

HITTE 9003 703

OZONE TEST
CHAMBERS

SATRA TEST ENGINEERING

For some materials, most notably rubber and plastics, one of the most damaging environmental pollutants is ozone. Ozone (O₃) is an allotrope of oxygen and can be formed from the more abundant dioxygen (O₂) by the action of ultraviolet light and atmospheric electrical discharges. In the home, outdoors, and in most industrial environments, ozone concentrations are likely to be fairly low. Under certain conditions, however, higher concentrations may be present, for example in an automotive engine compartment where continual electrical discharge can cause a build-up of ozone-rich air that over time can attack components such as rubber hosing.

Rubbers are particularly prone to ozone attack and exposure can cause a crazing effect on uncovered surfaces, eventually leading to cracking and fracture. Ozone attack can also bring additives to the surface and cause the rubber compounds to separate. Areas where rubber materials are flexed or moulded tend to fail first, as these areas are already under high stress. Many industries – including the automotive sector – specify accelerated ageing tests using high concentrations of ozone to assess under-bonnet components such as hoses and gaiters, as well as tyres.

A number of test methods exist for testing rubber in the form of ASTM, BS or ISO standards, or specific

manufacturers' specifications. The test method most commonly used for general rubber applications is ISO 1431-1:2004. Here, materials are placed in a chamber containing an ozone-rich atmosphere for a period of time, after which they are assessed for damage or tested for physical properties such as strength. Samples are often held in tension or flexed during the ozone exposure period.

Testing for ozone resistance is best carried out using relatively high concentrations of ozone in a controlled atmosphere, as a higher level of ozone will accelerate the process of attack. Typically, ozone concentrations used for testing are in the range of 50pphm (parts per hundred million) to 5ppm (parts per million), although there is occasionally scope for significantly higher concentrations for specific applications. In a typical untreated rubber component under a small amount of stress, significant cracking can often be seen following only 24 hours of ozone exposure at 50pphm.

SATRA ozone testing technology has evolved as a result of more than 30 years of experience. Construction techniques have been combined with expertise to produce a reliable, accurate, fully automated, labour- and cost-saving ozone test machine that is truly environmentally safe.



HORIBA

OZONE CONTROL

TEMPERATURE CONTROL

SATRA

Ozone Test Cabinet 703

WARNING
OZONE
Hazardous to health
Do not breathe
Do not touch
Do not ingest

HTE⁹⁰³ 703

OZONE TEST CHAMBERS

SATRA designs and manufactures two ozone test chambers: SATRA HTE 703 and the SATRA HTE 903, which incorporates relative humidity (RH) control in the temperature range 23-40°C. Both chambers can be set up to test materials and components at temperatures between 0°C and 70°C, the lower setting allowing the testing of rubber in conditions that replicate freezing. Both machines incorporate a heavy-duty aluminium exposure chamber with anti-corrosive interior and a racking system to accept sample-mounting apparatus. A range of static and dynamic sample holders to international standards is available. Access is via a double-glazed, airtight and safety interlocked door. Entry to the test area is prevented until the interior environment reverts to safe ambient levels. Exterior lighting can be excluded from the test area via a shade, while the interior can be lit by the integral test inspection lamp.

An integral closed loop air-ozone system ensures that hazardous ozone gas is contained internally, eliminating the need to provide additional external venting and filtering of the spent gases.

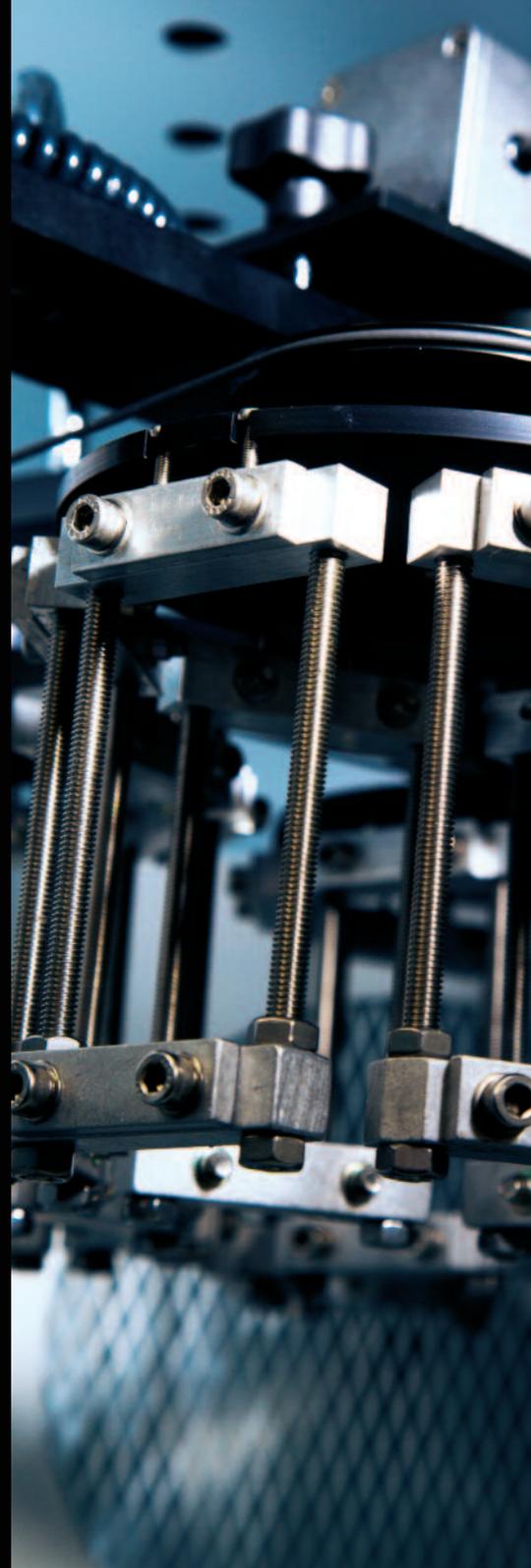
Controls and digital displays are logically laid out on a control panel and reflect the simplicity of operation required to set up a test routine. The only requirement is to set the ozone concentration, temperature, airflow, relative humidity (HTE 903 only), test start and finish time.

