STD·NEMA C78·376-ENGL 1996 ■ 6470247 0512767 809 ■

AMERICAN NATIONAL STANDARD

ANSI C78.376-1996

AMERICAN NATIONAL STANDARD FOR ELECTRIC LAMPS— SPECIFICATIONS FOR THE CHROMATICITY OF FLUORESCENT LAMPS

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION
1300 NORTH 17TH STREET, SUITE 1847, ROSSLYN, VA 22209
(703) 841-3200 FAX: (703) 841-3300

Copyright National Electrical Manufacturers Association
Provided by IHS under license with NEMA
No reproduction or networking permitted without license from IHS
Not for Resale

STD.NEMA C78.376-ENGL 1996 ■ 6470247 0512768 745 ■

ANSI C78.376-1996
Revision of ANSI C78.376-1969 (R1991)

AMERICAN NATIONAL STANDARD

for electric lamps—

Specifications for the Chromaticity of Fluorescent Lamps

Secretariat C78

National Electrical Manufacturers Association

Approved June 6, 1996

American National Standards Institute, Inc.

Copyright National Electrical Manufacturers Association
Provided by IHS under license with NEMA
No reproduction or networking permitted without license from IHS

Not for Resale

ANSI C78.376-1996
Revision of ANSI C78.376-1969 (R1991)

American National Standard

Approval of an American National Standard requires verification by ANSI that the requirements for due process, consensus, and other criteria for approval have been met by the standards developer.

Consensus is established when, in the judgment of the ANSI Board of Standards Review, substantial agreement has been reached by directly and materially affected interests. Substantial agreement means much more than a simple majority, but not necessarily unanimity. Consensus requires that all views and objections be considered, and that a concerted effort be made toward their resolution.

The use of American National Standards is completely voluntary; their existence does not in any respect preclude anyone, whether he has approved the standards or not, from manufacturing, marketing, purchasing, or using products, processes, or procedures not conforming to the standards.

The American National Standards Institute does not develop standards and will in no circumstances give an interpretation of any American National Standard. Moreover, no person shall have the right or authority to issue an interpretation of an American National Standard in the name of the American National Standards Institute. Requests for interpretations should be addressed to the secretariat or sponsor whose name appears on the title page of this standard.

CAUTION NOTICE: This American National Standard may be revised or withdrawn at any time. The procedures of the American National Standards Institute require that action be taken periodically to reaffirm, revise, or withdraw this standard. Purchasers of American National Standards may receive current information on all standards by calling or writing the American National Standards Institute.

Published by

National Electrical Manufacturers Association
1300 North 17th Street, Suite 1847, Rosslyn, VA 22209

Copyright © 1997 National Electrical Manufacturers Association
All rights reserved.

No part of this publication may be reproduced in any form, in an electronic retrieval system or otherwise, without prior written permission of the publisher.
Printed in the United States of America

Copyright National Electrical Manufacturers Association
Provided by IHS under license with NEMA
No reproduction or networking permitted without license from IHS

Not for Resale

ANSI C78.376-1996
Revision of ANSI C78.376-1969 (R1991)

THIS PAGE INTENTIONALLY LEFT BLANK

Copyright © 1997 by National Electrical Manufacturers Association
1300 North 17th Street, Suite 1847, Rosslyn, VA 22209

First Edition
April 1997

Copyright National Electrical Manufacturers Association
Provided by IHS under license with NEMA
No reproduction or networking permitted without license from IHS

Not for Resale

ANSI C78.376-1996
Revision of ANSI C78.376-1969 (R1991)

Table of Contents

Page No.

Foreword v

1 Scope 1
2 Color specification basis 1
3 Nominal color temperature 1
4 Objective chromaticities 1
5 Chromaticity tolerances 2

Copyright © 1997 by National Electrical Manufacturers Association
1300 North 17th Street, Suite 1847, Rosslyn, VA 22209

First Edition
April 1997

Copyright National Electrical Manufacturers Association
Provided by IHS under license with NEMA
No reproduction or networking permitted without license from IHS
Not for Resale

ANSI C78.376-1996
Revision of ANSI C78.376-1969 (R1991)

THIS PAGE INTENTIONALLY LEFT BLANK

Copyright © 1997 by National Electrical Manufacturers Association
1300 North 17th Street, Suite 1847, Rosslyn, VA 22209

First Edition
April 1997

Copyright National Electrical Manufacturers Association
Provided by IHS under license with NEMA
No reproduction or networking permitted without license from IHS
Not for Resale

Foreword (This Foreword is not part of ANSI C78.376-1996.)

This standard covers the objectives and tolerances for the chromaticity of T8, T10 and T12 fluorescent lamps, with a nominal loading of from 5 to 10 watts per foot at their normal 100-hour rating point. It is a revision of the existing standard, ANSI C78.376-1969, which was last reaffirmed in 1991.

