THERMAL OXIDATION STABILITY OF JET FUELS

Faster analyses for D3241 with an Easier to Use Tube Handling System

Features of the smaller and faster Falex 430 ETR...

The Falex 430 ETR is the first quantitative and completely objective instrument for the analysis of D3241 Jet Fuel Thermal Oxidation Stability heater tube deposit thickness.

The Falex 430 ETR determines average deposit thickness of a 2.5 mm^2 spot and the complete deposit volume for the ultimate in heater tube deposition measurement as designated in ASTM D3241 Annex 3. Fully automated, completely enclosed laser light source with an optical detection system for safety. Large color display simplifies reporting and produces a three-dimensional representation of the deposit, showing the exact spot the average deposit thickness was determined. The operator can run the default Annex 3 heater tube analysis or make custom analyses by changing reflectivity of the tube or density of the deposit.

- Tube analysis now just 18 minutes
- The Falex 430 conforms to Annex 3, THE referee method for D1655
- Durable, simplified mechanical structure
- Easy tube handling and automatic "tube centering"
- Automatic initialization
- Field calibration using NIST-certified reference tubes
- Reads ALL deposits
- Reads ALL heater tubes without need for individual calibration
- Eliminates the variability and subjectivity of the Visual Tube Rater
- More powerful laser quality with improved bandwidth

- ☑ Automatic shutter for safety
- ☑ Simple one button test procedure
- ☑ Photograph of heater tube serial number
- ☑ Consistent Linux operating system

Used in Standard Test Methods

D3241	Standard Test Method for Thermal Oxidation Stability of Aviation Turbine Fuels
IP 323	Determination of Thermal Oxidation Stability of Gas Turbine Fuels
ISO 6249	Determination of Thermal Oxidation Stability of Gas Turbine Fuels

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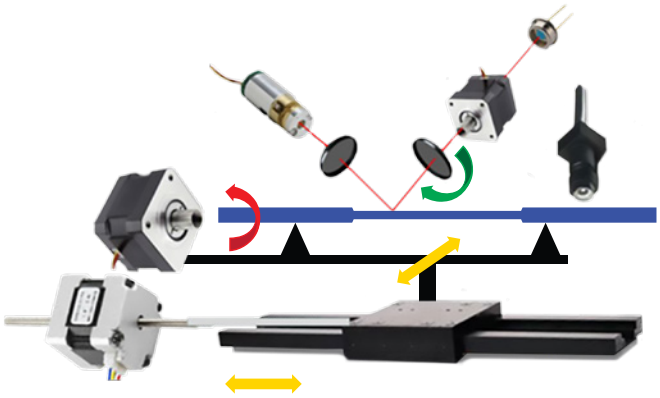
The Falex 430 ETR Offers Uncompromised Accuracy With Tube Centering and Initialization

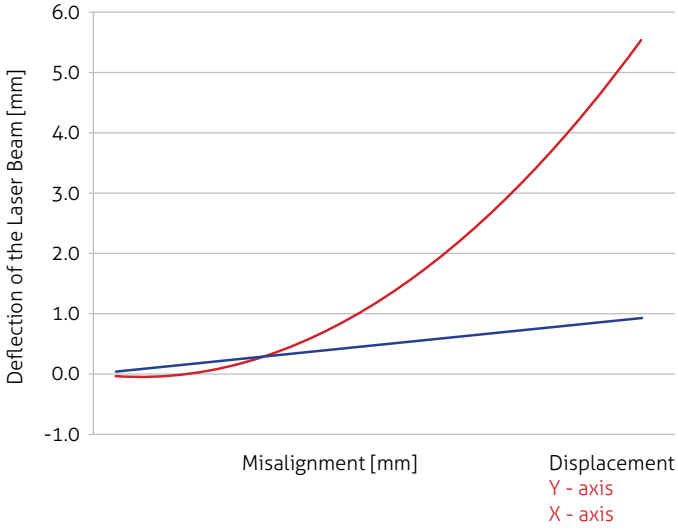
Automatic Tube Centering

When light is focused on and reflected from a curved surface for data collection, it is important that the measurement be made at the center of the tube to yield an accurate measurement. If light hits the tube off center, the center of the reflection will not be detected accurately.

The Falex 430 ETR physically moves the heater tube side to side until the signal output is at its greatest before the measurement is made. This eliminates tube curvature and any other aberrations from the tube.

