the case of silver, the referee will normally use one or other spectrographic analysis method and determine the silver assay by difference (with dissolved gases such as oxygen counting as silver). The referee will provide to the LBMA the elemental analysis of the dip sample as well as the silver assay obtained by difference.

If the assays of the refiner and referees fail to agree within the tolerances described in Section 3 below, the refiner will also be asked to unseal one of the spare samples, carry out an assay on it and submit a new assay report to the LBMA within five working days.

4. “Four-Nines” Gold refiners

The LBMA considers that all refiners on the Good Delivery Gold List must be able to assay across the full range of Good Delivery alloys (namely a fineness range from 995.0 to 999.9) most of which can only be accurately assayed using the method of corrected fire assay. At the top end of this range, on the other hand, spectrographic methods can provide assays of the necessary precision and accuracy. In that these high-gold alloys can be thus assayed without requiring the use of fire assaying, they cannot be used to demonstrate that the refiner is able to assay over the full range of Good Delivery alloys. For refiners where the production technology (as well as the products marketed) only involve gold of fineness 999.9 and above, it is recognised that it would be disruptive and onerous for them to have to produce a special low gold content alloy for the purposes of LBMA monitoring. A refiner which, for the reasons described above, is unable to provide a gold dip sample with a fineness of less than 999.0, may instead opt to have an alternative form of monitoring, whereby the LBMA will send it a set of six approximately 5-gram reference samples for the refiner to assay using the corrected fire assay method. On receipt of the samples, the refiner must submit to the LBMA within six working days a report showing the mean assay of each sample to five significant figures.

5. Assessment Criteria and Further Testing

The refiner's mean assay value (in the case of dip samples) and detailed trial results (in the case of the four-nines gold procedure) will be assessed by the LBMA Executive as described below. In cases where the refiner is deemed to have failed, the mean assays and the standard deviations of the assay results may be viewed by members of the LBMA Physical Committee (each of whom is bound by confidentiality in relation to the data provided by refiners being monitored).

The criteria are shown below. The tolerances on assaying shown here are expressed in terms of fineness (parts per thousand). Thus, for instance, ± 0.10 for an assay of, say, 998.55 means a range of fineness from 998.45 to 998.65.

5.1 Consideration of Assays from First Dip Samples

The criteria used for assessing the assays on the dip samples provided are based on those contained in the Good Delivery Rules for new applicants. The refiner's and referees' assay results on the two dip samples provided by the refiner will be assessed as follows:

Full pass – In the case of gold, where the dip sample must have a fineness of less than or equal to 999.0, agreement between the referee's and refiner's assays within ± 0.15 will be regarded as a full pass with no further testing being required. In the case of silver, where the fineness of the dip sample can be in the range from 999.0 to 999.9+, different criteria apply depending on whether the sample's fineness (as assayed by the referee) is above or below 999.5. Above 999.5

agreement within ± 0.05 will be regarded as a full pass while below 999.5 agreement within ± 0.15 will be regarded as a full pass.

Borderline failure – i.e., agreement in the range $\pm 0.16-0.25$ (or for silver samples of fineness of 999.5 and above, agreement in the range $\pm 0.06-0.15$). This will require that the refiner be asked to assay one of the spare samples which have been sealed and left at the refinery by the supervisor. On receiving the assay results from the refiner, the LBMA Executive will compare all of the results once again and, if necessary taking technical advice, decide on whether the results are acceptable. If they are not, the refiner will be asked to arrange for a new dip sample to be witnessed within one month and provide a further two samples for testing by the LBMA's referees.

Fail – i.e. a divergence of >0.25 (or for silver samples of fineness of 999.5 and over, a divergence of >0.15). In this case, the refiner would be required to provide a further two samples from a new witnessed dip sample within one month.

5.2 Cases where a Second Dip Sampling Operation is Required

In general, two different referees will assay the second pair of samples compared to those that assayed the first samples. The LBMA will assess the results based on the criteria described above but taking into account all the assay results provided by the refiner and the referees. If necessary after taking advice from its technical consultant, the LBMA will then decide on one of the following courses of action.

- The refiner will be informed that it has passed the monitoring test.
- The refiner will be asked to assay a set of LBMA reference samples as described in Section 8.2 below (under similar conditions as for a new applicant for Good Delivery accreditation).

In the latter case, the LBMA will assess the assay report subsequently provided by the refiner and decide whether:

- The refiner has satisfied the criteria and will therefore be informed that it has succeeded in passing the monitoring test, or
- The refiner will be required to undergo a full re-application for Good Delivery accreditation.

