**《测长仪校准规范》**

**试验验证报告**

2024年03月

实验用主要标准器

|  |  |  |  |
| --- | --- | --- | --- |
| 主要标准器 | 型号 | 准确度等级/扩展不确定度/最大允许误差 | 器具编号 |
| 量块 | (0.5~90)mm | 二等 | 15816 |
| 量块 | (1~100)mm | 二等 | 78036 |
| 量块 | (125~500)mm | 二等 | 77825 |
| 量块 | (600~1000)mm | 二等 | 83214 |
| 标准环规 | φ(14~65)mm | *U*=0.5μm(*k*=2) | / |

被测仪器信息及实验条件

|  |  |  |  |
| --- | --- | --- | --- |
| 设备型号： | SJ-5100-PREC-1000 | 出厂编号： | SJGC2310108 |
| 生产厂家： | 深圳市中图仪器股份有限公司 | 试验地点： | 深圳市中图仪器股份有限公司恒温室 |
| 环境温度： | 20.8℃ | 相对湿度： | 55%RH |
| 试验日期： | 2023年12月12日 | 试验人员： | 王晓飞、钱征宇、晏浩、常青、张鹏 |
| MPE：±(0.15μm +*L*/1000) | | | |

试验结果

1. 示值变动性

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| 测量位置 | 中 | 上 | 下 | 前 | 后 | 测量结果 |
| 读数值(μm) | 0.00 | 0.30 | 0.28 | 0.20 | 0.18 | 0.30 |

1. 示值误差

10mm以下受校点以1mm量块对零，10mm及以上受校点直接测量。

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| 标称值(mm) | 修正值(μm) | 测得值 | | | 平均值 | 示值误差  (μm) |
| I | II | III |
| 1 | -0.06 | / | / | / | / | / |
| 1.003 | 0.04 | 1.00302 | 1.00305 | 1.00305 | 1.00304 | 0.00 |
| 1.005 | -0.02 | 1.00498 | 1.00499 | 1.00497 | 1.00498 | 0.00 |
| 1.007 | 0.04 | 1.00707 | 1.00702 | 1.00702 | 1.00704 | 0.00 |
| 1.009 | 0.04 | 1.00905 | 1.00908 | 1.00901 | 1.00905 | 0.01 |
| 10 | -0.02 | 10.00002 |  |  | 10.00002 | 0.04 |
| 20 | -0.16 | 19.99982 |  |  | 19.99982 | -0.02 |
| 30 | -0.08 | 29.99990 |  |  | 29.99990 | -0.02 |
| 40 | -0.10 | 39.99997 |  |  | 39.99997 | 0.07 |
| 50 | -0.09 | 49.99987 |  |  | 49.99987 | -0.04 |
| 60 | -0.10 | 59.99996 |  |  | 59.99996 | 0.06 |
| 70 | 0.23 | 70.00017 |  |  | 70.00017 | -0.06 |
| 80 | -0.07 | 79.99988 |  |  | 79.99988 | -0.05 |
| 90 | -0.38 | 89.99952 |  |  | 89.99952 | -0.10 |
| 100 | -0.02 | 99.99990 |  |  | 99.99990 | -0.08 |
| 150 | 0.22 | 150.00025 |  |  | 150.00025 | 0.03 |
| 200 | 0.79 | 200.00087 |  |  | 200.00087 | 0.08 |
| 300 | 0.06 | 299.99992 |  |  | 299.99992 | -0.14 |
| 400 | -0.39 | 399.99920 |  |  | 399.99920 | -0.41 |
| 500 | 1.14 | 500.00074 |  |  | 500.00074 | -0.40 |
| 600 | 1.18 | 600.00059 |  |  | 600.00059 | -0.59 |
| 700 | 1.28 | 700.00074 |  |  | 700.00074 | -0.54 |
| 800 | 0.97 | 800.00048 |  |  | 800.00048 | -0.49 |
| 900 | 1.02 | 900.00114 |  |  | 900.00114 | 0.12 |
| 1000 | -0.62 | 999.99931 |  |  | 999.99931 | -0.07 |

