

LM-79-08 TEST REPORT

for

RAB Lighting INC

170 Ludlow Avenue, Northvale, New Jersey 07647 USA

LED Tube

Model: T5HO-9-24G-840-DIR

Laboratory: Leading Testing Laboratories

NVLAP CODE: 200960-0

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Report No.: HZ20090061ak

The laboratory that conducted the testing detailed in this report has been accredited for SSL by NVLAP.

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Oct. 26, 2020

Note: This report does not imply product certification, approval, or endorsement by NVLAP, NIST, or any agency of the Federal Government.

TEST SUMMARY

Model	T5HO-9-24G-840-DIR
Luminous Efficacy (Lumens /Watt)	110.5
Total Luminous Flux (Lumens)	1282.7
Power (Watts)/2	11.61
Power Factor	0.9879
CCT (K)	3984
CRI	84.1
Stabilization Time (Light & Power)	60 mins
Note	4000K

Table 1: Executive Data Summary

Test specifications:

Date of Receipt : Sep. 28, 2020

Date of Test : Oct. 23, 2020

Test item : Total Luminous Flux, Luminous Efficacy, Correlated Color Temperature, Color Rendering Index, Chromaticity Coordinate, Electrical parameters

Reference Standard : IESNA LM-79-2008 Approved Method for the Electrical and Photometric Measurements of Solid-State Lighting Products
ANSI/IES TM-30-18 IES Method for Evaluating Light Source Color Rendition