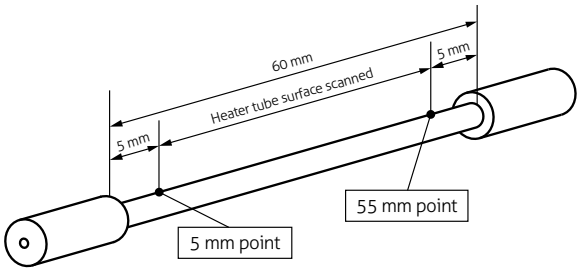


Influence of the misalignment between laser beam and heater tube (optical length l=100mm)

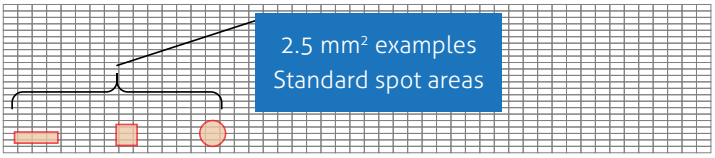


Automatic Initialization

For consistent results, tube analysis must start at the same point on the tube, every time. Since the analysis of the tube is actually a 1,200-point grid, if the starting point of the grid is inconsistent, results will vary and highs and lows will miss detection. The 430 ETR notes the location of the tube serial number to consistently begin analysis at the same point on the tube.

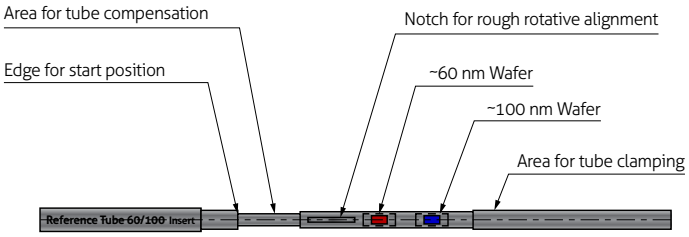


Grid of 50 x 24 points



NIST Traceability

The Falex 430 ETR is the only instrument that can be re-calibrated in the field using NIST certified reference tubes.



Annex 3 is the Referee Method for D1655

Pure Science

Developed in the 1990's by the Coordinating Research Council (CRC) headed by Spence Taylor ("Thickness measurement of JFTOT tube deposits by Ellipsometer", Spence E. Taylor, 5th International Conference on Stability and Handling of Liquid Fuel, October, 1994.), the method is considered the only referee for Annex 3 because of its universality and sustainability.

- » Defines all the elements needed--light angle, frequency and mathematics-- to convert the change in polarization into deposit thickness
- » 1550 nm light frequency resides in an area of the light spectrum that is not absorbed by the colored deposits.
- » A CRC test of 641 independent heater tubes developed a correlation between visual and ETR results, determining the ETR as a universal method (over Annex 2 and 4) to produce the true thickness of deposit
- » Accepted in both D3241 and D1655 to determine heater tube deposits

Advantages of Annex 3

- » Annex 3 is THE referee
- » Utilizes original ellipsometric optical design - *Sustainable Pure Science*
- » Measures colored deposits
- » The final result from this rating procedure is an absolute measurement determined by defined mathematics
- » Design accepted worldwide throughout the jet fuel industry
- » Procedure allows for visibility of *all* deposits

Acceptance of Annex 3 as the Referee Method

To use Annex 2 or 4 instead of Annex 3 (the ETR referee method), results must be directly compared to Annex 3. It has yet to be proven that Annex 2 and 4 produce the same results as Annex 3 for the methods to be considered equivalent. To date, no testing has been scheduled.

ASTM D1655-17a Specification for Aviation Turbine Fuels contains the only reference to a heater tube deposit rating referee method in Table 1, Note N. It states that in cases of disputes, the referee SHALL BE CONSIDERED the Annex 3 ETR ("ellipsometer/ETR"). Therefore, when an off-specification result is disputed, the ETR is the only referee method.

Ellipsometric Tube Rating (ETR) method Annex 3 is the referee method for analyzing

	Annex 3	Annex 2	Annex 4	VTR
3D Map of Deposits	X	X	X	-
Reads All Deposits	X	-	?	X
Automatic Tube Centering	X	-	-	-
D3241/323 Approved	X	X	X	X
D1655/DefStan 9191 Approved	X	X	-	X
Referee Method	X	-	-	-
Sustainable Method	X	-	-	-
Automatic Tube Initialization	X	-	-	-
NIST Tube Cal. In Field	X	-	-	-

Falex 430 ETR Technical Data

Weights and Dimensions:

Space (LxWxH)	15" x 17" x 19" 38 x 43 x 48 cm
Estimated Weight	45 lbs. 20.5 Kg

Measurable Tube Deposit Depth	0-330 nm
Film Thickness Precision @85nm	r: 1.55 nm R: 4.13 nm
Analysis Time	Less than 20 min.
Power	100-240 VAC, 250 W, 50/60 Hz

CLASS 1 LASER PRODUCT
IEC 60825-1 Ed 2 2007 USA
EN/IEC 60825-1 Ed 3 2014 non-USA

Ordering Information

Part Number	Description
430-001-002	Ellipsometer for Rating Deposits on ASTM D3241 Heater Tubes
430-200-002	Ellipsometer Reference Verification Tube Kit
650-201-024	Color Inkjet Printer Kit
665-430-004	Ellipsometer Case (with wheels)

Falex Corporation follows a policy of continuous product improvement. Specifications are subject to change without notice.

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