Technical News Bulletin
Clearwater, 3 Dec. 2010

Veritas™ iC Application Notes

Section 1 Overview
The Veritas iC is a six-, nine- or 12-camera, non-contact, sidewall, sidewall stress, and dimensional inspection machine designed to inspect glass containers. As a stand-alone inspection system, it is capable of inspecting ware at speeds of up to 600 bpm for round and non-round ware (high speed inspection of non-round ware requires mega pixel cameras). It also can be coupled with other Veritas modules to create a fully integrated, data correlated, multi-inspection system. Once a job is created, all of the lighting, camera setting, and inspection parameters are saved in a job file database. Job changing to a saved job requires no tools and takes approximately one minute to perform.

In addition to the Veritas iC, there are two other machines in the Veritas series.

The Veritas iM is a five-station, servo-indexing, rotary inspection system designed to inspect glass containers. The system uses two basic types of starwheels: 9-pocket and 18-pocket. Maximum machine speed depends on the type of starwheel used; however the starwheel configuration does not affect the number of inspection stations.

The Veritas iB, is a six-station stepper motor driven, belt handler machine with vision inspection systems offering sealing surface, base, base stress, vision plug, vision dip/saddle inspections, as well as vision mold number reading.

This document applies to the Veritas iC only.
The Veritas iC is capable of performing the following inspections:

- **Opaque sidewall defects** (standard) – Image acquisition is performed using patented wrap-around lighting from super bright LED light sources, and high speed, high resolution area matrix cameras (1024x768 resolution) providing six views of the container.
  - Common defects detected: stones, birdswings, seeds, dirt, fused glass, mold dope, and other opaque, aspect-related defects.

- **Transparent sidewall defects** (standard) – Image acquisition is performed using patented patterned lighting with super bright LED light sources, and high speed, high resolution area matrix cameras (1024x768 resolution) providing up to six views of the container.
  - Common defects detected: large soft blisters, ribbon tears, loading marks, heavy washboard, blow-out, and other transparent, aspect-related defects.

- **Stress sidewall defects** (standard) – Image acquisition is performed using patented electronic cross polarizing filters with polarized lighting from super bright LED light sources and high speed, high resolution area matrix cameras (1024x768 resolution) providing up to six views of the container.
  - Common defects detected: stones causing stress and cords.

- **Dimensional sidewall defects** – Image acquisition is performed using patented wrap-around lighting from super bright LED light sources, and high speed, high resolution area matrix cameras. (1024x768 resolution) [up to 6 views] [standard]
  - Common defects detected: height, lean, filler offset, diameters, profiles
Section 2  Ware Range

Standard Specifications:
Diameter: 16-170mm [0.625-to 7.0 inches]
Height: 38mm-381mm [1.5-15.0 inches]

The Veritas iC is designed to handle both round and non-round containers.

Round containers – Includes nearly all cylindrical round shapes and most tapers within the machine’s ware range.

Non-round containers – Some containers that are rectangular in shape might need to be oriented prior to entering the Veritas iC.

Some containers can cause handling problems and should be tested by Emhart Glass. Examples of these containers include:
- Containers with extreme tapers
- Containers with offset necks or finishes

Section 3  Machine Speed

Maximum Speed:

The Veritas iC is designed to acquire images at a maximum speed of 600 bpm. The actual maximum speed is based on container diameter, container spacing, and conveying speed.

The following formula can be used to calculate the maximum speed for a particular container:

A minimum spacing of two bottle diameters is required to maintain accurate inspection spacing (refer to illustration).

Conveyor speed per minute ÷ (max. bottle diameter x 2) = max. bpm

Example:
- Max. bottle diameter = 68mm
- Conveyor speed = 45,720mm/min.

\[
45720 ÷ (68 \times 2) = 336.2 \text{ bpm}
\]

**NOTE:** When the Veritas iC is close-coupled to another machine, the maximum speed of the close-coupled machine is limited to the maximum speed of the slowest machine in the configuration.
Section 4  Inspection Notes

Container height and smallest detectable defect requirements will determine the lens selection for the Veritas iC. To maintain the highest image resolution, select the appropriate lenses from the table that meets the container height requirements. If you do not want to change lenses, select a lens that will inspect the entire height range of your production.