Suggestions for improvement of this standard should be submitted to the Secretariat, C78, National Electrical Manufacturers Association, 1300 North 17th Street, Suite 1847, Rosslyn, VA 22209.

This standard was processed and approved for adoption by Accredited Standards Committee on Electric Lamps, C78. Committee approval of the standard does not necessarily imply that all committee members voted for that approval. At the time it approved adoption of this standard, the C78 Committee had the following members:

Al Rousseau, Chair, C78
David Mullen, Technical Coordinator
Randolph N. Roy, Secretariat
Jeanne L. Spicer, Coordinating Editor

Organization Represented:	*Name of Representative:*
Advance Transformer Company	Norman Grimshaw
Duro-Test Corporation	Herbert Strauss
Edison Electric Institute	William Maguire (Delegate)
Electrical Testing Laboratories	Craig Davenport
General Electric	John Krissinger
Illuminating Engineering Society	Rita M. Harrold
National Electrical Manufacturers Association	(vacant)
OSRAM SYLVANIA INC.	Peter Bleasby
Philips Lighting Company	Al Rousseau
Underwriters Laboratories, Inc.	David Belt

Subcommittee C78-2 on Fluorescent Lamps, which developed this standard, had the following members:

David Mullen, Chair, C78-2
Randolph N. Roy, Secretariat

Organization Represented:	*Name of Representative:*
Advance Transformer Company	Norman Grimshaw
	Beth Jug
	Arnold Stout
AROMAT-NAIS	Dail Swanson
Duro-Test Corporation	(vacant)
Electronic Lighting, Inc.	Hubertus Notohamiprodjo
Electrical Testing Laboratories	Mike Neary
General Electric	Edward E. Hammer
	Rolf Bergman
	John Krissinger
Kingtec, Inc.	Gil Forrler
MagneTek	George Mortimer
	William Dunham
	Kenneth J. Denton
	Bill Brosius

Copyright © 1997 by National Electrical Manufacturers Association
1300 North 17th Street, Suite 1847, Rosslyn, VA 22209

Copyright National Electrical Manufacturers Association
Provided by IHS under license with NEMA
No reproduction or networking permitted without license from IHS
Not for Resale

ANSI C78.376-1996
Revision of ANSI C78.376-1969 (R1991)

Motorola Lighting, Inc.	Howard Wolfman
OSRAM SYLVANIA INC.	David T. Mullen
	Tom Gavenonis
	Warren Anderson
Philips Lighting Company	Frank M. Latassa
	Thomas O. Leyh
Thomas & Betts (American Electric)	Greg Steinman
Underwriters Laboratories, Inc.	John Marshall
	David Belt
Valmont Electric	Charles E. Dwinal
	Art Nemirow

Copyright © 1997 by National Electrical Manufacturers Association
1300 North 17th Street, Suite 1847, Rosslyn, VA 22209

First Edition
April 1997

Copyright National Electrical Manufacturers Association
Provided by IHS under license with NEMA
No reproduction or networking permitted without license from IHS
Not for Resale

AMERICAN NATIONAL STANDARD **C78.376-1996**
Revision of ANSI C78.376-1969 (R1991)

for electric lamps—

Specifications for the Chromaticity of Fluorescent Lamps

1 Scope

This standard covers the objectives and tolerances for the chromaticity of T8, T10, and T12 fluorescent lamps with a nominal loading of from 5 to 10 watts per foot at their normal 100 hour rating point. The colors included are 3000K/warm white, 3500K/white, 4000K/4100K/cool white, 5000K, and 6500K/daylight. The lamp under test shall be operated under reference conditions as specified in ANSI C78.375 Guide for Operation of Fluorescent Lamps and in the relevant C78 lamp standard.

2 Color specification basis

The x and y coordinates used in this specification are based on the 1931 CIE* Chromaticity Diagram. Lamps shall be rated in terms of the measurements standards established by the National Institute of Standards and Technology. Tolerances are based on the ellipses defined by David L. MacAdam in his paper "Specification of Small Chromaticity Differences" printed in *Journal of the Optical Society of America,* vol 33, no.1, Jan 1943, pp 18-26.

*International Committee on Illumination

3 Nominal color temperature

Values of correlated color temperature (CCT) will vary within a chromaticity tolerance ellipse since they are a function of color coordinates. For colors which are designated by nominal color temperature, the value shall be based on the CCT of the objective chromaticity.

For new colors, the nominal value of the color temperature shall differ from the CCT of the objective chromaticity by less than 100 degrees K. For a color with a nominal color temperature generally established prior to this standard, the value may be retained when it differs from the CCT of the objective chromaticity by a slightly greater amount.

4 Objective chromaticities

The objective chromaticities are shown in table 1.