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SAMPLE PHOTO

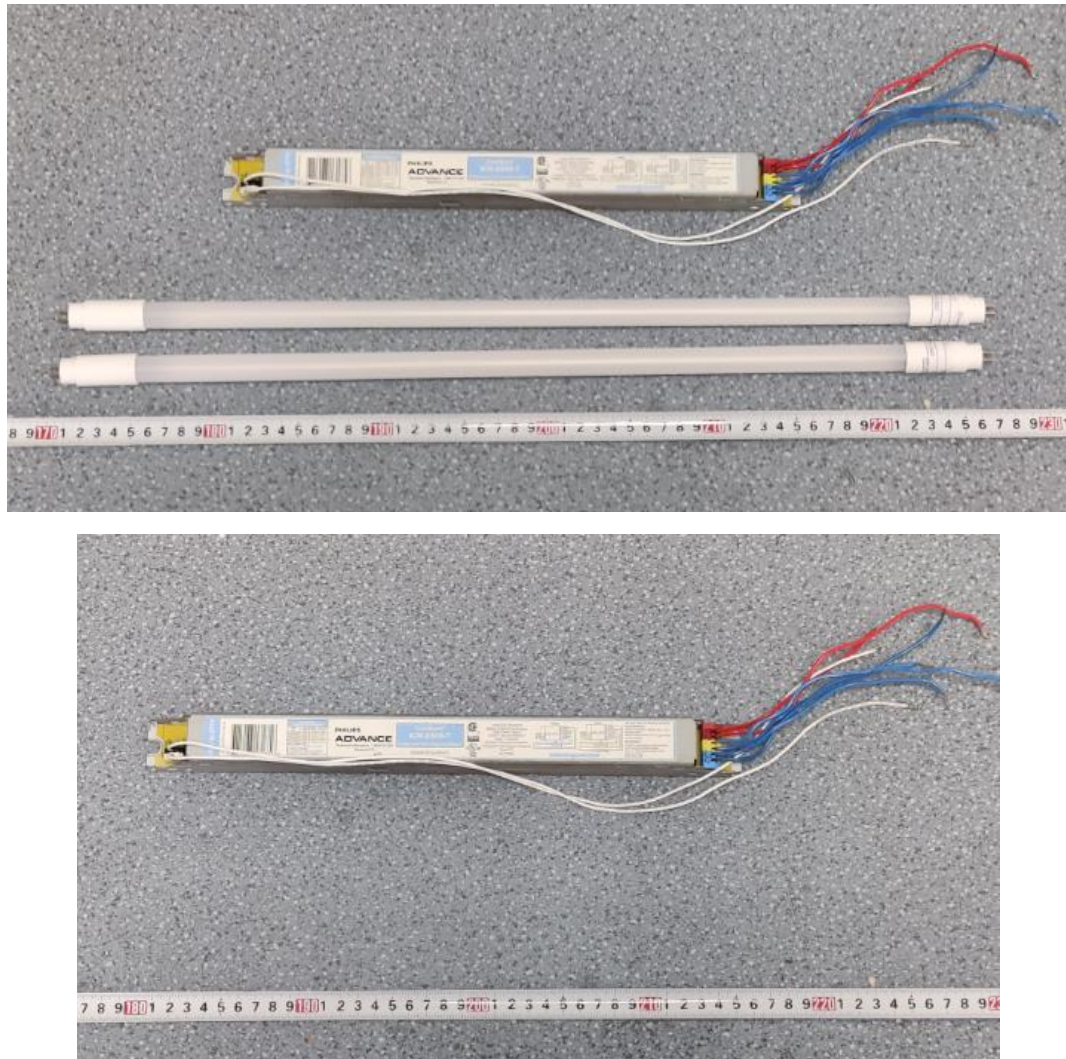


Figure 1- Overview of the sample

Equipment Under Test(EUT)

Name	: LED Tube
Model	: T5HO-9-24G-840-DIR
Electrical Ratings	: 120-277V, 50/60Hz
Product Description	: 4000K LED Tubes supplied by a high frequency fluorescent lamp ballast: ICN-2S39-T

TEST RESULTS

Test ambient temperature was 26.0 °C.

Base orientation was horizontal. Test was conducted without a dimmer in the circuit.

The stabilization time of the sample was 60 minutes, and the total operating time including stabilization was 65 minutes.

Sphere-Spectroradiometer Method

Parameter	Result	
Test Voltage (V)	120.0	277.0
Voltage frequency (Hz)	60	60
Test Current (A)	0.196	0.093
Power Factor	0.9879	0.9176
Test Power (W)/2	11.61	11.80
THD A%	11.75	11.93
Luminous Efficacy (lm/W)	110.5	108.7
Total Luminous Flux (lm)	1282.7	1282.7
Color Rendering Index (CRI)	84.1	
R9	10.1	
Correlated Color Temperature (CCT)(K)	3984	
Chromaticity Chroma x	0.3817	
Chromaticity Chroma y	0.3797	
Chromaticity Chroma u	0.2248	
Chromaticity Chroma v	0.3354	
Duv	0.0010	
Chromaticity Chroma u'	0.2248	
Chromaticity Chroma v'	0.5030	

Special Color Rendering Indices	
R1	82.4
R2	91.2
R3	96.3
R4	82.3
R5	82.7
R6	87.8
R7	85.7
R8	64.4
R9	10.1
R10	79.1
R11	81.7
R12	65.7
R13	84.8
R14	98.4

Table 2: Test data per Sphere-Spectroradiometer Method

Note: According to CIE 1976 (u', v') diagram, $u' = u = 4x/(-2x+12y+3)$, $v' = 3v/2 = 9y/(-2x+12y+3)$.

