



Mercury Dispensers for Fluorescent Lamps

we support your **innovation**

saes
getters



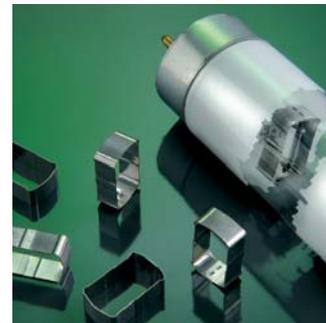
Mercury Dispensers for Fluorescent Lamps

Bringing Innovation to Light

For nearly three decades, the SAES® Getters Group has been supporting all the major fluorescent lamp manufacturers worldwide with innovative technology solutions capable of enhancing production quality and throughput, as well as of dramatically reducing the environmental impact of the lamps, both in manufacturing and disposal.

SAES Getters low-mercury dosing product lines make it possible to dose mercury very accurately, at levels ranging from a few milligrams to less than one milligram and to ensure high reliability of the final device, safe working conditions and a sound, environment-friendly approach to the problem of mercury pollution.

SAES Getters products address and meet the most severe technical requirements posed by lamp manufacturers and the most challenging environmental restrictions set by governmental organizations and main industry associations, by delivering an optimized trade-off between mercury dispensing operations and environmental regulations.



In-house dedicated R&D teams and state-of-the-art lab equipment allow the Group to constantly be at the forefront of mercury dispensing innovation and to actively partner with lamp manufacturers, from design and testing to mass production, to support and enable the development of tomorrow's lighting technologies.



Precise, reliable
and safe Hg
dispensers

Advanced Solutions Supporting the Fluorescent Lamp Industry

SAES Getters supports the lamp industry with mercury dispensing product lines tailored for every type of linear and circular fluorescent lamps for industrial, commercial and domestic lighting applications. Building on its expertise in gettering and special metallurgy, SAES developed its St 505 titanium-alloy as the safest and most effective solution commercially available for a controlled mercury release inside fluorescent lamps.

All of SAES Getters mercury dispensing solutions are based on the St 505 alloy and integrate this proprietary composition with the St 101[®] zirconium-aluminum getter alloy, which chemically absorbs and removes gaseous impurities from the bulb, thus improving the lamp performance and operational lifetime.

Further developments of SAES' mercury dispensing product line resulted in an extended product portfolio offering solutions that exploit a breakthrough technology, capable of delivering the complete and quick release of mercury contained in the dispenser. This patented "total yield" innovation adds a family of promoters to the St 505 alloy and constitutes the basis of the High Yield GEMEDIS[®], Roof and Total Quality Shield - TQS[®] products. Their technological excellence, along with the easy integration into existing standard and high-speed production lines, have already been outstandingly appreciated by all major fluorescent lamp manufacturers worldwide.



Wide variety of
Hg dispensers
for any
fluorescent lamp
application



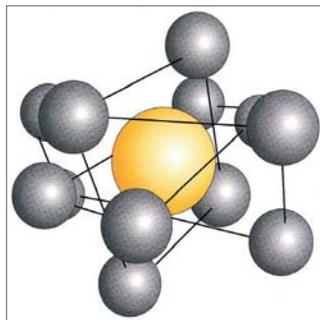
High
performance
gettering action



Suitable
environmental -
friendly solutions
for fluorescent
lamps
production

In all SAES dispensers the mercury is chemically bonded in an extremely stable intermetallic compound. Mercury release takes place from the dispenser mounted inside the lamp only after the lamp sealing by means of a short heating process called activation: this process allows both the release of mercury from the St 505 and the activation of the St 101 getter alloy which starts to absorb gaseous impurities possibly present in the filling gas of the lamp.

The heating profile may vary by product line and application, but a typical time-temperature combination for the High Yield GEMEDIS mixture is 900 °C for about 15 seconds, achieved by radio frequency induction.



Residual gas
analysis tests at
SAES Getters' labs



Lattice structure
on St 505



Our Integrated Core Competencies

SAES Getters' core competencies span from special metallurgy, material science, ultra-high vacuum technology and gas-surface interaction to chemical and physical analysis, gas purification and mathematical modeling.

The commitment to the continuous improvement of the proprietary production processes makes possible SAES to offer and deliver extremely reliable and high quality products. The manufacture with state-of-the-art technology may surely grant very precise Hg dosing and effective getter performances inside the lamps.



