



Measurement & Analytics | Measurement made easy

LiMCA CM

Liquid cleanliness analyzer for continuous monitoring

# Liquid metal cleanliness analyzer for continuous monitoring



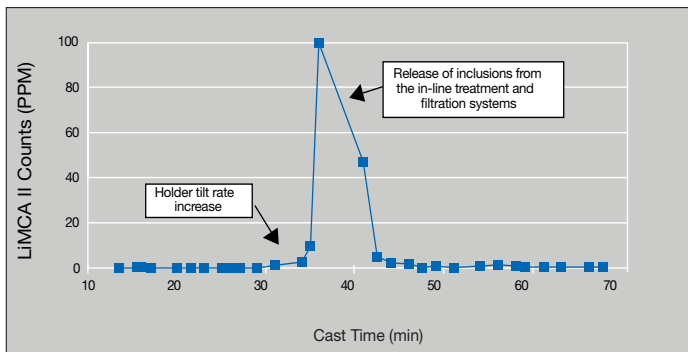
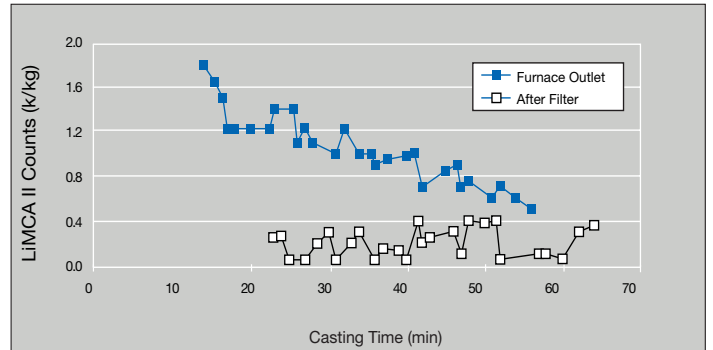
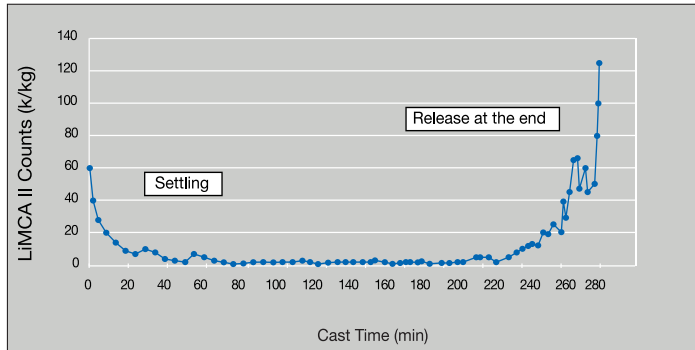
To maintain their edge, world-class aluminum plants must be able to monitor in real-time and with precision the quality of their liquid aluminum. They must be able to access process data easily and be able to find crucial information at a glance. LIMCA CM can meet this challenge.

- Direct, in-line and real-time inclusion measurement
- Fully automated
- Minimum maintenance
- Integrated to the Process

ABB's LIMCA CM is the proud successor of the well known LIMCA II. Designed for robustness and reliability, the LIMCA CM can run continuously (7/24) in the harsh environment of aluminum plants and requires minimal scheduled maintenance.

The LIMCA CM allows for in-line, real-time measurements. Inclusion monitoring is tracked every minute providing a detailed view of process quality at all times.

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## LiMCA CM Measurement Overview

The LiMCA CM system measures total concentration and size distribution of inclusions present in aluminum alloys. Its measuring principle is based on an objective and user-independent method. It is ideally suited for process control and quality assurance.

The LiMCA CM system can characterize the cleanliness of a melt at time intervals in the order of one minute. It can therefore monitor, in real-time, the evolution of cleanliness along a cast as a function of process parameters and melt-handling practices. The impact of furnace preparation, alloying practice, feedstock mix, settling time, and similar parameters on melt cleanliness is easily determined.

## Effect of settling on cleanliness

Settling time is often based on experience. What if you knew the level of cleanliness you could achieve just by selecting the right settling time in your furnace? Without this information, productivity is lost.