In the latter case, except in cases of gross failure, the refiner will normally continue to be listed until the results of the re-application are available.

5.3 Criteria for Assays provided by “Four-Nines” Gold refiners

In the case of the “Four-Nines” gold refiners which opt to be monitored by means of assaying a set of six LBMA reference samples, the criteria for passing the test are similar to those applicable in the case of new applicants for listing.

- assays of 999.5 and above should agree to ± 0.05 ; for example, the assay determined on a sample assaying 999.84 according to the LBMA referee would have to fall within the range 999.79 to 999.89
- assays below 999.5 should agree within ± 0.15 provided that no significant bias is apparent; for example, the assay determined on a sample assaying 996.73 according to the LBMA referee would have to fall within the range 996.58 to 996.88.

However, it will be deemed acceptable if there is not more than one divergence provided that this is not greater than ± 0.25 .

6. Conclusion of Monitoring

The LBMA Executive will inform the refinery of the outcome of the assay comparisons as soon as they have been reviewed by the LBMA's Physical Committee. A table showing the comparison of the mean assay values will be provided to the refiner and the referees which participated on an anonymous basis. The LBMA will provide the refiner with a certificate confirming the success of the Proactive Monitoring exercise.

7. Provision of Comparisons of Assay Results

Proactive Monitoring is designed to assist the refining industry to maintain the highest standards in the assaying of gold and silver bullion. To this end the Executive will provide, to the refiner and the referee, the relevant fire assay determinations of the other party on an anonymous basis. For silver dip samples the Executive will provide guidance to the refiner about the differences between its analysis and that of the referee by highlighting any elements which are found in noticeably higher concentrations.

8. Charges for Reference Samples and Re-Testing

In cases where the comparison of the refiner's and referees' dip sample assay results suggests the need for the refiner's assaying ability to be more thoroughly checked by means of it assaying a small set of reference samples, as described above, there will be an additional charge as follows:

- (a) Set of six approximately 5-gram gold samples at a price of £2,790 including the value of the metal content, plus VAT (as applicable)
- (b) Set of six approximately 30-gram silver samples at a price of £2,490 including the value of the metal content, plus VAT (as applicable)

The cost of shipment of these samples to the refinery will be payable in addition.

The same charge as in (a) above will be made for "Four-Nines" gold refiners which opt for the testing of a set of LBMA gold samples.

