Date of issue	2022-05-31
Version	1.0
Total pages	20

Test report of

IES LM-79-08

Approved Method: Electrical and Photometric

Measurements of Solid-State Lighting Products

Applicant:

P.Q.L., Inc.

Address:

2285 Ward Avenue
Simi Valley, CA 93065

For Product:

High Bay Luminaires (Commercial and Industrial)

Model No.:

CHB3-400-D-MV-30K-170S, CHB3-400-D-MV-65K-170S

Test laboratory: Shenzhen Belling Efficiency Testing Lab Co., Ltd, 1Floor, No.1 Building, Meibaohe Industrial Park, Dalang Street, Longhua District, Shenzhen, Guangdong Prov.518101 China.

Complied by: Sam Chen

Review by: Jason zhou

Project Engineer

Technical Manager

1 General

1.1 Product Information

Manufacturer	P.Q.L., Inc.
Manufacturer Address	2285 Ward Avenue Simi Valley, CA 93065
Brand Name	PQL
Luminaire Type	High Bay Luminaires (Commercial and Industrial)
Model Number	CHB3-400-D-MV-30K-170S, CHB3-400-D-MV-65K-170S
Rated Inputs	AC 100-277V, 50/60Hz
Rated Power	400 W
Nominal CCT	3000K, 6500K
Dimming Capability	Continuous, 0-10V
Integral Control Sensors	No
Date of Receipt Samples	2022-04-26
Date of test	2022-04-27 to 2022-05-24
Burning Time Before Test	0hour(For New Products)

1.2 Standards or methods

- ANSI C78.377-2017:Specifications for the Chromaticity of Solid State Lighting Products
- ANSI C82.77-10:2014:Harmonic Emission Limits - Related Power Quality Requirements for Lighting Equipment - Solid State
- CIE Publication No.13.3-1995:Method of Measuring and Specifying Color Rendering of Light Sources
- IESNA LM-79-08 Approved Method: Electric & Photometric Measurement of Solid-state Lighting Products

1.3 Equipment list

Device	Manufacture	Model No.	Serial No.	Calibration due date
Goniophotometeric System	SENSING	GMS-3000	N.A	2023-04-08
AC Power Source	ALL POWER	APW-105N	970780	2023-04-10
Total Luminous Flux Standard Lamp	SENSING	110V/100W	S13100188	2023-03-30
Total Luminous Flux Standard Lamp	OSRAM	12V/20W	LSD1220173	2023-03-30
Digital Power Meter	YOKOGAWA	WT310	C2QM02030V	2023-04-10
Thermostatic stabilized photometric sphere	SENSING	SPR-600M	N.A	2023-04-08
Digital Power Meter	YOKOGAWA	WT210	91L929742	2023-04-10
Spectral radiometer	SENSING	SPR-3000	S1101108	2023-04-08
Environment Measurer	XUYAO	HS-1	N/A	2023-03-30
Environment Measurer	XUYAO	HS-1	N/A	2023-03-30
Stop watch	KISLO	K610	N/A	2023-04-14
Digital Anemometer	TECMAN	TD8901	026141	2022-09-08

Statement of Traceability: Shenzhen Belling Efficiency Testing Lab Co., Ltd attests that all calibration has been performed using suitable standards traceable to national primary standards and International System of Unit (SI).

2 Test conducted and method

2.1 Ambient Condition

The ambient temperature in which measurements are being taken was maintained at 25°C ±1°C, the air flow around the sample(s) being tested did not affect the performance.

2.2 Power Supply Characteristics

The AC power supply had a sinusoidal voltage wave shape at the prescribed frequency (60 Hz) such that the RMS summation of the harmonic components does not exceed 3 percent of the fundamental during operation of the test item.

The voltage of AC power supply (RMS voltage) applied to the device under test was regulated to within±0.2 percent under load.

2.3 Seasoning and Stabilization

No seasoning was performed in accordance with IESNA LM-79-08. And before the measurement, the sample was stabilized until the light output and power variations were less than 0.5% in 30 minutes intervals (3 readings, 15 minutes apart).

2.4 Integrating Sphere System

The system includes AC power source, digital power meter, DC power supply, spectrophotometer, and integrating sphere. The integrating sphere system is calibrated by standard light source before measurement. The system and standard light source has been calibrated regularly and traceable to the National Primary Standards. 4π geometry was used during measurement. The product was operated in its intended orientation in application and was recorded in this report.

Integrating Sphere Uncertainty: The uncertainty of the light output (luminous flux) measurements is U=1.8% (K=2), at the 95% confidence level. The uncertainty of the correlated color temperature measurements is U=20K (K=2), at the 95% confidence level. The uncertainty of the CRI is U=1.8(K=2), at the 95% confidence level. The uncertainty of power meter AC current U=0.18% of rdg, AC Voltage U=0.16% of rdg, Power U=0.20% (K=2), at the 95% confidence level.

2.5 Goniophotometer System

The goniophotometer system is calibrated by standard light source before measurement. The standard light source has been calibrated regularly and traceable to the National Primary Standards.

Type C goniophotometer was used for measuring total luminous flux, luminous intensity distribution, and color spatial uniformity. The product was operated in its intended orientation in application and was recorded in this report. The method according to IESNA LM-79-08 following chapter.

Goniophotometer Uncertainty :The uncertainty of the luminous intensity is U=1.6% (K=2), at the 95% confidence level.

3 Test Result Summary

3.1 Integrating Sphere System (Total operating time for integrating sphere test: 1.0 hour)

3.1.1 Model Number: CHB3-400-D-MV-30K-170S

Electrical data

Input Voltage(V)	Frequency (Hz)	Input Current (A)	Power (W)	Power Factor
120.03	60	3.355	398.72	0.990

