



FIRE ASSAY



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MABOR®

CUPELS & BLOCKS

4-Feb-18
C506_1_Mabor.doc

CUPELLATION OF PRECIOUS METALS

Made with high quality magnesia, **MABOR**® cupels and blocks are renowned for their fine surface and constancy in weight and size, and are used by gold mines, precious metal refiners, alloy melters, assay offices, hallmarking, geological, test & umpire laboratories worldwide.

They provide security and will quickly absorb great amounts of litharge without cracking or pitting. The prill or bead will not adhere to their surface. Cupellation temperature and time are reduced and losses are minimal, achieving higher accuracy and better yields.

1. SINGLE CUPELS - Absorption (PbO) ~ 70% wt / wt @ 980° C

- A wide range of sizes cover all assayers' needs
- Each size will suck in swiftly and without leaking the specified charge

WIDEST ASSORTMENT



THE RIGHT CUPEL FOR EVERY ASSAYER'S JOB

- **GOLD & SILVER ALLOYS** Lead Foil + Sample + Inquart
 - From # 1 to # 2X: ► Silver analysis & microcupellation
 - From # 3 to # 6: ► Gold : bullion, white / yellow alloys
- **FULL FIRE ASSAY** Lead Buttons
 - From # 7A to # 8S: ► Ores, ashes, sweeps, scrap
 - From # 9 to # 12: ► Concentrates, electrolytic slimes
 - From # 14 to # PC: ► Production of gold & silver

New ►

2. BULLION BLOCKS - Absorption capacity (PbO): ~ 8 g / hole

- Fully exploit Fire Assay's **parallel processing** capabilities
- Allow **full scalability** to mass analysis production stage
- Samples, duplicates, standards & blanks on same block
- High **accuracy** - samples undergo equal ambient conditions
- **Save time** – reduce manipulation hazards
- **Stability** is better due to larger base
- Assays keep original array – **no misplace errors**
- Ideal for **mass analysis** of same carat alloy samples
- Several bevelled blocks may be handled **all at once**
 - **TOOLS**: Block Handling / Block Loading:
 - Scoops (BS)
 - Forks (TF / BF)
 - Trays (P)
 - Multi-Loaders (ML)

New ►

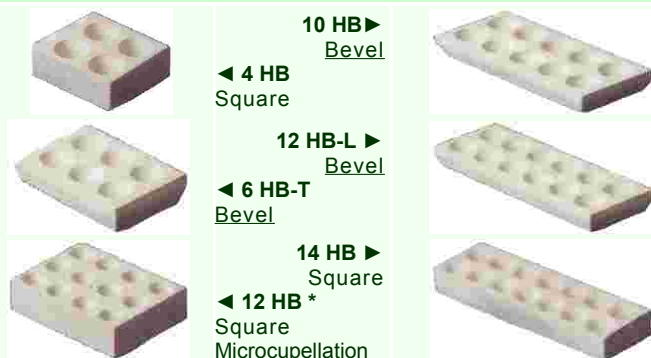
► Sq = 90°

► Bvl = 70°

New ►

| SIZE Ref # | CUPEL | | CUP | | WEIGHT | | CARTON | |
|------------------|---------|---------|---------|-------------|------------|--------------|------------------|------------|
| | Ø mm | H mm | Ø mm | Depth mm | Piece g | Carton kg | Content Piece | Price € |
| 1 | 22 | 18.4 | 17.5 | 4.3 | 13 | 19.5 | 1441 | * |
| 2X | 24 | 16.3 | 19 | 7 | 13 | 17.5 | 1296 | * |
| 3 | 26.3 | 17 | 21.3 | 7 | 16.5 | 18.6 | 1080 | * |
| 4 | 30.4 | 18.2 | 25.4 | 7.5 | 20 | 17.2 | 819 | * |
| 4A | 27 | 22 | 24 | 6 | 22 | 20.5 | 900 | * |
| PM | 27 | 24 | 23.4 | 8 | 27.5 | 20.5 | 720 | * |
| 5 | 31.6 | 19.7 | 26.2 | 7 | 24.5 | 18.5 | 728 | * |
| 6 | 36.3 | 21.2 | 26.4 | 8.5 | 37.5 | 18 | 462 | * |
| 7A | 39.7 | 28.5 | 31.2 | 11.8 | 59 | 18.5 | 300 | * |
| 7B | 39.7 | 32 | 31.2 | 11.8 | 67.5 | 21.1 | 300 | * |
| 7X | 39.7 | 35 | 31.2 | 11.8 | 76 | 23.6 | 300 | * |
| 8A | 45.3 | 35 | 38 | 12.5 | 100.5 | 20.8 | 200 | * |
| 8S | 44.0 | 40 | 38 | 14.0 | 107 | 20 | 180 | * |
| 9 | 51 | 29 | 40 | 10.5 | 109 | 21.7 | 192 | * |
| 9C | 51 | 33.5 | 42 | 12 | 126 | 20.9 | 160 | * |
| 10 | 60 | 30.2 | 52.6 | 11.5 | 148.5 | 21.5 | 140 | * |
| 11 | 56.8 | 44 | 47.8 | 14.8 | 197 | 22.7 | 112 | * |
| 12 | 80.2 | 47 | 57.5 | 16.5 | 443 | 20.6 | 45 | * |
| 14 | 110 | 70 | 80 | 24 | 1187 | 19.7 | 16 | * |
| 15 | 150 | 130 | 120 | 40 | 4725 | 20.0 | 4 | * |
| PC | 254 | 161.6 | 184.7 | 55.4 | 16 kg | 16.6 | 1 | * |

| SIZE Ref # | E-D- GE angle | DIMENSIONS | | | CUP | | WEIGHT | | CARTON | | ►TOOLS Ref ►BS►TF |
|------------------|---------------------|------------|----|----|-----|-----|--------|------|--------|-------|-------------------------|
| | | L | W | H | Ø | Dpt | Pc | Ctn | Cont. | Price | |
| | | mm | mm | mm | mm | mm | g | kg | pc | € | |
| 4-HB | Sq | 48 | 48 | 20 | 18 | 6.5 | 97 | 22.8 | 224 | * | BS 4 |
| 4-SAHB | Sq | 80 | 80 | 26 | 30 | 9.0 | 321 | 19.8 | 60 | * | BS 12 |
| 12-HB | Sq | 80 | 60 | 20 | 14 | 7.0 | 204 | 22.2 | 105 | * | BS 12 |
| 14-HB | Sq | 179 | 54 | 20 | 20 | 7.5 | 367 | 21.7 | 56 | * | BS 14 |
| 6-HB-T | Bvl | 81.5 | 60 | 20 | 22 | 7.0 | 184 | 22.8 | 120 | * | TF 1 |
| 10-HB | Bvl | 138 | 60 | 20 | 22 | 7.0 | 307 | 19.2 | 60 | * | TF1 /BF10 |
| 12-HB-L | Bvl | 165 | 60 | 20 | 22 | 7.0 | 375 | 19.1 | 48 | * | TF1 /BF12 |
| 18-HB | Bvl | 147 | 76 | 20 | 22 | 7.0 | 400 | 21.3 | 42 | * | TF2 /BF18 |
| 21-HB | Bvl | 172 | 76 | 20 | 22 | 7.0 | 476 | 21.3 | 42 | * | TF2 /BF21 |
| 24-HB | Bvl | 124 | 84 | 20 | 16 | 7.0 | 402 | 20.3 | 48 | * | - |

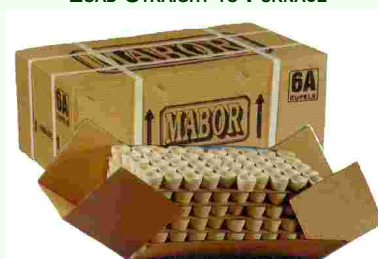


MINIMIZE TIME / LOSSES



- Our Cupels "drive" at < 1000°C :
 - Shorter cupellation time
 - Reduced Au / Ag losses
- No need to preheat

LOAD STRAIGHT TO FURNACE



Well layered cupel arrays :
"fork in" directly from box to furnace

MABOR® is a registered Trade Mark of SEP (Pty) Ltd. (formerly Mabor Ltd. UK)



- Unaffected by atmospheric changes / moisture
- Quick absorption of large quantities of litharge
- Special range for micro-cupellation methods
- Manufacturing experience: 119 years !
- Continuous R & D + Testing in own assay lab
- ISO 9001 - ISO 14001 – QM & EM Certificates

- Consistent low losses
- Reduced tendency to freeze
- Robust mechanical strength
- Perfect uniformity of quality
- No spitting of lead
- Latest manufacturing machinery

- Absorption ~70% cupel weight at 980°C
- Quality immune to storage time
- 20-kg box easy to handle / store
- Beads easily removed
- Free from cracking and pitting
- Accuracy 5 times better than ICP

CUPELLATION : ► Cupels ► Blocks ► Instructions ► Certificates ► Tools ► Consumables – **FIRE ASSAY**: ► Crucibles ► Accessories ► Parting / Annealing
TERMS: ► Cupellation ► Fire Assay ► Reagents ► Other Methods ► Metals ► Context – **INDEX**: ► Programme – **BROCHURE**: ► **MABOR**



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MABOR®

CUPELS - DATA SHEET

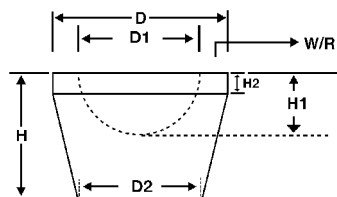
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12



7F



| | |
|----------------|------------------|
| D | Diameter at Top |
| D ₁ | Diameter of Cup |
| D ₂ | Diameter at Base |
| H | Height of Cupel |
| H ₁ | Depth of Cup |
| H ₂ | Height of Rim |
| W _R | Width of Ridge |

