

Wool Testing Services Info-bulletin

Guidance on test precision

Most of the test methods under which we operate have well-defined sampling and measurement regimes. The following tables summarize the 95% confidence limits and Maximum Probable Difference estimates (see Info-Bulletin 5.7) for some of the more common certification and reporting situations. This information is for guidance only – for detailed data refer to the appropriate test methods. The precision of a delivery is improved by combination of multiple results (see IWTO-31).

Woolbase and Vegetable Matter Base (IWTO-19)

The precision depends upon the level and the sampling and testing regime. This table has been simplified to cover a 2 subsample test on a 20 cores/lot sampling regime. The MPD values in the IWTO Core Test Regulations are based on a worse case than for New Zealand wool.

Parameter	Level	Precision Statistics		IWTO CTR (%)
		95%CL (%)	MPD (%)	
Woolbase New Zealand Machine coring	< 40%	± 1.9	2.7	3.1
	40 - 45%	± 1.7	2.4	2.8
	45 - 50%	± 1.4	2.0	2.5
	50 - 55%	± 1.2	1.7	2.1
	55 - 60%	± 1.0	1.4	1.9
	60 - 65%	± 0.9	1.3	1.8
	> 65%	± 0.8	1.1	1.6
Woolbase New Zealand Manual coring	< 40%	± 2.0	2.8	3.1
	40 - 45%	± 1.8	2.5	2.8
	45 - 50%	± 1.5	2.1	2.5
	50 - 55%	± 1.3	1.8	2.1
	55 - 60%	± 1.2	1.7	1.9
	60 - 65%	± 1.0	1.4	1.8
	> 65%	± 1.0	1.4	1.6
VM Base	0 - 0.5%	± 0.1	0.2	0.3
	0.6 - 1.0%	± 0.3	0.4	0.5
	1.1 - 1.5%	± 0.4	0.6	0.6
	1.6 - 2.0%	± 0.5	0.7	0.8
	2.1 - 3.0%	± 0.6	0.8	1.0
	3.1 - 4.0%	± 0.8	1.1	2.0
	4.1 - 5.0%	± 0.9	1.3	2.0

Colour

Whilst the statistics apply to D65/10⁰ measurement space, the precision is similar in C/2⁰ space

Form		95%CL (units D65/10 ⁰)		MPD (units D65/10 ⁰)	
		Y	Y-Z	Y	Y-Z
Greasy	IWTO-56	± 2.1	± 0.9	3.0	1.3
Sliver	IWTO-35	± 1.5	± 0.7	2.1	1.0

Mean Fibre Diameter

The precision depends on the level and on the test method used:

Level	95%CL (μm)				MPD (μm)			
	Airflow IWTO-28	Laserscan IWTO-12	OFDA IWTO-47	PM IWTO-8	Airflow IWTO-28	Laserscan IWTO-12	OFDA IWTO-47	PM IWTO-8
Greasy wool				not certifiable				not certifiable
15	± 0.33	± 0.21	± 0.25		0.5	0.3	0.4	
20	± 0.45	± 0.35	± 0.37	± 0.9	0.6	0.5	0.5	1.3
25	± 0.57	± 0.48	± 0.48		0.8	0.7	0.7	
30	± 0.68	± 0.60	± 0.60		1.0	0.8	0.8	
35	± 0.80	± 0.75	± 0.70	± 1.1	1.1	1.1	1.0	1.6
40	± 0.92	± 0.85	± 0.82		1.3	1.2	1.2	
45	± 1.03		± 0.92		1.5		1.3	
Sliver	IWTO-6			600 snippets	IWTO-6			
15		± 0.12	± 0.18	± 0.6		0.2	0.3	0.8
20	± 0.57	± 0.25	± 0.30	± 0.7	0.8	0.4	0.4	1.0
25	± 0.63	± 0.38	± 0.42	± 1.0	0.9	0.5	0.6	1.4
30	± 0.70	± 0.51	± 0.54	± 1.2	1.0	0.7	0.8	1.7
35		± 0.64	± 0.66	± 1.6		0.9	0.9	2.2
40		± 0.77	± 0.78	± 2.0		1.1	1.1	2.8
45		± 0.90	± 0.90			1.3	1.3	

Staple Length and Strength (IWTO-30)

	Wool type	95%CL	MPD
Mean staple length (mm)	Fleece	± 4.8	7
	non-fleece	± 5.4	8
Mean staple strength (N/ktex)	both	± 5.9	8

Length After Carding (LAC) – NZS8719

This is certified under the Sampling Regulations drafted by the National Council of New Zealand Wool Interests. The precision is dependent on level.

Level	95%CL (mm)	MPD (mm)
Barbe < 80.1 mm	± 3.8	5.4
Barbe > 80.0 mm	± 6.0	8.5

Core bulk – NZS 8716

There are no specific sampling regulations for this test, although the IWTO Core Test Regulations are used by default. It is not, therefore, certifiable. The precision is level-dependent.

Level	95%CL (cm^3/g)	MPD (cm^3/g)
< 22	± 1.6	2.3
22 to 26	± 1.8	2.5
27 to 30	± 1.9	2.7
31 to 34	± 2.1	3.0
> 34	± 2.3	3.2

Mean fibre length (Almeter) (IWTO-17)

The precision is dependent on both level and the sampling regime. IWTO certification only applies to Hauteur and a minimum of 5 laboratory samples must be measured.