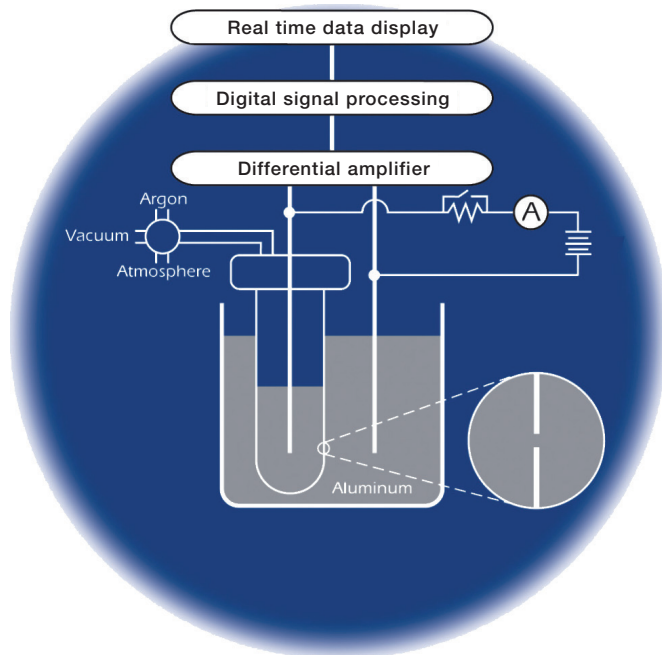
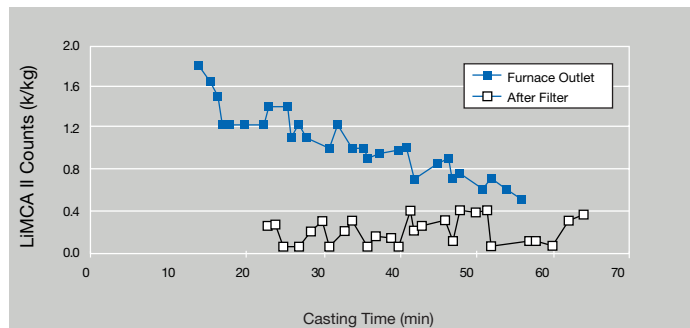
## Inclusion release from a sudden metal level change while casting

When systems are unstable, variations in quality occur. What if you knew how and why your process was unstable? Without this information, it is difficult to know the cause of your rejects.

## LiMCA results showing filter efficiency

Top quality producing plants rely on expensive in-line filtration systems. What if you knew your filtration efficiency and its limitations? Without this information, you may use your filtration system incorrectly.

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## LiMCA CM Benefits

The LiMCA CM is designed to operate continuously (24/7), readily providing inclusion measurement data directly to the casting database system with minimal operator intervention. It is installed at a stationary location and operates autonomously.

**Integrated to the process:** The LiMCA CM system is installed above the launder and is integrated to the process software environment.

**Automated measurement:** When molten metal starts to flow, the LiMCA CM detects it, lowers to immerse its probes and starts measuring. This is done automatically without any user intervention. At the end of the cast, the LiMCA CM raises from metal and stops measurement.

**Minimal operator intervention:** When the LiMCA CM is in its upper position, a casting operator installs a new probe. Then, the LiMCA is ready for the next cast. No additional user intervention is required.

**Robust design:** The LiMCA CM system is designed to operate in harsh plant environment. It has an integrated cooling system to withstand the heat. Its modular design makes it easy to maintain: If a module breaks, it can be easily troubleshot and replaced in minutes.