MAGNESIA CUPELS — MANUFACTURING PROGRAMME

| ITEM | SIZE | PRESS | D I A M E T E R S | | | H E I G H T S | | | RIDGE | WEIGHT | C O N T E N T | | | |
|------|-----------|-------|-------------------|----------------|----------------|---------------|----------------|----------------|----------------|--------|---------------|-------------------|----------------|----------------|
| LINE | REF. | TYPE | D | D ₁ | D ₂ | H | H ₁ | H ₂ | W _R | PIECE | CONTENT | D I M E N S I O N | | |
| n° | # | | mm | mm | mm | mm | mm | mm | mm | g | Pc / ctn | C _L | C _W | C _H |
| 1 | 1 | | 22.0 | 17.5 | 16.5 | 18.4 | 4.3 | 5.0 | 2.30 | 13.0 | 1440 | 390 | 230 | 180 |
| 2 | 2X | | 24.0 | 19.0 | 19.4 | 16.3 | 7.0 | 5.0 | 2.50 | 13.0 | 1296 | 390 | 230 | 185 |
| 3 | 3 | | 26.3 | 21.3 | 20.2 | 17.0 | 7.0 | 5.0 | 2.50 | 16.5 | 1080 | 390 | 225 | 190 |
| 4 | 4 | | 30.4 | 25.4 | 19.9 | 18.2 | 7.5 | 5.0 | 2.50 | 20.0 | 819 | 380 | 215 | 200 |
| 5 | 4A | | 27.0 | 24.0 | 20.0 | 22.0 | 6.0 | 7.5 | 1.50 | 22.0 | 900 | 395 | 270 | 160 |
| 6 | PM | | 27.0 | 23.4 | 26.8 | 24.0 | 8.0 | — | 1.80 | 27.5 | 720 | 430 | 235 | 170 |
| 7 | 5 | | 31.6 | 26.2 | 21.9 | 19.7 | 7.0 | 5.0 | 2.70 | 24.5 | 728 | 395 | 220 | 190 |
| 8 | 6 | | 36.3 | 26.4 | 26.1 | 21.2 | 8.5 | 8.0 | 4.95 | 37.5 | 462 | 395 | 225 | 180 |
| 9 | 6A | | 40.0 | 32.7 | 30.0 | 25.4 | 12.3 | 6.0 | 3.65 | 47.5 | 300 | 415 | 230 | 180 |
| 10 | 6C | | 40.2 | 30.3 | 30.5 | 27.5 | 8.0 | 9.0 | 4.95 | 62.0 | 300 | 420 | 230 | 180 |
| 11 | 6D | | 38.8 | 32.8 | 30.0 | 30.0 | 7.8 | 9.5 | 3.00 | 61.5 | 300 | 405 | 220 | 190 |
| 12 | SA | | 40.0 | 30.2 | 30.0 | 25.4 | 8.7 | 6.0 | 4.90 | 54.5 | 300 | 420 | 230 | 180 |
| 13 | 7 | | 39.5 | 31.2 | 29.0 | 22.0 | 11.0 | 6.5 | 4.15 | 44.5 | 300 | 415 | 225 | 170 |
| 14 | 7A | | 39.7 | 31.2 | 30.0 | 28.5 | 11.8 | 9.0 | 4.25 | 59.0 | 300 | 420 | 230 | 195 |
| 15 | 7AL | | 39.7 | 31.2 | 30.0 | 28.5 | 12.3 | 6.0 | 4.25 | 55.0 | 420 | 505 | 307 | 170 |
| 16 | 7B | | 39.7 | 31.2 | 30.0 | 32.0 | 11.8 | 12.5 | 4.25 | 67.5 | 300 | 420 | 230 | 220 |
| 17 | 7C | | 40.0 | 33.0 | 30.0 | 30.0 | 9.5 | 4.0 | 3.50 | 59.0 | 300 | 420 | 230 | 205 |
| 18 | 7F | | 36.0 | 29.0 | 30.0 | 39.0 | 10.0 | 11.5 | 3.50 | 73.5 | 250 | 380 | 200 | 215 |
| 19 | 7X | | 39.7 | 31.2 | 30.0 | 35.0 | 11.8 | 15.5 | 4.25 | 76.0 | 300 | 420 | 230 | 230 |
| 20 | 8 | | 44.3 | 34.2 | 34.6 | 27.1 | 8.5 | 9.0 | 5.05 | 72.5 | 240 | 380 | 295 | 160 |
| 21 | 8A | | 45.3 | 38.0 | 36.9 | 35.0 | 12.5 | 13.0 | 3.65 | 100.5 | 200 | 465 | 245 | 160 |
| 22 | 8AM | | 45.3 | 34.0 | 36.9 | 35.0 | 11.5 | 13.0 | 5.65 | 105.5 | 200 | 465 | 245 | 160 |
| 23 | 8B | | 45.3 | 34.0 | 36.9 | 35.0 | 14.5 | 13.0 | 5.65 | 101 | 200 | 465 | 245 | 160 |
| 24 | 8C | | 44.8 | 34.0 | 35.5 | 31.0 | 12.5 | 11.0 | 5.40 | 89.0 | 240 | 385 | 302 | 175 |
| 25 | 8D | | 44.3 | 34.2 | 34.6 | 27.1 | 12.5 | 9.0 | 5.05 | 71.0 | 300 | 465 | 245 | 195 |
| 26 | 8F | | 44.5 | 34.5 | 35.0 | 38.0 | 13.0 | 10.5 | 5.00 | 100.5 | 200 | 465 | 255 | 170 |
| 27 | 8S | | 44.0 | 38.0 | 34.0 | 40.0 | 14.0 | 13.0 | 3.00 | 107 | 180 | 455 | 278 | 140 |
| 28 | 8Y | | 42.0 | 38.0 | 42.0 | 33.0 | 9.0 | — | 2.00 | 98 | 200 | 445 | 235 | 150 |
| 29 | 9 | | 51.0 | 40.0 | 42.1 | 29.0 | 10.5 | 9.0 | 5.50 | 109 | 192 | 425 | 230 | 200 |
| 30 | 9C | | 51.0 | 42.0 | 43.0 | 33.5 | 12.0 | 5.5 | 4.50 | 126 | 160 | 425 | 230 | 190 |
| 31 | 9F | | 51.0 | 42.0 | 41.0 | 40.0 | 14.0 | 11.0 | 4.50 | 138.5 | 128 | 430 | 235 | 180 |
| 32 | 10 | | 60.0 | 52.6 | 49.7 | 30.2 | 11.5 | 11.0 | 3.70 | 148.5 | 140 | 440 | 260 | 170 |
| 33 | 11 | | 56.8 | 47.8 | 48.8 | 44.0 | 14.8 | 10.0 | 4.50 | 197 | 112 | 420 | 250 | 200 |
| 34 | 11A | | 56.8 | 47.8 | 48.8 | 44.0 | 11.5 | 10.0 | 4.50 | 210 | 112 | 420 | 250 | 200 |
| 35 | 12 | | 80.2 | 57.5 | 62.5 | 47.0 | 16.5 | 11.0 | 11.35 | 443 | 45 | 425 | 265 | 160 |
| 36 | 12A | | 80.2 | 57.5 | 62.5 | 52.5 | 16.5 | 16.5 | 11.35 | 507 | 45 | 425 | 265 | 180 |
| 37 | 14 | | 110.0 | 80.0 | 88.0 | 70.0 | 24.0 | 14.0 | 15.00 | 1,187 | 16 | 465 | 255 | 160 |
| 38 | 15 | | 150.0 | 120.0 | 128.0 | 130.0 | 40.0 | 25.0 | 15.00 | 4,725 | 4 | 335 | 335 | 145 |
| 39 | PC | | 254.0 | 184.7 | 203.2 | 161.6 | 55.4 | 32.3 | 34.65 | 16,000 | 1 | 295 | 295 | 175 |

Sizes: **Stocked (red bold) (19)** / Made to Order (grey) (20)

| USAGE | • MICRO-CUPELLATION - SILVER ALLOYS | • GOLD ALLOYS | • SCRAP / LEMEL / ORES | • CONCENTRATES | • GOLD / SILVER PRODUCTION |
|--------|---|---------------|------------------------|----------------|----------------------------|
| SIZE | #1 to #2X | # 1 to # 6 | # 6A to # 8Y | # 9 to # 12A | # 14 to PC |
| HOW TO | ▶ Work with small cupels / Bullion Blocks | to ISO 11426 | ▶ Work with big cupels | to ISO10478 | — |



- Unaffected by atmospheric changes / moisture
- Quick absorption of large quantities of litharge
- Special range for micro-cupellation methods
- Manufacturing experience: 111 years !
- Continuous R & D + Testing in own assay lab
- ISO 9001 - ISO 14001 — QM & EM Certificates

- Consistent low losses
- Reduced tendency to freeze
- Robust mechanical strength
- Perfect uniformity of quality
- No spitting of lead
- Latest manufacturing machinery

- Absorption ~70% cupel weight at 980°C
- Quality immune to storage time
- 20-kg box easy to handle / store
- Beads easily removed
- Free from cracking and pitting
- Accuracy 5 times better than ICP



Samples wrapped in Pb foil



Pb button cube



Hot cupels & doré (Au + Ag) bead



Pb foil, Pb rods & Ag inquant "lentils"

CUPELLATION : ▶ Cupels ▶ Blocks ▶ Instructions ▶ Certificates ▶ Tools ▶ Consumables — FIRE ASSAY: ▶ Crucibles ▶ Accessories ▶ Parting / Annealing
TERMS: ▶ Cupellation ▶ Fire Assay ▶ Reagents ▶ Other Methods ▶ Metals ▶ Context — INDEX: ▶ Programme — BROCHURE: ▶ MABOR



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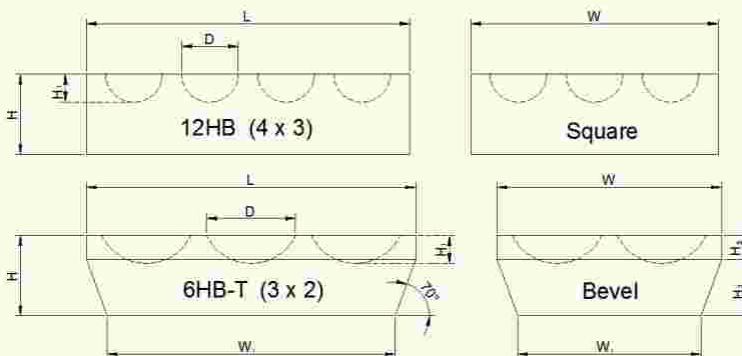
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MABOR

BULLION BLOCKS - DATA SHEET

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FULL SCALABILITY



Parallel batch processing allows:
productivity gains at every workload level

- Blocks fully exploit Fire Assay's inherent **parallel processing** capabilities
- Graded path to **mass analysis** stage
- **Higher accuracy** - Samples, duplicates and standards undergo same ambient conditions
- **Save hearth space** - More assays per batch
- **Save time** – reduce manipulation hazards
- Better **stability** – due to larger base
- Assays keep array – **no misplace errors**

