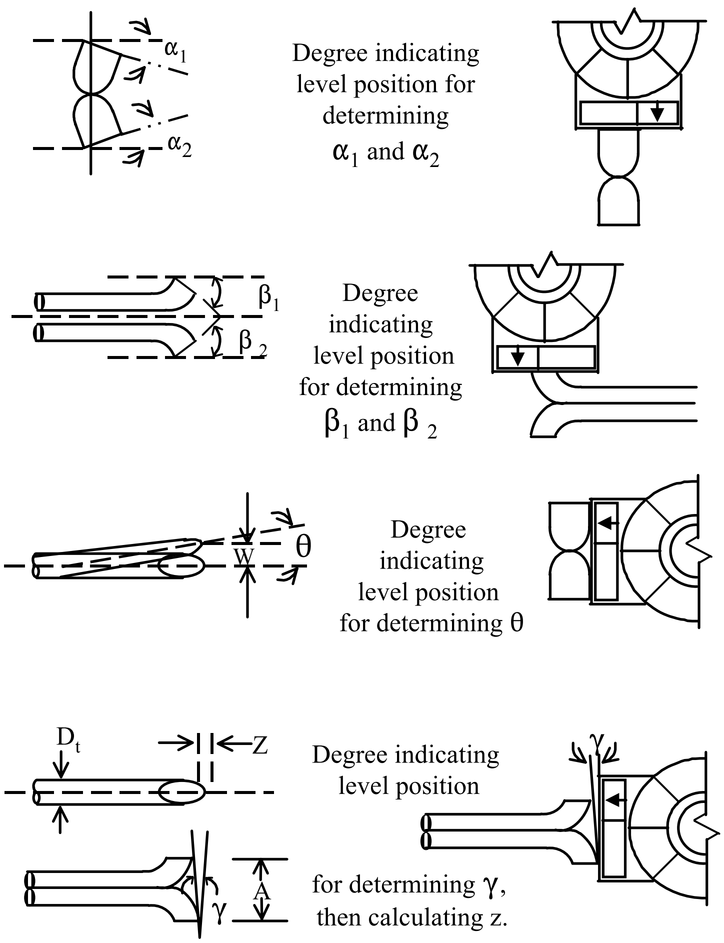
Table 2G-1. Type S Probe Inspection Sheet

Note: Method 2 provides the criteria for an acceptably constructed Type S pitot tube. However, the procedure for making the necessary measurements is not specified. One approach is given below.

1. Use a vise with parallel and perpendicular faces. Use an angle-measuring device (analog or digital) for this check.
2. Place the pitot tube in the vise, and level the pitot tube horizontally using the angle-measuring device.
3. Place the angle-measuring device as shown below.
4. Measure distance A, which is P_A plus P_B. Method 2 specifies that $P_A = P_B$, but provides no tolerance for this measurement. Because this measurement is very difficult, it is suggested that $P_A = P_B = A/2$.
5. Measure the external tube diameter (D_t) with a micrometer, machinist's rule, or internal caliper.
6. Record all data as shown on the form below.
7. Calculate dimensions w and z as shown below.



Level and perpendicular?	
Obstruction?	
Damaged?	
α_1 $(-2° \le \alpha_1 \le +2°)$	
α_2 $(-2° \le \alpha_2 \le +2°)$	
β_1 $(-2° \le \beta_1 \le +2°)$	
β_2 $(-2° \le \beta_2 \le +2°)$	
γ	
θ	
$z = A (\tan\gamma)$ [≤ 0.5 mm (0.02 in.)]	
$w = A (\tan\theta)$ [≤ 0.5 mm (0.02 in.)]	
D_t [≥ 9.5 mm (3/8 in.)]	
A	
$A/2D_t$ $(1.05 \le P_A/D_t \le 1.5)$ *	

* Recommended dimensions

QA/QC Check
Completeness__________ Legibility__________ Accuracy__________
Specifications__________ Reasonableness__________

Certification
I certify that the Type S probe ID ________ meets or exceeds all specifications, criteria, and applicable design features.

Certified by:____________________ Date:__________

Table 2G-2. Rotational Position Check

Source:____________________ Date:____________________

Test Location:____________________ Tester(s):____________________

Probe Type:____________________ Affiliation:____________________

Probe ID:____________________ Fully-Assembled Probe Length in mm (in.):__________

Position	**Angle Comparisons**		
Distance of 2nd measurement device from probe head impact port in mm (in.)	**1st Device** Angle measured by device aligned on the reference scribe line, including algebraic sign (degrees)	**2nd Device** Angle measured by device mounted at each position to be used during testing, including algebraic sign (degrees)	**R_{ADO}** Difference between readings by 1st and 2nd angle-measuring devices (degrees)[a]
(Col. A)	(Col. B)	(Col. C)	(Col. C - Col. B)

[a] The algebraic sign must be consistent with section 8.3.2.

Specifications: For the pre-test rotational position check, the value of R_{ADO} at each location along the probe shaft must be determined to within ±1°. In the post-test check, R_{ADO} at each location must remain within ±2° of the value obtained in the pre-test check.

Table 2G-3. Example EPA Method 2G Field Data Form

Source: ____________________ Date: ____________________

Source Location: ____________________ Test Personnel: ____________________

Measurement Location: ____________________ Probe Type: ____________________

Run ID:	
Start Time:	
End Time:	
Pitot Tube ID:	
Pitot Tube Coefficient (C_p):	
Pressure Gauge ID:	
Pressure Gauge Readability:	in. H_2O
Temperature Gauge ID:	
Measurement System Response Time	sec.