Spectral Power Distribution - Sphere Spectroradiometer Method

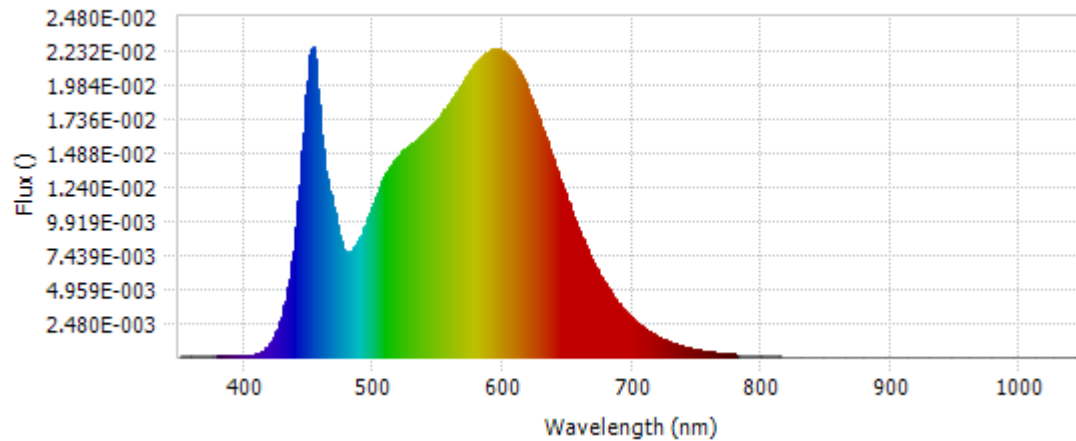
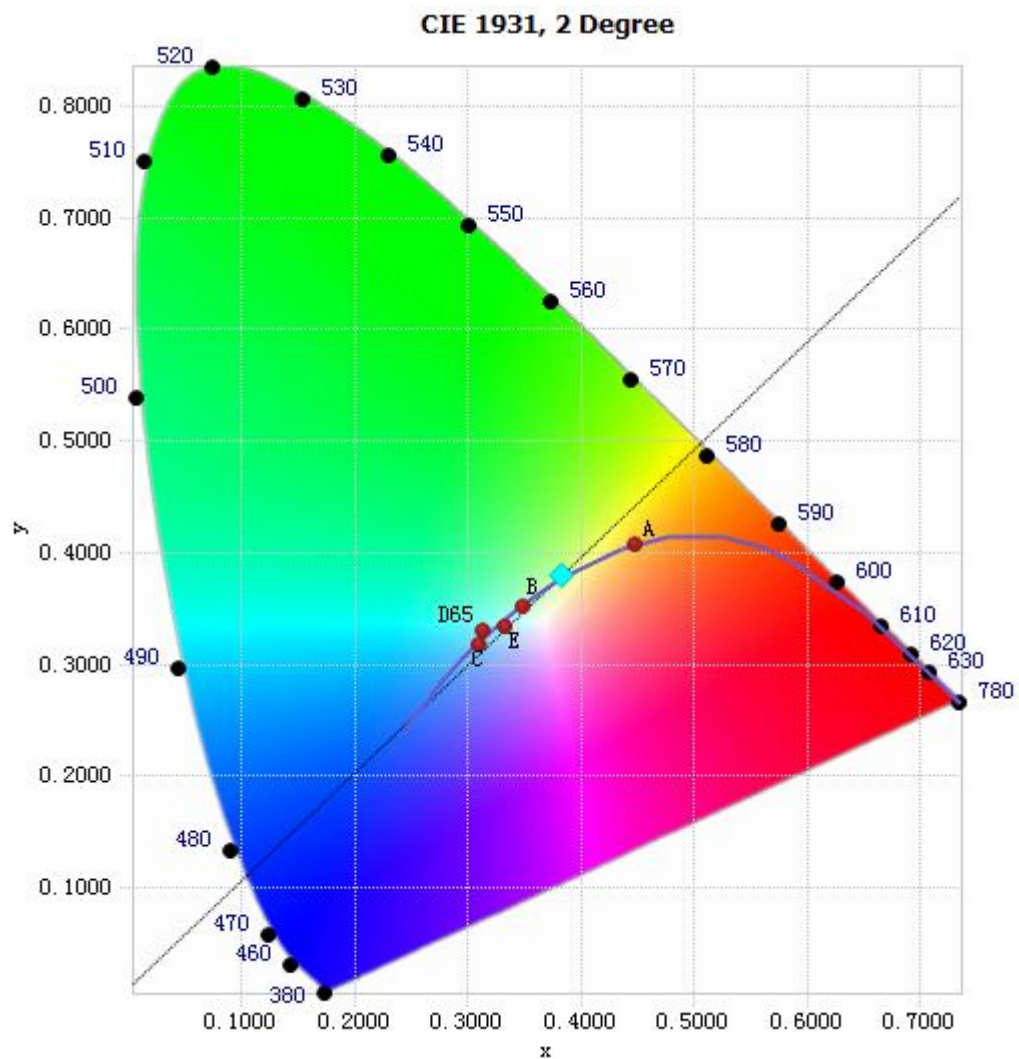


