

GMP 12

**Good Measurement Practice
on
Standard Operating Procedure Selection**

Good laboratory practices, use of proper standards and equipment, and selection of standard operating procedures are essential for providing calibration results with accurate and traceable values with appropriate and suitable uncertainties. The following matrix recommends SOPs based on the parameter, type of test items, and level of uncertainty needed.

Parameter	Test Item	Recommended SOP
Mass		
	Railroad test cars	SOP 27, Railroad Test Cars using a Master Track Scale
	Weight carts	SOP 33, Calibration of Weight Carts (References SOP 4 and SOP 7)
HB 105-1, Class F ASTM, OIML	Class F Class 5, 6, 7 Class M1, M2, M3 e.g., 10 kg to 250 kg (≥500 lb) cast iron 1 mg to 5 kg (1 μlb to 10 lb) stainless steel	SOP 8, Modified Substitution - may be used if expanded uncertainty is less than 1/3 of the tolerance SOP 7, Single Substitution - to be used, as a minimum, if conditions given for SOP 8 cannot be met NOTE: Balances and standards must be selected properly for these conditions to be met.
ASTM, OIML	Class 3, 4 (P) Class F1, F2 e.g., 1 kg kit, 100 g kit	SOP 7, Single Substitution - may be used if expanded uncertainty is less than 1/3 of the tolerance. If uncertainty is greater than 1/3 of the tolerance, then use SOP 4. SOP 4, Double Substitution - to be used for buoyancy corrections and if expanded uncertainty is less than 1/3 of the tolerance Modified SOP 4/5, to be used to incorporate measurement control into SOP 4 NOTE: Balances and standards must be selected properly for these conditions to be met.
ASTM, OIML	Class 1, 2 (S, S-1) Class E2 for use in balance calibration	SOP 5, 3-1 Weighing Design (preferred) Modified SOP 4/5, to be used to incorporate measurement control with SOP 4

Parameter	Test Item	Recommended SOP
ASTM, OIML	Class 0, 1 (S) Class E1 for use as laboratory standards	Weighing Designs per TN 952, TN 844, NISTIR 5672, SOP 28, with appropriate check standards
Volume		
HB 105-2	Glass flasks	SOP 16, Volume Transfer (acceptable, SOP 14 preferred)
HB 105-3	20 L test measures (5 gal or 10 gal)	SOP 18, Volume Transfer (single delivery from slicker plate type standard; if glass standards SOP 19). When temperature instability is observed during the calibration process, use SOP 19.
HB 105-3	Large graduated neck type provers - used for meter verification	SOP 19, Volume Transfer for Graduated Neck Type Provers
HB 105-4	LPG provers	SOP 21, Volume Transfer for LPG Provers
HB 105-7	Dynamic Small Volume Provers	SOP 26, Gravimetric Calibration of Dynamic Small Volume Provers
	Laboratory standards Glassware: burets, pipetes, flasks	SOP 13, Gravimetric Calibration with a Single Pan Mechanical Balance OR SOP 14, Gravimetric Calibration with an Electronic Balance
	Laboratory standards Laboratory slicker plate standards	SOP 14, Gravimetric Calibration with an Electronic Balance OR SOP 15, Gravimetric Calibration with an Equal Arm Balance
	Micropipetes	SOP 13, Gravimetric Calibration with a Single Pan Mechanical Balance OR SOP 14, Gravimetric Calibration with an Electronic Balance

Parameter	Test Item	Recommended SOP
HB 105-3	Large graduated neck type provers - used as laboratory standards	SOP 19, Volume Transfer for Graduated Neck Type Provers OR SOP 14, Gravimetric Calibration with an Electronic Balance OR SOP 15, Gravimetric Calibration with an Equal Arm Balance
Length		
	Tapes	SOP 11, Tape to Tape OR SOP 12, Bench Method (lower uncertainties)
	Rigid Rules	SOP 10, Rigid Rule
	Pi Tapes	SOP 23, Pi Tape Calibration
Liquid-in-Glass Thermometers		
HB 105-6	Field standards for weights and measures	SOP 25
Timing Devices		
HB 105-5	Field standards for weights and measures	SOP 24
Traffic Speed Gun Tuning Forks		
	For highway official use	SOP 22

Parameter	Process	Recommended SOP
Measurement Assurance		
All Process Measurement Assurance	SOP 30	Use of process measurement assurance programs
Mass	SOP 5, 28	Use of check standards in procedure TN 952, TN 844, NISTIR 5672
Mass	SOP 4, 6, 7, 8	SOP 9
		Redundancy built into procedures

Parameter	Process	Recommended SOP
Measurement Assurance		
Length	SOP 10, 11, 12, 23	
Volume	SOP 13, 14, 15, 16, 18, 19, 21, 26	SOP 17, laboratory check standards OR SOP 20, range charts and standard deviation charts
Temperature	SOP 25	Use of check standards in procedure
Uncertainty		
All parameters	All SOPs	SOP 29, Calculation of Uncertainty