Example: A 12mm lens can be used to inspect the maximum container height, 381mm [15 inches]. It also can be used to inspect the shortest container, 38mm [1.5 inches]. However, the smallest detectable defect will be based on the lens being used.

<table>
<thead>
<tr>
<th>Container Height</th>
<th>Lens</th>
<th>Emhart Part #</th>
<th>Square Pixel Side Length</th>
<th>Pixel Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>38-93mm [1.5-3.6 in.]</td>
<td>50 mm</td>
<td>12745P</td>
<td>0.095mm</td>
<td>0.009mm²</td>
</tr>
<tr>
<td>38-185mm [1.5-7.3 in.]</td>
<td>25 mm</td>
<td>12744P</td>
<td>0.191mm</td>
<td>0.036mm²</td>
</tr>
<tr>
<td>38-289mm [1.5-11.4 in.]</td>
<td>16 mm</td>
<td>12473P</td>
<td>0.298mm</td>
<td>0.089mm²</td>
</tr>
<tr>
<td>38-381mm [1.5-15.0 in.]</td>
<td>12 mm</td>
<td>12959P</td>
<td>0.397mm</td>
<td>0.158mm²</td>
</tr>
</tbody>
</table>

The smallest detectable defect size is one pixel based upon 100% contrast.

NOTE: To achieve repeatable defect detection in a production environment, a reasonable defect size is 2 to 3 pixels in diameter.

Opaque defect detection

Using LED lighting and up to 12 cameras, the Veritas iC achieves a full 360° view of the container sidewall. The machine’s unique wrap-around lighting design enables the Veritas iC to inspect areas of containers that traditionally have been impossible to inspect. Features on the container such as embossing and uneven glass distribution (settle waves) now become inspectable areas of the container. In addition to the optics and lighting, the Veritas iC uses powerful inspection algorithms and filters, to help reduce the visual effects from embossing and distribution.
Transparent defect detection

Using the same cameras as the opaque defect detection, a second set of images is acquired. This second trigger of the LED light sources is performed using an adjustable light pattern. This patterned lighting is achieved by controlling rows of LEDs on the light board and illuminating them with different intensities. The result is an image of the container with defects on or near the surface of the glass being highlighted with sharp, easy to see edges (refer to illustration at right). Even very large soft blisters in the glass now appear with high contrast edges.

Stress defect detection

Using the same cameras as the opaque defect detection in station two or with a set of dedicated cameras, an electronic cross polarizing filter attached to the camera lenses is triggered. The result is a black image. If a container has any type of stress causing defect present, the image will have white areas highlighting the defect.

Dimensional defect detection

Dimensional inspection can be performed on any or all of the transparent images or with dedicated cameras. The dimensional defect inspection consists of software tools that measure container height, lean, filler offset, and body diameter. This is accomplished by placing calipers where dimensional monitoring is desired, then teaching the software the required dimensional units and tolerances.

During testing of the dimensional inspection capabilities for lean, the standard deviation for lean was approximately 0.279 mm [0.011 in.], min/max measurement was ±0.559 mm [± 0.022in.].*

*These specifications are for a specific container (35.5 cl [12.0 oz.] longneck amber beverage container) and are provided as a guide. Measurement capability stated is based on tests conducted on a standard, 6-camera Veritas iC with standard optics and inspections. Actual inspection capabilities in production will vary depending on container color, quality, glass composition and thickness, container handling, and inspection setup.
Section 5  Job Change

The Veritas iC requires no job change parts. If the machine is equipped with an Emhart Glass SBS 1000 High Speed Bottle Spacer (optional), it might be necessary to change the bottle spacer’s finger wheel to accommodate different bottle diameters.

Recalling a previously saved job. If a job is stored in the job data base library, it can be recalled and loaded. Total job change time for this is usually less than one minute.

Modifying a previously saved job. For job changing to a similar size or shaped container, the best way to job change is to modify an existing job. Lighting and inspection parameter changes might be required. This type of job change usually takes approximately 30 minutes.

Creating a new job. Setting up a new job requires a complete setup, including lighting, inspection parameters, and machine timing. This might take as long as 1.5 hours for a trained, but non-experienced operator. An experienced operator should be able to complete this task in one hour or less.