Stack Diameter:		
Stack Area:		
Barometric Pressure (P_{bar}):	in. Hg	
Static Pressure (P_g):	in. H_2O	
R_{SLO}		
R_{ADO}		
	Pre-test	Post-test
Pitot Tube Condition: Damage Noted?		
Leak Check Performed?		

Clock Time	Traverse Point	Yaw Angle, including algebraic sign (degrees)	Differential Pressure (Δ P)	Stack or Duct Gas Temperature (° F)

Table 2G-4. Wind Tunnel Velocity Pressure Cross-Check

Wind Tunnel Facility: ______________________________

Date: ______________________________

Wind Tunnel Temperature: ______________________________

Barometric Pressure: ______________________________

Test Point Locations: ______________________________

Lowest Test Velocity in m/sec (ft/sec): ______________________________

Highest Test Velocity in m/sec (ft/sec): ______________________________

Port		Rep.	Velocity Pressure (ΔP_{std})	
			@ Lowest Test Velocity	@ Highest Test Velocity
Calibration Pitot Tube Location		1		
		2		
		3		
		Average		
Calibration Location Test Points *	1	1		
		2		
		3		
		Average		
		% Difference **		
	2	1		
		2		
		3		
		Average		
		% Difference **		
	..	1		
		2		
		3		
		Average		
		% Difference **		

* Measurements must be taken at all points in the calibration location as specified in section 10.1.1

** Percent Difference = $$\frac{(\textit{Calibration Location Test Point Avg} - \textit{Cal. Pitot Tube Location Avg})}{\textit{Cal. Pitot Tube Location Avg}} \times 100\%$$

Specification: At each velocity setting, the average velocity pressure obtained at the calibration location shall be within ±2 percent or 0.01 in. H_2O, whichever is less restrictive, of the average velocity pressure obtained at the fixed calibration pitot tube location.

Table 2G-5. Wind Tunnel Axial Flow Verification

Wind Tunnel Facility: ____________________
Date: ____________________
Wind Tunnel Temperature: ____________________
Barometric Pressure: ____________________
Probe Type/I.D. Used To Conduct Check: ____________________
Test Point Locations: ____________________
Lowest Test Velocity in m/sec (ft/sec): ____________________
Highest Test Velocity in m/sec (ft/sec): ____________________

Port		@ Lowest Test Velocity		@ Highest Test Velocity	
		Yaw Angle * (degrees)	Pitch Angle * (degrees)	Yaw Angle * (degrees)	Pitch Angle * (degrees)
Calibration Location Test Points **	1				
	2				
	3				
	..				
Calibration Pitot Tube Location					

* When following the procedures in section 10.1.2.1, both the yaw and pitch angles are obtained from the same port. When following the procedures in section 10.1.2.2, the yaw angle is obtained using the port for the tested probe, and the pitch angle is obtained using the port for verification of axial flow.

** Yaw and pitch angle measurements must be taken at all points that define the calibration location (as per the requirements in section 10.1.1)

Specification: At each velocity setting, each measured yaw and pitch angle shall be within ±3° of 0° in accordance with the requirements in section 10.1.2.

Table 2G-6. Yaw Angle Calibration

Probe Type: ________________________ **Tester(s):** ________________________

Probe ID: ________________________ **Affiliation:** ________________________

Test Location: ________________________ **Date:** ________________________

	Repetition 1		Repetition 2	
Nominal Velocity Setting in m/sec (ft/sec)	θ_{null} **(degrees)**	R_{SLO} **(degrees)***	θ_{null} **(degrees)**	R_{SLO} **(degrees)***
________	________	________	________	________
________	________	________	________	________
________	________	________	________	________
________	________	________	________	________
________	________	________	________	________
________	________	________	________	________
________	________	________	________	________
________	________	________	________	________
________	________	________	________	________

Average of all recorded R_{SLO} values: ________

* Include magnitude and algebraic sign in accordance with section 10.5.6.

Table 2G-7. Determining the Magnitude of Reference Scribe Line Offset

Probe/Angle-Measuring Device	Magnitude of R_{SLO}
Type S probe with inclinometer	θ_{null}
Type S probe with protractor wheel and pointer	$90° - \theta_{null}$
3-D probe with inclinometer	$90° - \theta_{null}$
3-D probe with protractor wheel and pointer	θ_{null}

Table 2G-8. Probe Calibration for Method 2G

Wind Tunnel Facility: ___________________________

Wind Tunnel Location: __________________________

Probe Type: ____________________________________

Probe ID: ______________________________________

Probe Calibration Date: _________________________

Test Point Location: ____________________________

Ambient Temperature (°F): ______________________

Barometric Pressure (P_{bar}): ______________________

Repetition	Low Velocity Setting (ft/sec)	Calibration Pitot		Tested Probe		Calculated C_p or F_2
		ΔP_{std} (in. H_2O)	Temp. (°F)	ΔP or P_1-P_2 (in. H_2O)	Yaw Angle (°)	
1						
2						
3						
					Average ($C_{p(avg-low)}$) =	

Repetition	High Velocity Setting (ft/sec)	Calibration Pitot		Tested Probe		Calculated C_p or F_2
		ΔP_{std} (in. H_2O)	Temp. (°F)	ΔP or P_1-P_2 (in. H_2O)	Yaw Angle (°)	
1						
2						
3						
					Average ($C_{p(avg-high)}$) =	

$$\% \text{ Difference} = \frac{C_{p(avg-low)} - C_{p(avg-high)}}{C_{p(avg-low)}} \times 100\% = \_\_\_\_\_\_\_\_ \%$$

Note: (1) The percent difference between the low and high velocity setting C_p values shall be within ±3 percent.
(2) If calibrating a 3-D probe for this method, the pitch angle setting must be 0°.