MAGNESIA BULLION BLOCKS – MANUFACTURING PROGRAMME



4 HB
2 x 2
Square (1)

6 HB
3 x 2
Square (3)

6 HB-T
3 x 2
Bevel (6)

10 HB
5 x 2
Bevel (7)

12 HB (†)
4 x 3
Square (4)

12 HB-L
6 x 2
Bevel (8)

14 HB
7 x 2
Square (5

21 HB
7 x 3
Bevel (10

| It Li | BLOCK Ref # | P t | HOLES # Array | ED- GE deg | D I M E N S I O N S | | | | | | | C U P | | Ab PbO | Wt g | C | | R T O N S | | | ▶ TOOLS Ref. | |
|---------------------|-------------------|--------|------------------|------------------|---------------------|----------------------|---------|----------------------|---------|----------------------|----------------------|---------|----------------------|-----------|---------|---------|--------|-------------------------------------|--|----------------|---------------------------------|----------|
| | | | | | L mm | L ₁ mm | W mm | W ₁ mm | H mm | H ₂ mm | H ₃ mm | D mm | H ₁ mm | | | CONTENT | | D I M E N S I O N C _L | C _W | C _H | | Wt kg |
| | | | | | | | | | | | | | | | | pc | assays | | | | | |
| S Q U A R E | | | | | | | | | | | | | | | | | | | ▶ SCOOPS BS4 BS12 BS12 BS12 BS14 | | | |
| 1 | 4 HB | FP | 4 2 x 2 | 90° | 48 | — | 48 | — | 20 | — | — | 18 | 6.5 | 7 | 97 | 224 | 896 | 420 | | 230 | 185 | 22.8 |
| 2 | 4 SAHB (+) | FP | 4 2 x 2 | 90° | 80 | — | 80 | — | 26 | — | — | 30 | 9 | 40 | 321 | 60 | 240 | 420 | | 260 | 130 | 19.8 |
| 3 | 6 HB | HP | 6 3 x 2 | 90° | 76.5 | — | 51 | — | 20 | — | — | 20.5 | 8 | 8 | 150 | 120 | 720 | 410 | | 240 | 155 | 18.8 |
| 4 | 12 HB (†) | HP | 12 4 x 3 | 90° | 80 | — | 60 | — | 20 | — | — | 14 | 7 | 4 | 204 | 105 | 1260 | 430 | | 215 | 180 | 22.2 |
| 5 | 14 HB | PP | 14 7 x 2 | 90° | 179 | — | 54 | — | 20 | — | — | 20 | 7.5 | 8 | 367 | 56 | 784 | 400 | 215 | 190 | 21.7 | |
| B E V E L L E D (‡) | | | | | | | | | | | | | | | | | | | ▶ FORKS / ML TF1 TF1 / BF10 / ML10 TF1 / BF12 / ML12 TF2 / BF18 TF2 / BF21 — | | | |
| 6 | 6 HB·T | HP | 6 3 x 2 | 70° | 81.5 | 71.5 | 60 | 50 | 20 | 6 | 14 | 22 | 7 | 10 | 184 | 120 | 720 | 435 | | 270 | 150 | 22.8 |
| 7 | 10 HB | HP | 10 5 x 2 | 70° | 138 | 128 | 60 | 50 | 20 | 6 | 14 | 22 | 7 | 10 | 307 | 60 | 600 | 440 | | 275 | 130 | 19.2 |
| 8 | 12 HB·L | HP | 12 6 x 2 | 70° | 165 | 155 | 60 | 50 | 20 | 6 | 14 | 22 | 7 | 10 | 375 | 48 | 576 | 389 | | 199 | 225 | 19.1 |
| 9 | 18 HB | HP | 18 6 x 3 | 70° | 147 | 137 | 76 | 66 | 20 | 6 | 14 | 22 | 7 | 10 | 400 | 42 | 756 | 325 | | 260 | 195 | 18.0 |
| 10 | 21 HB | HP | 21 7 x 3 | 70° | 172 | 162 | 76 | 66 | 20 | 6 | 14 | 22 | 7 | 10 | 476 | 42 | 882 | 360 | 250 | 200 | 21.3 | |
| 11 | 24 HB (†) | HP | 24 6 x 4 | 70° | 124 | 114 | 84 | 74 | 20 | 6 | 14 | 16 | 7 | 8 | 402 | 48 | 1152 | 350 | 265 | 185 | 20.3 | |

(+) Assay of Ores • **Stocked (red)** / Non-stocked (grey) • "Pt" = Press Type • "Ab" = Absorption : g (PbO) / hole • "ML": Multi-Loader Tool •

† MICROCUPELLATION

- Shorter processing time
- Fewer amount of Reagents
- Less destructive method
- 10 mg sample + 2 g Pb foil
- Scrap taken at hidden places
- Still high accuracy

‡ BEVELLED BLOCKS

- Bevels allow lifting from under
- Fork takes blocks without clamping
- Fork may handle several blocks
- No damage from tongs squeeze
- ~10% less weight & thermal inertia
- Increased heat exchange surface

TOOLS ►
Specially designed

- FORKS (BF - TF)
Take 1 to 4 bevelled blocks in / out of furnace all at once

- MULTI-LOADERS (ML)
Charge many samples across several blocks all at once



- ISO 9001 - ISO 14001 – QM & EM Certificates



Forks for Bevelled blocks:

- **BF1** takes - 10HB x 4 (across)
- **TF1** takes - 6HB·T, 10HB & - 12HB·L (along)



Multiloader **ML 10-40** - Overview view
- Holes Position: open

CUPELLATION : [▶Cupels](#) [▶Blocks](#) [▶Instructions](#) [▶Certificates](#) [▶Tools](#) [▶Consumables](#) – **FIRE ASSAY:** [▶Crucibles](#) [▶Accessories](#) [▶Parting / Annealing](#)
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INSTRUCTIONS

4-Feb-18
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WORKING WITH SMALL "MABOR" CUPELS / BULLION BLOCKS

GOLD DETERMINATION IN GOLD ALLOYS FOLLOWING **ISO 11426**

BEHAVIOUR OF MABOR CUPELS & BULLION BLOCKS - Do's AND DON'Ts

DON'T USE CUPELS / BLOCKS MORE THAN ONCE

- Attempts to re-use will lead to cracking / breakage / loss of sample

DON'T USE UP ALL CUPELS' **LITHARGE** RETAINING CAPACITY

- At 980°C Cupels absorb & retain near 70 % of **PbO** (wt / wt %)
 ◦ Thus at 980°C Cupel #8A (wt 100 g) may retain up to 70 g PbO
- Leave safety margin
 ◦ So that **PbO** doesn't leak down to furnace floor
- Spare capacity is visible as a non tanned white strip below Cupel
- Retaining capacity decreases as temperature increases
 ◦ PbO becomes more fluid at high temperatures
- Increase Cupel capacity by augmenting Cupel mass
 ◦ Use Cupels of greater diameter
 ◦ If floor space limited, use taller Cupels / compact bullion Blocks

DON'T LOAD CUPELS / BLOCKS IN A FURNACE IF WETTED

- Though non hygroscopic, may become wet in contact with water
- If wetted, moist Cupels should be dried in oven before use

NO NEED TO PREHEAT CUPELS / BLOCKS

- Warm / cold load: both possible. If preheated, time to be < 30 min.

DON'T LEAVE CUPELS "DWELLING" IN A HOT FURNACE

- Cupels / Blocks **are**:
 ◦ Sophisticated high temperature *filters*:
 ◊ Stop penetration of molten metal
 ◊ Allow flux to come in and stay in
 ◦ Efficient porous containers
 ◊ Capable to trap great amounts of flux
 ◊ Inert to chemical attack of flux
- Cupels / Blocks **are not**:
 ◦ Refractory "fixtures" designed to stay long in a furnace
 ◊ Long exposition to high temps causes cracks in cupels

DON'T FORCE CUPELS WHEN THEY STICK TO HEARTH

- Use MgO powder as parting media to prevent sticking
- Maborite** MgO powder also aid at improving refractory lining life

| STEP | CUPELLATION SEQUENCE | IMAGE | TIME (min.) |
|--|--|-------|-------------|
| 1 | Start (from cold) <ul style="list-style-type: none"> Switch Furnace electric power 'ON' Set temp. control to 1050 °C | | - |
| 2 | Preheat Furnace (empty) <ul style="list-style-type: none"> Allow temp. inside Furnace to reach 1050° C (<i>variable time</i>) Time depends on furnace power and refractory lining thermal inertia | | 20 |
| 3 | Load empty cupels <ul style="list-style-type: none"> Open door <ul style="list-style-type: none"> Place empty Cupels / Bullion Blocks on the Furnace Hearth Close door | | 1 |
| 4 | Allow temp. inside Furnace to reach 1050° C again | | 2 |
| 5 | Load samples <ul style="list-style-type: none"> Open door <ul style="list-style-type: none"> Charge the cups of the Cupels / Bullion Blocks with <ul style="list-style-type: none"> Sample (125 to 250 mg) Lead Foil / Tablet (4 - 5 g for yellow gold; (8 - 10 g for white gold) Ag inquart (all items above to be tightly packed using Pb foil for wrapping) Close door | | 1 |
| 6 | Allow temp. inside Furnace to reach 1050° C again | | 2 |
| 7 | Cupellation process begins (<i>variable time</i>) <ul style="list-style-type: none"> Watch the <u>driving</u> process Make sure that no <u>spitting</u> occurs Wait for <u>play of colours</u> to appear When <u>play of colours</u> ceases, Cupellation process is completed | | 15 - 20 |
| 8 | Switch furnace electric power 'OFF' | | - |
| 9 | Ensure no "sprouting" occurs <ul style="list-style-type: none"> May happen if Au + Ag <u>bead</u> cools too quickly Slow <u>bead</u> cooling rate to allow O₂ degassing before crust solidification | | - |
| 10 | Withdraw cupels from furnace <ul style="list-style-type: none"> Set them on a non metallic refractory tray / plate to cool | | 1 |
| TOTAL CUPELLATION TIME (excluding / including furnace preheating) | | | ~ 30 / ~ 45 |

CUPELLATION : ▶ Cupels ▶ Blocks ▶ Instructions ▶ Certificates ▶ Tools ▶ Consumables — FIRE ASSAY: ▶ Crucibles ▶ Accessories ▶ Parting / Annealing
 TERMS: ▶ Cupellation ▶ Fire Assay ▶ Reagents ▶ Other Methods ▶ Metals ▶ Context — INDEX: ▶ Programme — BROCHURE: ▶ MABOR

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®

INSTRUCTIONS

4-Feb-18
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WORKING WITH BIG "MABOR" CUPELS / BULLION BLOCKS GOLD DETERMINATION IN MINERALS / CONCENTRATES / RESIDUES FOLLOWING ISO 10378

BEHAVIOUR OF MABOR CUPELS & BULLION BLOCKS - Do's AND DON'Ts

DON'T USE CUPELS / BLOCKS MORE THAN ONCE

- Attempts to re-use will lead to cracking / breakage / loss of sample

DON'T USE UP ALL CUPELS' LITHARGE RETAINING CAPACITY

- At 980°C Cupels absorb & retain near 70 % of PbO (wt / wt %)
 - Thus at 980°C Cupel #8A (wt 100 g) may retain up to 70 g PbO
- Leave safety margin
 - So that PbO doesn't leak down to furnace floor
- Spare capacity is visible as a non tanned white strip below Cupel
- Retaining capacity decreases as temperature increases
 - PbO becomes more fluid at high temperatures
- Increase Cupel capacity by augmenting Cupel mass
 - Use Cupels of greater diameter
 - If floor space scarce use taller Cupels / compact 4SAHB blocks

DON'T LOAD CUPELS / BLOCKS IN A FURNACE IF WETTED

- Though non hygroscopic, may become wet in contact with water
- If wetted, moist Cupels should be dried in oven before use

NO NEED TO PREHEAT CUPELS / BLOCKS

- Warm / cold load: both possible. If preheated, time to be < 30 min.