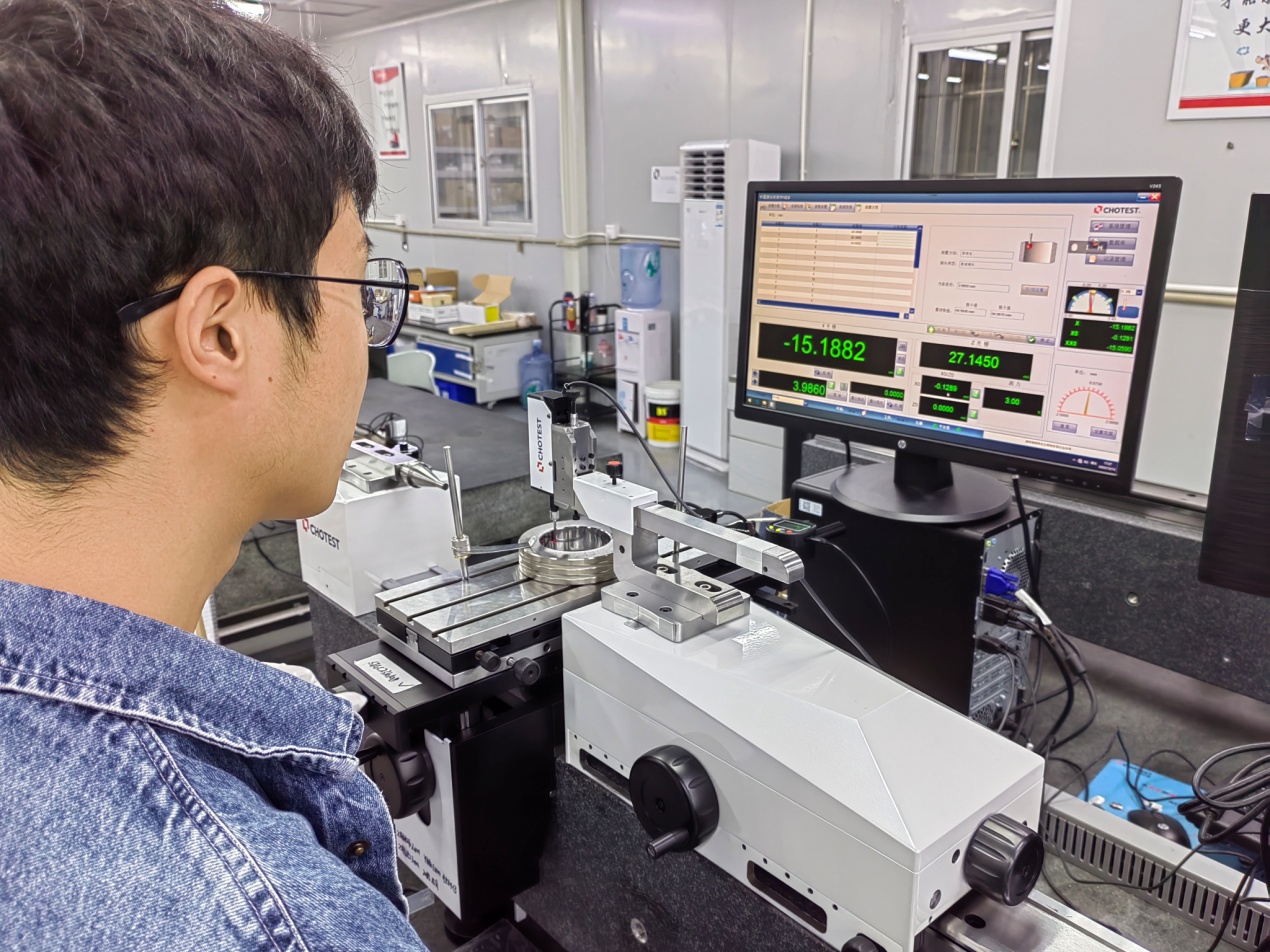
3、测量重复性

|  |  |  |
| --- | --- | --- |
| 序号 | 测得值(μm) | 重复性(μm) |
| 1 | 49.99869 | *s*=0.017 |
| 2 | 49.99872 |
| 3 | 49.99874 |
| 4 | 49.99874 |
| 5 | 49.99874 |
| 6 | 49.99874 |
| 7 | 49.99872 |
| 8 | 49.99872 |
| 9 | 49.99871 |
| 10 | 49.99873 |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 序号 | | 测得值(μm) | 极差值/*c* | 重复性*s*p(μm) |
| I | 1 | 49.99872 | 0.0118 | *s*p=0.013 |
| 2 | 49.99872 |
| 3 | 49.99874 |
| II | 1 | 49.99874 | 0.0000 |
| 2 | 49.99874 |
| 3 | 49.99874 |
| III | 1 | 49.99872 | 0.0059 |
| 2 | 49.99872 |
| 3 | 49.99871 |
| IV | 1 | 49.99872 | 0.0237 |
| 2 | 49.99868 |
| 3 | 49.99870 |
| V | 1 | 49.99868 | 0.0118 |
| 2 | 49.99869 |
| 3 | 49.99867 |

4、内尺寸示值误差

|  |  |  |  |
| --- | --- | --- | --- |
| 直径标称值(mm) | 直径实际值(mm) | 测得值(mm) | 示值误差(μm) |
| 13.9997 | 14.0004 | 14.0002 | -0.2 |
| 65.0000 | 64.9996 | 64.9995 | -0.1 |



实验用主要标准器

|  |  |  |  |
| --- | --- | --- | --- |
| 主要标准器 | 型号 | 准确度等级/扩展不确定度/最大允许误差 | 器具编号 |
| 量块 | (0.5~100)mm | 2等 | 60705 |
| 量块 | (125~500)mm | 2等 | 0810 |
| 量块 | (600~1000)mm | 2等 | 37432 |
| 标准环规 | Φ(3~90)mm | 2等 | LG-15-05 |

被测仪器信息及实验条件

|  |  |  |  |
| --- | --- | --- | --- |
| 设备型号： | ULM 600-E | 出厂编号： | 1683/16 |
| 生产厂家： | **Mahr** | 试验地点： | 苏州市协兴街6号C栋210恒温室 |