With proper training and experience, a single technician should be able to completely job change the Veritas iC in one hour or less, depending on the inspection configuration and requirements. Achieving this goal requires a strong preventative maintenance program and thorough training for all setup, maintenance, and operation techniques (see Section 14 for more information on Veritas iC training programs offered by Emhart Glass).

Section 6  Conveyor Systems

The conveyor running through the Veritas iC, serves a critical role in the inspection accuracy, especially for dimensional inspection. Accurate dimensional inspection requires that containers are uniformly stable as they pass through the inspection areas. A flat, tabletop chain link conveyor is recommended when the dimensional inspection accuracy is critical. The conveyor width can also affect the machine’s ability to inspect low on the heel of the container. The Veritas iC can be run with a 191mm (7.5 inches) wide conveyor, however, the narrowest conveyor width possible should be chosen for the range of ware to be inspected. The Veritas iC is not supplied with a conveyor.

NOTE: Emhart Glass cannot be responsible for the modification or performance of a conveyor control system. Our responsibility is limited to the supply and performance of the Veritas iC. Any conveyor/machine control issues must be reviewed and resolved during machine specification. These issues are part of site preparation, which is the customer’s responsibility and is covered in the machine instruction manual. Emhart Glass will work with customers and/or their conveyor supplier(s) to meet specific line requirements; however, the customer has the ultimate responsibility for any changes that must be made to the conveyor control to enable interfacing with the Veritas iC.
Section 7  Operating Environment

Enclosures: All electrical/electronic enclosures used in the Veritas iC should be considered rated for NEMA 1 and IP20.

Operating Temperatures: The Veritas iC is controlled by electronic equipment that is designed to operate in the majority of glass plant environments without modification. However, since conditions can vary from one installation to another, the following operating conditions must be observed. Failure to maintain these requirements will affect the applicable warranties covering the Emhart Glass hardware and software associated with the Veritas iC. If the proper operating conditions are not maintained, the electronic hardware will not function as designed.

1. Emhart Glass recommends that the temperature inside the Veritas iC (covers closed) be maintained at 20°C [68°F] at all times. The internal temperature (with covers closed) must be maintained at or below 40°C [104°F].

2. The maximum allowable temperature inside the machine is 40°C [104°F]. Although control components can operate at this upper temperature, life expectancy of the electronic components will be reduced. The lowest recommended operating temperature is 5°C [41°F] (refer to illustration at right). Relative humidity must be maintained at 20 to 95%, non-condensing.

CAUTION! Components within the electronic consoles must be kept clean. The life expectancy of electronic components will be substantially reduced if they are contaminated with plant dirt (swab oil, dust, etc.). The accumulation of these substances on electronic components causes the actual temperature of these components to be much higher than the temperature of air within the control cabinet.
3. If in-plant ambient conditions normally exceed 40°C [104°F] and/or relative humidity exceeds 95% (non-condensing), special cooling/dehumidification devices are required. For more information about these devices contact an Emhart Glass representative.

**Container Temperature:** The machine handling equipment is rated for 60°C [140°F] maximum container temperature at machine infeed. Containers hotter than this can cause damage to handling equipment and can cause the internal machine temperature to rise above acceptable limits as outlined above.

### Section 8 Utility Requirements

**Operating Voltages and Currents.** 230 VAC, 1 Phase, 12 Amps, 50/60 Hz standard. The following line voltages can be handled with the optional multi-tap transformer (PN 13133P):

- 380/400 VAC 3 Phase, 9 Amps, 50 Hz
- 415 VAC 3 Phase, 8.5 Amps 50/60 Hz
- 460 VAC 3 Phase, 8 Amps 50/60 Hz

Machine critical components are protected from surge, brownout and power loss by an uninterruptible power supply (UPS).

**Air Pressure:** 3.5 bar [50 PSI] minimum, 7.0 bar [100 PSI] maximum; 0.8 to 0.85m3/minute [25-30 CFM] maximum consumption. Air regulation, lubrication and filtering are provided within the machine.

### Section 9 Maintenance Requirements

The following maintenance routine should be performed at regular intervals. The machine is equipped with a Power Cycle meter and an Hours Run meter to make scheduling of preventative maintenance easier to track. Detailed procedures for performing these and other maintenance tasks can be found in the machine reference manual.