DON'T LEAVE CUPELS "DWELLING" IN A HOT FURNACE

- Cupels / Blocks are:
 - Sophisticated high temperature *filters*:
 - Stop penetration of molten metal
 - Allow flux to come in and stay in
 - Efficient porous containers
 - Capable to trap great amounts of flux
 - Inert to chemical attack of flux
- Cupels / Blocks are not:
 - Refractory "fixtures" designed to stay long in a furnace
 - Long exposition to high temps causes cracks in cupels

DON'T FORCE CUPELS WHEN THEY STICK TO HEARTH

- Use MgO powder as parting media to prevent sticking
- Maborite MgO powder also aid at improving refractory lining life

| STEP | CUPELLATION SEQUENCE | IMAGE | TIME (min.) |
|--|---|-------|-------------|
| 1 | Start (from cold) <ul style="list-style-type: none"> Switch Furnace electric power / burner 'ON' Set temp. control to 900 °C | | -- |
| 2 | Preheat Furnace (empty) <ul style="list-style-type: none"> Allow temp. inside Furnace to reach 900° C (<i>variable time</i>) Time depends on furnace power and refractory lining thermal inertia | | 20 |
| 3 | Load empty cupels <ul style="list-style-type: none"> Open door <ul style="list-style-type: none"> Place empty Cupels inside furnace Close door Set temp. control to 860 °C (if both Au and Ag are determined) Set temp. control to 900 °C (if only Au is to be determined) | | 1 |
| 4 | Allow temp. inside Furnace to reach 860° C / 900° resp. | | 2 |
| 5 | Load samples <ul style="list-style-type: none"> Open door <ul style="list-style-type: none"> Charge the cups of the Cupels with: <ul style="list-style-type: none"> Lead buttons (30 - 45 g) Close door | | 1 |
| 6 | Allow temp. inside Furnace to reach 860° C / 900° resp. again | | 2 |
| 7 | Cupellation process begins (<i>variable time</i>) <ul style="list-style-type: none"> Watch the <u>driving</u> process Make sure that no <u>spitting</u> occurs Make sure that no <u>freezing</u> of litharge occurs Wait for <u>play of colours</u> to appear When <u>play of colours</u> ceases, cupellation process is completed | | 30 - 40 |
| 8 | Switch furnace electric power / burner 'OFF' | | -- |
| 9 | Ensure no <u>sprouting</u> occurs <ul style="list-style-type: none"> May happen if Au + Ag <u>bead</u> cools too quickly Slow <u>bead</u> cooling rate to allow O₂ degassing before crust solidification | | -- |
| 10 | Withdraw cupels from furnace <ul style="list-style-type: none"> Set them preferably on a non metallic refractory tray to cool | | 1 |
| TOTAL CUPELLATION TIME (excluding / including furnace preheating) | | | ~ 40 / ~ 65 |

CUPELLATION : ▶ Cupels ▶ Blocks ▶ Instructions ▶ Certificates ▶ Tools ▶ Consumables — FIRE ASSAY: ▶ Crucibles ▶ Accessories ▶ Parting / Annealing
 TERMS: ▶ Cupellation ▶ Fire Assay ▶ Reagents ▶ Other Methods ▶ Metals ▶ Context — INDEX: ▶ Programme — BROCHURE: ▶ MABOR

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® **CERTIFICATES**

4-Feb-18
 C506_6_Mabor_Cert.doc

BS EN ISO 9001 : 2008 QUALITY MANAGEMENT SYSTEM

The manufacture of
"MABOR" magnesia cupels_
and bullion blocks

ISO 14001 : 2004 ENVIRONMENT MANAGEMENT SYSTEM

The manufacture of
"MABOR" magnesia cupels
and bullion blocks



CERTIFICATE # **11311**

Issued: **20 March 2001**
 Reissued: **7 August 2015**
 Valid Until: **7 August 2018**
 EAC Code **15**



015 - NQA

CERTIFICATE # **E1264**

Issued: **20 March 2001**
 Reissued: **07 July 2015**
 Valid Until: **07 August 2018**

CUPELLATION : ▶ Cupels ▶ Blocks ▶ Instructions ▶ Certificates ▶ Tools ▶ Consumables — **FIRE ASSAY:** ▶ Crucibles ▶ Accessories ▶ Parting / Annealing
TERMS : ▶ Cupellation ▶ Fire Assay ▶ Reagents ▶ Other Methods ▶ Metals ▶ Context — **INDEX:** ▶ Programme — **BROCHURE:** ▶ MABOR

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CUPELLATION TOOLS

1. CUPEL & GOLD ANNEALING TRAYS



◀ **P53**
with 28 cupels
4 (7 x 4)

CAPACITIES:

P53 :
4 (9 x 4)
4A (10 x 4)
10HB (1 x 4)



◀ **Tray P51**
◀ **Fork TF1**

Capacity:
P51
4A (x 16)

Move many cupels / blocks at once, easing manipulation while keeping rank order.
Two parallel wide grooves under Tray allow flat fork (TF) prongs inlet.

Trays also protect furnace hearth from litharge (PbO) spills.

Always spread **MABORITE** powder on tray top to absorb PbO spills.

MABORITE prevents cupels from sticking to Tray and increases Tray life. **Litharge** attack is stopped and emissions of noxious PbO vapours notably reduced.

- Trays P51 - P52 - P53 used to handle small cupels (# 1 to # 6) ▶ **Capacities**
- Tray P235 used to handle bigger cupels (# 7A to # 12) ▶ **Capacities**

| TRAY ref | L _o / L _i mm | W _o / W _i mm | Ht / Dp mm | WGt kg | Rim mm | FITS FORK | PRICE € / u |
|--------------|---------------------------------------|---------------------------------------|---------------|-----------|-------------|--------------|----------------|
| P 51 | 155 | 140 | 30 / 15 | 0,67 | Flat | TF 1 | * |
| P 52 | 155 / 143 | 162 / 137 | 30 / 15 | 0,92 | (4+7) × H 4 | TF 1 | * |
| P 53 | 311 / 288 | 162 / 137 | 30 / 15 | 1,83 | (4+7) × H 4 | TF 1 | * |
| P 235 | 235 / 207 | 235 / 207 | 30 / 15 | 1,81 | (6+8) × H 5 | TF 2 | * |

2. HANDLING TOOLS : CUPEL TONGS, BULLION BLOCK SCOOPS & TRAY / BLOCK FORKS



Scoops: **BS12** - 12HB & **BS4** - 4HB
Tongs: **CT2** - n°8A ▶



• **Cupel Tongs** (CT): allow single hand cupel manipulation - with forearm lever support at ring end.

• **Block Scoops** (BS) take square-edge blocks from underneath. L ~ 65 cm

• **Tray Forks** (TF): two flat prongs fitting under tray grooves permit speedy tray introduction / extraction, reducing hot handling hazards. L ~ 152 cm

Versatile TF Forks also handle *alongside* following bevel blocks:

TF1: 6HB-T / 10HB / 12HB-L (Bloc width 60 mm) Trays P140 / P52 / P53

TF2: 18HB / 21HB (Bloc width 76 mm) Trays P235

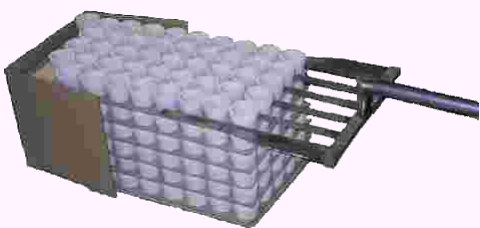
• **Block Forks** (BF): two "L" angled prongs designed to take across bevelled Blocks. **BF10: 10 HB** ; **BF12: 12HB-L** ; **BF18: 18HB** Cap.: 1 - 4 blocks. L ~ 147 cm



Block Fork **BF10** - 10HB (x4 across) &
Tray Fork **TF1** - 12HB-L (x1 alongside)

| TONGS | DIM | FITS | PRICE | FORK | W | FITS | PRICE |
|--------------|------|---------|-------|--------------|--------|-------------------------|-------|
| Scoop | cm | ▶ Cupel | € / u | ref. | mm | ▶ Tray (P) ▶ Block (HB) | € / u |
| CT 1 | 75 | 1 ↔ 6 | * | TF 1 | 95x55 | P140 / P53 / P52 | * |
| CT 2 | 76 | 7 ↔ 10 | * | | | 6HBT / 10HB / 12HBL | — |
| BS 4 | 5x5 | 4 HB | * | TF 2 | 110x70 | P235 / 18HB & 21HB | * |
| BS 12 | 8x6 | 12 HB | * | BF 10 | 150 | 10HB (x 4) | * |
| BS 14 | 18x6 | 14 HB | * | BF 12 | 178 | 12HB-L (x 4) | * |
| | | | | BF 18 | 160 | 18HB (x 4) | * |
| | | | | BF 21 | 184 | 18HB (x 4) | * |

3. CUPEL MULTI LOADING FORKS FOR SINGLE CUPELS



Cupel Fork
◀ **MF 7-30**

Capacity:
30 cupels
7A (5 x 6)

Directly from
box to furnace

Multi-load directly from packing carton to furnace.

Just lift carton cover, open both carton sides and straddle a complete assay batch. Ideal for laboratories with high workload.

| FORK ref | L cm | W cm | WGt kg | SAMPLES Up to | ARRAY W x L | FITS # | ▶ CUPEL - Ø | PRICE € / u |
|-----------------|---------|---------|-----------|------------------|----------------|-----------|----------------|----------------|
| MF 4A-25 | 107 | 16 | 1,10 | 25 | 5 × 5 | 4A | - 27 mm | * |
| MF 7-30 | 133 | 23 | 1,45 | 30 | 5 × 6 | 7A ↔ 7X | - 40 mm | * |
| MF 7-36 | 124 | 27 | 2,25 | 36 | 6 × 6 | 7A ↔ 7X | - 40 mm | * |
| MF 8-30 | 133 | 28 | 1,75 | 30 | 5 × 6 | 8 ↔ 8S | - 44 mm | -- |

4. LEAD FOIL SAMPLE PACKED MULTI-LOADER FOR BULLION BLOCKS



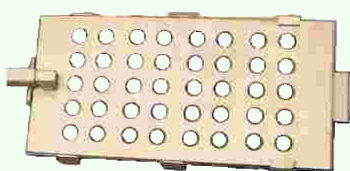
Multiloader
◀ **ML 10-40**

Capacity:
40 samples
(5 x 8 array)

Detail of
sliding plates

Drop all lead foil packed samples onto red hot Blocks inside furnace with a single motion, minimize heat losses & assayer's exposure to lead oxide vapours.
20-fold productivity gains

| LOADER ref | L cm | W cm | WGt kg | SAMPLES Up to | ARRAY W x L | FITS > BLOCK Ref (xQty) | PRICE € / u |
|-----------------|---------|---------|-----------|------------------|----------------|-----------------------------|----------------|
| ML 10-40 | 130 | 15,5 | 2,65 | 40 | 5 × 8 | 10HB (x4) | * |
| ML 12-48 | 130 | 18,2 | 3,5 | 48 | 6 × 8 | 12HB-L (x4) | -- |