Mean Hauteur	95% confidence limits (mm)							
	Number of laboratory samples							
range	1	2	3	4	5	6	7	8
less than 50.0	0.5	0.4	0.3	0.3	0.3	0.2	0.2	0.2
50.0 to 59.9	1.0	0.8	0.7	0.7	0.6	0.6	0.6	0.6
60.0 to 69.9	1.5	1.2	1.1	1.0	1.0	1.0	1.0	1.0
70.0 to 79.9	1.9	1.6	1.5	1.4	1.4	1.4	1.3	1.3
80.0 to 89.9	2.4	2.1	1.9	1.8	1.8	1.7	1.7	1.7
90.0 and above	2.9	2.5	2.3	2.2	2.2	2.1	2.1	2.1

Mean Hauteur	Maximum probable difference (mm)							
	Number of laboratory samples measured in each laboratory							
range	1	2	3	4	5	6	7	8
less than 50.0	0.7	0.6	0.4	0.4	0.4	0.3	0.3	0.3
50.0 to 59.9	1.4	1.1	1.0	1.0	0.8	0.8	0.8	0.8
60.0 to 69.9	2.1	1.7	1.6	1.4	1.4	1.4	1.4	1.4
70.0 to 79.9	2.7	2.3	2.1	2.0	2.0	2.0	1.8	1.8
80.0 to 89.9	3.4	3.0	2.7	2.5	2.5	2.4	2.4	2.4
90.0 and above	4.1	3.5	3.3	3.1	3.1	3.0	3.0	3.0

Mean Barbe	95% confidence limits (mm)							
	Number of laboratory specimens							
range	1	2	3	4	5	6	7	8
less than 60.0	0.8	0.7	0.7	0.7	0.7	0.7	0.7	0.6
60.0 to 79.9	1.4	1.2	1.2	1.1	1.1	1.1	1.1	1.1
80.0 to 99.9	1.9	1.7	1.6	1.6	1.6	1.5	1.5	1.5
100.0 to 119.9	2.5	2.2	2.1	2.0	2.0	2.0	2.0	1.9
120.0 and above	3.0	2.7	2.5	2.5	2.4	2.4	2.4	2.4

Mean Barbe	Maximum probable difference (mm)							
	Number of lab. specimens measured in each laboratory							
range	1	2	3	4	5	6	7	8
less than 60.0	1.1	1.0	1.0	1.0	1.0	1.0	1.0	0.8
60.0 to 79.9	2.0	1.7	1.7	1.6	1.6	1.6	1.6	1.6
80.0 to 99.9	2.7	2.4	2.3	2.3	2.3	2.1	2.1	2.1
100.0 to 119.9	3.5	3.1	3.0	2.8	2.8	2.8	2.8	2.7
120.0 and above	4.2	3.8	3.5	3.5	3.4	3.4	3.4	3.4

Condition Tests (IWTO-33 & 34)

Neither test method specifies the precision. It may be inferred from the IWTO Regulations. The precision applies to the **Oven-dry weight**:

state		95%CL (%)	MPD (%)
scoured	IWTO-33	± 1.1	1.6
sliver	IWTO-34	± 0.7	1.0

Residual grease level (IWTO-10)

Whilst there is no detectable level-dependency, the precision is dependent on the number of subsamples tested. In the case of scoured and carbonized wool, the precision quoted is for a test result on 7000kg. In the case of tops, the precision estimate is for a test result on 5000kg.

state	95%CL (%)	MPD (%)
scoured	± 0.12	0.18
sliver	± 0.22	0.31

Miscellaneous tests

None of the measurements shown below are certifiable under IWTO Regulations. For the sake of brevity, precision values are quoted as 95% confidence limits. Under normal circumstances, the MPD values would be $1.414 * 95\%CL$.

Fibre diameter distribution – standard deviation:

Both level-dependent and method-dependent:

		Mean standard deviation (µm)				
		3	5	7	9	11
Greasy	IWTO-12	± 0.18	± 0.23	± 0.28	± 0.33	± 0.38
	IWTO-47	± 0.27	± 0.31	± 0.00	± 0.38	± 0.42
Sliver	IWTO-12	± 0.15	± 0.25	± 0.34	± 0.44	± 0.54
	IWTO-47	± 0.26	± 0.31	± 0.35	± 0.40	± 0.45

Fibre length distribution – coefficient of variation of Hauteur (IWTO-17)

	Number of laboratory specimens							
	1	2	3	4	5	6	7	8
95%CL CvH (%)	± 2.7	± 2.4	± 2.3	± 2.2	± 2.2	± 2.2	± 2.2	± 2.2

Percentage medullation

Both level-dependent and method-dependent. IWTO-8 data based on ASTM estimates.

limits		Mean medullation level						
		0.5%	1%	2%	3%	4%	5%	10%
IWTO-8	lower	0.2%	0.5%	1.2%	2.0%	2.9%	3.7%	8.1%
	upper	1.2%	1.8%	3.1%	4.3%	5.5%	6.6%	12.2%
IWTO-57		± 0.34%	± 0.53%				± 1.5%	± 2.4%

pH of water extract (IWTO-2): 95% CL ± 0.7 pH units

Alkali solubility (IWTO-DTM-4): 95% CL ± 2.2% <20.1, ± 2.8% >20.0

Chemical Residue Analysis (IWTO-DTM-59): Limited data suggests that in the normal range of residue levels encountered in raw wool, typical 95%CL values are in range of 30 to 35% of the mean result.

Fleece testing methods

Data from AWI 2004 trials. Precision estimates for whole-fleece mean fibre diameter based on single test:

		Sample site	MFD (µm)	CvD (%)	Comfort factor (%)	Mean curve (°/mm)
Laboratory	OFDA100	Midside	± 1.1	± 2.4	± 1.5	± 10
	Laserscan	Midside	± 1.0	± 2.9	± 1.6	± 13
On-farm	OFDA2000	Midside	± 1.2	± 2.2	± 1.6	± 12
	Fleecescan	Whole fleece	± 1.2	± 3.4	± 1.8	± 13