ADVANCED MOLTEN ALUMINUM QUALITY CONTROL SOLUTIONS

Hydrogen Analysis • Porosity Assessment • Density & Process Verification



H2A-100
AT-LINE Hydrogen Analyzer



RDI-300
RPT & Density Index Measurement



H2M-200
IN-MELT Hydrogen Analyzer



RPT100
Reduced Pressure Test



ALDLink
Density Measurement

Local Spare Parts

Fast Local Service

Technical Support

Annual Calibration & Preventive Maintenance (CAL & PM)

Calibration Certificate - ISO/IEC 17025

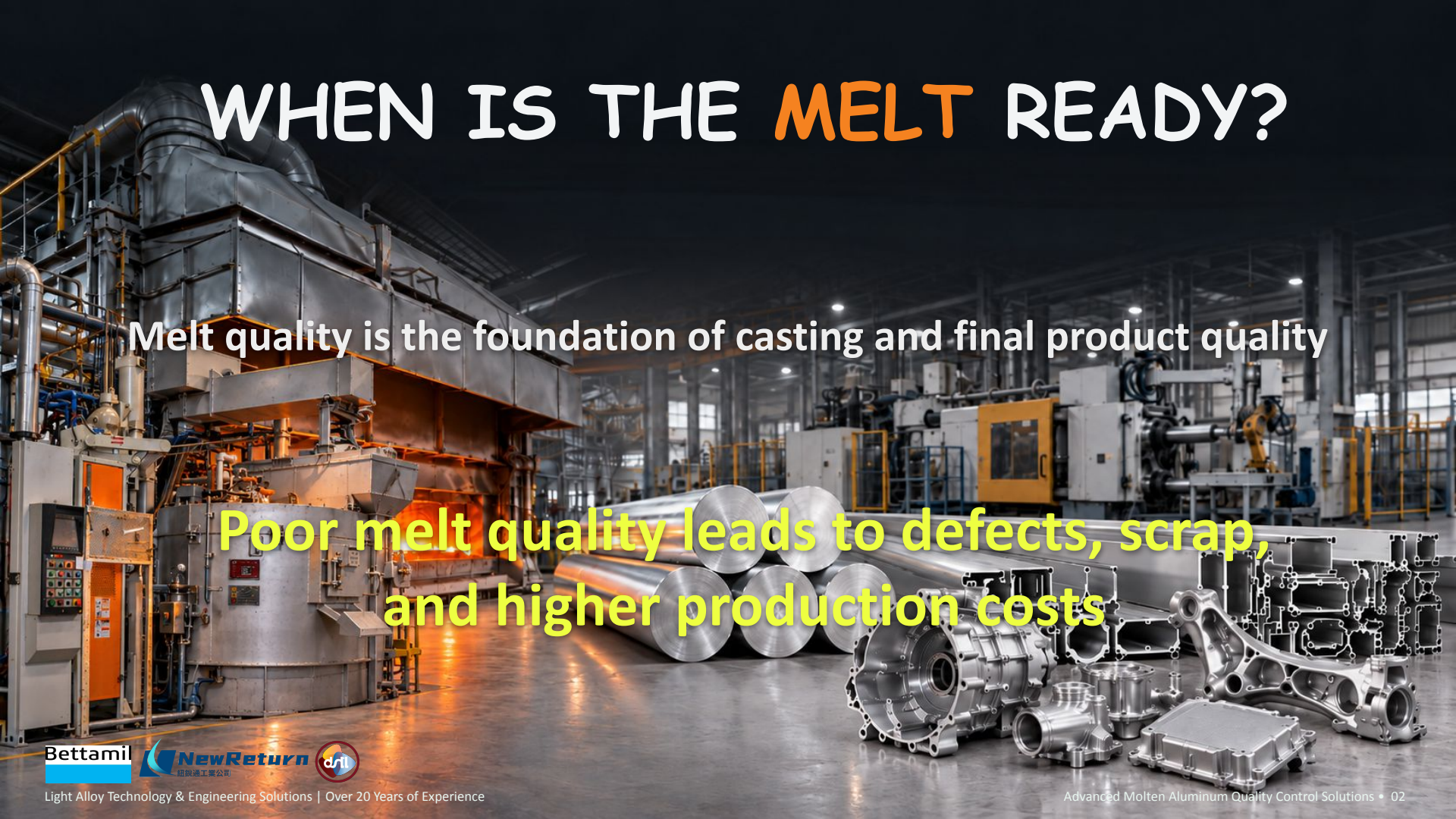
Somjit Uppamatho
Managing Director & Technical Consultant
Phone: +66 94 484 9687
Email: btmbox54@gmail.com