Multiloader **ML 10-40** - Overview view - Holes Position: open



Hot cupel & doré bead



Red hot 6HB bullion blocks



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CUPEL TRAY CAPACITIES

4-Feb-18
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TRAYS P52 & P53 + Fork TF1

| | | |
|---------------------------|--|-------------------------------|
| 1. TRAY P52 (near square) | L 162 x W 155 x H 30 - Rim (3 sides): W 6 x H 12 | Weight 0,92 kg |
| 2. TRAY P53 (rectangular) | L 311 x W 162 x H 30 - Rim (4 sides): W 6 x H 12 (P53 has double capacity than P52) | Weight 1,83 kg |
| 3. Fork TF1 | L 1520 x W _E 95 x W _I 55 | Weight 1,5 kg (all dim. "mm") |

CUPEL CAPACITIES

CUPELS # 2X — Ø 24 x H 16.3 mm — 36 pieces (matrix 6 x 6)



CUPELS # 4A — Ø 27 x H 22 mm — 25 pieces (matrix 5 x 5)



CUPELS # 7A — Ø 39.7 x H 28.5 mm — 12 pieces (matrix 4 x 3)



CUPELS # 9C — Ø 51 x H 33.5 mm — 8 pieces (matrix 3+2+3)



1. Cupel & GOLD ANNEALING Trays



◀ P53
 with 28 cupels
 # 4 (7 x 4)

Capacities:

P53 :

4 (9 x 4)
 # 4A (10 x 4)
 10HB (1 x 4)



◀ Tray P140
 ◀ Fork TF1

Capacity:
 P140
 # 4A (x 16)

Move many cupels / blocks at once, easing manipulation while keeping rank order.
 Two parallel wide grooves under Tray allow flat fork (TF) prongs inlet.
 Trays also protect furnace hearth from litharge (PbO) spills.
 Always spread MABORITE powder on tray top to absorb PbO spills.
 MABORITE prevents cupels from sticking to Tray and increases Tray life. Litharge attack is stopped and emissions of noxious PbO vapours notably reduced.

- Trays P140 - P52 - P53 used to handle small cupels (# 1 to # 6) ▶ Capacities
- Tray P235 used to handle bigger cupels (# 7A to # 12) ▶ Capacities

| TRAY ref | L _o / L _i mm | W _o / W _i mm | Ht / Dp mm | Wgt kg | Rim mm | Fits FORK | PRICE € / u |
|----------|------------------------------------|------------------------------------|------------|--------|---------------|-----------|-------------|
| P 51 | 155 | 140 | 30 / 15 | 0,67 | Flat | TF 1 | * |
| P 52 | 155 / 143 | 162 / 137 | 30 / 15 | 0,92 | W (4+7) × H 4 | TF 1 | * |
| P 53 | 311 / 288 | 162 / 137 | 30 / 15 | 1,83 | W (4+7) × H 4 | TF 1 | * |
| P 235 | 235 / 207 | 235 / 207 | 30 / 15 | 1,81 | W (6+8) × H 5 | TF 2 | * |



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CUPEL TRAY CAPACITIES

4-Feb-18
 C507_3_P235_Tray_Cap.doc

TRAY P235 + FORK TF2

| | | |
|-----------------------|---|-------------------------------|
| 1. TRAY P235 (square) | L 235 x W 235 x H 30 - Rim: W 6 + Bevel 8 x H 5 | Weight 1,81 kg |
| 2. FORK TF2 | L 1520 x W _{out} 110 x W _{ins} 55 | Weight 1,5 kg (all dim. "mm") |

CUPEL CAPACITIES

CUPELS # 2X — Ø 24 x H 16.3 mm — 64 pieces — (matrix 9 x 9)



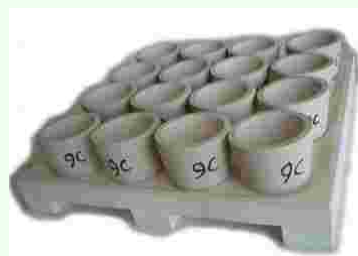
CUPELS # 3 — Ø 26.3 x H 17 mm — 64 pieces (matrix 8 x 8)



CUPELS # 7A — Ø 39.7 x H 28.5 mm — 25 pieces (matrix 5 x 5)



CUPELS # 8A — Ø 45.3 x H 35 mm — 20 pieces (matrix 5 x 4)



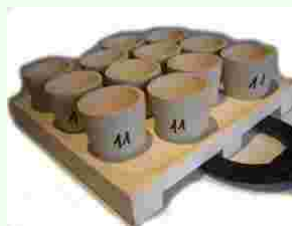
CUPELS # 9C
 Ø 51 x H 33.5 mm
 16 pieces
 (matrix 4 x 4)



CUPELS # 10 — Ø 60 x H 30.2 mm — 12 pieces (matrix 4 x 3)



CUPELS # 11 — Ø 56.8 x H 44 mm — 12 pieces (matrix 4 x 3)



◀ P53
 with 28 cupels
 # 4 (7 x 4)
Capacities:
 P53 :
 # 4 (9 x 4)
 # 4A (10 x 4)
 10HB (1 x 4)



◀ Tray P140
 ◀ Fork TF1
 Capacity:
 P140
 # 4A (x 16)

Move many cupels / blocks at once, easing manipulation while keeping rank order. Two parallel wide grooves under Tray allow flat fork (TF) prongs inlet.

Trays also protect furnace hearth from litharge (PbO) spills.

Always spread MABORITE powder on tray top to absorb PbO spills.

MABORITE prevents cupels from sticking to Tray and increases Tray life. Litharge attack is stopped and emissions of noxious PbO vapours notably reduced.

- Trays P140 - P52 - P53 used to handle small cupels (# 1 to # 6) ▶ Capacities
- Tray P235 used to handle bigger cupels (# 7A to # 12) ▶ Capacities

| TRAY | L _o / L _i | W _o / W _i | Ht / Dp | W _{GT} | Rim | FITS | PRICE |
|-------|---------------------------------|---------------------------------|---------|-----------------|---------------|------|-------|
| ref | mm | mm | mm | kg | mm | FORK | € / u |
| P 51 | 155 | 140 | 30 / 15 | 0,67 | Flat | TF 1 | * |
| P 52 | 155 / 143 | 162 / 137 | 30 / 15 | 0,92 | W (4+7) × H 4 | TF 1 | * |
| P 53 | 311 / 288 | 162 / 137 | 30 / 15 | 1,83 | W (4+7) × H 4 | TF 1 | * |
| P 235 | 235 / 207 | 235 / 207 | 30 / 15 | 1,81 | W (6+8) × H 5 | TF 2 | * |



FIRE ASSAY



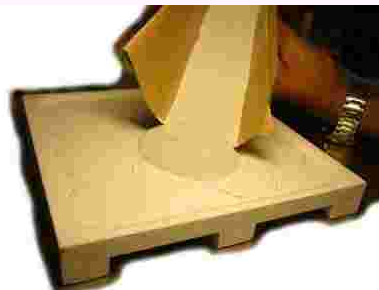
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MABORITE ANTI-STICKING POWDER

4-Feb-18
C507_4_Maborite.doc

APPLICATION OF MABORITE POWDER



LAYER SPREAD ONTO TRAY OR FURNACE HEARTH

- Prevents cupels from sticking to hearth
- Increases Tray / Refractory Lining life
- Limits [litharge](#) attack to electric elements
- MABORITE has same composition as cupels
- So MABORITE *absorbs* and *retains* LITHARGE
- Reduces emissions of noxious PbO vapours
- Stuck cupel may break when forced
- Broken cupels could cause sample loss
- Assayer's & cupel stress notably reduced !

Maborite in Use on P235 Tray



64 CUELS
2X



MATRIX
8 x 8



64 CUELS
3



MATRIX
8 x 8



20 CUELS
8A



MATRIX
5 x 4



25 CUELS
8S



MATRIX
5 x 5



MABORITE Non-Sticking Powder

- Prevents Cupels from sticking to Trays & Hearths
 - Stops *Litharge* / Flux attack: increase refractory life
 - Noxious PbO vapour emissions are notably reduced
- Same MgO composition as [Mabor](#) cupels

| MABORITE® POWDER | 5 kg | 25 kg |
|------------------------------|----------|----------|
| 88% <u>Magnesia</u> (MgO) | € / pail | € / sack |
| Refractory parting / bedding | * | * |



Non-Vit Zircon Refractory Coating

- Protects furnace surfaces exposed to hardest conditions, as *Litharge* / Flux attack
- Use: 4,5 kg/m² & 1,5 mm layer (min 2 layers)
- Temp. 1910°C (Seger cone) - ► [Furnascote](#)

| FURNASCOTE® COATING | 5 kg | 25 kg |
|----------------------------------|----------|----------|
| 63% Zirconia (ZrO ₂) | € / pail | € / drum |
| Non-Vit - Patching / Coating | * | * |

CUPELLATION : ► Cupels ► Blocks ► Instructions ► Certificates ► Tools ► Consumables — FIRE ASSAY: ► Crucibles ► Accessories ► Parting / Annealing
TERMS : ► Cupellation ► Fire Assay ► Reagents ► Other Methods ► Metals ► Context — INDEX: ► Programme — BROCHURE: ► MABOR



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CUPELLATION ACCESSORIES

4-Feb-18
C507_5_CupelAcc.doc

1. MABORITE NON-STICKING POWDER — FURNASCOTE FLUX RESISTING COATING & PATCHING MORTAR



MABORITE® Non-Sticking Powder



Non-Vit Zircon Refractory Coating

- Prevents Cupels from sticking to Trays & Hearths
 - Stops *Litharge* / Flux attack: increase refractory life
 - Noxious PbO vapour emissions are notably reduced
- Same MgO composition as Mabor cupels
- Protects furnace surfaces exposed to hardest conditions, as *Litharge* / Flux attack
- Use: 4,5 kg/m² & 1,5 mm layer (min 2 layers)
- Temp. 1910°C (Seger cone) - ► Furnascote

| MABORITE® POWDER | 5 kg | 25 kg |
|------------------------------|----------|----------|
| 88% Magnesia (MgO) | € / pail | € / sack |
| Refractory parting / bedding | * | * |

| FURNASCOTE® COATING | 5 kg | 25 kg |
|----------------------------------|----------|----------|
| 63% Zirconia (ZrO ₂) | € / pail | € / drum |
| Non-Vit - Patching / Coating | * | * |

2. POLISHED HAMMER AND POLISHED ANVIL FOR BEAD FLATTENING



Hammer 010



Anvil P7 4 legs



Small doré anvil
Horns flat- round

- Hammer with polished round / square ends. Cast steel
- Anvils : P7 table top mounting (4 legs), polished top; 19841 chromium plated.