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	1.18E-04	485	7.96E-03	590	2.23E-02	695	3.32E-03
385	1.09E-04	490	8.77E-03	595	2.24E-02	700	2.85E-03
390	1.06E-04	495	9.93E-03	600	2.23E-02	705	2.44E-03
395	1.02E-04	500	1.12E-02	605	2.19E-02	710	2.07E-03
400	1.05E-04	505	1.24E-02	610	2.12E-02	715	1.77E-03
405	1.43E-04	510	1.34E-02	615	2.04E-02	720	1.51E-03
410	2.60E-04	515	1.42E-02	620	1.94E-02	725	1.29E-03
415	5.09E-04	520	1.48E-02	625	1.81E-02	730	1.10E-03
420	1.00E-03	525	1.52E-02	630	1.68E-02	735	9.33E-04
425	1.86E-03	530	1.56E-02	635	1.55E-02	740	7.90E-04
430	3.34E-03	535	1.60E-02	640	1.42E-02	745	6.79E-04
435	5.72E-03	540	1.64E-02	645	1.28E-02	750	5.74E-04
440	9.44E-03	545	1.69E-02	650	1.14E-02	755	4.88E-04
445	1.50E-02	550	1.74E-02	655	1.02E-02	760	4.18E-04
450	2.11E-02	555	1.80E-02	660	9.00E-03	765	3.58E-04
455	2.17E-02	560	1.87E-02	665	7.92E-03	770	3.07E-04
460	1.62E-02	565	1.94E-02	670	6.92E-03	775	2.58E-04
465	1.25E-02	570	2.01E-02	675	6.04E-03	780	2.23E-04
470	1.05E-02	575	2.09E-02	680	5.23E-03		
475	8.45E-03	580	2.15E-02	685	4.51E-03		
480	7.61E-03	585	2.20E-02	690	3.88E-03		

Table 3: Spectral Power Distribution Numerical Data per Sphere - Spectroradiometer Method

Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.3817, 0.3797)

Chart 2: Chromaticity Diagram per Sphere - Spectroradiometer Method

Note: The location on the diagram of the tristimulus coordinates are indicated by the blue diamond.