In parallel to metallurgical skills, SAES has developed an exceptionally deep knowledge of the gas-surface interactions that are fundamental to gettering and related phenomena, a key understanding for the development of new alloys and products.

The ability to chemically and physically characterize material properties is also an essential competence: having in-house capabilities to carry out these analyses allows the SAES Getters Group to quickly and reliably meet the demands of a continuously evolving marketplace.

In addition to its own material analysis and characterization, SAES Getters has applied its analytical skills to customers' materials and devices, to determine outgassing rates, getter effectiveness, residual gas compositions and mercury doses.

Our mathematical modeling solutions can be applied to virtually any of our customers' devices.

The global expertise achieved throughout the last six decades allows the SAES Getters Group to offer an all-round approach appreciated by fluorescent lamp makers all over the world to enjoy premium technological solutions.

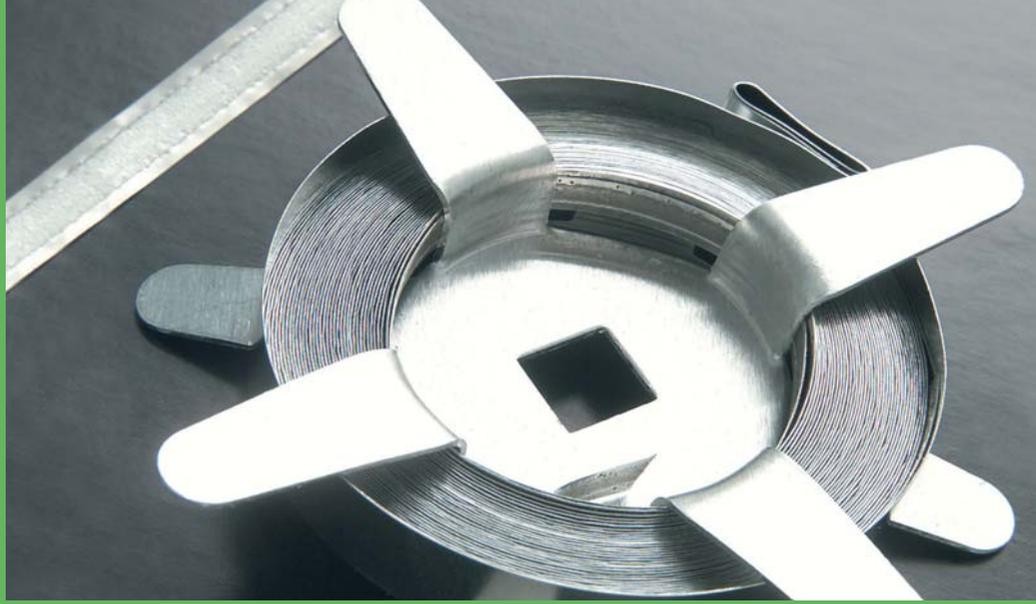




Our Competitive Advantages

- Advanced solutions that fit, and in many cases anticipate, new product requirements and fully comply with the most severe environmental regulations
- Optimized mercury release to ensure the best lamp performance and to guarantee the device operational lifetime
- Totally safe, controlled and easy handling of mercury
- Mercury total yield achievable through advanced technological solutions
- Getter alloy integration into any mercury dispenser model, for production of cleaner lamps
- Environment-friendly technologies, both in terms of products and processes
- Smooth product integration into customers' standard and high-speed manufacturing lines
- State-of-the-art lab equipment for analysis on residual gases and mercury content in customers' final devices
- In-house vertically integrated processes, from melting of alloys to final component production
- ISO 9001:2000 certified manufacturing sites and processes
- 60 years of expertise in partnering with industry key players and research centers for the development of optimized technological solutions
- Global sales and service network to support customers for any product development and manufacturing stage

High Yield GEMEDIS®



HIGHLIGHTS

General Features

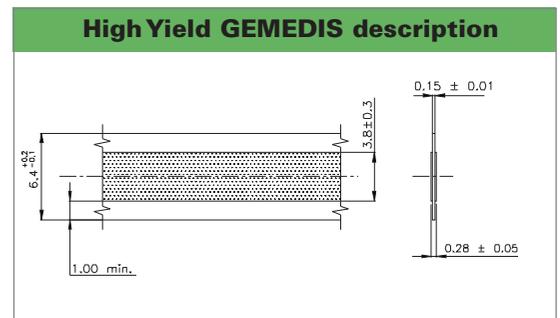
- Optimized, precise and reproducible mercury dosing
- Safe mercury dispensing
- Products and processes fully compliant with environmental regulations
- Reduced lamp filling gas degradation, through the getter component action
- Easy integration into standard and high-speed manufacturing lines

