

EVALUATION OF MEASUREMENT UNCERTAINTY

1. COMPANY NAME : Super Auto Forge Private Limited DATE : 22-02-2024

2. DEVICE UNDER CALIBRATION : 856

Range/Size (mm) : 12	Least Count (mm) : 35.2
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3. STANDARDS / EQUIPMENT USED FOR CALIBRATION :

Sr.No	Master Name	Range/Size (mm)	L.C. (mm)	Uncertainty (mm)	Accuracy (mm)	Material
Master 1	CMM - I-CMM-01		23	58	42.1	Carbide

4. ENVIRONMENTAL PARAMETERS

Start Temp T1 (°C)	End Temp T2 (°C)	Mean Temp (TA= (T1+T2)/2)	Ref. Temp (TR)	Thermal Expansion of master (mm/m°C) (αM)	Thermal Expansion of DUC (mm/m°C) (αD)	Uncertainty of Temperature Indicator (°C) UT (±)
52	6	29.00	3	0.0047	0.0047	63

5. REPEATABILITY (mm)

R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	Standard Deviation	n
25	6	3	4	5	8	9	5	6	8	6.2973	10

6. UNCERTAINTY BUDGET

Source of uncertainty Xi		Estimates (Xi)	Probability Distribution	Type	Factor (x)	Standard Uncertainty u = (Xi / x)	Sensitivity Coefficient (y)	Uncertainty contribution ui = (x * y)	Degree of freedom vi = (n - 1)
U1	Uncertainty due to Calibration of Master 1 mentioned in the certificate	58.0000	Normal	Type B	2	29.0000	1	29.0000	∞
U2	Uncertainty due to Calibration of Master 2 mentioned in the certificate		Normal	Type B	2		1		∞
U3	Uncertainty due to Calibration of Master 3 mentioned in the certificate		Rect	Type B	√3		1		∞
U4	Uncertainty due to accuracy of Master 1	42.1000	Rect	Type B	√3	24.3064	1	24.3064	∞
U5	Uncertainty due to accuracy of Master 2		Rect	Type B	√3		1		∞
U6	Uncertainty due to accuracy of Master 3		Rect	Type B	√3		1		∞
U7	Uncertainty due to Least count of Master 1	11.5000	Rect	Type B	√3	6.6395	1	6.6395	∞
U8	Uncertainty due to Least count of Master 2		Rect	Type B	√3		1		∞
U9	Uncertainty due to Least count of Master 3		Rect	Type B	√3		1		∞
U10	Standard Unc due to deviation from reference temperature	26.0000	Rect	Type B	√3	15.0111	0.0001	0.0015	∞
U11	Standard Unc due to temperature difference between DUC and Master	5.2000	Rect	Type B	√3	3.0022	0.0001	0.0003	∞
U12	Standard Unc due to difference in thermal expansion coefficient of Master (10%)	0.0005	Rect	Type B	√3	0.0003	0.3120	0.0001	∞
U13	Standard Unc due to difference in thermal expansion coefficient	0.0005	Rect	Type B	√3	0.0003	0.3120	0.0001	∞

	of DUC (10%)								
U14	Standard Unc due to uncertainty of temperature monitoring System	63	Normal	Type B	2	31.5000	0.0001	0.0032	∞
U15	Standard Unc due to repeatability	6.2973	Normal	Type A	$\sqrt{10}$	1.9914	1	1.9914	9

Combined Uncertainty (Uc) : 38.4688 mm

Coverge Factor (k) : 2

Degree of freedom (veff): 1253266

Expanded Uncertainty (U): ± 76.9376 mm

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Prepared By