Procedure Title: **Wire Cloth and Electroformed Sieves (10060)**
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1.0 Scope

The purpose of this procedure is to define the method of test to measure the average wire and hole diameter of woven wire cloth sieves and electroformed sieves. **The diameter of the material between the openings of the electroformed sieve will be referred to as the wire diameter throughout this procedure.**

This procedure is intended to satisfy the requirements of two different specifications pertaining to sieves. First, is the certification of wire cloth sieves as satisfying ASTM E11 "Standard Specification for Wire-Cloth Sieves for Testing Purposes". Second, is the certification of electroformed sieves as satisfying ASTM E-161 "Standard Specification for Precision Electroformed Sieves (Square Opening Series)".

2.0 DEFINITIONS AND REFERENCES

2.1 References

ASTM Designation E 11 - 87 "Standard Specification for Wire-Cloth Sieves for Testing Purposes"

ASTM Designation E 161 - 87 "Standard Specification for Precision Electroformed Sieves (Square Opening Series)

Doiron, Ted and John Stoup. Uncertainty and Dimensional Calibrations. Journal of Research of the National Institute of Standards and Technology; Vol. 102, Number 6, November-December 1997.

2.2 Definitions

Definitions pertaining to Wire-Cloth Sieves:

Shoot Wires - The first wires laid down in weaving sieve cloth. They are usually straighter than warp wires in the finished cloth.

Warp Wires - These wires are woven into the shoot wires to make the cloth. Generally, they are visibly more curved than the shoot wires.

NOTE! Finer mesh sieves sometimes have visible streaks in one direction of the sieve. This is an optical effect caused by the difference between the curvature of the warp and shoot wires in the weave. The streaks are parallel to the shoot wires.

3.0 General

This procedure certifies electroformed sieves as being compatible with sieves manufactured according to Specification E-11. Therefore, frames for electroformed sieves are required to meet the same specifications as the wire-cloth sieves.

NOTE! The method is the same for testing both types of sieves. However, refer to the specification which corresponds to the particular type of sieve being tested for the correct aperture tolerance.

3.1 Sieves shall be unpacked and logged in according to the normal log-in procedure.

3.2 Sieves should not need cleaning. Sieves with a few particles may be measured as is, or blown out with the compressed air in the API shipping room. Sieves needing more than gentle air cleaning should be returned as unsuitable for measurement.

NOTE! If unfamiliar with the pressures in the various air hoses in the API Lab/Shipping Room consult API Lab Personnel for guidance.

3.3 If the sieve cloth is defective (sagging, torn, holes, inadequate solder seal) the company should be called to ask for directions. Manufacturers will usually send a replacement sieve and other customers usually call their supplier for a replacement to be sent.

3.4 As each sieve is unpacked the data sheet for each sieve and the summary sheet for the test should be filled out (see sample data sheet at end of procedure). The customer name, sieve manufacturer, size, and serial number (if any) are recorded on the sheet. If there are no serial numbers and there are more than one sieve of the same size a temporary ID number should be put on the sieve frame with a grease pencil.

4.0 Environment

The wire and hole diameters are small enough that thermal expansion is not a factor. The frame tolerances are also modest. Any temperature in the range ± 2 °C around 20 °C is adequate for the performance of this calibration.

5.0 Set-up Procedure

5.1 All sieves to be tested should place on or near the Jones & Lamson Optical Comparator located in API Lab. Since the sieve frames are thin, there is no time requirement to allow for thermal stability.

5.2 Locate the GO and NO-GO gages and place them on the lab table.

5.3 Make sure the vertical/horizontal cross hair template is mounted on the optical comparator screen.

5.4 Set the optical comparator as follows:

- **LENS SELECTOR SWITCH** 100X
- **LAMP CONTROL SWITCH** 100X
- **REFLECTION SWITCH** OFF

NOTE! Different magnifications can be used depending on the aperture size. The 100X is most commonly used.

5.5 Hold the **START LAMP BUTTON** until the green projection light is visible. Proceed to the frame tests allowing the comparator time to warm-up.

NOTE! After completing the required measurements with the optical comparator turn the **LAMP CONTROL SWITCH** to **LINE.** This allows the fan to operate cooling the light source.

6.0 Measurement Procedure

As mentioned in Section 3.0, the method of test and parameters to be tested are the same for wire-cloth and electroformed sieves. Only aperture tolerances are different.

6.1 Frame Diameter Test

6.1.1 Test each sieve against the frame and skirt gages in turn. The sieve should fit the GO gages with only slight pressure. For the NO-GO gages, only slight force should be used. If the sieve fits over the NO-GO gage but seems stuck on, excessive force was used then the sieve is considered to have passed the test.

6.1.2 Record PASS or FAIL on the data sheet, under the appropriate test parameter. After all sieves are tested, return the gages to the proper storage area.

6.2 Wire Mesh (Pitch)

6.2.1 The wire pitch (number of wires per centimeter) is measured with the Jones & Lamson Optical Comparator. The optical comparator consists of a projection screen and a traveling stage which is driven manually by a micrometer head. The optical comparator is equipped with a digital readout, which should be set to metric units with resolution of one micron.

6.2.2 For wire cloth sieves determine the direction of the shoot and warp wire and using a grease pencil label the frame appropriately. For precision electroformed sieves mark wires in one direction "0°" and wires in another direction "90°".

6.2.3 Using the proper mount, place the mount and the sieve on the stage of the optical comparator. The bottom of the sieve should be facing the comparator screen.

6.2.4 To focus the sieve material on the screen move the mount and sieve forward and backward on the optical comparator stage until the image is visible on the screen. Then use the focus knob located to the left of the lamp as the fine adjustment.