| 环境温度： | 20.1℃ | 相对湿度： | 55%RH |
| 试验日期： | 2023年12月19日 | 试验人员： | 王云祥、黄红平、吴建平 |
| MPE：±(0.085 +*L*/1500) μm (*L*:mm) | | | |

试验结果

1. 示值变动性

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| 测量位置 | 中 | 上 | 下 | 前 | 后 | 测量结果 |
| 读数值(μm) | 0.00 | 0.12 | 0.18 | 0.19 | 0.20 | 0.20 |

1. 示值误差

10mm以下受校点以1mm量块对零，10mm及以上受校点直接测量。

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| 标称值(mm) | 修正值(μm) | 实测值(mm) | | | 平均值(mm) | 示值误差  (μm) |
| I | II | III |
| 1 | 0.05 | / | / | / | / | / |
| 1.003 | 0.10 | 1.00310 | 1.00309 | 1.00311 | 1.00310 | 0.00 |
| 1.005 | 0.09 | 1.00509 | 1.00508 | 1.00507 | 1.00508 | -0.01 |
| 1.007 | 0.06 | 1.00704 | 1.00705 | 1.00706 | 1.00705 | -0.01 |
| 1.009 | 0.02 | 1.00901 | 1.00900 | 1.00902 | 1.00901 | -0.01 |
| 10 | -0.05 | 9.99994 |  |  | 9.99994 | -0.01 |
| 20 | 0.01 | 19.99998 |  |  | 19.99998 | -0.03 |
| 30 | 0.08 | 30.00005 |  |  | 30.00005 | -0.03 |
| 40 | 0.07 | 40.00002 |  |  | 40.00002 | -0.05 |
| 50 | 0.09 | 50.00002 |  |  | 50.00002 | -0.07 |
| 60 | 0.42 | 60.00036 |  |  | 60.00036 | -0.06 |
| 70 | -0.02 | 69.99990 |  |  | 69.99990 | -0.08 |
| 80 | 80.00001 |  |  | 80.00001 | 80.00001 | -0.07 |
| 90 | 90.00003 |  |  | 90.00003 | 90.00003 | -0.10 |
| 100 | 100.00008 |  |  | 100.00008 | 100.00008 | -0.11 |