Copyright © 1997 by National Electrical Manufacturers Association
1300 North 17th Street, Suite 1847, Rosslyn, VA 22209

First Edition
April 1997

Copyright National Electrical Manufacturers Association
Provided by IHS under license with NEMA
No reproduction or networking permitted without license from IHS
Not for Resale

ANSI C78.376-1996
Revision of ANSI C78.376-1969 (R1991)

Table 1 – Objective chromaticities

	x	y
3000K/Warm white	0.440	0.403
3500K/White	0.411	0.393
4100K/4000K/Cool white	0.380	0.380
5000K	0.346	0.359
6500K/Daylight	0.313	0.337

5 Chromaticity tolerances

For the lamps covered by this standard the chromaticity tolerance is defined by a 4 step MacAdam ellipse. The ellipses are shown in figures 1 through 5.

In the construction of these ellipses the data shown in table 2 are used. The values of g_{11}, $2g_{12}$, and g_{22} are taken from MacAdam's paper referred to above. They are the basis for calculating θ, a, and b. θ is the angle between the major axis of the ellipse and the x axis. a and b are major and minor semi-axis of a one step ellipse, respectively.

Table 2 – Data for construction of ellipses

	g_{11}	$2g_{12}$	g_{22}	θ	a	b
3000K/Warm White	39×10^4	-39×10^4	27.5×10^4	53° 13'	0.00278	0.00136
3500K/White	38×10^4	-40×10^4	25×10^4	54° 00'	0.00309	0.00138
4000K/4100K/Cool White	39.5×10^4	-43×10^4	26×10^4	53° 43'	0.00313	0.00134
5000K	56×10^4	-50×10^4	28×10^4	59° 37'	0.00274	0.00118
6500K/Daylight	86×10^4	-80×10^4	45×10^4	58° 34'	0.00223	0.00095

Copyright © 1997 by National Electrical Manufacturers Association
1300 North 17th Street, Suite 1847, Rosslyn, VA 22209
First Edition
April 1997

Copyright National Electrical Manufacturers Association
Provided by IHS under license with NEMA
No reproduction or networking permitted without license from IHS
Not for Resale