The ozone concentration is variable from 25-500 parts per hundred million (pphm) – 25-2,000pphm option – and is automatically controlled and monitored. The set concentration and monitored concentration are digitally displayed, and the monitored concentration can be output to a PC.

Ozone delivery is accurate to $\pm 5\%$ nominal of full-scale deflection (FSD) or better, typically achieving $\pm 2\text{PPHM}$ in concentrations of 50PPHM, measured under stable absorption conditions. Typical recovery times after sample insertion: returning to within 10 per cent of set point within 15 minutes.

Ozone generation is via UV ozone lamps with a maximum ozone generated output of 200pphm at 250 litres/min, and there is a high ozone option of 2,000pphm. The ozonised air flow of 40-440 litres/min is variable, allowing a maximum of three air changes per minute and an effective velocity of 3.3-33.3mm/sec. The internal circulation fan can be switched on to give 600mm/sec (2 feet/sec) which is in accordance with ASTM D 1149. Ozone concentration measurement accuracy is $\pm 2\text{pphm}$. Control accuracy is 4 per cent of set point ($\pm 2\text{pphm}$ at 50pphm).

The test timer provides digital programming of up to seven days, with test start and test stop.



Specification	HTE 703	HTE 903
Features	Allows tests to be conducted at various temperatures	Allows tests to be conducted at various temperatures and humidities
Relative humidity (RH) control	n/a	Range 50-80 per cent RH over exposure chamber temperature range of 23-40°C. Control accuracy of ±5 per cent RH is achieved at constant temperature
Water supply	n/a	A recirculating chiller system is recommended to supply the cooling water required for humidity control. This will allow the humidity function to be operated down to 20°C and is an alternative to mains water supply for cooling. Soft (de-calcinated) water is required for humidity generation.
Electrical supply	220-240V/single phase/50-60Hz rated at 1kVA system, unaffected by variations of 10 per cent from normal	220-240V/single phase/50-60Hz rated at 3kVA system unaffected by variations of 10 per cent from normal
Dimensions (cm)	172(H) 88(W) 125(L)	172(H) 88(W) 185(L)
Mass (kg)	370	520
Temperature range	<i>Standard model:</i> temperature range (laboratory ambient temperature +5°C) up to 70°C <i>Low temperature option:</i> temperature range 10°C up to 70°C <i>Extra low temperature option:</i> temperature range -2°C up to 70°C Note: low temperature options cannot be operated at the same time as the humidity function of the HTE 903	
Temperature control accuracy	±1°C at 40°C	
Ozone generation options	<i>Single lamp:</i> Ozone concentration 500pphm (200pphm practical working maximum) <i>Twin lamp:</i> Ozone concentration 1,000pphm (400pphm practical working maximum) Other lamp combinations are possible up to a maximum of five lamps <i>Five lamp:</i> Ozone concentration 2,000pphm (1,100pphm practical working maximum) Air flow rate 40 to 440 L/min	

The SATRA HTE 703 and 903 machines can be purchased separately or as part of a SATRA LabPlus package.

For further information or to arrange a demonstration, please contact:

test.equipment@satra.com

29.8

OUTPUT
MIN

W-LAMP

0
1

AUTO

H

RANGE

OUTPUT
MAX

TEMPERATURE CONTROL

7.70

All SATRA test machines benefit from world-renowned
technical expertise from start to finish.



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