| HAMMER / ANVIL | REF. | L x W x H mm | TABLE mm | WGt kg | PRICE € |
|----------------|------|-----------------|-------------|-----------|------------|
| Hammer | 010 | 280 x 110 x 40 | □ 36 x Ø 40 | 0,460 | * |
| Anvil - 4 legs | P7 | 110 x 75 x 95 | 110 x 75 | 4,500 | * |
| Anvil 2 Horns | 481 | 112 x 25 x 42 | 56 x 25 | 0,420 | * |

3. ADJUSTABLE CUPEL BRUSH (GLASS FIBRE) & STAINLESS STEEL BEAD TWEEZERS



| CUPEL BRUSH | L x Ø mm | PRICE € / u |
|----------------------------|-------------|----------------|
| Glass fibre | | |
| Brush - Adjust. Length | 125 x 10 | * |
| Spare Insert - Fibre Bunch | 25 x 4 | * |

| TWEEZERS | L mm | PRICE € / u |
|----------------|---------|----------------|
| crooked nipper | | |
| Grooved tips | 145 | * |

4. THERMAL PENCIL & HIGH TEMPERATURE CRAYON



Pencils
Keep track of cupels

Crayons
Mark cupels & crucibles



- Cobalt blue **Pencil** identifies cupels after furnace passage (1.200°C).
- Ceramic marking **Crayons**, 100 % useable, no outer shell (1300°C).

| PENCIL | L x Ø mm | PRICE € / dz. | € / u |
|--------|-------------|------------------|-------|
| ref | | | |
| BLU604 | 176 x 8 | * | * |

| CRAYON | L x Ø mm | PRICE € / u |
|--------|-------------|----------------|
| Ref | | |
| Blue | 130 x 12 | * |

5. PURE BI-REFINED SILVER INQUART CUPS & FOIL / ROD LEAD (99.99% PB "FOUR NINES" & 99.999% "FIVE NINES")



Silver Inquart Lenses



GOLD COLLECT SET



Lead Foil & Tablets

Gold free inquart disks

| Ag | WEIGHT mg / u | PRICE € / u |
|-----|------------------|----------------|
| Ø 9 | 200 | * |
| Ø 9 | 500 | * |

| Pb Foil | WEIGHT kg / ro | PRICE € / kg |
|----------|-------------------|-----------------|
| 50 x 0.1 | 2 | * |
| 50 x 0.1 | 5 | * |
| 50 x 0.1 | 10 | * |
| 70 x 0.1 | 10 | * |

- Lead (Pb) available in Foil & Tablet forms
- Certificates of analysis provided with order

| Pb Tablets | WEIGHT g / u | PACK kg | PRICE € / kg |
|----------------|-----------------|------------|-----------------|
| mm | | | |
| Ø 10 x 2,2 (O) | 2 | 5 | * |
| Ø 9 x 4,5 (C) | 3 | 5 | * |
| Ø 12 x 3,2 (C) | 4 | 5 | * |
| Ø 12 x 4 (C) | 5 | 5 | * |
| Ø 12 x 6 (C) | 6 | 5 | * |
| Ø 16 x 4,4 (O) | 10 | 10 | - - |

Roll Holder (for Pb foil 2kg - 10kg) - See Ph1 & Ph2

6. INGOT MOULDS FOR GOLD & SILVER - CAST IRON



UM1 - With Steps



M50



M500SP

Ext. 343 x 216 x 127 mm
Int. 165 x 89 x 55 mm

| INGOT MOULD | C | A | P | A | C | I | T | Y | WEIGHT | PRICE |
|-------------|-----------|-----------|-----------|-------|---|---|---|---|--------|-------|
| Ref | oz (doré) | g (Au) | g (Ag) | kg | € | | | | | |
| UM-1 (392) | 1 - 5 | 30 - 150 | 15 - 75 | 0,58 | * | | | | | |
| UM-2 (393) | 5 - 10 | 150 - 300 | 75 - 150 | 0,795 | * | | | | | |
| UM-3 (391) | 10 - 20 | 300 - 600 | 150 - 300 | 1,035 | * | | | | | |
| M20 | 20 | 600 | 300 | 1,075 | * | | | | | |
| M50 | 50 | 1500 | 750 | 1,76 | * | | | | | |
| M100 | 100 | 3000 | 1500 | 2,57 | * | | | | | |
| M500SP | 500 | 15000 | 7500 | 20 | * | | | | | |

- UM: Steps for variable ingot sizes
- SP: Side Pour (for cascade pouring)



6. ALUMINISED GLOVES

Gloves
Screen 85 %
radiant heat.



Aluminium foil backed leather Gloves. - Fireproof leather palm.
Reflect infrared radiation and withstand liquid metal splashes.
Good finger feel. Backing: Marlan fireproof webbing. Inside lining: Nomex

| GLOVES Ref | L cm | PRICE € /pair |
|---------------|---------|------------------|
| 206-BDA | 38 | * |

7. touchSTONES, NEEDLES & WOODEN CASE SET. For testing / classifying gold samples before fire assay.

Case with complete Set

Touchstone & Needles (Star Se

Touchstones - On which needles plus tested items are rubbed and wetted with acid to determine match. **Test Needles** - 5 needles of known Au/Ag contents.
Case set : 5 glass bottles with ground stoppers / applicators, standard touchstone, 5 needles, 5 sealed acid vials (9 k - 14 k - 18 k - Ag - Pt), flint paper P280.

| TOUCHSTONE COMPONENT | DESCRIPTION | PRICE € |
|--------------------------|--------------------------------|------------|
| Touchstone (standard) | Dark - 38 x 22 x 10 mm | * |
| Touchstone (large size) | Dark -152 x 102 x 2 mm | * |
| Needles - Set 5 needles | 9 - 14 - 18 - 22 karat Au + Ag | * |
| Wooden Case Complete Set | 120 x 84 x 95 mm | * |

- Powder has same MgO composition as Mabor cupels
- Temp. 1910°C (Seger cone) - ► Furnascote



HIGH PERFORMANCE FUSION CRUCIBLES : **UNIVERSAL RANGE**



GOLD ANALYSIS IN ORES / CONCENTRATES / SCRAPS / RESIDUES



Photo 1 - Eroded furnace hearth

SINGLE LOADING / POURING — manual —

- Work up to 1250 °C
- Suitable for single tongs handling / mechanical load & pour automated systems
- Adequate for multiple reuse processes
- High resistance to flux / slags erosion & thermal shock
- **UNIVERSAL RANGE** reduces shipping / storage costs

MULTI LOADING / POURING — manual or automatic —



Photo 2 – Multi-Load Tool

High performance, multi-use crucibles serve for determination of Precious Metals (PM): – Au, Ag, and Platinum Group Metals (PGM): Pt, Pd, Ir, Rh, Ru, Os – by Fire Assay / Cupellation method (aka "Docimasy").

Crucibles are used to "flux-melt" under high temp. reducing conditions following kinds of samples:

- **Exploration ores** from drill cores / trenching / grabbing by gold mines and Geological Labs.
- Mineral **concentrates** and electrolytic slimes processed by copper smelters.
- **Scraps & Residues** (ashes) from sweeps / filings / lemel / catalysts / recycled by PM refineries.

♦ **UNIVERSAL RANGE : FOR ALL PRECIOUS METALS ASSAY LABORATORIES**

Given the diversity of furnaces/ handling systems existing in laboratories worldwide, **UNIVERSAL RANGE** was developed to suit most Assayers' jobs. Capacities: from 1 to 2-¼ assay-tons: (A. T.) (+).

Designed to provide erosion and cracking resistance under harsh working conditions, **UNIVERSAL RANGE** pots yield longer life, faster fusion, constant melting speed and resistance to thermal shock.

♦ **COMPOSITION & MANUFACTURE**

A carefully blended mix of fireclays and additives ensures a product of **dense body** to minimize absorption losses while retaining the ability to resist flux (litharge) penetration, erosion and cracking under all furnace working conditions, flux compositions and lead (Pb) or nickel sulfide (NiS) Precious Metal collection methods.

♦ **CAPACITIES — DIMENSIONS — WEIGHTS — PACKING**

| UNIVERSAL RANGE | Ref. (‡)► | 30P | 40P | 50M | 55M | 65M |
|-------------------------------|------------|---------|---------|----------|---------|----------|
| CAPACITIES | | | | | | |
| Nominal Ore Sample (‡) | g | 30 | 40 | 50 | 55 | 65 |
| Nominal Ore Sample (+) | A.T. | 1 | 1-½ | 1-¾ | 2 | 2-¼ |
| Real Volume - Brimful | mL | 240 | 340 | 435 | 390 | 550 |
| DIMENSIONS (†) | | | | | | |
| Ø - Upper External / Internal | mm | 88 / 74 | 90 / 80 | 103 / 91 | 90 / 80 | 106 / 91 |
| Ø - Down External | mm | 55 | 59 | 57 | 57 | 57 |
| H - External | mm | 107 | 135 | 143 | 158 | 164 |
| WEIGHTS (†) | g / u | 480 | 500 | 570 | 620 | 720 |
| PACKING | | | | | | |
| Carton 38 x 38 x 31 cm | pc / box | 64 | 48 | 36 | 48 | 27 |
| Crate 116 x 116 x 96 cm | pc / crate | 2040 | 1680 | 1440 | 1380 | 1200 |
| PRICE | € / u | * | * | * | * | * |

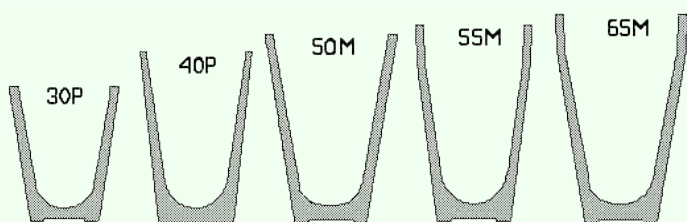
(+) A.T.: Assay Ton: Standard ore sample quantity: 29.166 g (short A.T. - USA) or 32.666 g (long A.T. - UK)

(†) **Dimensions** and **Weight** are nominal. May change with differing drying / firing shrinkage rates

(‡) "Ref." indicates Nominal Ore Sample Capacity (g); **not** total "charge" capacity (Ore + Flux + Inquart)

UNIVERSAL RANGE PROFILE SECTION

- **Wall thickness** provides good resistance to flux attack
- **Wide base** confers stability over eroded furnace hearths (ph. 1)
- **Outer Taper** form adapts to single tongs / multi-load tools (ph. 2)
- Sturdy **conical shape** allows pot 'nesting' saving space in crates
- **Nesting** shrinks crate volume & reduces storage needs
- **Compact packing** cuts transport cost to remote locations





FIRE ASSAY



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FIRE ASSAY TOOLS

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1. LONG TONGS FOR HANDLING FIRE ASSAY CRUCIBLES AND CUPELS



Cupel Tongs CT 3: 10 X 6 mm
For Mabor cupels # 6 till # 12 (Ø 35 - 60 mm)