Photometric data

Luminous Flux (lm)	Efficacy (lm/W)	CCT (K)
62638.74	157.1	2919

Chromaticity Coordinate

Duv	x	y	u'	v'
-0.001	0.4413	0.4030	0.2539	0.5216

Color Rendering

CRI	R9	Rf	Rg	Rcs,h1(%)
76.2	-8	78	96	-13

Spectral Distribution
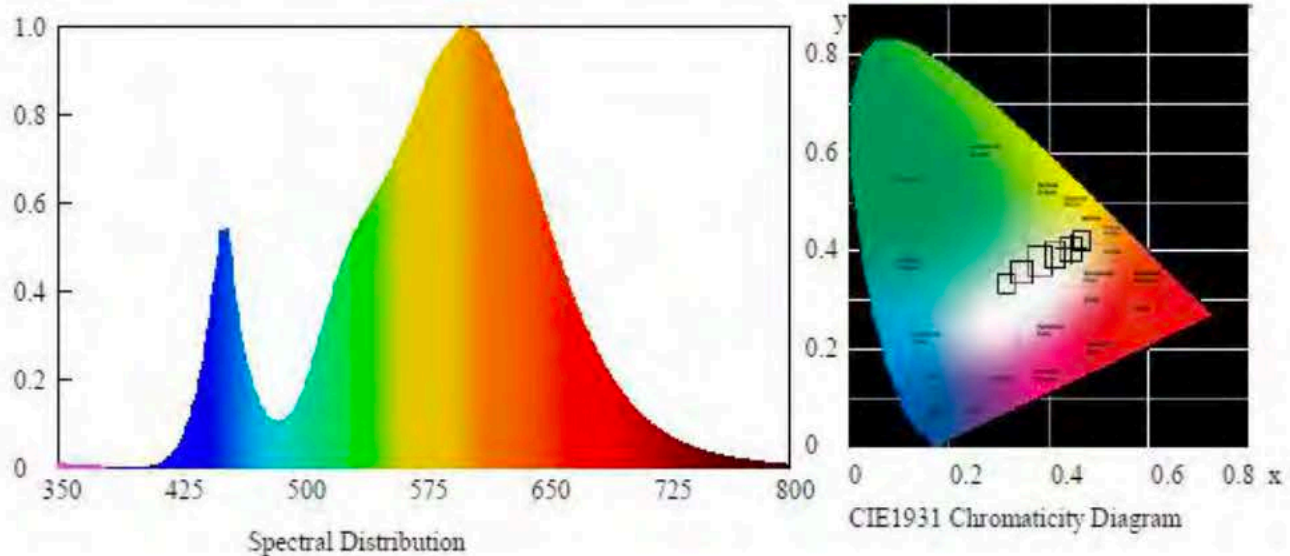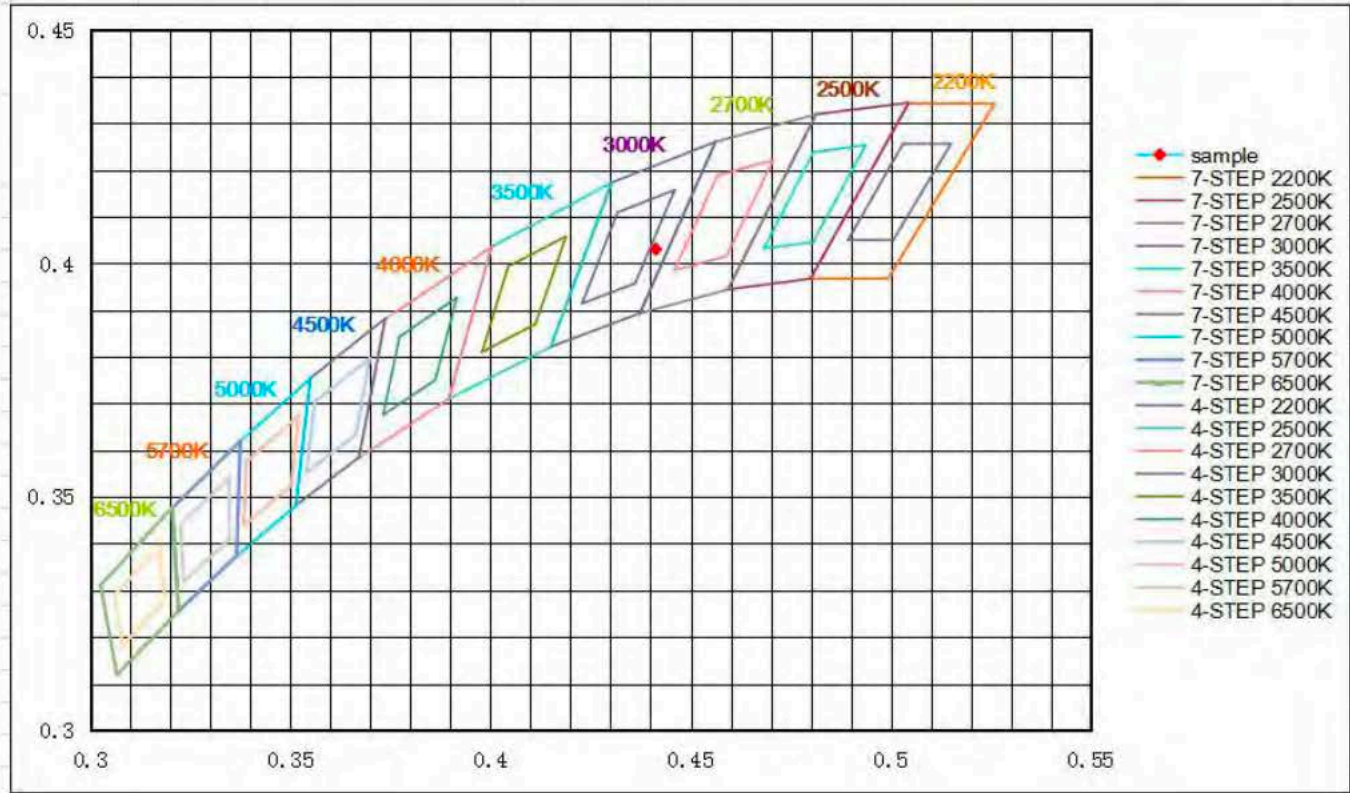
Spectral Distribution