Bettamil Co., Ltd.
54 Phutthabucha 44, Bang Mot,
Thung Khru, Bangkok 10140, Thailand

Bettamil | NewReturn 紐銳通工業公司 | dsil | KMUTT | RCAMP

Light Alloy Technology & Engineering Solutions | Over 20 Years of Experience

WHEN IS THE MELT READY?



Melt quality is the foundation of casting and final product quality

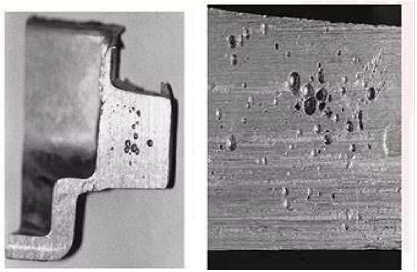
Poor melt quality leads to defects, scrap, and higher production costs

MELT-RELATED QUALITY DEFECTS

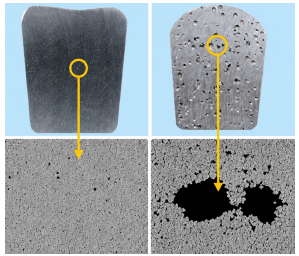
Different Defects — Different Product Impacts

CASTING PRODUCTS

Sand Casting, Gravity Die Casting, Low-Pressure Casting, High-Pressure Die Casting



Casting Porosity



Low Porosity High Porosity



Shrinkage Porosity
Not Hydrogen-Related

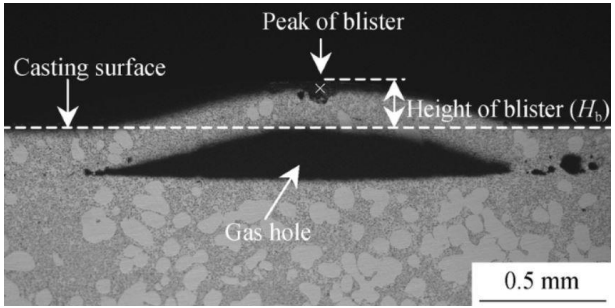
Hydrogen Gas Porosity

Dissolved hydrogen can form H_2 gas during solidification, producing pinholes, spherical pores and microporosity.

Hidden hydrogen porosity may remain inside castings and be exposed by machining.

BILLET, SLAB & OTHER WROUGHT PRODUCTS

Extrusion, Rolling, Forging, Heat Treatment



Blistering Ref. Lu et al., *Rare Met.* 42 (2023)

Potential Blistering

Hidden gas pores can elongate during forming and develop into surface blisters during heating.

HOW MUCH HYDROGEN IS REALLY IN YOUR MELT?

Measured hydrogen levels support informed process decisions

?

mL H_2 / 100 g Al

Preferred Target

mL H_2 / 100 g Al

TARGET RANGE ?

Do you know your actual hydrogen level?