6.2.5 When a clear focus is achieved, rotate the sieve in the mount until one direction of wires coincide with the horizonal reticle. This alignment will take a few minutes since the stage must be moved left and right while the sieve is rotated by small amounts. The sieve is aligned well enough when the wire stays aligned to the horizontal reticle to the level of 0.1 wire diameter over the travel range of one measurement (usually about 1 cm).

6.2.6 Align one edge of a sieve wire with the center of the reticle line. Move the sieve using the micrometer head counting the number of wires passed. For the number 1 to 25 sieves, 2 cm worth of wires in three places along the diameter should be measured. For sieves over 25, 100 wires at three positions along the diameter should be measured. The number of wires divided by the total length of travel is taken as the average mesh, in wires/cm.

6.2.7 Record each value on the data sheet under the column labeled "Total Length Traveled" in the section which corresponds with the appropriate direction of wire.

6.2.8 Steps 6.2.5 through 6.2.7 should be done for both directions of wire. When all the measurement values are recorded, average both groups individually and record the values on the data sheet in entry blanks labeled "Average Calculated Mesh (N)".

6.3 Wire Diameter

The wire diameter is also to be measured using the optical comparator in the API Lab.

6.3.1 Align the sieve so that the wires to be measured are vertical when viewed on the optical

comparator. Be sure to record each measurement under the appropriate direction of wires.

NOTE! Usually for wire cloth sieves, the shoot wire edges are completely in focus, but the warp wires, weaving above and below the shoot wires, are in focus only along a part of their length.

6.3.2 Measure the wire diameter of 3 wires in five places along the diameter. This is to be done for both directions of wires. Enter each measurement on the data sheet in the Wire Diameter Section under the column labeled "Measured Diameter".

NOTE! When measuring the diameter of warp wires, measure only where the focus is good, out of focus measurements will bias the results.

6.3.3 Calculate the average of all the diameter measurements for each wire direction and record this value in the entry blank labeled "Average Wire Diameter".

7.0 Data Analysis

7.1 Record the average mesh again, for each wire direction, at the bottom of the second data sheet as indicated.

7.2 Record the average wire diameter again, for each wire direction, at the bottom of the second data sheet as indicated.

7.3 Calculate the effective hole diameter from the formula:

Effective hole diameter = 10/N - D

where N is the mesh in wires/cm, D is the average wire diameter

Record the calculated value, for each wire direction, at the bottom of the second data sheet as indicated.

7.4 Wire-Cloth Sieves. Check the wire diameter and hole diameter against the ASTM E-11 tolerance table at the end of this procedure.

7.6 Electroformed Sieves. Check the hole diameter (aperture size) against the E161 tolerance table at the end of this procedure.

7.6 If the each parameter is within the specified tolerance the sieve passes. If the measured diameters are <u>not</u> within the tolerance, write the tolerance limits at the bottom of the data sheet as a reference.

7.7 If a measurement is within 2 ìm of the tolerance boundary the sieve should be rechecked. If possible verify this measurement using the traveling micrometer, located in Room A16.

8.0 Report and Sieve Marking

8.1 Each sieve that passes the aperture tolerance receives a serial number. Locate the sieve card box. Enter the next numbers in the sieve sequence, and the additional information requested by the card. In the remarks column put "OK" if the sieve passed both the aperture and frame tests. If the sieve failed one or more frame tests, record the failures.

8.2 Using a hammer and number stamps, label each sieve with the inscription " NIST NO XXXXX-YY " where XXXXX is the sieve ID number and YY is the last two digits of the year shown on the calibration folder.

8.3 If the sieve passed the frame tests as well as the aperture tests, the sieve is stamped with the "NBS" stamp. The NBS stamp should be used until a new NIST stamp can be obtained.

8.4 If the sieve already has an ID number from a previous NIST calibration, place the new ID either under or next to the old number.

8.5 Fill in the sieve sizes, ID numbers, pass/fail information and measurement values on the sieve report. The sieve report form is located in a Wordperfect file called "SIEVXXXX". When finished store the report with XXXX replaced with the M number from the logbook. Thus if the calibration is M1234 in the logbook, the report is saved as SIEV1234.

SIEVE DATA SHEET Page 1 of 2

Manufacturer_____ Obs. _____ Group Control No. M_____
Customer _____ Sieve No. _____ NIST No. _____
Date _____ Description _____

Frame(Inside Dia.) Pass ___ Fail ___		**Skirt Dia. Pass ___ Fail ___**	
Warp / 0 °			
Mesh (N) = Wires/cm			
Location	Number of Wires	Total Length Traveled (cm)	Calculated Mesh (N)
1			
2			
3			
Average Calculated Mesh (N)			
Wire Diameter (W)			
Location	Wire Number	Measured Diameter (cm)	
1	1		
	2		
	3		
2	1		
	2		
	3		
3	1		
	2		
	3		
4	1		
	2		
	3		
5	1		
	2		
	3		
Average Wire Diameter (W)			

Group Control No. M____ **Sieve Data Sheet** Page 2 of 2

Customer _____

Shoot / 90 °
Mesh (N) = Wires/cm

Location	Number of Wires	Total Length Traveled (cm)	Calculated Mesh (N)
1			
2			
3			
Average Calculated Mesh (N)			

Wire Diameter (W)

Location	Wire Number	Measured Diameter (cm)
1	1	
	2	
	3	
2	1	
	2	
	3	
3	1	
	2	
	3	
4	1	
	2	
	3	
5	1	
	2	
	3	
Average Wire Diameter (W)		

Warp / 0 ° Calculations		**Shoot / 90 ° Calculations**	
Average Mesh (N)		Average Mesh (N)	
Average Wire Diameter (W)		Average Wire Diameter (W)	
Calculated Mean Opening = 10/N-W		Calculated Mean Opening = 10/N-W	