Nominal CCT Quadrangles – Sphere Spectroradiometer Method

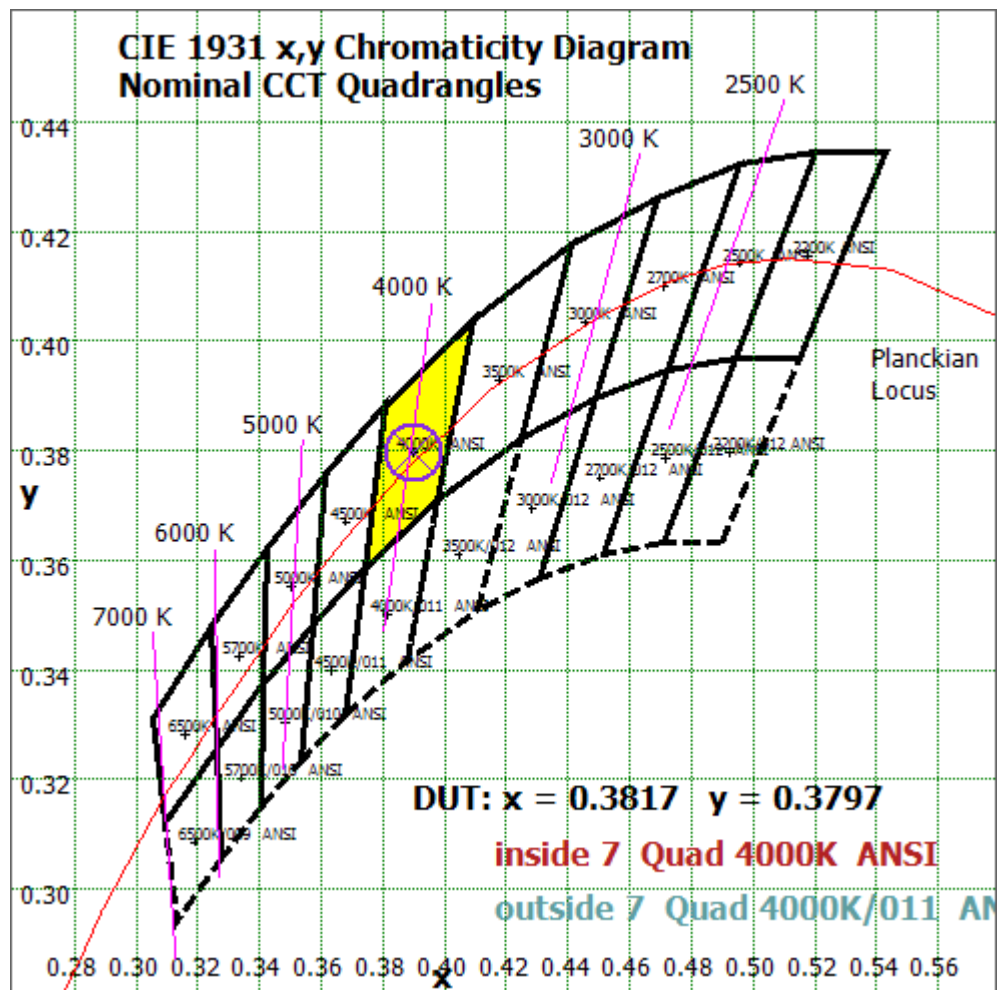


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

Color Rendition Report – Sphere Spectroradiometer Method

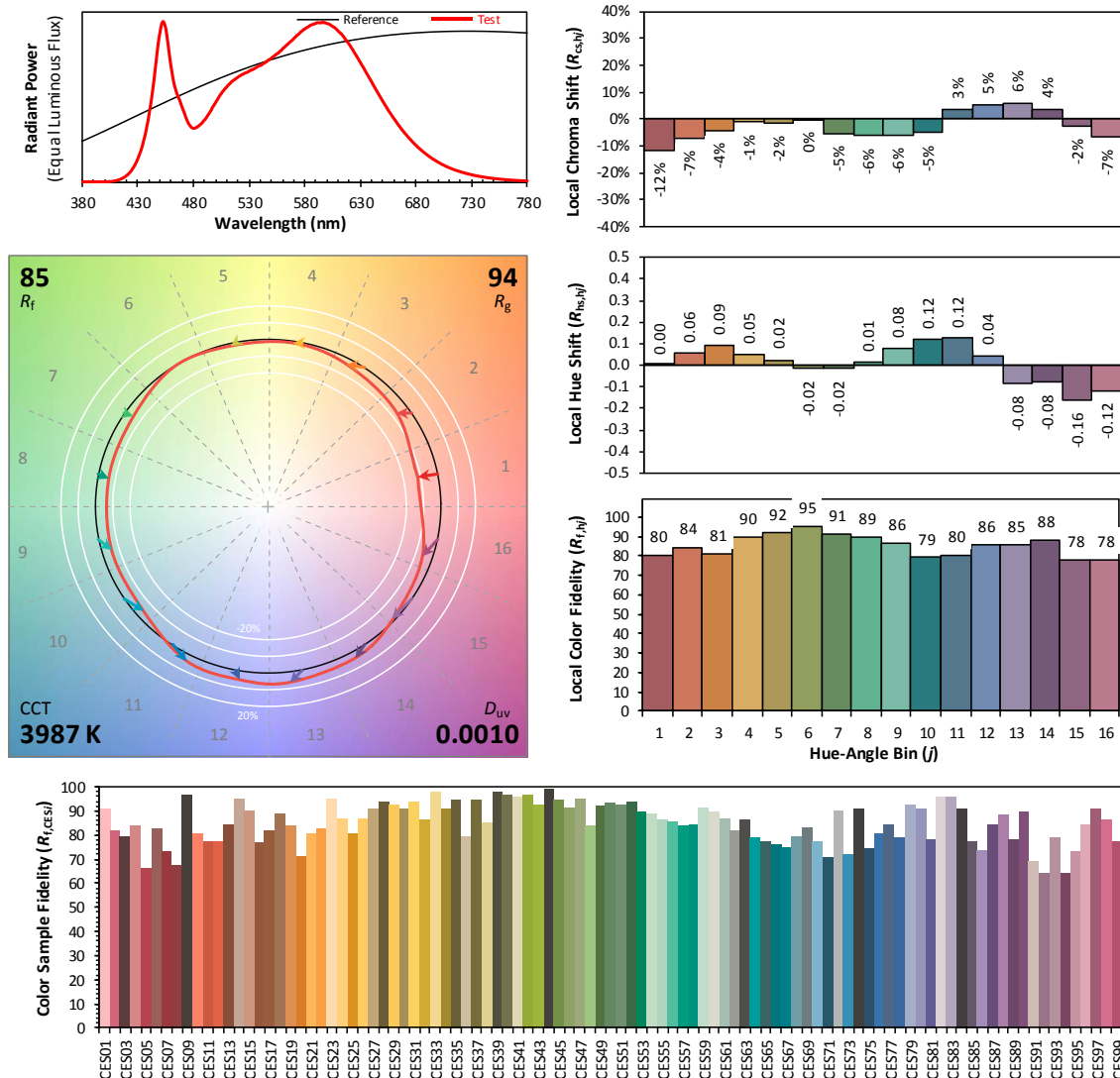
ANSI/IES TM-30-18 Color Rendition Report