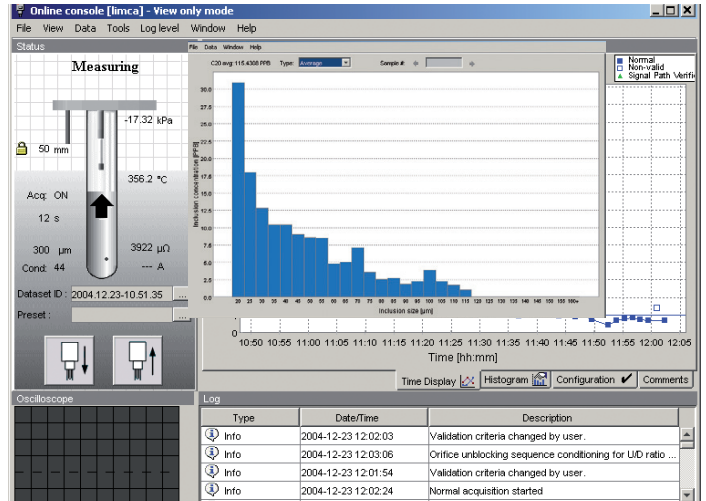
## Theory of Operation

The LiMCA CM system measures total concentration and size distribution of inclusions suspended in aluminum alloys.

The heart of the measuring system consists of a closed glass tube (electrically insulating material) bearing a small orifice at its bottom. The tube is positioned in liquid metal. By creating a vacuum inside the tube, the metal with the suspended inclusions to be detected is forced through the small orifice.

Two electrodes are necessary: one inside the tube and the other outside. Both electrodes are immersed in the liquid metal. A constant electrical current is applied between the electrodes. The current flows through the liquid metal by the small orifice in the tube.

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When an inclusion enters the orifice, it displaces its volume of conducting fluid, temporarily rising electrical resistance. The increase of resistance generates a voltage pulse. The magnitude of the voltage pulse is a function of the volume of the particle. The duration of the pulse is related to the transit time of the inclusion. The voltage pulses are amplified and their amplitude measured digitally. The size distribution and total concentration are displayed in real-time on a computer screen.

The LiMCA requires minimal maintenance and operates autonomously: only minimal interventions, such as replacing the probes, are required and can be easily done by the operators. Well trained technicians or metallurgists can focus on more important tasks than routine operation.

The LiMCA CM modular design reduces significantly the maintenance required. Replacement of any defective part is made easy.

## Other benefits:

- Simpler to configure
- Robust probe seal
- Robust in-probe thermocouple assembly
- Robust maximum immersion detector
- Only three electrodes
- No more batteries to change: replaced by Ultra-capacitors
- Metal level float replaced by a laser.

ABB's LiMCA CM brings liquid aluminum process monitoring one step further to simplicity and efficiency.

# Liquid metal cleanliness analyzer for continuous monitoring



## Analyzer performance specifications

- Particle size measurement	20-155 $\mu\text{m}$
- Particle size detection	15-300 $\mu\text{m}$
- Inclusion concentration (numerical)	0.05-1000 k/kg
- Inclusion concentration (volumetric)	1-100,000 PPB
- Reproducibility at high inclusion concentration	$\pm 10\%$
- Reproducibility at low inclusion concentration	Dominated by statistical noise
- Typical melt sample mass	17.5 g
- Typical melt sample volume	7.5 ml
- Typical data sample interval	80.0 seconds

## Analyzer ambient operating and storage specifications

- Operating ambient temperature	0-50 $^{\circ}\text{C}$	(32-122 $^{\circ}\text{F}$ )
- Storage ambient temperature	-40-85 $^{\circ}\text{C}$	(-40-185 $^{\circ}\text{F}$ )
- Internal operating temperature	0-65 $^{\circ}\text{C}$	(32-149 $^{\circ}\text{F}$ )
- Ambient humidity	5-95 % RH	non-condensing

## Analyzer electrical supply specifications

- Rated nominal line voltage	100-120 or 220-240 VAC
- Line voltage phases	Single, neutral grounded VAC
- Maximum line voltage fluctuation	10 %
- Rated frequency	47-63 Hz
- Rated power consumption	750 VA
- Breaker type (115VAC)	10A, 2 poles, Curve C
- Breaker type (230VAC)	10A, 2 poles, Curve C
- Minimum extension wire gauge	14 AWG