Applications

- Linear fluorescent lamps
- Circular fluorescent lamps

SAES® High Yield GEMEDIS® (HYG) has been used for the last ten years for safe, optimized and reproducible mercury dispensing in linear and circular fluorescent lamps. As environmental awareness grew and increasingly severe regulations on mercury use were issued, the SAES Getters Group developed and streamlined the production of an advanced technology that enabled lamp manufacturers to fully comply with the new restrictions while preserving the required lamp performance and lifetime. High Yield GEMEDIS offers total mercury yield, allowing the introduction of only the quantity of Hg necessary for optimum lamp operation.

High Yield GEMEDIS safely contains mercury as a stable solid in St 505 mercury-titanium inter-metallic compound: in the activation process, a copper-tin promoter mixed with SAES' St 505 alloy assures the release of 100% of Hg. This technique enables very precise and reproducible mercury dosing down to a few milligrams, ensuring homogeneous lamp performance.



When the mercury dose is reduced, lamp filling gas degradation typically becomes a critical issue: oxygen traps Hg forming mercury oxide and hydrogen increases the lamp starting voltage. To help reduce these degradation phenomena, High Yield GEMEDIS has been engineered as a double-side coated strip: one side is coated with St 505 and promoter, the other side is coated with SAES St 101® zirconium-aluminum getter alloy, which removes gaseous impurities from the lamp during production and for its lifetime. High Yield GEMEDIS can be integrated into vertical and horizontal lines for the production of tubular fluorescent lamps, since it can easily replace the cathode shield.

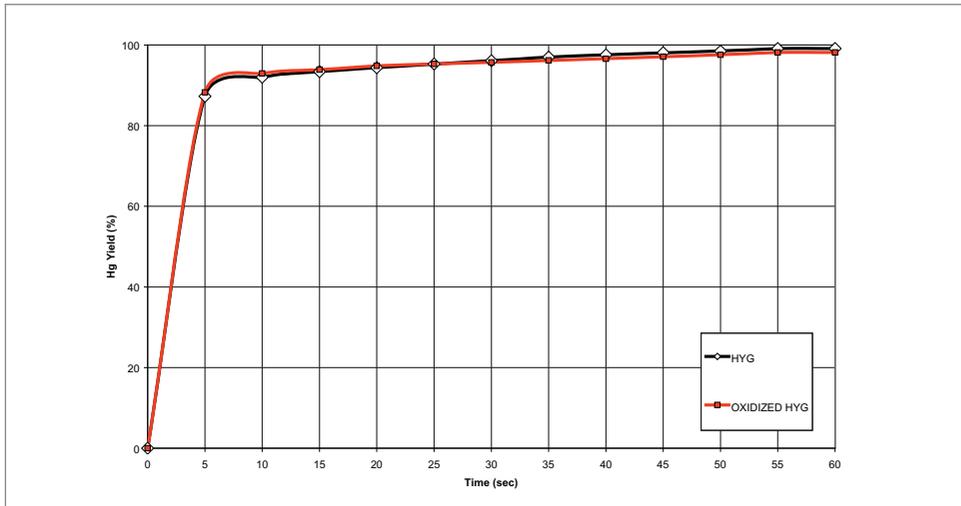
Principal characteristics of standard	Product description	
HYG nominal strip dimensions	HYG/CTL/6.3-4.5	HYG/CTL/6.3-3.2
Product code	4E0131	4E0160
Strip width (mm)	6.3	6.3
Coating width (mm)	3.5	3.8
Total thickness (mm)	0.25	0.25
Total mercury loading (mg/cm)	4.5	3.2
St 101 getter alloy weight (mg/cm)	8.0	8.0
Gas emission (ml-mbar/cm)	<10	<10