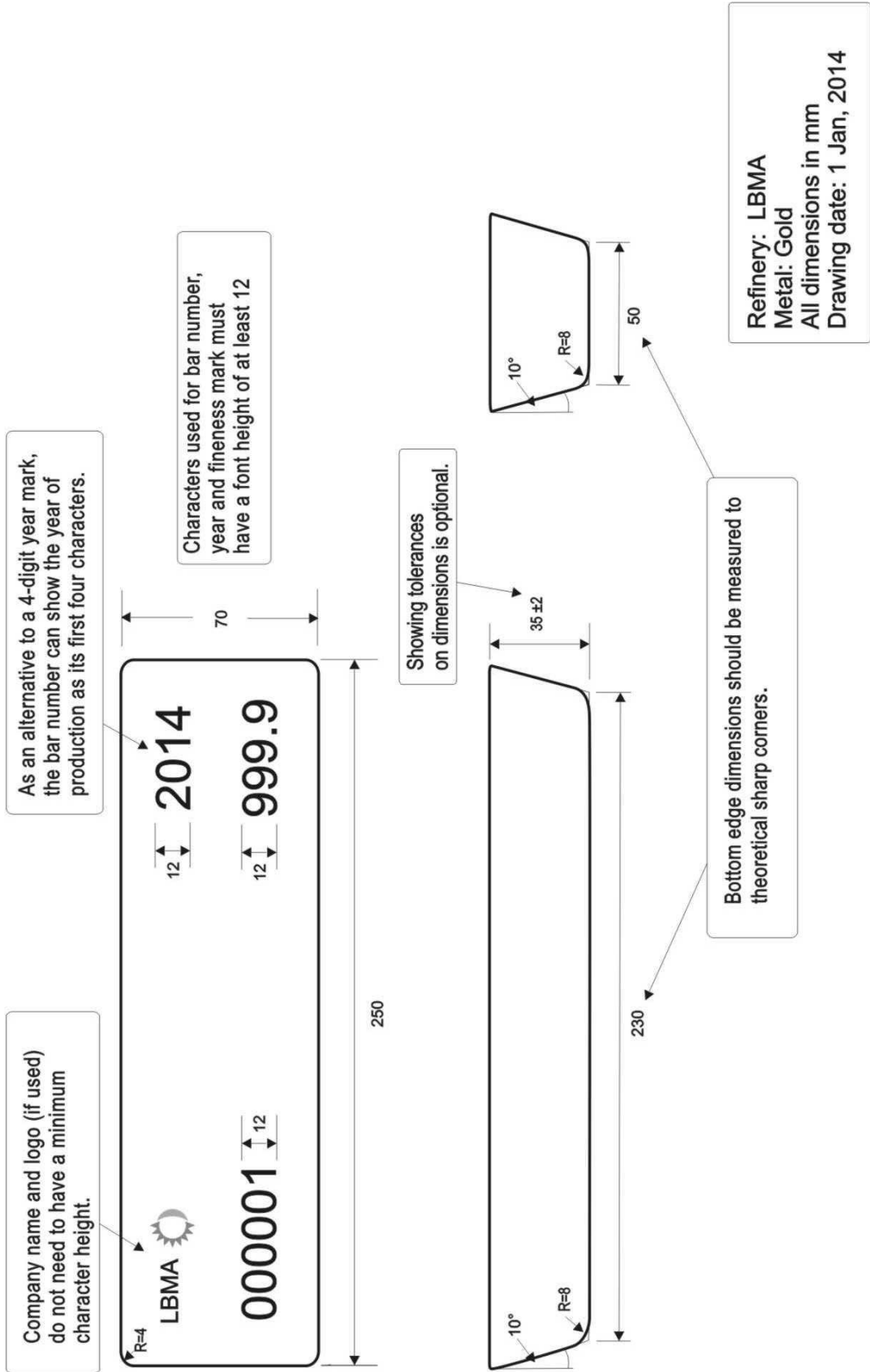
The additional charge for a complete reapplication and re-test of the refiner's assaying ability and bars would be the same as for new Good Delivery applicants (see Section 6 of the Good Delivery Rules: currently a total