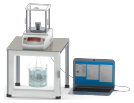
?

mL H_2 / 100 g Al

Very High
Immediate Attention

MELT QUALITY MEASUREMENT TOOLS

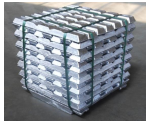
Equipment Selection Guide

Product	Model	Equipment Name	Measures	Method	Output	Test Time	Best For
	**H2A-100**	At-Line Hydrogen Analyzer	Hydrogen	Reduced Pressure Measurement	mL H_2 / 100 g Al	≤ 5 min	**Samples from** Melting Furnace / Holding Furnace / Transfer Ladle / Launder / Lab. Melting Furnace
	**H2M-200**	In-Melt Hydrogen Analyzer	Hydrogen	Recirculating Gas + Sieverts' Law	mL H_2 / 100 g Al	10–15 min	**Direct Measurement in Melting** Furnace / Holding Furnace / Launder / Lab. Melting Furnace
	**RPT100**	Reduced Pressure Test	Porosity	Reduced Pressure Test	Visual Porosity	≤ 5 min	**Samples from** Melting Furnace / Holding Furnace / Transfer Ladle / Launder / Lab. Melting Furnace
	**RDI-300**	RPT & Density Index Measurement	Porosity Density & DI	RPT + Archimedes' Principle	RPT Sample, Density, DI %	≤ 5 min	**Samples from** Melting Furnace / Holding Furnace / Transfer Ladle / Launder / Lab. Melting Furnace
	**ALDLink**	Density Measurement	Density	Archimedes' Principle	Density / DI (%)	≤ 3 min	**Samples from** RPT100 / RDI-300

MELT QUALITY CONTROL POINTS IN THE DIE CASTING PROCESS

Recommended measurement points for hydrogen, porosity & density





RAW MATERIALS

- Aluminum Ingots
- Return Scrap
- Recycled Aluminum



MELTING & MELT TREATMENT

Melt cleanliness control
Initial degassing, refining & inclusion control



TRANSFER LADLE

HOLDING FURNACE
& DEGASSING SYSTEM



HOLDING & DIE CASTING

Final melt quality check
Regular H_2 monitoring before casting
Degassing if H_2 exceeds the control limit



FINISHED DIE-CAST PARTS

Hydrogen / Porosity / Density Analysis
Sampling from the melting furnace / ladle



Melt Quality Measurement Tools

Hydrogen / Porosity / Density Analysis
Sampling from the holding furnace



Melt Quality Measurement Tools

H2A-100 | AT-LINE HYDROGEN ANALYZER

Quantitative Hydrogen Measurement • Mobile measurement at any melt sampling location



Specifications
Size: 500 x 630 x 940 mm
Weight: Approx. 100 kg
Power: 100 or 220VAC, 50Hz



0.278 mL H_2 / 100 g Al
7-Inch Touchscreen

0.01–0.50
mL H_2 / 100 g Al

≤ 5 min
Measurement Time

660–750°C
Sample Temperature

Fast & Flexible Measurement from Any Melt Location

- Sample from melting furnace, holding furnace, launder, or transfer ladle
- Quantitative direct hydrogen measurement under reduced pressure
- No consumables required
- No alloy correction required
- Stores >100 records; USB export and thermal printing

PV = nRT

The hydrogen pressure measured in the isolated vacuum chamber is converted directly into hydrogen content

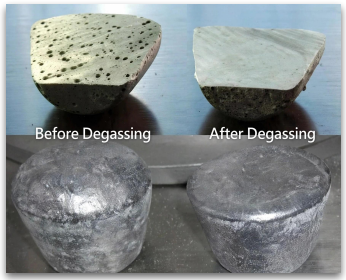
KEY BENEFITS
Direct hydrogen readout to 3 decimal places (mL H_2/100 g Al)

RDI-300 | RPT & DENSITY INDEX MEASUREMENT

RPT + Density + Density Index • Combined melt quality evaluation for casting alloys



Specifications
Size: 800 x 500 x 1260 mm
Weight: Approx. 100 kg
Power: 100 or 220VAC, 50Hz



RPT Samples for Density Index Evaluation



7-Inch Touchscreen with Density & Density Index Results

≤ 5 min
Sample Preparation

10–150 mbar
Adjustable Vacuum Pressure

0.01%
DI Resolution

Fast, Automatic & Mobile Density Index Evaluation

Density Index reflects the combined effects of dissolved gas, oxide films, and inclusions under reduced-pressure solidification