CIE1931 Chromaticity Diagram

7/4 Step Quadrangle

ANSI/IES TM-30-18 Color Rendition Report

Source:	BL220426006-9	**Manufacturer:**	P.Q.L., Inc.
Date:	2022-05-31	**Model:**	CHB3-400-D-MV-30K-170S
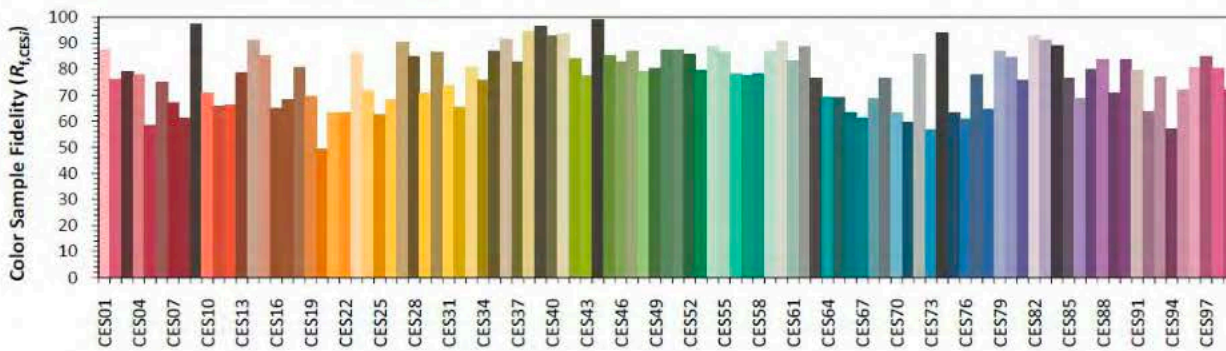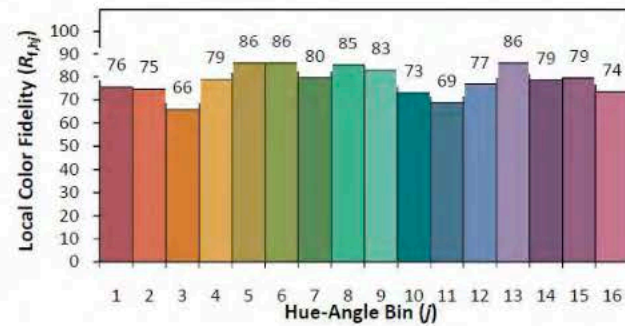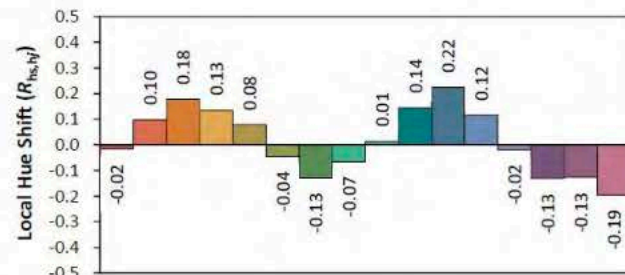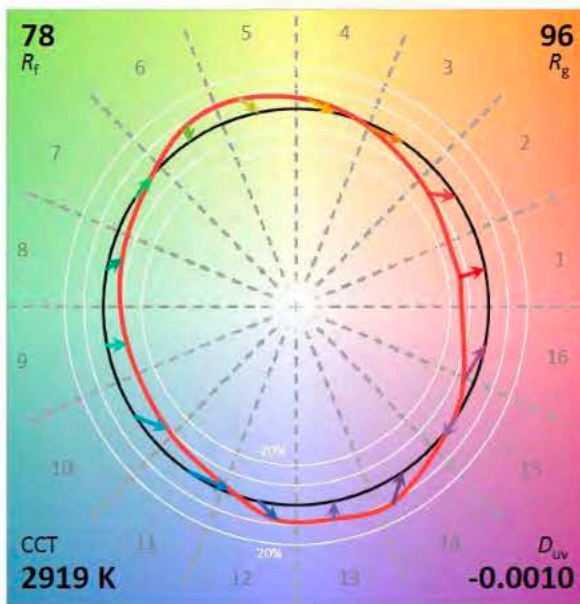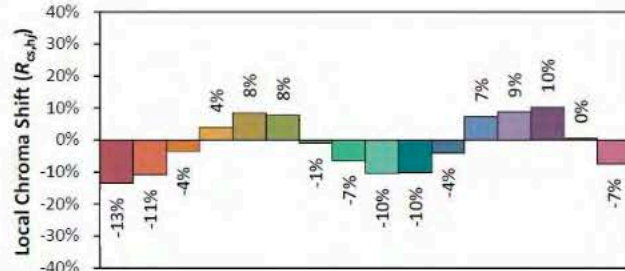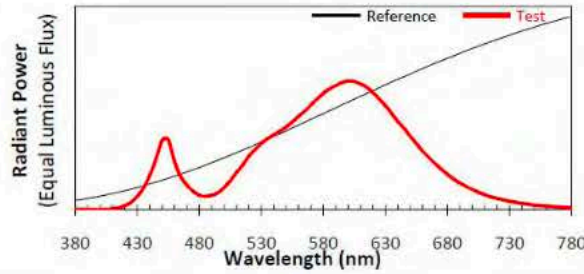
Notes: This is a recommended method for displaying ANSI/IES TM-30-18 information.

x	0.4413
y	0.4030
u'	0.2539
v'	0.5216

CIE 13.3-1995 (CRI)

R_a	76
R_9	-8

Colors are for visual orientation purposes only. Created with the ANSI/IES TM-30-18 Calculator Version 2.00.

3.1.2 Model Number: CHB3-400-D-MV-65K-170S

Electrical data

Input Voltage(V)	Frequency (Hz)	Input Current (A)	Power (W)	Power Factor
120.09	60	3.352	398.51	0.990

Photometric data

Luminous Flux (lm)	Efficacy (lm/W)	CCT (K)
68742.74	172.5	6456

Chromaticity Coordinate

Duv	x	y	u'	v'
+0.00584	0.3129	0.3344	0.196	0.4712

Color Rendering

CRI	R9	Rf	Rg	Rcs,h1(%)
72.3	-27	73	92	-18

Spectral Distribution

Spectral Distribution

CIE1931 Chromaticity Diagram

7/4 Step Quadrangle

ANSI/IES TM-30-18 Color Rendition Report

Source:	BL220426006-9	Manufacturer:	P.Q.L., Inc.
Date:	2022-05-31	Model:	CHB3-400-D-MV-65K-170S

