



QUALITY CONTROL PROCEDURE

Inspection and Testing	Sampling
<p>Quality Control System</p> <p>Documented procedures have been established and are being maintained under ISO 9001 for production, inspection and testing for Norbulb glass bulbs. All test activities are carried out in accordance with stringent in-house regulations and all applicable international quality standards.</p> <p>Quality Control Records are compiled for every batch of glass bulbs produced. They provide evidence of all inspections listed below as well as the results of the glass bulb strength test, the operating temperature test and the sensitivity test where applicable. The Quality Control Records are kept on file and can be made available on request. A list with the key test results of each lot will be attached to every shipment.</p> <p>1. Glass Bulb Dimensions - Visual Inspections</p> <p>The following dimensions are continuously controlled with our Opto-Electronic Control system (OEC) and additional visual inspections for compliance with the drawings:</p> <ul style="list-style-type: none">- assembly length between the recommended seat diameters- length and diameter of the tip- diameter of shaft, shoulder and bottom end- dome radius, shoulder angle and eccentricities- quality of the closure, irregularities in the glass <p>2. Glass Bulb Strength Test</p> <p>The glass bulb samples are mounted in hardened steel crush test fixtures between two holes with the recommended seat diameters and are subjected to a load increasing at a rate of 250 N / s until fracture. Calculation of the statistical mean, standard deviation and the Lower Tolerance Limit as defined in UL 199.</p> <p>3. Operating Temperature Test</p> <p>The glass bulb samples are immersed in a well agitated and controlled liquid bath, water for nominal temperatures up to 79°C and glycerine for 93°C and above. The bath temperature is being raised at rate of 0.5°C/min. All glass bulb activations are recorded and checked for compliance with the applicable temperature range, generally $\pm 3.5\%$ of the nominal temperature in °F.</p>	<p>per batch</p> <p>100 %</p> <p>25 – 50 samples</p> <p>100 samples</p>



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<p>4. Lower Temperature Limit Weed-Out</p> <p>All glass bulbs operating below the lower applicable temperature limit are <u>weeded out</u> in a liquid bath by keeping all glass bulbs at the lower temperature limit for 5 minutes.</p>	100 %
<p>5. Bubble Size / Disappearance Control</p> <p>All glass bulbs showing a larger bubble when heated up during the weed-out test (4) are <u>sorted out</u>. By this method those glass bulbs that are damaged, having low filling levels or have improper closures.</p>	100 %
<p>6. Thermal Shock Test</p> <p>Glass Bulbs are subjected to a sudden temperature change from a liquid bath heated up to their lower temperature limit to a cold water bath immersion. This is repeated in three cycles.</p>	100 samples periodically
<p>7. Sensitivity Test / Functional Test</p> <p>Fast response, intermediate response and standard response glass bulbs are tested in a windtunnel in standard sprinkler frames in best orientation for compliance with the applicable UL, FM and ISO sensitivity standards. The RTI is being calculated and compared with the requirements for each response category.</p> <p>The glass fragments from these tests are checked for their size to be smaller than the critical sizes defined in the standards.</p>	10 samples periodically
<p>8. Final Visual Inspection</p> <p>Prior to packaging all glass bulbs are subject to a final visual inspection for shape, defects, bubble size and especially for the closure.</p>	100%
<p>9. Calibration System</p> <p>All inspection-, measuring- and testing equipment is calibrated against certified masters with the required accuracy at regular intervals under the ISO 9001 quality system. Calibration records are being maintained for all equipment and masters used to document its conformance to the required degree of precision.</p>	100 %