- Atmospheric and vacuum samples from the same melt
- Automatic density and DI calculation
- Vacuum setpoint typically 80 mbar
- USB export, storage and printing
- Smaller DI generally indicates cleaner melt
- No consumables required

$$DI\ (\%) = [(\rho_{air} - \rho_{vac}) / \rho_{air}] \times 100$$

Lower DI = Cleaner Melt
Higher DI = Higher Gas / Porosity Tendency

Typical guideline — actual limits depend on alloy and process conditions

KEY BENEFITS
Automatic density and Density Index (DI) calculation
Mobile and ready for shop-floor testing

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H2M-200 | IN-MELT HYDROGEN ANALYZER

Quantitative Hydrogen Measurement • Direct immersion into molten aluminum



Specifications
Size: 340 x 240 x 475 mm
Weight: Approx. 13 kg
Power: 100 or 220VAC, 50Hz



0–0.46	±0.01	10–15 min	660–800°C
mL H_2 / 100 g Al	mL H_2 / 100 g Al Accuracy	Measurement Time	Temperature Range

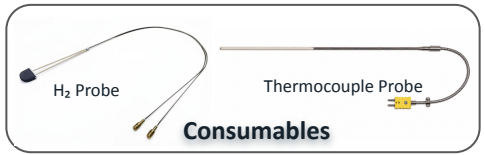
High-Precision Hydrogen Measurement

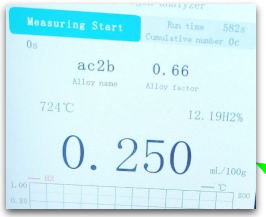
- Direct probe immersion in molten aluminum
- Closed-loop nitrogen circulation and TCD measurement
- Built-in N_2 cylinder supports mobile testing
- 7-inch touchscreen, USB data recording and thermal printing

Molten Al (H_2) ⇌ N_2 Loop→TCD→ H_2

RECIRCULATING GAS / SIEVERTS' LAW PRINCIPLE
Recirculating N_2 exchanges H_2 with the melt until equilibrium; TCD + Sieverts' Law determine dissolved H_2 content.

Consumables required
1. H_2 probe life: approx. 15 immersions or 3 cumulative hours
2. Thermocouple probe life: approx. 100 immersions
3. N_2 purity: 99.99%





0.250 mL H_2 / 100 g Al

KEY BENEFITS
Direct Readout to 3 Decimal Places (mL H_2 / 100 g Al)

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RPT100 | REDUCED PRESSURE TEST (RPT)

Qualitative Porosity Assessment • Visual assessment of hydrogen-related porosity





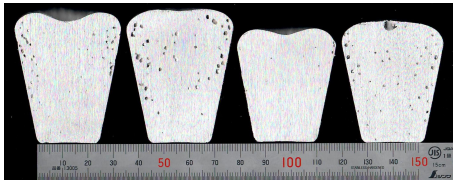
Low Porosity



High Porosity



Specifications
Size: 350 x 310 x 430 mm
Weight: Approx. 23 kg
Power: 230VAC, 50Hz



≤ 5 min
Test Cycle

< 8 s
Vacuum Time

-50 to -99 kPa
Adjustable Vacuum Range

660–800°C
Sample Temperature Range

Fast & Reliable Visual Porosity Assessment

Simple, reliable, and effective for routine melt-quality assessment

- Compact, space-saving design, 23 kg
- Cost-effective qualitative screening
- Simple operation and low maintenance
- Adjustable vacuum pressure and test time
- Clear visual comparison against an approved reference
- Samples ready for Density & Density Index measurement
- No consumables required

PV = nRT

Reduced Pressure Test
Expands Entrapped Gas
Making Porosity Easier to Detect

KEY BENEFITS
Fast visual assessment of hydrogen-related porosity against an approved reference

Bettamil NewReturn 紐銳通工業公司 Samples from RPT100

RPT100 | REDUCED PRESSURE TEST (RPT) | Detailed Technical Specifications



No Consumables Required

Samples ready for Density & Density Index measurement



Low Porosity High Porosity

Sample from RPT100

Evaluates molten aluminum quality and porosity tendency, while preparing samples for density measurement and Density Index calculation under controlled and reliable test conditions