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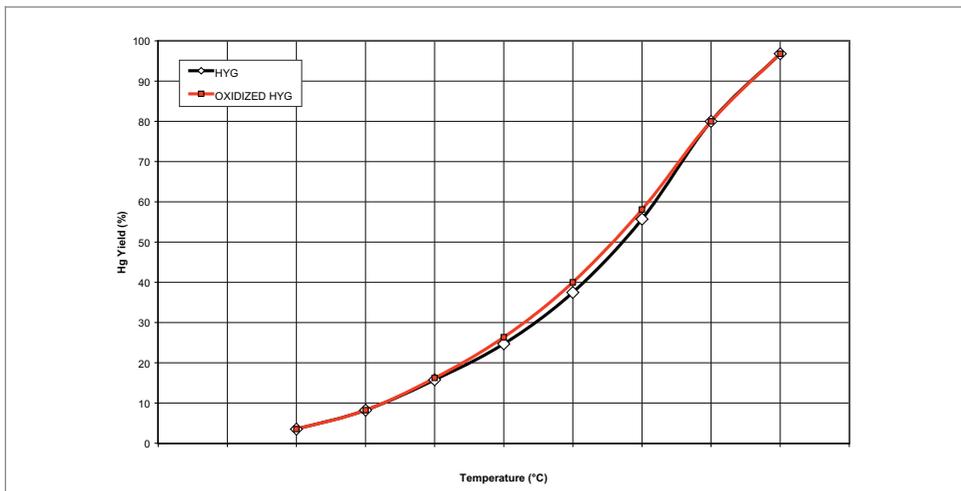
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Product Activation

The chart below shows the percentage of Hg released as a function of the heating time at 900 °C for the High Yield GEMEDIS strip. Similar yield characteristics are also obtained after oxidation in air at 400 °C for 45 seconds, to simulate exposure to high temperature during the lamp production process. The Hg release of High Yield GEMEDIS both before and after the oxidation heating is exceptional: more than 95% of its mercury is released for both the fresh and oxidized product, even after heating for 5 seconds.



The following chart indicates the percentage of mercury released as a function of temperature for a total heating time of 30 seconds for fresh High Yield GEMEDIS and after oxidizing in air at 400 °C for 45 seconds. In the time shown, the Hg release approaches 100%. It is important to note that, even under vacuum, below 450 °C practically no Hg emission occurs.



Packaging

High Yield GEMEDIS is packaged in an airtight metal drum containing 14 to 16 spools. Each spool is characterized by a length of about 100 m. The total length of High Yield GEMEDIS strip per drum is approximately 6,000 meters. Silica gel desiccant is used to ensure a dry atmosphere in the drum.

High Yield GEMEDIS®

The SAES Getters Group manufacturing companies are ISO9001 certified, the Asian and Italian companies are ISO14001 certified also. Full information about our certifications for each company of the Group is available on our website at: www.saesgetters.com

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SAES Getters Group
www.saesgetters.com
lamps@saes-group.com

TQS® and Roof



HIGHLIGHTS

General Features

- Total mercury yield
- Totally controlled, precise and safe mercury dispensing
- Reduced environmental impact of products and processes
- Improved lamp performance and lifetime through the getter component action
- Easy integration into standard and high-speed manufacturing lines

Applications

T8LFL - T10LFL - T12LFL for TQS
T5LFL - T8FL - CFL for Roof

- Three-band phosphor lamps
- Halo-phosphor lamps

A Revolutionary Technology

SAES® Total Quality Shield - TQS® and SAES Roof are the most advanced technological solutions for precise, reliable and safe mercury dispensing in Linear Fluorescent Lamps. These products have been developed at SAES Getters Group in close co-operation with customers to fully comply with the real needs of cutting-edge lamp production technologies.

TQS and Roof innovative approach consists in offering total mercury yield under extremely safe operation conditions. SAES products total mercury yield is obtained, after lamp tip-off, when TQS or Roof are heated for some time at high temperature.

TQS and Roof are reliable low mercury dosing products capable to release very small quantities of mercury. The adoption of TQS and Roof in fluorescent lamps production allows being compliant with the existing and upcoming more stringent environmental regulations that will be imposed.

TQS is usually mounted to replace one of the lamp cathode shields, while Roof is mounted on top of, or on one side of the lamp cathode. These mercury dispensers can withstand the typical manufacturing process of fluorescent lamps without any problem.

The quality of TQS and Roof is continuously monitored by on-line checking systems, in order to guarantee the maximum reliability and reproducibility of mechanical features and of the mercury dose.

