

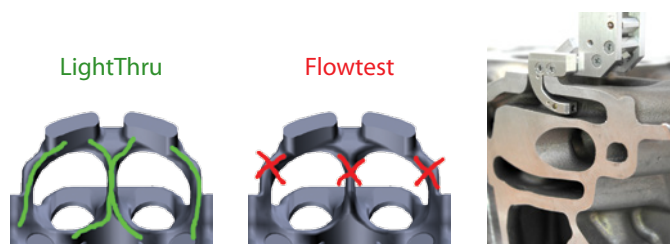
LightThru & Nanocameras Channel Inspection

Manufacturing aluminum castings with inner cores has various pitfalls. A sand core inserted into the mold is very fragile and can be damaged either when handled or in the actual casting. Also, when the final product is de-cored, a portion of the core can be left inside. All of these defects may have disastrous consequences for the final product.

LightThru is a system primarily intended for the manufacture of cylinder heads and engine blocks, where production takes place through conventional aluminum alloy gravity casting in semi-permanent sand core molds. The sand core sometimes breaks or is otherwise damaged, and the cavity becomes completely or partially blocked after the core is removed. Because the channel no longer works properly, it can, and usually does, adversely affect the engine's life and performance. In addition, detected core remnants and chips captured after machining reduces the risk of complaints about engine operation or of car accidents caused by the problem not having been caught before assembly.

› Advantages and Benefits

- 100% automated inspection of production;
- Very short inspection cycle times;
- Inspection of branched ducts and channels in a casting;
- Localizing the defect within a casting;
- Greater range of inspection in the casting compared with conventional solutions;
- Reduced investment costs when integrating multiple measurements in one facility.



LightThru



- Full blockages cause by broken core
- Blocked channels from wrong decoring

Nanocameras



- Partial blockages of various origin
- Machining chips stuck in narrow channels
- Flashes on glued core connections

› LightThru - System parameters

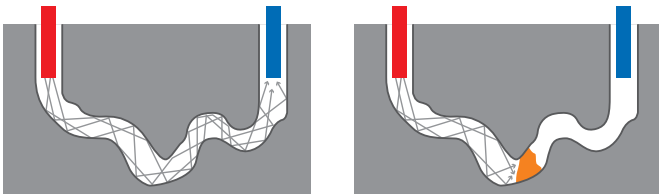
Measuring signal range	100 dB
Standard cycle time	26 s (as low as 16 s possible)
Max number of senders	32 per Sender Unit
Max number of receivers	16 per Receiver Unit
Detection of full blockages	Yes
Detection of partial blockages	No

› Method of Measurement

The LightThru system operates on the principle of measuring a light passing through the channels of the casting. The light is transmitted via LEDs and measured by photodiodes. A system of special probes designed for each product is separately inserted into the casting. Each probe includes transmitters and/or receivers. By measuring the signal between selected transmitter-receiver pairs, the system evaluates whether the passability of that part of the casting falls within tolerances expected, or if the product was damaged. Measurement takes place separately after each transmitter so defects can be clearly localized.

When the channels are completely blocked, the signal decreases to zero. Should the signal fall below the standard process variability, the system will suspect partial casting.

The basic advantage LightThru has over the built-in, air flow-based Flowtest system that is currently used is the option of independently measuring branched channels. Individual transmitters and receivers are positioned on the probes to be optimally directed into each channel, enabling them to be independently measured.



Principle of LightThru signal passing through channels without and with a blockage

› Integration Options

LightThru can be fully integrated into the production process. There are various mechanical designs based on the type of manufacturing process. Major advantages are its modularity and the option to integrate other types of inspections into a single device.

- Separated measuring device with manual loading;
- Inline device with conveyor-based handling;
- Robotically operates in an automatic cell;
- OMS integrates 3D measuring in surface inspections, checks of internal IIT threats and other measuring systems in a device.

› Nanocameras - System parameters

Measuring resolution	250x250 pixels
Standard cycle time	26 s (as low as 16 s possible)
Max number of LEDs	32 per Sender Unit
Max number of nanocameras	16 per MUX Unit
Detection of full blockages	Yes
Detection of partial blockages	Yes

› Method of Measurement

Nanocameras dramatically expand the ability to inspect internal channels in castings. Miniature cameras are built into same probes as LightThru. In back-light configuration they do not only determine the total amount of light transmitted through the channels (like LightThru does), but also the direction from where the signal is coming. In front-light configuration, they work the same as visual inspection done by operators with lots of different image processing functions for full automation of the process. This provides substantial opportunities for expanding the inspection, such as:

- Detection of partial blockages of channels by evaluating the precise cross-sectional shape;
- Independent measurement of branched multi channels;
- Detection of presence of foreign objects in the channels.

Each camera measures 1x1.8 mm, including the objective lens to allow further miniaturization of LightThru/Nanocamera probes and to reach "deeper into the core of the issue".