Crucible Tongs CrT 1
For crucibles 30P, 40P, 55M (Ø ≈ 90 mm)
Crucible Tongs CrT 2
For crucibles 50M, 65M (Ø ≈ 90 105 mm)

Cupel tongs (CT-3) are adequate for moving bigger range of cupels used in ore analysis. (▶ Cupels)

Crucible Tongs (CrT) handle fire assay crucibles. Open ring (210°) is adequate for horizontal movements in and out of the furnace. Rod holds crucible while pouring into moulds.

| TONG ref | L cm | WGT kg | FITS: ▶ CRUCIBLES Ref | ▶ CUPELS Ø (mm) | PRICE € / u |
|----------|------|--------|-----------------------|-----------------|-------------|
| CT 3 | 90 | 0,86 | # 6 till # 12 | 35 – 60 | * |
| CrT 1 | 140 | 0,5 | 30P – 40P – 55M | 88 – 90 | * |
| CrT 2 | 140 | 0,5 | 50M – 65M | 105 | * |

2. LEAD BUTON POURING MOULDS - Up to 12 charges, conic holes - Cast Iron.



Mould **BM6a** (6x1)

◀ Mould **BM12** (4x3)

| REF | L x W x H mm | # | CONE mm | cm ³ | WGT kg | PRICE € / u |
|------|---------------------|-----|-----------|-----------------|--------|-------------|
| BM 2 | 160 x 75 x 55 | 2x1 | Ø 51 x 32 | 21 | 3,6 | * |
| BM 6 | 385 x 60 x 45 | 6x1 | Ø 51 x 28 | 19 | 5,5 | * |
| BM6a | 676 x 105 / 40 x 60 | 6x1 | Ø 75 x 38 | 55 | 14 | * |
| BM12 | 355 x 254 x 46 | 4x3 | Ø 75 x 38 | 55 | 6,1 | * |

BM2 & BM6 incorporate cast iron handle protruding 170 mm

3. MABORITE NON-STICKING POWDER – FURNASCOTE FLUX RESISTING COATING & PATCHING MORTAR



MABORITE Non-Sticking Powder



Non-Vit Zircon Refractory Coating

- Prevents Cupels from sticking to Trays & Hearths
 - Stops *Litharge* / Flux attack: increase refractory life
 - Noxious PbO vapour emissions are notably reduced
- Same MgO composition as Mabor cupels
- Protects furnace surfaces exposed to hardest conditions, as *Litharge* / Flux attack
- Use: 4,5 kg/m² & 1,5 mm layer (min 2 layers)
- Temp. 1910°C (Seger cone) ▶ Furnascote

| MABORITE® POWDER | 5 kg | 25 kg |
|------------------------------|----------|----------|
| 88% Magnesia (MgO) | € / pail | € / sack |
| Refractory parting / bedding | 18,00 | 47,50 |

| FURNASCOTE® COATING | 5 kg | 25 kg |
|----------------------------------|----------|----------|
| 63% Zirconia (ZrO ₂) | € / pail | € / drum |
| Non-Vit - Patching / Coating | 42,90 | 129,00 |

4. LITHARGE – Yellow lead oxide crystalline powder (99,8% PbO) - Ref Batch L-1109026 - Cert.



| IMPURITIES % (max) | Fe < 0.0015 | Cu < 0.0010 | Bi < 0.0250 | Ag < 0.0020 | Zn < 0.0010 | Sb < 0.0010 |
|--------------------|------------------|------------------|----------------------|-------------|-------------|------------------|
| | Apparent Density | Molecular weight | Granulometry | ADR Classif | ONU Danger | CAS |
| 9.5 | 1.9 – 2.3 | 223.21 | <40 µ 100% <10 µ 60% | 6.1, III | 60-2291 | 1371-36-8 |
| | | | | | | 25 kg € / drum * |

FUNCTIONS OF LITHARGE

- COLLECTOR**: Part of PbO is reduced.

Pb droplets *rain down* through the sample collecting all metals

- FLUXING AGENT**
- DESULPHURISER**
- SOLVENT** for metallic oxides

How LITHARGE (MP. 888°C, BP. 1477°C, Dens. 9.35) WORKS INSIDE THE CRUCIBLE

- INCREASES FLUIDITY** in combination with an acid ore constituent.
- Prevents formation of '**MATTE**' (by oxidation of S) and of '**SPEISS**' (by oxidation of Sb & As).
- PREVENTS REDUCTION** into lead button of those **metals below Pb** in the redox potential series.
- Combined with acid reagents PbO forms an **EFFICIENT SOLVENT** for acid and basic **OXIDE COMPOUNDS** that are too viscous at furnace temperature.



Fire Assay Crucible



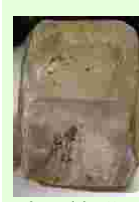
Charge being poured into conical mould



Solidified charge after release from mould



Separation of metallic phase & slag phase



Lead button hammered to cube



Lead Button cube on Cupel

CUPELLATION : ▶ Cupels ▶ Blocks ▶ Instructions ▶ Certificates ▶ Tools ▶ Consumables – **FIRE ASSAY**: ▶ Crucibles ▶ Accessories ▶ Parting / Annealing
TERMS: ▶ Cupellation ▶ Fire Assay ▶ Reagents ▶ Other Methods ▶ Metals ▶ Context – **INDEX**: ▶ Programme – **BROCHURE**: ▶ MABOR



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PARTING & ANNEALING

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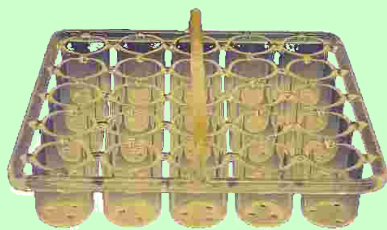
FIRE ASSAY OF PRECIOUS METALS

1. QUARTZ GLASSWARE - for efficient Assay processing - Allowed by ISO 11426:1997 (§ 7.1.4)

- ◆ Withstands concentrated / boiling nitric acid attack.
- ◆ Resists temperatures up to 1000°C and thermal shock.
- ◆ Cornets travel untouched through parting / rinsing / annealing.
- ◆ Extends inherent **parallel processing** capabilities of Fire Assay.

- ◆ **Full scalability to mass analysis production stage.**
- ◆ Save time - reduce manipulation hazards.
- ◆ Assays keep original array — no misplace errors.
- ◆ Labour, Reagents (HNO₃ - H₂O), Energy costs greatly reduced.

1.1 QUARTZ PARTING & ANNEALING BASKETS



Basket QB-25 (5 x 5 array)



Quartz Baskets packs 20, 25 or 30 cornet batch for *simultaneous treatment* through: a) 2 nitric acid attacks + 2 water rinses: once @ 33% and once @ 49% (m / m), b) drying and c) 750°C annealing.

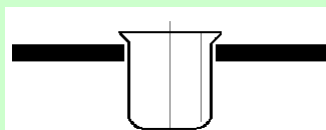
Consists of 25 type 'D3' crucibles framed together plus a handle.

| BASKET | DIMENSIONS | CAPACITY | WEIGHT | PRICE |
|--------|----------------|------------|--------|---------|
| Ref. | mm | Samples | kg | € |
| QB-20 | 100 x 80 x 50 | 20 (5 x 4) | | * |
| QB-25 | 100 x 100 x 50 | 25 (5 x 5) | | * |
| QB-30 | 120 x 100 x 50 | 30 (6 x 5) | | 1100,00 |

1.2. QUARTZ PARTING & ANNEALING TRAYS



< Tray QT-20 (5 x 4 array)



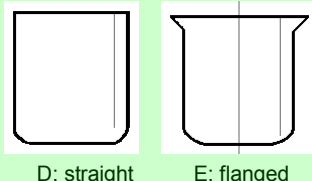
Thimble 'E' inserted in hole

Quartz Tray performs same functions as basket, but permits easy change of thimble spare parts in case of accidental breakage.

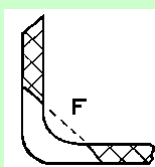
Capacities: 20 or 25 removable type 'E' (flanged) thimbles. Plate: 4 mm thick. With 4 legs (height 25 mm) and 2 handles (Ø 6 mm).

| TRAY | DIMENSIONS | CAPACITY | WEIGHT | PRICE |
|-------|----------------|------------|--------|-------|
| Ref. | mm | Probes | kg | € |
| QT-20 | 170 x 142 x 48 | 20 (5 x 4) | | * |
| QT-25 | 170 x 170 x 48 | 25 (5 x 5) | | |

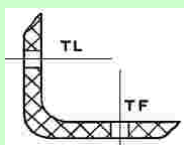
1.3. QUARTZ PARTING & ANNEALING CRUCIBLES - Allowed by ISO 11426:1997 (§ 7.1.4 "quartz thimbles")



D: straight E: flanged



F: Bottom Rim Slot 1,5 mm wide



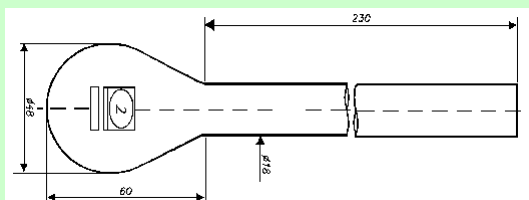
TL: Lateral Hole Ø 2.5 mm
 TF: Bottom Hole Ø 2.5 mm

Type E (flanged) may be placed on quartz tray QT20 / QT25 for speedier handling. See § 1.2 above.

Four perforation variants to suit different gold cornet sizes.

| THIMBLE | | Ø | | HGHT | SLIT | HO LES | | PRICE |
|---------|----------|---------|-------|--------|-------|--------|--------|-----------|
| Ref. | TYPE | OUT mm | IN mm | OUT mm | 'F' # | 'TL' # | 'TF' # | € / piece |
| D1 | straight | 17 | 14 | 20 | — | — | — | - |
| D2 | " | 17 | 14 | 20 | 4 | — | — | - |
| D3 | " | 17 | 14 | 20 | — | — | 3 | - |
| D4 | " | 17 | 14 | 20 | — | 9 | 3 | - |
| E1 | flanged | 17 / 21 | 14 | 20 | — | — | — | - |
| E2 | " | 17 / 21 | 14 | 20 | 4 | — | — | - |
| E3 | " | 17 / 21 | 14 | 20 | — | — | 3 | * |
| E4 | " | 17 / 21 | 14 | 20 | — | 9 | 3 | - |

2. BOROSILICATE GLASS PARTING FLASKS



Parting Flask made with low thermal expansion borosilicate glass withstands both nitric acid attack and thermal shock.