R_f 73 R_g 92

CCT 6455 K D_{uv} 0.0058
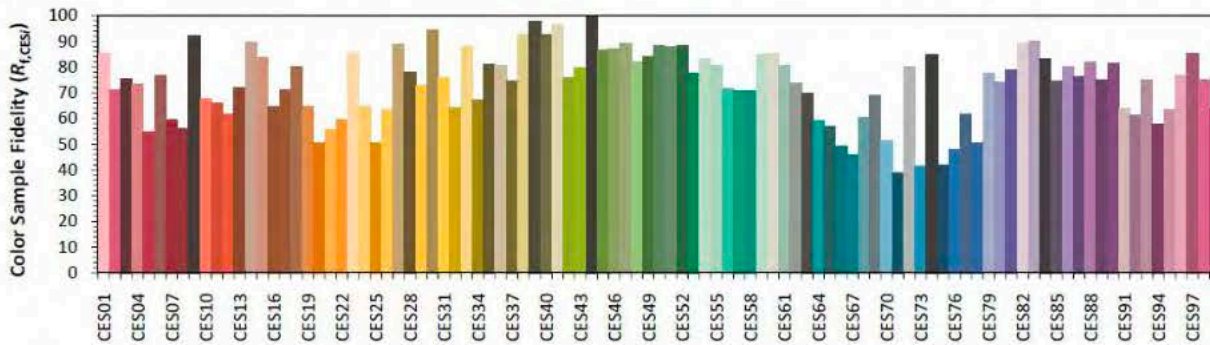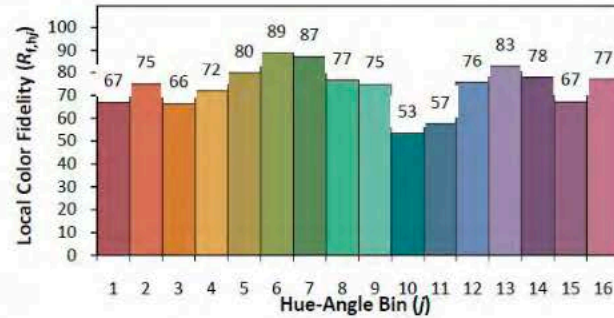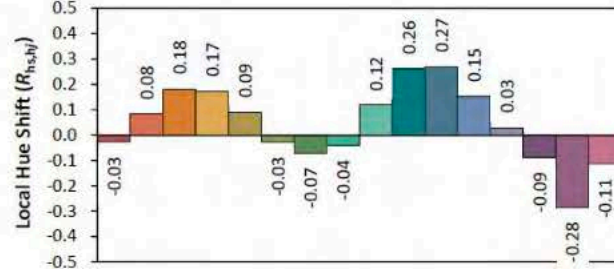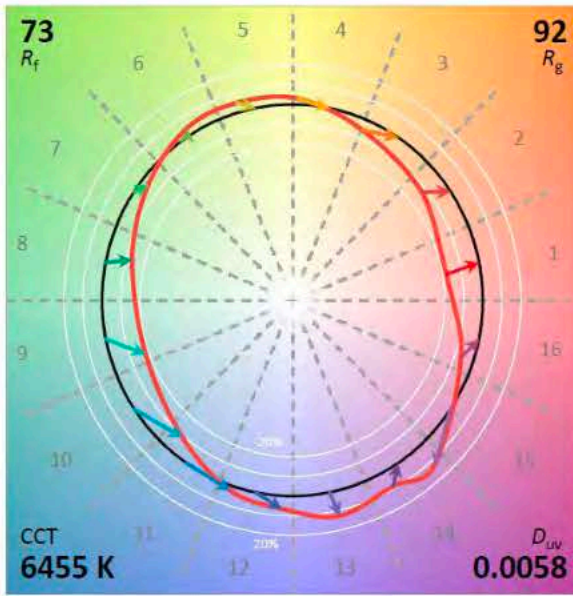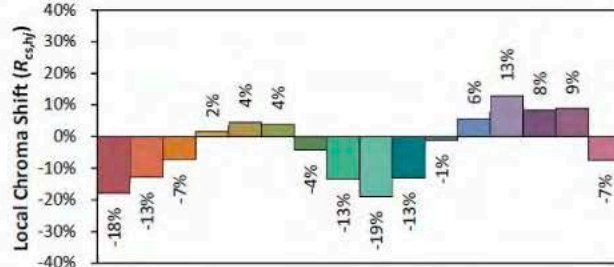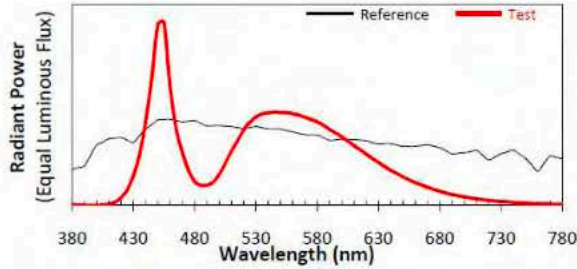
Notes:	This is a recommended method for displaying ANSI/IES TM-30-18 information.		

x	0.3129		
y	0.3344	CIE 13.3-1995 (CRI)	
u'	0.1960	R_a	72
v'	0.4712	R_9	−28

Colors are for visual orientation purposes only. Created with the ANSI/IES TM-30-18 Calculator Version 2.00.

3.2 Goniophotometer System (Total operating time for luminous intensity distribution: 1.0 hour)

3.2.1 Model Number: CHB3-400-D-MV-30K-170S

Electrical data

Input Voltage(V)	Frequency (Hz)	Input Current (A)	Power (W)	Power Factor
120.07	60	3.330	398.50	0.9966

Photometric data

Luminous Flux (lm)	Efficacy (lm/W)	Zonal Lumen in 20-50°(%lm)
62570.00	157.01	53.45

Zonal Flux Diagram

Zonal flux distribution table

γ(°)	Average I(cd)	Zonal F(lm)	Sum F(lm)	Eff Flux(%)	Eff Sum(%)
0.0	24070.400	0.000	0	0.00%	0.00%
5.0	23925.318	573.775	573.775	0.00%	0.92%
10.0	23540.178	1697.990	2271.765	0.00%	3.63%
15.0	22964.137	2758.605	5030.37	0.00%	8.04%
20.0	22199.066	3722.082	8752.452	0.00%	13.99%
25.0	21232.406	4555.160	13307.612	0.00%	21.27%
30.0	20085.000	5228.752	18536.364	0.00%	29.63%
35.0	18749.900	5718.711	24255.075	0.00%	38.76%
40.0	17216.951	6000.797	30255.873	0.00%	48.36%
45.0	15500.049	6057.818	36313.691	0.00%	58.04%
50.0	13621.504	5884.436	42198.127	0.00%	67.44%
55.0	11577.707	5479.147	47677.274	0.00%	76.20%
60.0	9357.035	4839.006	52516.28	0.00%	83.93%
65.0	7046.725	3987.785	56504.065	0.00%	90.31%
70.0	4671.117	2967.033	59471.098	0.00%	95.05%
75.0	2468.841	1866.270	61337.369	0.00%	98.03%
80.0	814.593	878.556	62215.924	0.00%	99.43%
85.0	92.004	246.344	62462.268	0.00%	99.83%
90.0	4.689	26.475	62488.744	0.00%	99.87%
95.0	3.407	2.217	62490.96	0.00%	99.87%
100.0	3.647	1.917	62492.877	0.00%	99.88%
105.0	4.689	2.230	62495.107	0.00%	99.88%
110.0	6.386	2.895	62498.002	0.00%	99.88%
115.0	8.483	3.765	62501.767	0.00%	99.89%
120.0	10.888	4.709	62506.476	0.00%	99.90%
125.0	13.573	5.654	62512.13	0.00%	99.91%
130.0	16.432	6.524	62518.654	0.00%	99.92%
135.0	18.957	7.151	62525.805	0.00%	99.93%
140.0	21.161	7.428	62533.233	0.00%	99.94%
145.0	23.311	7.420	62540.653	0.00%	99.95%
150.0	25.222	7.147	62547.799	0.00%	99.96%
155.0	26.478	6.543	62554.342	0.00%	99.97%
160.0	26.732	5.581	62559.923	0.00%	99.98%
165.0	26.478	4.385	62564.308	0.00%	99.99%
170.0	26.317	3.132	62567.44	0.00%	100.00%
175.0	26.892	1.903	62569.343	0.00%	100.00%
180.0	28.076	0.657	62570	0.00%	100.00%