of £25,540 in the case of gold and £19,100 for silver – both subject to VAT as applicable).

Annex J – Specimen Technical Line Drawings

(1) 400 Ounce Gold Bar

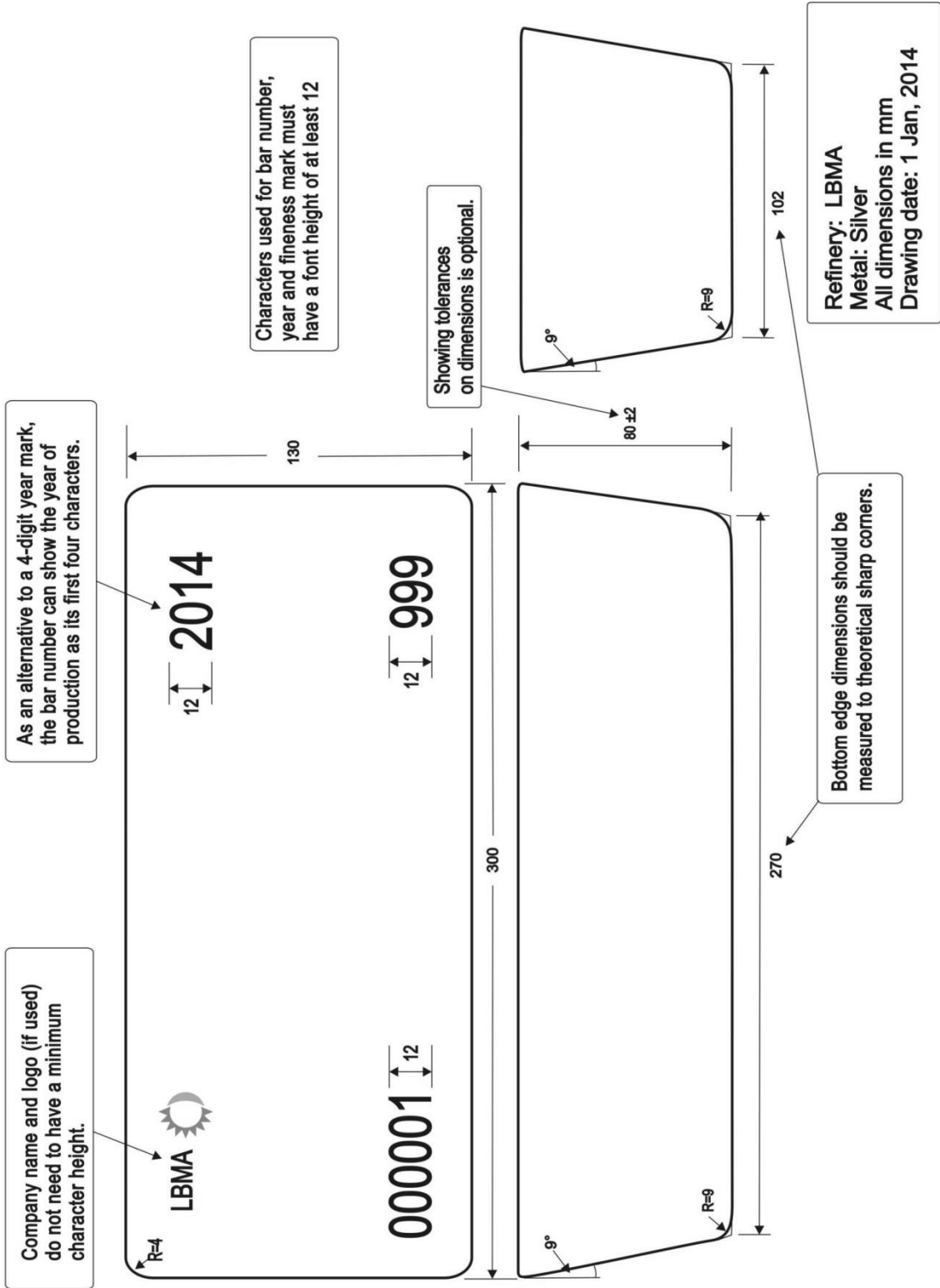
Sample Technical Drawing for a Good Delivery Gold Bar