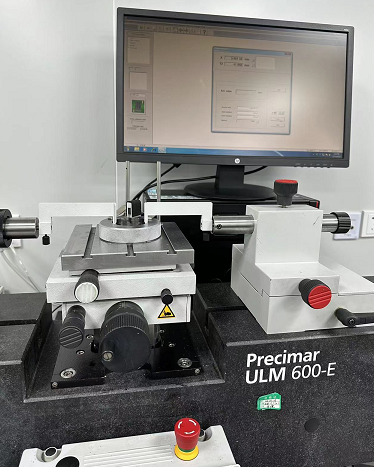
3、测量重复性

|  |  |  |
| --- | --- | --- |
| 序号 | 测得值(mm) | 重复性(μm) |
| 1 | 100.00003 | *s*=0.013 |
| 2 | 100.00003 |
| 3 | 100.00001 |
| 4 | 100.00002 |
| 5 | 100.00001 |
| 6 | 100.00002 |
| 7 | 100.00000 |
| 8 | 100.00000 |
| 9 | 100.00001 |
| 10 | 100.00003 |



4、内尺寸示值误差

|  |  |  |  |
| --- | --- | --- | --- |
| 直径标称值(mm) | 直径实际值(mm) | 实测值(mm) | 示值误差(μm) |
| Φ27.0000 | 26.9970 | 26.9968 | -0.2 |
| Φ50.000 | 49.9980 | 49.9977 | -0.3 |



实验用主要标准器

|  |  |  |  |
| --- | --- | --- | --- |
| 主要标准器 | 型号 | 准确度等级/扩展不确定度/最大允许误差 | 器具编号 |
| 量块 | (0.5~100)mm | 2等 | 60705 |
| 量块 | (125~500)mm | 2等 | 0810 |
| 量块 | (600~1000)mm | 2等 | 37432 |
| 标准环规 | Φ(3~90)mm | 2等 | LG-15-05 |

被测仪器信息及实验条件

|  |  |  |  |
| --- | --- | --- | --- |
| 设备型号： | LABCP1000 | 出厂编号： | 1475 |
| 生产厂家： | **TRIMOS** | 试验地点： | 苏州市协兴街6号C栋210恒温室 |
| 环境温度： | 20.1℃ | 相对湿度： | 55%RH |
| 试验日期： | 2023年12月18日 | 试验人员： | 王云祥、黄红平、吴建平 |
| MPE：±(0.15 +*L*/2000) μm (*L*:mm) | | | |

试验结果

1. 示值变动性

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| 测量位置 | 中 | 上 | 下 | 前 | 后 | 测量结果 |
| 读数值(μm) | 0.00 | 0.16 | 0.22 | 0.20 | 0.24 | 0.24 |