Luminous Intensity Distribution Diagram

Light Distribution Curve [Unit:cd]
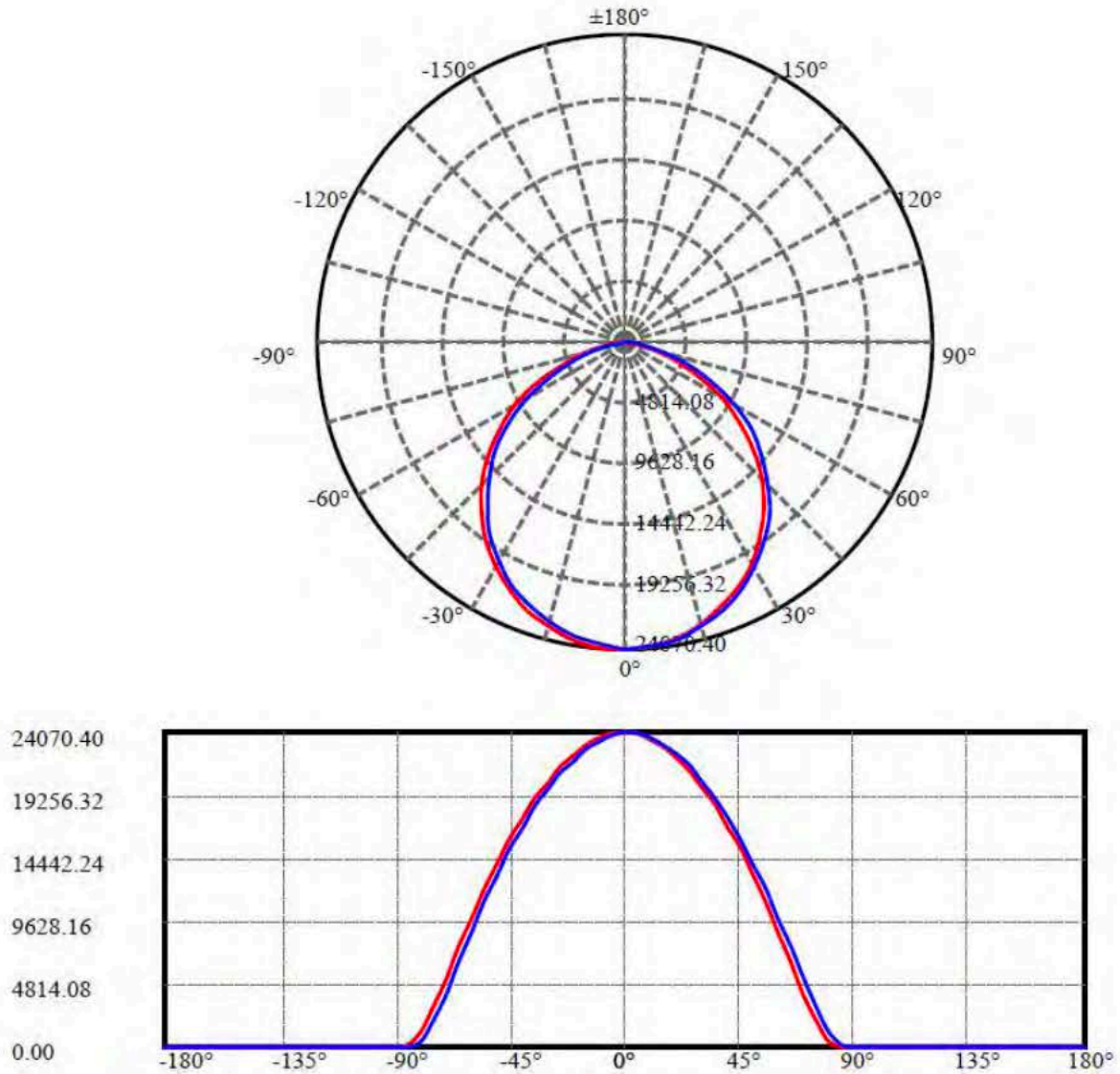
C0/C180: ————