Product Composition & Models

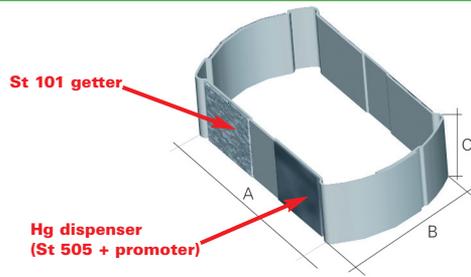
TQS and Roof are based on SAES Getters' High Yield GEMEDIS® material and incorporate a copper-tin family of promoters to ensure that St 505, the proprietary titanium-mercury inter-metallic compound, maximizes Hg release. The lamp performance and lifetime are boosted by SAES St 101® zirconium-aluminum getter alloy, which is part of TQS and Roof structure: after activation, the non-evaporable getter alloy starts absorbing gaseous impurities in the bulb, such as hydrogen that is known to increase lamp starting voltage, and oxygenated gases, which could irreversibly trap Hg through the formation of mercury oxide. St 505, in combination with the promoter and St 101, are coated in different tracks on a nickel plated iron wide strip: TQS and Roof can be customized to specific application requirements, offering extreme flexibility in terms of geometry and number of powder tracks.

The products are capable of withstanding temperature processing in air up to 450 °C without losing mercury, and are suitable to dispense mercury in high-speed horizontal lines, horizontal lines and vertical lines.

we support your innovation

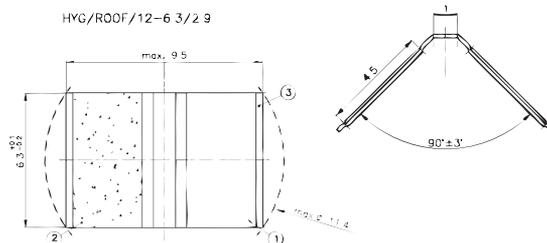
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Standard TQS description



Product code	Product description TQS/AXBXC/	Hg content (mg)	St 101 content (mg)
5E0002	TQS1/16X8X5/4.5	4.5	25
5E0007	TQS1/16X8X5/8	8	10
5E0021	TQS1/18X7X6/6	6	23
5E0023	TQS1/16X8X5/9	9	10
5E0026	TQS1/16X8X5/6.5	6.5	10
5E0038	TQS1/18X7X5/4.5	4.5	10
5E0039	TQS1/13X8X5/4.5	4.5	20
5E0043	TQS1/16X8X5/3.3	3.3	25
5E0056	TQS1/16X8X4.4/2.9	2.9	22

Roof description



Product code	Product description	Hg content (mg)	St 101 content (mg)
5E0028	HYG/ROOF/12-5/2.5	2.5	8
5E0041	HYG/ROOF/12-8.4/3.5	3.5	13
5E0042	HYG/ROOF/12-8.4/8	8	-
5E0047	HYG/ROOF/12-6.3/3.3	3.3	10
5E0054	HYG/ROOF/12-6.3/2.9	2.9	10

Product Activation

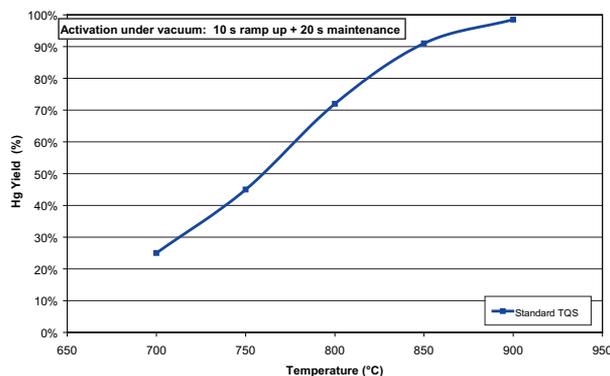
TQS and Roof release Hg and start getting action after lamp tip-off through a specific process, the so called "activation".

During activation, TQS or Roof are heated by radio frequency induction up to 800-900 °C for 15-30 seconds.

The mercury release is enhanced and accelerated by the presence of the copper-tin promoter.

The heating process also allows the getter to get active and remove impurities in lamp.

**TQS - Typical Hg yield curve:
% of Hg release vs. Temperature**



The SAES Getters Group manufacturing companies are ISO9001 certified, the Asian and Italian companies are ISO14001 certified also. Full information about our certifications for each company of the Group is available on our website at: www.saesgetters.com

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Lainate, Italy - Avezzano, Italy - Tortoli, Italy - Cologne, Germany - Weil am Rhein, Germany - Moscow, Russia - Daventry, UK - Nanjing, P.R. of China - Shanghai, P.R. of China - Tokyo, Japan - Seoul, Korea - Jincheon-kun, Korea - Jhubei City, Taiwan - Singapore - Cleveland OH, USA - Colorado Springs CO, USA - San Luis Obispo CA, USA - New Hartford NY, USA - Watsonville CA, USA

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