Tall narrow neck designed to fit inside gold annealing cups.

| FLASK | DIMENSIONS | WEIGHT | PRICE |
|-------|-------------------|--------|-------|
| Ref. | mm | kg | € |
| "2" | 230 x Ø 48 x Ø 18 | | * |

3. FIRECLAY CUPS FOR GOLD CORNET ANNEALING



Cup # 0



Cup # 1

Fireclay **Annealing Cups**, possess a smooth unglazed surface.

Tronco-conical form designed for gold bead annealing and for ignition of precipitates such as barium sulphate and copper sulphide.

| CUP | Ø SUP. | Ø INF. | H | CAP. | WGHT | PRICE |
|-----|---------|--------|----|-----------------|------|--------|
| Ref | mm | mm | mm | cm ³ | g | € / u. |
| 0 | 29 - 25 | 19 | 32 | 8 | 11 | * |
| 1 | 35 | 22 | 35 | 14 | 19 | * |
| 2 | 41 | | 44 | | | - |



FIRE ASSAY


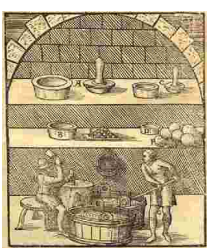


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FIRE ASSAY / CUPELLATION: PROGRAMME

| SECTIONS | ICONS | DETAILS | LINKS |
|--|---|---|---|
| 1. MAGNESIA CUPELS & BLOCKS  . (HISTORY). |  | • MAGNESIA CUPELS: ◇ MABOR®: General Presentation ◇ Data Sheet: Single CUPELS ◇ Data Sheet : BULLION BLOCKS ◇ Working Instructions - smaller cupels for Bullio Assay to ISO 11426 ◇ Working Instructions - bigger cupels for Ores Assay to ISO 10378 ◇ Quality and Environment Management Certificates: ISO 9001 & ISO 14001 ◇ Declaration of Conformity ◇ Brochure - full CUPELS & BULLION BLOCKS manufact. Programme (PDF, 3.6 MB) | ▼ 506/1 506/2 506/3 506/4 506/5 506/6 506/7 MABOR |
| 2. CUPELLATION TOOLS |  | • HANDLING TOOLS ◇ TRAYS & TONGS - For Single Cupels: ◇ Tray / Block FORKS, Automatic Sample LOADER - For Bullion blocks ◇ TONGS, HAMMERS & ANVILS - For <u>Doré</u> Handling | ▼ 507/1 507/2 507/3 |
| 3. CUPELLATION ACCESSORIES |  | • CUPELLATION CONSUMABLES: ◇ MABORITE® : Magnesite Powder. ◇ ASSAY LEAD: Tape & Tablets, ◇ SILVER Inquarts. ◇ Thermal PENCILS / CRAYONS, Cupel BRUSHES. | ▼ 507/4 507/5 |
| 4. FIRE ASSAY CRUCIBLES |  | • FIRE ASSAY CRUCIBLES (analysis of precious metals) ◇ UNIVERSAL CRUCIBLES (Silico-Aluminous Fireclay) – For Flux Fusion of auriferous Ores, Concentrates & Ashes under reductive conditions | ▼ 513/1 |
| 5. FIRE ASSAY TOOLS |  | • TOOLS & ACCESSORIES: ◇ Crucible TONGS ◇ MABORITE® : Magnesite Assay Powder. LITHARGE | ▼ 513/2 507/4 |
| 6. PARTING ANNEALING |  | • APPARATUS FOR PARTING & ANNEALING ◇ Annealing CRUCIBLES ◇ Parting FLASKS ◇ Annealing BASKETS | ▼ 513/3 |
| 7. ANNEALING CRUCIBLES |  | • REFRACTORY PARTS: ◇ FLUXING CRUCIBLES (Silico-Aluminous): ◇ Crucibles, Dishes, Capsules, Scorifiers | ▼ 514 |

FIRE ASSAY / CUPELLATION: BASIC INFORMATION

| SECTIONS | ICONS | DETAILS | LINKS |
|--|---|---|--|
| 8. GOLD ANALYSIS TERMINOLOGY (Multilingual) |  | • TECHNICAL VOCABULARY (English, German; Dutch, French; Italian, Spanish, Russian) ◇ GOLD DETERMINATION - Cupellation ISO 11426 – ASTM E1335-08 ◇ FIRE ASSAY: Minerals - Concentrates - Residues ISO 10378 – ASTM E1805-07 ◇ REAGENTS - Fluxes - Apparatus ◇ Other GOLD ASSAY METHODS ◇ PRECIOUS METALS - Its Alloys - Base Metals | ▼ Terms 1 Terms 2 Terms 3 Terms 4 Terms 5 |
| 9. ESSENTIAL FIRE ASSAY TERMS as used in Textbooks |  | • MEANINGS & CLUES of most Essential Fire Assay Terms ◇ Assay ton ◇ Blank Assay - Blank Test ◇ Cupellation Steps: Driving - Freezing - Opening (uncovering) - Blink - Flash - Scintillation ◇ Feathers ◇ Matte - Speiss - Regulus ◇ Play of colours - Brightening ◇ Spit - Spitting - (at beginning of Cupellation) ◇ Spit - Spitting - Sprout - " Sprouting " - Spurting- Vegetation (at end of Cupellation) ◇ Surcharge - Check Proof - Standard ◇ Inquart ◇ Hallmark - Microcupellation ◇ Cupel behaviour | ▼ A. T. Blank Steps Feather Matte Play Spit Spurt Charge Inquart Hmark Cupel |

10. FIRE ASSAY

BIBLIOGRAPHY:

IMPORTANT ARTICLES & PAPERS

(free download)



ANALYTICAL METHODS FOR DETERMINATION OF GOLD (Articles & Papers):

Articles from Word Gold Council (WGC)

- Assaying of Gold Jewellery - Review of Methods for Measuring Gold Content
- Gold Analysis - Comparisons of available Techniques

Articles from "Gold Technology" Magazine (WGC)

- "Assaying of Gold Jewel. - Choice of Technique" (GT, n° 32, 2001)
- "Analysis of Carat Gold" (GT, n° 22, Jul. 1997)
- "Assaying and Hallmarking in London" (GT, n° 3, Jan 1991)
- "Assaying Gold in Switzerland" (GT, n° 3, Jan 1991)
- "Touchstone Testing of Precious Metals" (GT, n° 3, Jan 1991)

Dr. C. W. Corti

M. Brill

D. W. Evans

Wälchi / Vuilleumier

Wälchi / Vuilleumier

Articles from "Gold Bulletin" Journal (WGC)

- "Analysis of Gold. A Review of Methods" (GB, Vol. 13, issue 1)

Roland S. Young

Articles from the "Alchemist" Journal, (LBMA)

- "The Art & Science of a Precious Metal Lab." (Alch., n° 48, LBMA)

David Court

Articles from "Pure & Applied Chemistry" Magazine"

- "Analytical Chemistry of Noble Metals" (Pure & Appl. Chem., Vol. 49) Dr. Jon Cl. van Loon

11. FIRE ASSAY

BIBLIOGRAPHY: TEXTBOOKS

INTERNET ARCHIVE I. A.



REFERENCE BOOKS - Free download ▶ INTERNET ARCHIVE ▶ (I.A.) ▶ Bewster Kahle

- "A Textbook on Fire Assaying"
- "Fire Assaying"
- "A Manual on Fire Assaying"
- "The Sampling and Assay of the Precious Metals"
- "Metallurgy of Gold"
- "The Precious Metals: comprising Gold, Silver and Platinum"
- "A Text Book of Assaying"

Edward E. Bugbee

Orson C. Shepard & Waldemar F. Dietrich

Charles Herman Fulton

Ernest Alfred Smith

Thomas K. Rose

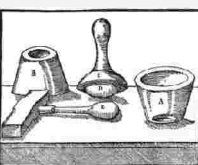
Thomas K. Rose

C. Beringer & J. J. Beringer

12. ASSAY

BEAUTIES: WOODCUTS & TEXTS & POEMS

(free download)



FOUNDATION STONES OF MODERN METALLURGY:

- "Das große Probierebuch", (Frankfurt am Main, 1598)
- "De Re Metallica", (Basel, 1556)
- "De la Pirotechnia", (Venezia, 1540)
- "Quilator de la Plata, Oro y Piedras", (Valladolid, 1572)
- "Alchemy, Chemistry & Metallurgy in Renaissance Europe"
- "Lo Canviador" - "The Exchanger" (c. 1420) - > Rialc - Unina

Lazarus Ercker von Schreckenfels

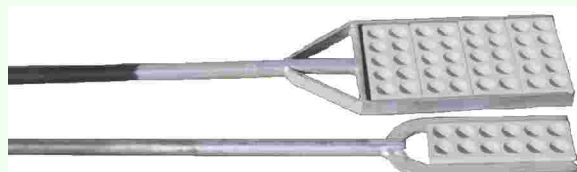
Georg Bauer "Agricola"

Vannoccio Biringuccio

Juan de Arfe y Villafante

Martinón-Torres & Rehren

Jordi de Sant Jordi



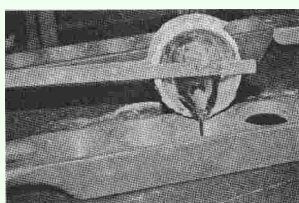
▶ Multiloading Bullion Block Forks & Tray Forks



▶ Maborite Magnesia (MgO)



>▶ Multiloading Forks • Cupellation Tools



▶ Lead Button Pouring Mould



▶ Silver Inquart Discs



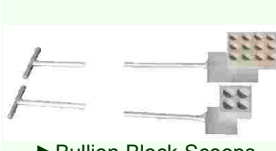
▶ Hammer & Anvil



▶ Lead (Pb): Foil & Tablets



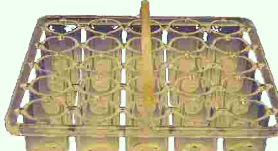
▶ Gold Bullion



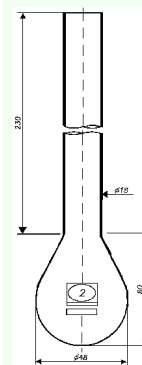
▶ Bullion Block Scoops



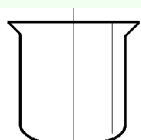
▶ Mabor Cupels



▶ Quartz Basket



▶ Borosilicate Glass Parting Flask



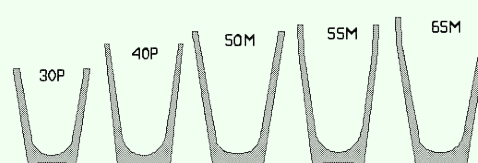
▶ Quartz Annealing Cup



▶ Cupellation Furnace



▶ Assay Lead (Pb) • Foil & Tablets •



▶ Fire Assay Crucibles • Universal Range

▼
Corti1
Corti2
▼
Corti3
Brill1
Evans
Wälchi1
Wälchi3
▼
Young
▼
Court
▼
vLoon

▼
Bugbee
Shepard
Fulton
Smith
Rose1
Rose2
Beringer

▼
Ercker
Bauer
Biring.
Arfe
Martin.
StJordi