C90/C270: ————

Field angle(10%Imax):C0/180Left:76.6 Right:73.9

:C90/270Left:73.8 Right:76.7

Beam Angle(50%Imax):C0/180Left:54.9 Right:52.9

:C90/270Left:52.6 Right:55.2

Lux distance Curve

1.0m	24070.4 , 7823.6 lx	275.36cm
2.0m	6017.6 , 1955.9 lx	550.72cm
3.0m	2674.5 , 869.3 lx	826.08cm
4.0m	1504.4 , 489.0 lx	1101.44cm
5.0m	962.8 , 312.9 lx	1376.79cm
6.0m	668.6 , 217.3 lx	1652.15cm
7.0m	491.2 , 159.7 lx	1927.51cm
8.0m	376.1 , 122.2 lx	2202.87cm
9.0m	297.2 , 96.6 lx	2478.23cm
10.0m	240.7 , 78.2 lx	2753.59cm
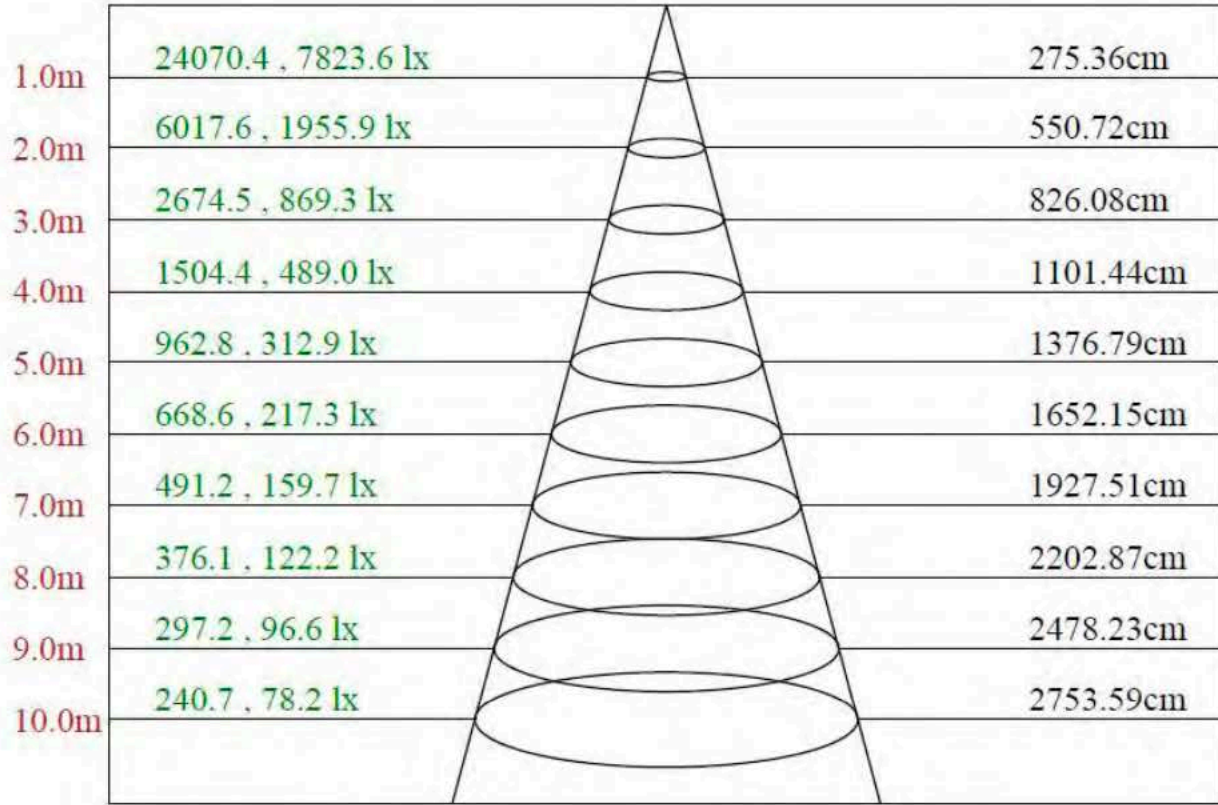
Max , Ave   Beam angle of C0 plane 108.02

UGR Glare

Illumination assessment according UGR										
Rf of Ceiling	70	70	50	50	30	70	70	50	50	30
Rf of Wall	50	30	50	30	30	50	30	50	30	30
Rf of Floor	20	20	20	20	20	20	20	20	20	20
Room dimensions X Y	Viewed crosswise					Viewed endwise				
2H 2H	23.41	24.99	23.77	25.30	25.62	23.41	24.99	23.77	25.31	25.62
3H	24.52	25.95	24.91	26.29	26.63	24.76	26.18	25.14	26.52	26.86
4H	24.73	26.06	25.12	26.42	26.78	25.11	26.45	25.51	26.80	27.16
6H	24.77	26.01	25.18	26.37	26.77	25.26	26.50	25.67	26.87	27.26
8H	24.72	25.91	25.13	26.29	26.69	25.24	26.44	25.66	26.81	27.22
12H	24.67	25.81	25.08	26.19	26.61	25.20	26.34	25.62	26.73	27.14
4H 2H	23.83	25.17	24.23	25.52	25.89	23.84	25.17	24.23	25.52	25.89
3H	25.06	26.19	25.48	26.58	26.99	25.24	26.36	25.66	26.75	27.16
4H	25.36	26.35	25.80	26.77	27.21	25.65	26.64	26.08	27.05	27.49
6H	25.39	26.26	25.85	26.71	27.15	25.77	26.64	26.23	27.09	27.53
8H	25.36	26.18	25.84	26.63	27.09	25.78	26.59	26.25	27.04	27.51
12H	25.34	26.10	25.82	26.54	27.04	25.76	26.52	26.24	26.96	27.47
8H 4H	25.38	26.19	25.85	26.64	27.11	25.65	26.47	26.12	26.92	27.38
6H	25.40	26.08	25.89	26.55	27.05	25.76	26.44	26.26	26.91	27.41
8H	25.43	26.02	25.94	26.53	27.02	25.82	26.41	26.34	26.92	27.41
12H	25.40	25.89	25.92	26.40	26.91	25.81	26.30	26.33	26.81	27.32
12H 4H	25.35	26.11	25.83	26.55	27.06	25.63	26.38	26.11	26.83	27.33
6H	25.42	26.01	25.93	26.52	27.01	25.78	26.37	26.29	26.88	27.37
8H	25.40	25.90	25.93	26.41	26.92	25.80	26.29	26.32	26.80	27.31
Variation with the observer position at spacings:										
S = 1.0H	0.5/-0.3					0.5/-0.4				
S = 1.5H	0.8/-0.8					0.7/-1.0				
S = 2.0H	1.8/-1.9					1.8/-1.6				
Standard tables:	BK2					BK2				
Uncorrected UGR	7.9					7.6				

UGR calculation is based on CIE Publ. 117 ,S/H = 1

Luminous Intensity Distribution Data

C/γ(°)	0.0	5.0	10.0	15.0	20.0	25.0	30.0	35.0	40.0
0.0	24070.40	23912.23	23484.74	22884.12	22080.44	21084.39	19938.72	18534.42	16922.79
22.5	24070.40	23931.46	23506.11	22886.25	22080.44	21067.29	19928.03	18528.01	16927.06
45.0	24070.40	23931.46	23510.39	22884.12	22078.30	21097.21	19902.38	18489.53	16869.35
67.5	24070.40	23910.09	23461.23	22858.47	22041.96	21037.36	19876.73	18478.85	16852.25
90.0	24070.40	23899.40	23593.75	23089.31	22405.33	21477.68	20344.83	19051.68	17583.26
112.5	24070.40	23925.05	23591.61	23074.35	22381.82	21466.99	20327.73	18991.83	17504.17
135.0	24070.40	23952.84	23595.88	23078.62	22351.89	21385.77	20235.82	18987.56	17478.52
157.5	24070.40	23959.25	23615.12	23067.94	22304.87	21372.94	20190.94	18895.65	17463.56
180.0	24070.40	23982.76	23640.77	23061.52	22307.01	21357.98	20252.92	18942.67	17472.11
202.5	24070.40	24023.37	23655.73	23080.76	22341.21	21398.59	20246.51	19011.07	17536.23
225.0	24070.40	24038.34	23687.79	23172.67	22426.70	21449.89	20340.56	19026.03	17578.98
247.5	24070.40	24044.75	23726.27	23176.95	22437.39	21546.08	20406.82	19137.18	17726.46
270.0	24070.40	23743.37	23313.74	22672.51	21892.34	20896.29	19746.35	18369.84	16758.20
292.5	24070.40	23828.87	23392.83	22798.62	21979.98	20992.48	19846.81	18483.12	16895.00
315.0	24070.40	23850.24	23416.34	22805.03	22018.45	21018.13	19891.70	18506.63	16922.79
337.5	24070.40	23871.62	23450.54	22834.96	22056.93	21069.43	19883.15	18564.34	16980.50
360.0	24070.40	23912.23	23484.74	22884.12	22080.44	21084.39	19938.72	18534.42	16922.79