This drawing shows marks in a landscape layout. Portrait layout is also allowed.



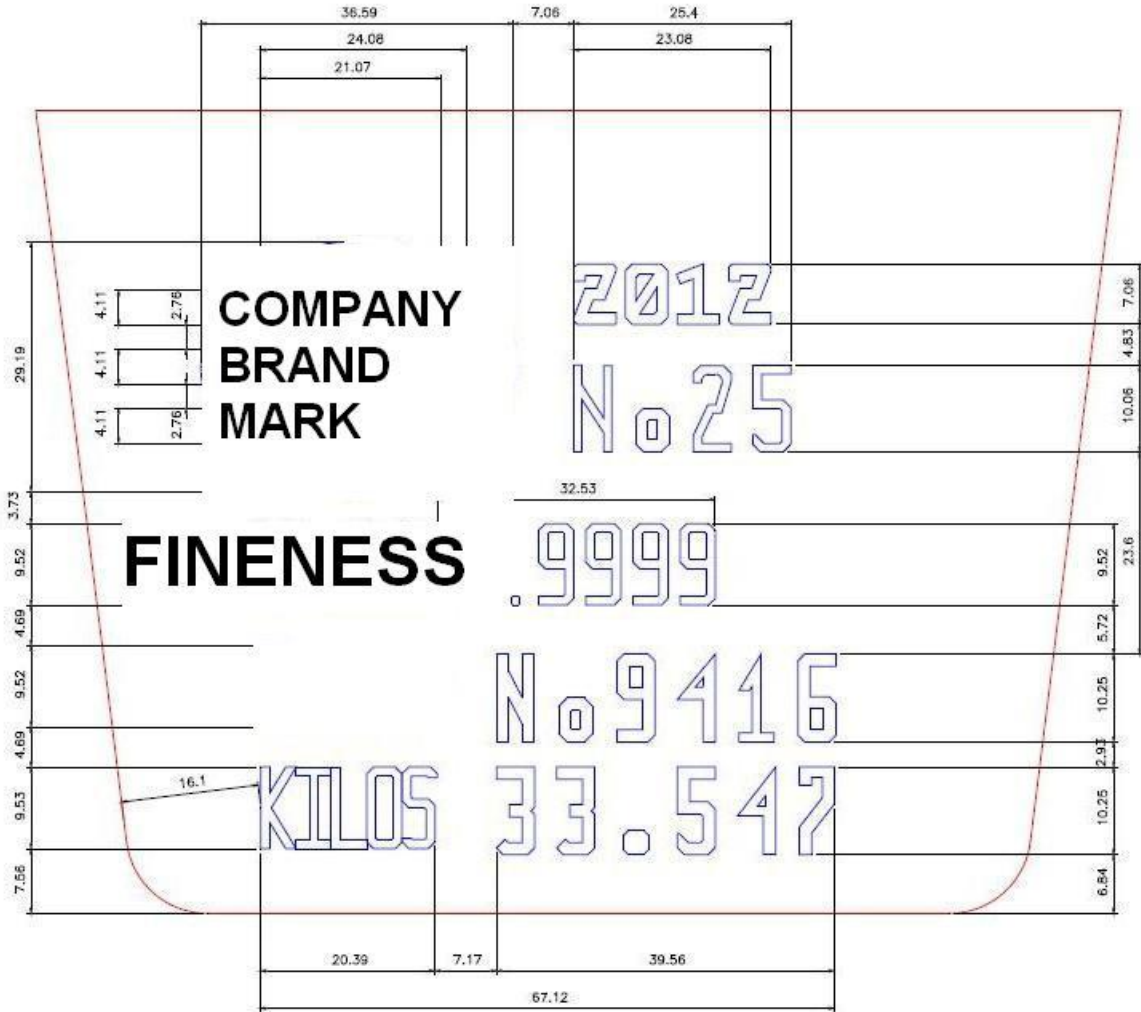
(2) 1,000 Ounce Silver Bar

Sample Technical Drawing for a Good Delivery Silver Bar
 This drawing shows marks in a landscape layout. Portrait layout is also allowed.



Annex K – Sample of End Stamping of Silver Bars

The layout shown below is not prescriptive but the height of the characters used for the bar number, year and assay mark should be approximately 10 mm.



Annex L – Facilitators

The following companies have been listed as Facilitators who may be able to provide assistance to applicants in putting together their Good Delivery applications.

An applicant should contact a Facilitator directly to agree the terms and conditions on which the Facilitator may be willing to provide services.

Inclusion in this list does not constitute or imply any representation or warranty by the LBMA as to creditworthiness or as to the services or goods supplied or quality or compliance with any specification relating thereto. No liability for direct or consequential loss, howsoever caused, whether by negligence or otherwise, whether by use of this list or reliance thereon, is accepted by the LBMA.

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Inspectorate International Limited	2 Perry Road Witham Essex CM8 3TU United Kingdom	T: +44 (0) 1376 536 800 F: +44 (0) 1376 536 819 E-mail: ian.gathercole@uk.bureauveritas.com (Mr Ian Gathercole - Sales and Marketing Manager, Precious Metals)
Inspectorate (Singapore) Pte Ltd	Blk 28 Ayer Rajah Crescent 01-03 Singapore 139959	T: +65 6594 0735 M: +65 9839 9856 derek.poh@sg.bureauveritas.com (Mr Derek Poh, Regional Business Development Manager - Asia)
Inspectorate (Shanghai) Ltd	5F Building 2 No. 658 Jin Zhong Road Shanghai 200335 People's Republic of China	T: +86 (0) 21 3103 0113 F: +86 (0) 21 3360 0120 jerry-yz.yang@cn.bureauveritas.com (Mr Jerry Yang, M&M Deputy Director)
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Annex M – Residual Elements**Determination of Residual Elements by Spectrographic Analysis**

Good Delivery applicants and refiners undergoing Proactive Monitoring which use spectrographic analysis for determining the assays of their materials are responsible for identifying and analysing all residual elements present in their bars or dip samples.

The list shown below is not intended to be prescriptive as far as refiners are concerned. It merely indicates the elements that LBMA Referees will typically look for when analysing gold and silver samples by spectrographic methods.

Residual Elements

	<u>Gold</u>	<u>Silver</u>
Gold – Au		x
Silver – Ag	x	
Platinum - Pt	x	x
Palladium - Pd	x	x
Rhodium – Rh	x	
Iridium – Ir	x	
Ruthenium – Ru	x	
Al - Aluminium	x	x
As - Arsenic	x	x
Bi - Bismuth	x	x
Ca - Calcium	x	x
Cd - Cadmium	x	x
Co - Cobalt	x	x
Cr - Chromium	x	x
Cu - Copper	x	x
Fe - Iron	x	x
In - Indium		x
Mg - Magnesium	x	x
Mn - Manganese	x	x
Pb - Lead	x	x
Ni - Nickel	x	x
Sb - Antimony	x	x
Se - Selenium	x	x
Si - Silicon	x	x
Sn - Tin	x	x
Te - Tellurium	x	x
Ti - Titanium	x	
Zn - Zinc	x	x