Easy to operate, robust construction, and low maintenance

High Reliability

OMRON PLC Control
KEYENCE Digital Vacuum Sensor
Digital Solidification Timer
Vacuum Time < 8 s

Vacuum chamber with sight glass



Digital control panel

TECHNICAL SPECIFICATIONS

- **Control System:** PLC automatic control
- **Vacuum control:** Digital setting and display, range 0 to −101.3 kPa; vacuum achieved < 8 s
- **Test Time:** Less than 5 minutes, adjustable with digital display
- **Vacuum Chamber:** Cast aluminum chamber with sight glass for sample observation
- **Test Cup:** Stainless Steel, 100 g Al capacity
- **Overall Dimensions:** 350 × 310 × 430 mm
- **Weight:** 23 kg
- **Power Supply:** 230 VAC, 50 Hz
- **Standard Accessories:** Test cup, O-ring, filter, cup handling tongs, and operation manual (EN/TH)

Compact Size
Automatic Test Cycle

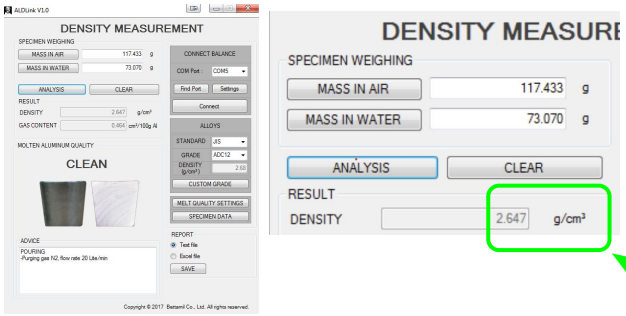
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ALDLink | DENSITY MEASUREMENT

Automated Density Measurement • Melt Quality Evaluation & Process Guidance



Specifications
Size: 420 x 455 x 678 mm
Weight: Approx. 14.5 kg
Power: 100-240 VAC, 50-60Hz



≤ 3 min
Analysis Time

0.001 g
Balance Readability

100–300 g
Sample Weight Range

Flexible PC Integration & Easy Data Transfer

- Compact, space-saving design
- PC-connected automatic density measurement with formula-based gas content estimation
- Easy data transfer for QC records, traceability, and process analysis
- Direct export to Text and Excel-compatible formats
- Alloy- and grade-specific reference settings
- Visual melt quality classification with condition-specific images
- No consumables required

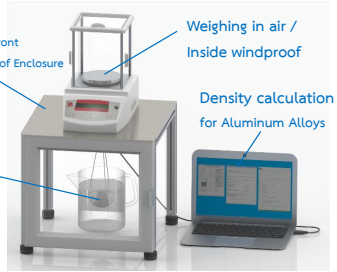
Density, ρ = Wair / (Wair − Wwater) × ρwater
Archimedes' Principle
Higher Density = Lower Internal Porosity Tendency

KEY BENEFITS
Automatic density calculation with clear melt quality classification, practical process guidance, and support for Density Index calculation in Excel

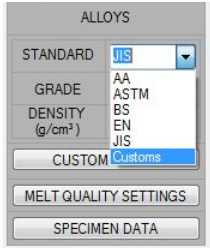
ALDLink | DENSITY MEASUREMENT | Detailed Technical Specifications

Table

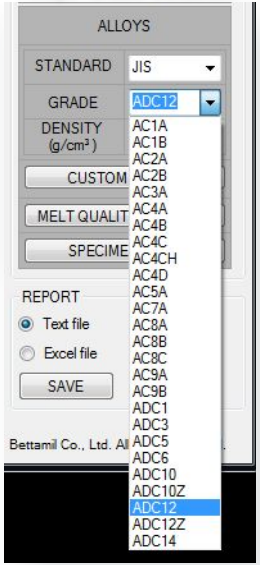
- Stainless steel top table
- Transparent swing door at front
- 3-Side Transparent Windproof Enclosure