C/γ(°)	45.0	50.0	55.0	60.0	65.0	70.0	75.0	80.0	85.0
0.0	15202.14	13272.03	11119.63	8894.55	6466.41	4093.42	1925.62	483.49	9.19
22.5	15103.82	13167.30	11093.98	8800.50	6406.56	3984.41	1893.13	453.99	8.34
45.0	15138.02	13130.96	10905.88	8663.70	6336.03	3954.27	1750.14	406.97	7.91
67.5	15037.56	13045.46	10931.53	8526.91	6192.82	3822.61	1765.74	365.08	7.27
90.0	15869.03	14030.82	12122.09	9935.48	7650.55	5307.92	3042.22	1161.27	160.31
112.5	15856.20	14035.10	12040.86	9858.53	7639.87	5245.93	2988.79	1122.80	157.96
135.0	15783.53	13947.46	12010.94	9847.85	7603.53	5203.18	2922.53	1071.50	155.39
157.5	15772.84	13973.11	11948.95	9847.85	7569.33	5179.67	2946.04	1099.29	150.05
180.0	15789.94	14024.41	12008.80	9903.42	7629.18	5248.07	3022.99	1154.86	168.86
202.5	15864.75	14052.20	12043.00	9952.58	7689.03	5354.94	3044.36	1189.06	175.91
225.0	15945.97	14167.62	12190.49	10008.15	7795.90	5416.92	3114.90	1274.56	203.49
247.5	16072.08	14280.91	12318.73	10140.68	7896.36	5566.55	3247.42	1310.89	231.06
270.0	15061.07	13130.96	11031.99	8798.36	6389.46	4014.98	1879.88	485.41	10.05
292.5	15120.92	13201.50	11143.14	8824.01	6451.45	4131.04	1981.84	488.19	8.76
315.0	15189.32	13284.86	11145.28	8828.29	6524.12	4166.95	1970.30	481.78	8.55
337.5	15193.59	13199.36	11188.02	8881.72	6507.02	4047.04	2005.56	484.35	8.98
360.0	15202.14	13272.03	11119.63	8894.55	6466.41	4093.42	1925.62	483.49	9.19

C/γ(°)	90.0	95.0	100.0	105.0	110.0	115.0	120.0	125.0	130.0
0.0	4.49	3.42	3.85	5.13	6.84	8.76	11.12	13.89	16.46
22.5	4.49	3.42	3.63	4.92	6.84	8.76	11.54	13.89	16.67
45.0	4.28	3.63	3.63	4.92	7.05	9.41	11.54	14.54	17.10
67.5	4.06	3.42	3.85	5.13	7.05	9.41	11.97	14.75	17.53
90.0	5.13	3.42	3.85	4.28	5.99	7.91	10.05	13.04	15.60
112.5	4.70	3.42	3.42	4.06	5.77	7.70	10.05	12.61	15.82
135.0	4.70	3.21	3.42	4.28	5.56	7.48	10.05	12.18	15.39
157.5	4.49	3.42	3.42	4.06	5.99	7.48	9.83	12.40	15.18
180.0	4.92	3.42	3.42	4.28	5.77	7.70	10.05	12.40	15.39
202.5	5.13	3.21	3.21	4.28	5.56	7.70	10.05	12.61	15.39
225.0	5.13	3.21	3.21	4.28	5.56	7.70	10.05	12.83	15.60
247.5	5.13	3.21	2.99	4.28	5.77	8.12	10.26	13.04	16.03
270.0	5.34	4.06	4.92	5.99	7.70	10.05	12.83	15.82	18.81
292.5	4.49	3.42	4.06	5.34	7.27	9.62	11.97	14.96	18.17
315.0	4.28	3.21	3.85	4.92	6.84	8.98	11.54	14.11	17.10
337.5	4.28	3.42	3.63	4.92	6.63	8.98	11.33	14.11	16.67
360.0	4.49	3.42	3.85	5.13	6.84	8.76	11.12	13.89	16.46

C/γ(°)	135.0	140.0	145.0	150.0	155.0	160.0	165.0	170.0	175.0
0.0	18.81	20.73	23.08	24.58	25.86	26.08	25.86	26.29	27.57
22.5	19.02	20.95	23.08	24.79	26.08	26.29	26.29	26.50	27.57
45.0	19.45	21.80	23.73	25.65	26.93	27.15	26.93	26.93	28.21
67.5	20.31	22.02	24.15	26.29	27.36	27.15	27.15	26.72	28.00
90.0	18.60	20.95	23.08	25.22	26.72	27.15	26.50	26.29	26.08
112.5	18.17	20.73	23.08	25.22	26.72	27.15	26.50	26.08	25.86
135.0	17.96	20.52	22.44	24.79	26.29	26.72	26.50	26.08	25.86
157.5	17.74	20.09	22.02	23.94	25.44	26.08	25.86	25.86	25.65
180.0	17.74	19.88	22.02	24.37	25.44	25.86	25.86	25.65	25.65
202.5	17.96	20.09	22.44	23.94	25.65	25.86	25.86	25.44	25.65
225.0	18.60	20.73	22.66	25.01	26.50	26.72	26.50	25.86	25.86
247.5	19.02	21.37	23.94	25.65	26.93	27.57	26.93	26.50	26.29
270.0	21.16	23.30	25.65	27.36	28.43	28.21	28.00	27.36	28.86
292.5	20.31	22.44	24.79	26.29	27.15	27.36	26.93	26.93	28.00
315.0	19.45	21.80	23.73	25.65	26.29	26.50	26.29	26.50	27.57
337.5	19.02	21.16	23.08	24.79	25.86	25.86	25.65	26.08	27.57
360.0	18.81	20.73	23.08	24.58	25.86	26.08	25.86	26.29	27.57