## Analyzer compressed air supply specifications

- Maximum temperature	40 $^{\circ}\text{C}$	(104 $^{\circ}\text{F}$ )
- Input pressure	690 kPa	(100 PSI)
- Maximum input pressure	1725 kPa	(250 PSI)
- Flow at 690kPa (100PSIG)	850 SLPM	(30 SCFM)
- Filter	5 $\mu\text{m}$	
- Oil content	Oil free	
- Dew point	-40 $^{\circ}\text{C}$	(-40 $^{\circ}\text{F}$ )
- LiMCA air hose internal diameter	12.7 mm	(0.5 in)
- Plant air hose minimum internal diameter	12.7 mm	(0.5 in)

## Analyzer compressed argon supply specifications

- Maximum temperature	40 $^{\circ}\text{C}$	(104 $^{\circ}\text{F}$ )
- Minimum pressure	550 kPa	(80 PSI)
- Maximum pressure	760 kPa	(110 PSI)
- Minimum flow	0.015 m <sup>3</sup> /mi	(0.5 SCFM)
- Filtration size	40 $\mu\text{m}$	
- Purity	99 %	
- Dew point	-40 $^{\circ}\text{C}$	
- LiMCA argon hose internal diameter	6.35 mm	(0.25 in)
- Plant argon hose minimum internal diameter	6.35 mm	(0.25 in)

# Liquid metal cleanliness analyzer for continuous monitoring

## Analyzer communication interface specifications

– Network interface type	Ethernet
	10/100baseT
– Network interface connector	Industrial RJ45
– Network interface cable type	Strait shielded

## Analyzer laser specifications

– Laser classification	Class 2 (IEC) / Class II (FDA)
– Laser power	less than 1mW
– Laser light source wavelength	635 nm
– Laser light source	visible red light
– Laser clearing distance	250 mm (9.8 in)
– Laser measuring range	500 mm (19.7 in)
– Laser measuring resolution	0.1 mm (0.004 in)

## Analyzer mechanical specifications

– Mass	60 kg (132 lbs)
– Perceived mass with counter weight	10 kg (22 lbs)
– Height	1011 mm (39.8 in)
– Width	475 mm (18.7 in)
– Depth	457 mm (18.0 in)
– Enclosure height	844 mm (33.2 in)
– Enclosure width	380 mm (15.0 in)
– Enclosure depth	385 mm (15.2 in)

## Actuator performance specifications

– Vertical maximum travel	780 mm (18.9 in)
– Vertical movement precision	1 mm (0.039 in)
– Maximum time to move over full vertical travel	50 seconds
– Upper and lower limit switch positions	Adjustable

## Actuator ambient operating and storage specifications

– Minimum operating ambient temperature	0 °C (32 °F)
– Maximum operating ambient temperature	50 °C (122 °F)
– Minimum storage ambient temperature	-40 °C (-40 °F)
– Maximum storage ambient temperature	85 °C (185 °F)
– Minimum internal operating temperature	0 °C (32 °F)
– Maximum internal operating temperature	65 °C (149 °F)
– Minimum ambient humidity	5% RH

– Maximum ambient humidity	95% RH non-condensing
– Minimum internal humidity	5% RH
– Maximum internal humidity	95% RH non-condensing

## Actuator mechanical specifications

– Mass	57 kg (126 lbs)
– Height	1411 mm (55.6 in)
– Width	210 mm (8.2 in)
– Depth	291 mm (11.5 in)

## Server computer requirements

– Recommended processor type	Intel Pentium III or better
– Recommended processor clock speed	1800 MHz
– Minimum RAM	256 MB
– Minimum recommended RAM	512 MB
– Minimum available hard-disk space	1 GB
– Recommended available hard-disk space	5 GB
– Network connection type	10/100 BaseT
– Video card and screen resolution	1024x768 pixels
– Video card minimum number of colors	256
– Minimum peripherals	Keyboard, pointing device, CD-ROM drive
– Tested operating system	Windows XP, Windows 7

## Console computer requirements

– Processor type	Intel Pentium III or better
– Recommended processor clock speed	1800 MHz
– Minimum recommended RAM	256 MB
– recommended available hard-disk space	1 GB
– Network connection type	10/100 BaseT
– Video card and screen resolution	800 x 600 pixels
– Video card minimum number of colors	256
– Minimum peripherals	Keyboard, pointing device, CD-ROM drive

# Contact us

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