Alloys Standard Database



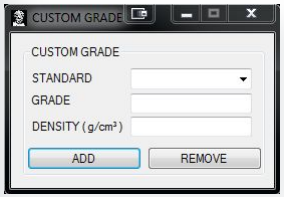
Alloys Grade Database



AUTOMATED DENSITY & MELT QUALITY ANALYSIS

Automatic density measurement with alloy- and grade-based melt quality classification. Provides practical process guidance, formula-based gas content estimation, and supports Density Index calculation in Excel. Flexible PC Integration & Easy Data Transfer for QC records, traceability, and process analysis

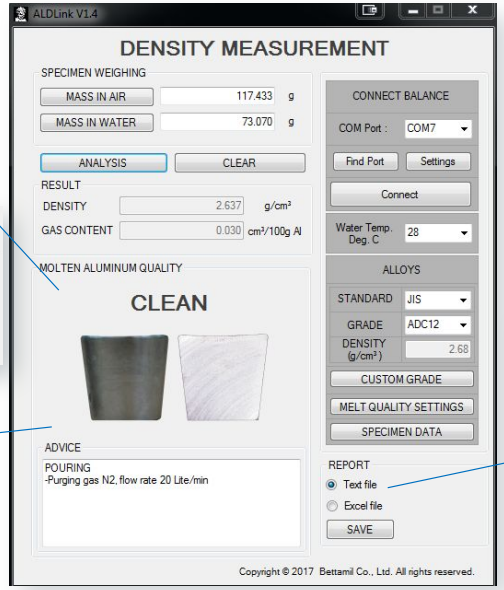
Custom Grade Available



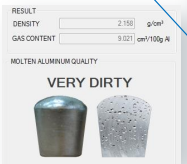
Adjustable Melt Quality Settings (EN/TH)



ALDLink Main Interface



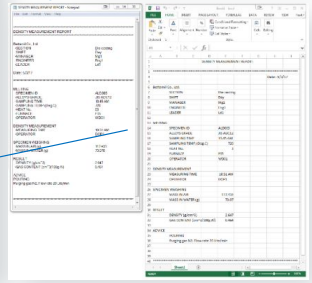
Example: Estimated Specimen Cross-Section Appearance



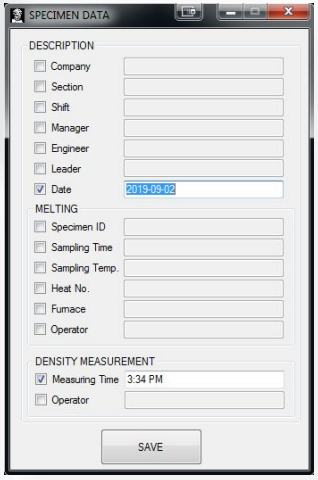
Advice

Process Advice for Melting Operators (EN/TH)

Output Files: Text Note, Excel



Specimen Data Input



Technical details

Overall Dimensions: 420 x 455 x 678 mm
Gross Weight: Approx. 14.5 kg
Maximum Specimen Size: Ø 50 x 55 mm (~ 300 g)
Computer: Windows 8, 10, 11 (64 bit)
Software: *ALDLink*
-Output file, Text Note, Excel

Balance Specifications
- Readability: 0.001 g
- Capacity: 400 g
- Input Voltage: 100-240 VAC, 50-60 Hz

Bettamil

THANK YOU

MELT QUALITY SHOULD BE MEASURED—NOT ASSUMED

Let’s establish your hydrogen baseline and verify your process with real data

COMPLETE SOLUTIONS • MEASUREMENT • CONTROL • CONFIDENCE

Local Spare Parts • Fast Local Service • Technical Support
Annual Calibration & Preventive Maintenance (CAL & PM)
Calibration Certificate — ISO/IEC 17025 Accredited Laboratory

Somjit Uppamatho
Managing Director & Technical Consultant
+66 94 484 9687 | btmbox54@gmail.com

Bettamil Co., Ltd.
54 Phutthabucha 44, Bang Mot, Thung Khru, Bangkok 10140 Thailand