1. 示值误差

10mm以下受校点以1mm量块对零，10mm及以上受校点直接测量。

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| 标称值(mm) | 修正值(μm) | 实测值(mm) | | | 平均值(mm) | 示值误差  (μm) |
| I | II | III |
| 1 | 0.05 | / | / | / | / | / |
| 1.003 | 0.10 | 1.0031 | 1.00309 | 1.00311 | 1.00310 | 0.00 |
| 1.005 | 0.09 | 1.00509 | 1.00508 | 1.006 | 1.00509 | 0.00 |
| 1.007 | 0.06 | 1.00707 | 1.00708 | 1.00706 | 1.00707 | 0.01 |
| 1.009 | 0.02 | 1.00901 | 1.00903 | 1.00905 | 1.00903 | 0.01 |
| 10 | -0.05 | 9.99996 |  |  | 9.99996 | -0.01 |
| 20 | 0.01 | 19.99999 |  |  | 19.99999 | -0.02 |
| 30 | 0.08 | 30.00005 |  |  | 30.00005 | -0.03 |
| 40 | 0.07 | 40.00002 |  |  | 40.00002 | -0.05 |
| 50 | 0.09 | 50.00005 |  |  | 50.00005 | -0.04 |
| 60 | 0.42 | 60.00038 |  |  | 60.00038 | -0.04 |
| 70 | -0.02 | 69.99993 |  |  | 69.99993 | -0.05 |
| 80 | 0.08 | 80.00001 |  |  | 80.00001 | -0.07 |
| 90 | 0.13 | 90.00003 |  |  | 90.00003 | -0.10 |
| 100 | 0.19 | 10.00010 |  |  | 10.00010 | -0.09 |
| 200 | 0.54 | 200.00044 |  |  | 200.00044 | -0.10 |
| 300 | 0.25 | 300.00013 |  |  | 300.00013 | -0.12 |
| 400 | 1.04 | 400.00089 |  |  | 400.00089 | -0.15 |
| 500 | -0.03 | 499.99975 |  |  | 499.99975 | -0.22 |
| 600 | -0.61 | 599.99910 |  |  | 599.99910 | -0.29 |
| 700 | 0.34 | 700.00002 |  |  | 700.00002 | -0.32 |
| 800 | 0.75 | 800.00040 |  |  | 800.00040 | -0.35 |
| 900 | 0.49 | 900.00016 |  |  | 900.00016 | -0.33 |
| 1000 | -1.02 | 999.99856 |  |  | 999.99856 | -0.42 |

3、测量重复性

|  |  |  |
| --- | --- | --- |
| 序号 | 测得值(mm) | 重复性(μm) |
| 1 | 100.00005 | *s*=0.015 |
| 2 | 100.00003 |
| 3 | 100.00001 |
| 4 | 100.00002 |
| 5 | 100.00002 |
| 6 | 100.00005 |
| 7 | 100.00004 |
| 8 | 100.00002 |
| 9 | 100.00001 |
| 10 | 100.00003 |



4、内尺寸示值误差

|  |  |  |  |
| --- | --- | --- | --- |
| 直径标称值(mm) | 直径实际值(mm) | 实测值(mm) | 示值误差(μm) |
| Φ15.000 | 15.0006 | 15.0004 | -0.2 |
| C:\Users\Administrator\Desktop\相机胶卷\2023_12_15_14_47_IMG_3445.JPGΦ50.000 | 49.9980 | 49.9978 | -0.2 |

实验用主要标准器

|  |  |  |  |
| --- | --- | --- | --- |
| 主要标准器 | 型号 | 准确度等级/扩展不确定度/最大允许误差 | 器具编号 |
| 量块 | (0.5~100)mm | 二等 | 46607 |
| 量块 | (125~500)mm | 二等 | 140085 |
| 标准环规 | φ(14~65)mm | *U*=0.5μm(*k*=2) | / |

被测仪器信息及实验条件

|  |  |  |  |
| --- | --- | --- | --- |
| 设备型号： | PLM 1000-E | 出厂编号： | 1202/2023 |
| 生产厂家： | **Mahr** | 试验地点： | 无锡市计量测试院西大楼1楼实验室 |
| 环境温度： | 20.2℃ | 相对湿度： | 59%RH |
| 试验日期： | 2024年01月05日 | 试验人员： | 王树刚、李惠、王晓飞 |
| MPE：±(0.08μm +*L*/1500) | | | |