Source: LED

Manufacturer: RAB Lighting INC

Date: 2020/10/23

Model: T5HO-9-24G-840-DIR



Notes: This is a recommended method for displaying ANSI/IES TM-30-18 information.

x 0.3817
 y 0.3797
 u' 0.2248
 v' 0.5030

CIE 13.3-1995
(CRI)
 R_a 84
 R_g 10

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

Chart 4: Full Report Created with the IES TM-30 Calculator

Note: The values in this diagram might be a little different from the values in Table 2 due to rounding.

EQUIPMENT LIST

Test Equipment	Model	Equipment No.	Calibration Date	Calibration Due date
Integrate Sphere system	3M	HZTE015-04	Aug. 05, 2020	Aug. 04, 2021
Digital Power Meter	WT210	HZTE008-01	Aug. 05, 2020	Aug. 04, 2021
AC Power Supply	PCR 500L	HZTE001-07	Aug. 05, 2020	Aug. 04, 2021
DC Power Supply	IT6154	HZTE004-04	Aug. 05, 2020	Aug. 04, 2021
Temperature and humidity recorder	JR900	HZTE018-02	Aug. 05, 2020	Aug. 04, 2021
Standard source	SCL-1400	HZTE012-02	Aug. 05, 2020	Aug. 04, 2021
Temperature Meter	TES1310	HZTE017-01	Aug. 05, 2020	Aug. 04, 2021

Table 4: Test Equipment List

TEST METHODS

Seasoning of SSL Product

For the purpose of rating new SSL products, SSL products shall be tested with no seasoning. Therefore, no seasoning was performed.

Sphere-Spectroradiometer Method- Photometric and Electrical Measurements

A Labsphere Model CDS 2100 Spectroradiometer and Two Meter Sphere was used to measure correlated color temperature, chromaticity coordinates, and the color rendering index for each SSL unit. The coating reflectance of each sphere is 98%. The measure geometry is 4π . Self-absorption correction is conducted in testing. Bandwidth of spectroradiometer is 350nm-1050nm.

Ambient temperature was measured at a position inside the sphere. Each SSL unit was operated on the client provided driver at the rated input voltage in its designated orientation.

The stabilization time typically ranges from 30 min (small integrated LED lamps) to 2 or more hours for large SSL luminaires). It can be judged that stability is reached when the variation (maximum – minimum) of at least 3 readings of the light output and electrical power over a period of 30 min, taken 15 minutes apart, is less than 0.5 %.

Electrical measurements including voltage, current, and power were measured using the Yokogawa Power Analyzer.

The standard reference of the integrated sphere system is halogen incandescent lamp, the intensity distribution type is omni-directional, and is traceable to the National Institute of Standards and Technology.

The uncertainty of integrating sphere system reported in this document is expended uncertainty is 2.1% with a coverage factor $k=2$.

*** End of Report ***

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