- Keep the machine clean of debris and broken glass daily.
- Clean part present sensors, camera lenses and light sources daily.
- Inspect all machine control switches and indicators for proper operation weekly.
- Check condition of all exposed cables weekly.
- Clean all fan filters weekly
- Drain fluid from the air tank monthly.
- Replace the airline filter at regular intervals.
Section 10  Conformity Statement
The Veritas iC conforms to the provisions of the following European CE directives and standards:


Section 11  Installation Notes

- To ensure smooth installation and machine commissioning, a final inspection line layout must be provided. This line layout must show the following:
  - Dimensions, including conveyor height
  - Cross-section view of the main line conveyor where the Veritas iC is to be installed
  - Cullet chute location
  - Location of all inspection machines and handling devices upstream and downstream of the proposed location for the Veritas iC.
- For proper ware flow and machine operation, ample free line space must be provided upstream and downstream of the Veritas iC. The general rule for optimum operation on high-speed lines is at least 5 meters [16.4 feet] upstream and downstream of the Veritas iC. For specifications, refer to the installation drawing 9016C4.
- Since rear access to the Veritas iC is required for some troubleshooting, proper cullet conveyor clearance is required. For specifications, refer to the installation drawing 9016C4.

Section 12  Specifications Required for Order Entry
The following items are configurable and require specification when ordering:

- Machine hand
- Plant voltage
- Conveyor height at installation
- SAR (supervisor of accurate rejection)
- Bottle spacing device
- Conveyor type
- Reject type
Section 13  Spare Parts
Spare parts kits are available for the basic machine. Although the Veritas iC is covered by a one-year parts and labor warranty, spare parts kits are highly recommended. If an adequate supply of spare parts is maintained, critical parts, when needed, will be available if they fail prematurely. An adequate spare parts inventory also helps reduce downtime or extended unsatisfactory machine operation caused by occasional out-of-stock conditions and time required to order and ship required parts. Parts covered under warranty will be replaced free of charge when returned to Emhart Glass under a Return Authorization number provided by Emhart Glass.

Section 14  Training
Setup, operation, and maintenance training by Emhart Glass personnel is mandatory for optimum machine operation and extended life. A machine-specific service program also is available for the Veritas iC. Training programs, offered either at an Emhart Glass training center, or at your plant, provide plant personnel with hands-on experience in all aspects of machine job change, maintenance, troubleshooting, and operation. We recommend training for all lead maintenance and setup personnel (at least one per shift). This helps facilitate optimum, 24-hour-a-day machine operation and can virtually eliminate costly machine maintenance and service calls.

Revisions

<table>
<thead>
<tr>
<th>Rev.</th>
<th>Date</th>
<th>Description</th>
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<tr>
<td>I</td>
<td>3 Dec., 2010</td>
<td>Sec. 4, Dimensional Defect Detection: Added specification guide for lean measurement.</td>
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<tr>
<td>H</td>
<td>13 Jun., 2007</td>
<td>Corrected various typographical errors.</td>
</tr>
<tr>
<td>G</td>
<td>24 May 2007</td>
<td>Sec. 1: Added information on additional cameras; Sec. 3: Clarified conveyor speed; Sec. 4: removed smallest pixel size, added information concerning dedicated cameras to stress defect and dimensional defect detection; Sec. *: removed multiple transformer part numbers, replaced with single part number for all.</td>
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<tr>
<td>F</td>
<td>28 Feb. 2007</td>
<td>Sec. 8 – corrected maximum air consumption</td>
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<tr>
<td>E</td>
<td>26 Sept. 2006</td>
<td>Added machine speed calculation to Sec. 3 – Machine Speed</td>
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<tr>
<td>D</td>
<td>6 July 2006</td>
<td>Reformatted, corrected temperature conversions in Sec. 7 – Operating Environment</td>
</tr>
<tr>
<td>C</td>
<td>16 March 2006</td>
<td>Removed incorrect reference to Veritas iB in Sec. 7 – Operating Environment</td>
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<tr>
<td>B</td>
<td>14 Feb. 2006</td>
<td>Corrected 12mm lens part number.</td>
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<tr>
<td>A</td>
<td>20 Jan. 2006</td>
<td>Updated temperature specifications.</td>
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