试验结果

1. 示值变动性

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| 测量位置 | 中 | 上 | 下 | 前 | 后 | 测量结果 |
| 读数值(μm) | 0.00 | 0.02 | 0.03 | 0.02 | 0.01 | 0.03 |

1. 示值误差

10mm以下受校点以1mm量块对零，10mm及以上受校点直接测量。

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| 标称值(mm) | 修正值(μm) | 测得值 | | | 平均值 | 示值误差  (μm) |
| I | II | III |
| 1 | +0.04 | / | / | / | / | / |
| 1.003 | +0.10 | 1.00312 | 1.00313 | 1.00314 | 1.00313 | 0.03 |
| 1.005 | +0.03 | 1.00506 | 1.00502 | 1.00502 | 1.00503 | 0.00 |
| 1.007 | +0.12 | 1.00713 | 1.00715 | 1.00714 | 1.00714 | 0.02 |
| 1.009 | +0.02 | 1.00902 | 1.00904 | 1.00904 | 1.00903 | 0.01 |
| 10 | +0.05 | 10.00006 | 10.00006 | 10.00007 | 10.00006 | 0.01 |
| 20 | +0.07 | 20.00011 | 20.00013 | 20.00012 | 20.00012 | 0.05 |
| 30 | +0.07 | 30.00011 | 30.00012 | 30.00011 | 30.00011 | 0.04 |
| 40 | -0.11 | 39.99996 | 39.99996 | 39.99994 | 39.99995 | 0.06 |
| 50 | -0.11 | 49.99996 | 49.99996 | 49.99994 | 49.99995 | 0.06 |
| 60 | -0.26 | 59.99981 | 59.99984 | 59.9998 | 59.99982 | 0.08 |
| 70 | -0.67 | 69.99938 | 69.99942 | 69.99941 | 69.99940 | 0.07 |
| 80 | -0.13 | 79.99993 | 79.99995 | 79.99996 | 79.99995 | 0.08 |
| 90 | -0.51 | 89.99959 | 89.99959 | 89.99961 | 89.99960 | 0.11 |
| 100 | -0.46 | 99.99965 | 99.99961 | 99.99962 | 99.99963 | 0.09 |
| 150 | -0.07 | 150.00004 | 150.00006 | 150.00007 | 150.00006 | 0.13 |
| 200 | -0.21 | 199.99989 | 199.99992 | 199.99991 | 199.99991 | 0.12 |

3、测量重复性

|  |  |  |
| --- | --- | --- |
| 序号 | 测得值(mm) | 重复性(μm) |
| 1 | 49.99996 | s=0.011 |
| 2 | 49.99994 |
| 3 | 49.99995 |
| 4 | 49.99994 |
| 5 | 49.99996 |
| 6 | 49.99997 |
| 7 | 49.99996 |
| 8 | 49.99996 |
| 9 | 49.99994 |
| 10 | 49.99996 |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 序号 | | 测得值(mm) | 极差值/*c* | 重复性*s*p(μm) |
| I | 1 | 49.99994 | 0.0059 | *s*p=0.011 |
| 2 | 49.99994 |
| 3 | 49.99993 |
| II | 1 | 49.99994 | 0.0118 |
| 2 | 49.99996 |
| 3 | 49.99994 |
| III | 1 | 49.99996 | 0.0059 |
| 2 | 49.99996 |
| 3 | 49.99995 |
| IV | 1 | 49.99997 | 0.0059 |
| 2 | 49.99997 |
| 3 | 49.99996 |
| V | 1 | 49.99995 | 0.0177 |
| 2 | 49.99998 |
| 3 | 49.99996 |

4、内尺寸示值误差

|  |  |  |  |
| --- | --- | --- | --- |
| 直径标称值(mm) | 直径实际值(mm) | 测得值(mm) | 示值误差(μm) |
| 15 | 14.9994 | 14.99947 | +0.07 |
| 50 | 50.0025 | 50.00274 | +0.24 |



以上试验均满足技术规范的要求。