C/γ(°)	180.0
0.0	28.08
22.5	28.08
45.0	28.08
67.5	28.08
90.0	28.08
112.5	28.08
135.0	28.08
157.5	28.08
180.0	28.08
202.5	28.08
225.0	28.08
247.5	28.08
270.0	28.08
292.5	28.08
315.0	28.08
337.5	28.08
360.0	28.08

4 Additional Test

Electrical data at 277V

Model Number	Test Voltage (V)	Frequency(Hz)	Power Factor	THD
CHB3-400-D-MV-30K-170S	277	60	0.950	8.2%
CHB3-400-D-MV-65K-170S	277	60	0.968	5.4%

5 Performance Assessment

Model name	CCT(K)	Total Luminous(lm)	Power(W)	Luminous Efficacy(lm/W)
CHB3-400-D-MV-30K-170S	3000	62638.74	398.72	157.1
CHB3-400-D-MV-35K-170S	3500	63656.07 [*1]	398.62 [*2]	159.7 [*3]
CHB3-400-D-MV-40K-170S	4000	64673.41 [*1]	398.62 [*2]	162.2 [*3]
CHB3-400-D-MV-45K-170S	4500	65690.74 [*1]	398.62 [*2]	164.8 [*3]
CHB3-400-D-MV-50K-170S	5000	66708.07 [*1]	398.62 [*2]	167.3 [*3]
CHB3-400-D-MV-57K-170S	5700	67725.41 [*1]	398.62 [*2]	169.9 [*3]
CHB3-400-D-MV-65K-170S	6500	68742.74	398.51	172.5

*1: This value is calculated and the calculation formula is as below:

63656.07=(68742.74-62638.74) /6+62638.74

64673.41=(68742.74-62638.74) /6+63656.07

65690.74=(68742.74-62638.74) /6+64673.41

66708.07=(68742.74-62638.74) /6+65690.74

67725.41=(68742.74-62638.74) /6+66708.07

*2: This value is calculated and the calculation formula is as below:

398.62=(398.72+398.51)/2

*3: This value is calculated and the calcuation formula is as below:

159.7=63656.07 /398.62

162.2=64673.41 /398.62

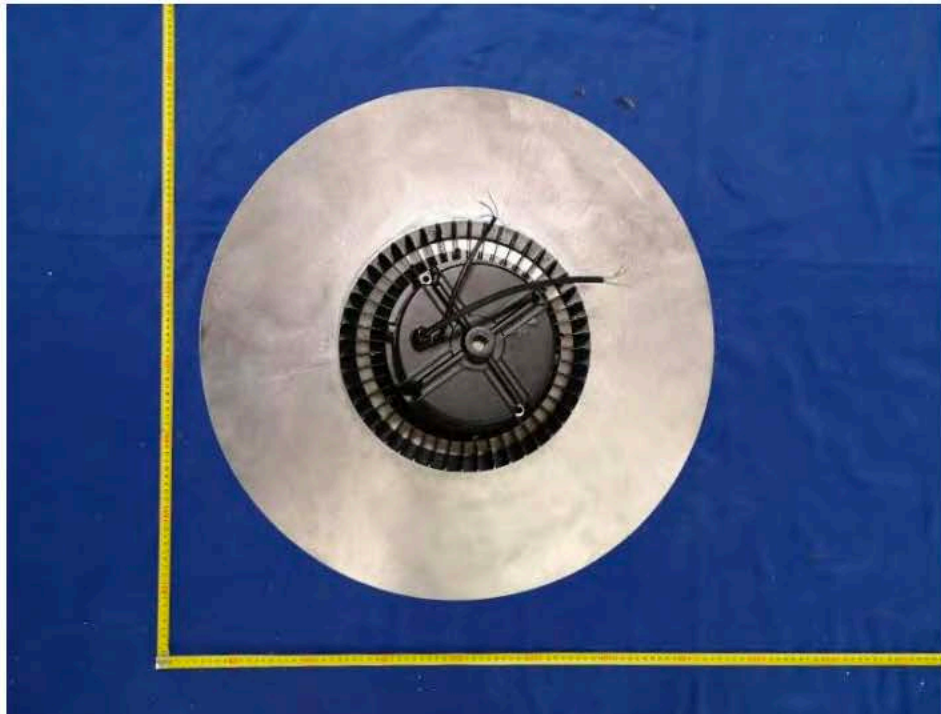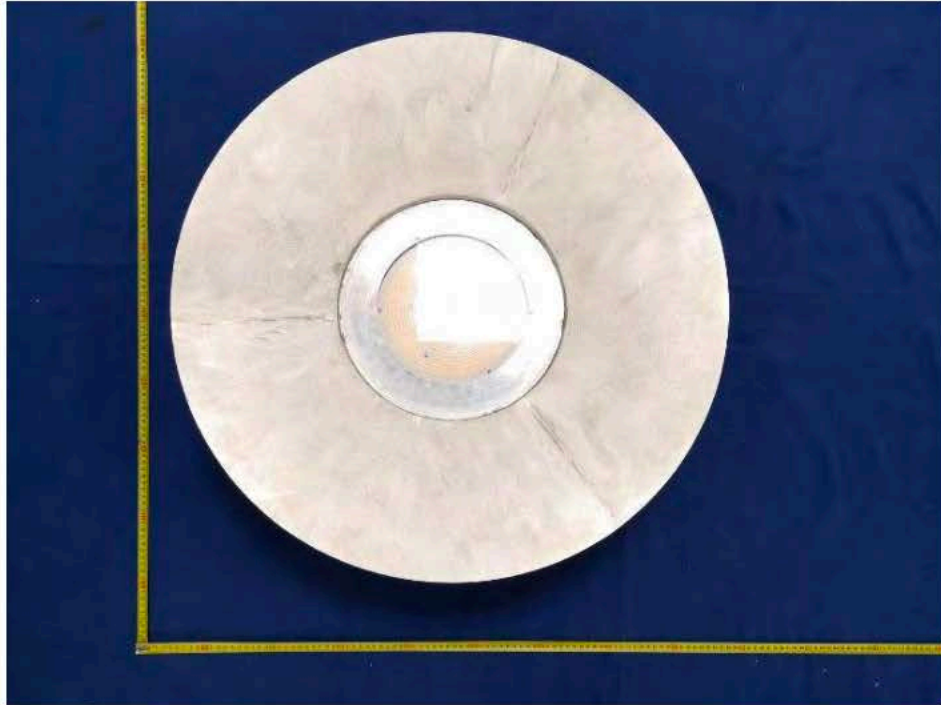164.8=65690.74 /398.62

167.3=66708.07 /398.62

169.9=67725.41 /398.62

Photo Document

****End of test report****