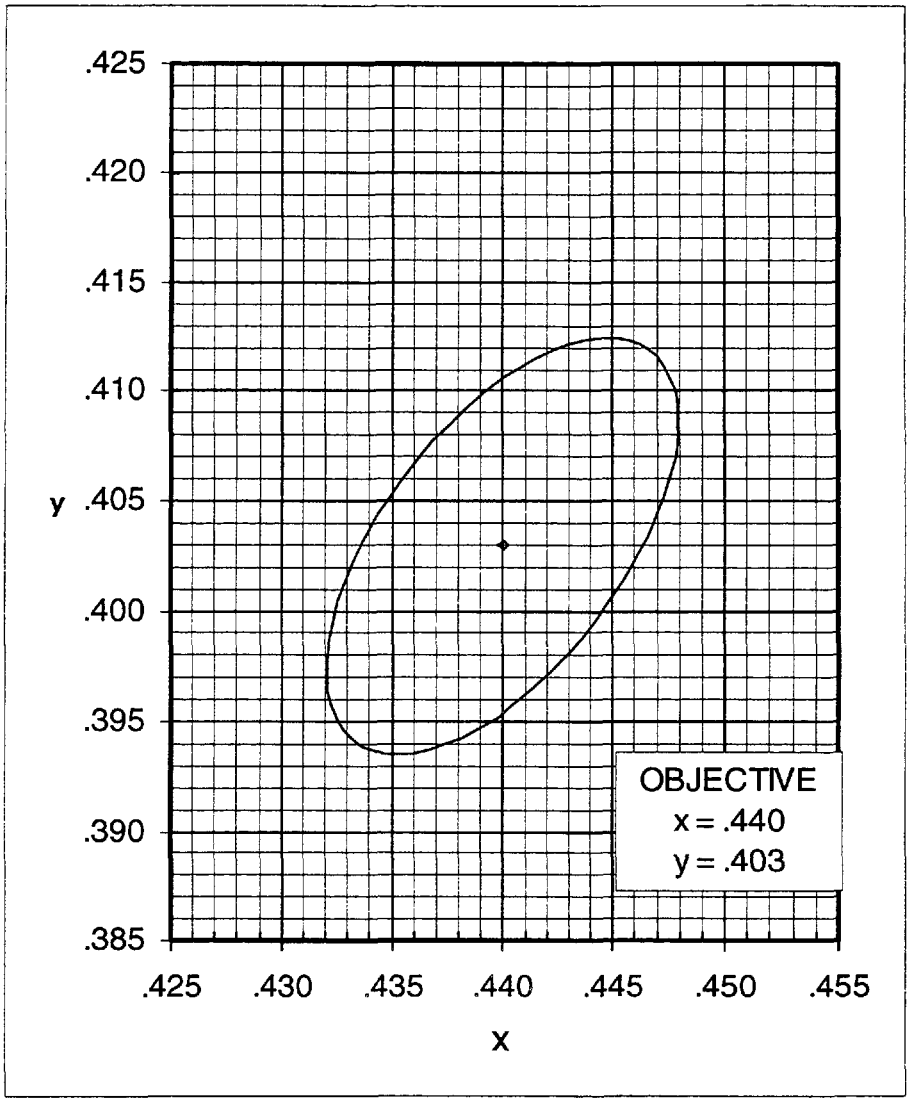

Figure 1 – 3000K/Warm White Chromaticity Limits (4 MacAdam Color Steps)

Copyright © 1997 by National Electrical Manufacturers Association
1300 North 17th Street, Suite 1847, Rosslyn, VA 22209

Copyright National Electrical Manufacturers Association
Provided by IHS under license with NEMA
No reproduction or networking permitted without license from IHS
Not for Resale

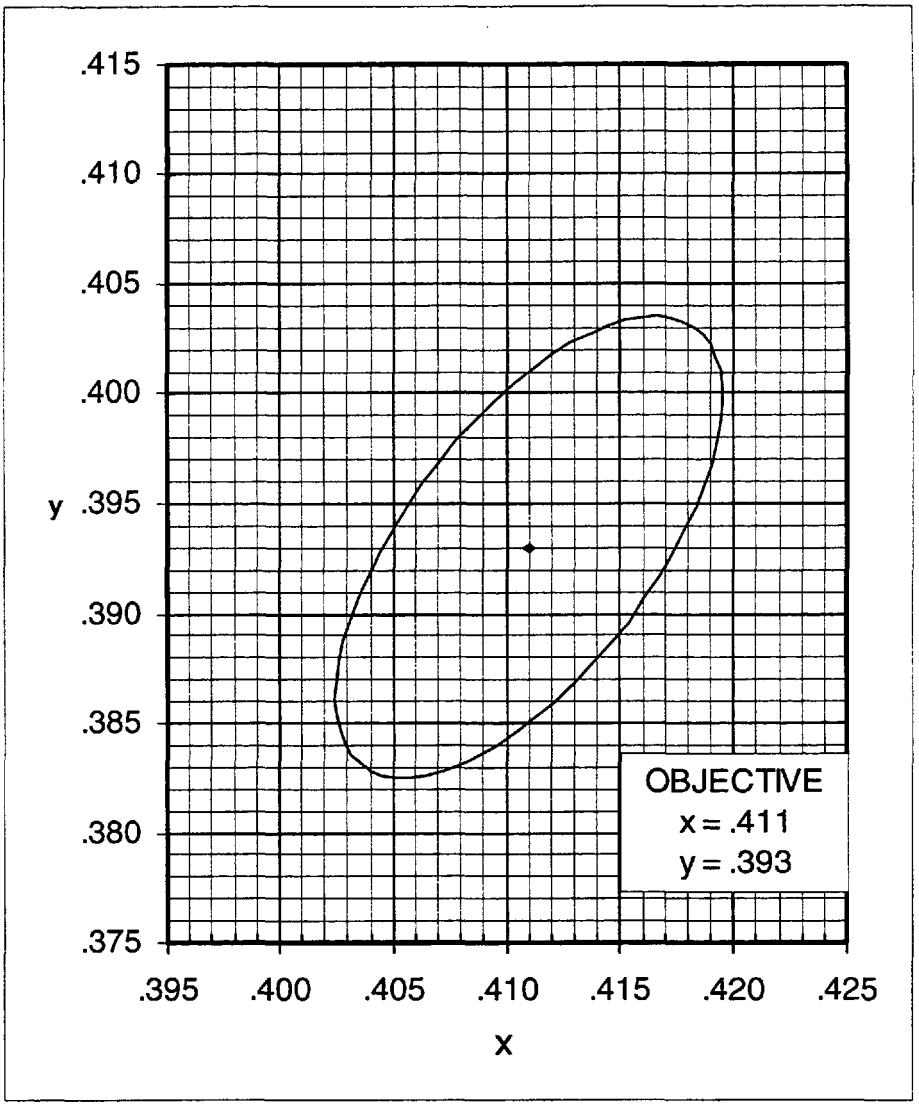

Figure 2 – 3500K/White Chromaticity Limits (4 MacAdam Color Steps)

Copyright © 1997 by National Electrical Manufacturers Association
1300 North 17th Street, Suite 1847, Rosslyn, VA 22209

Copyright National Electrical Manufacturers Association
Provided by IHS under license with NEMA
No reproduction or networking permitted without license from IHS
Not for Resale

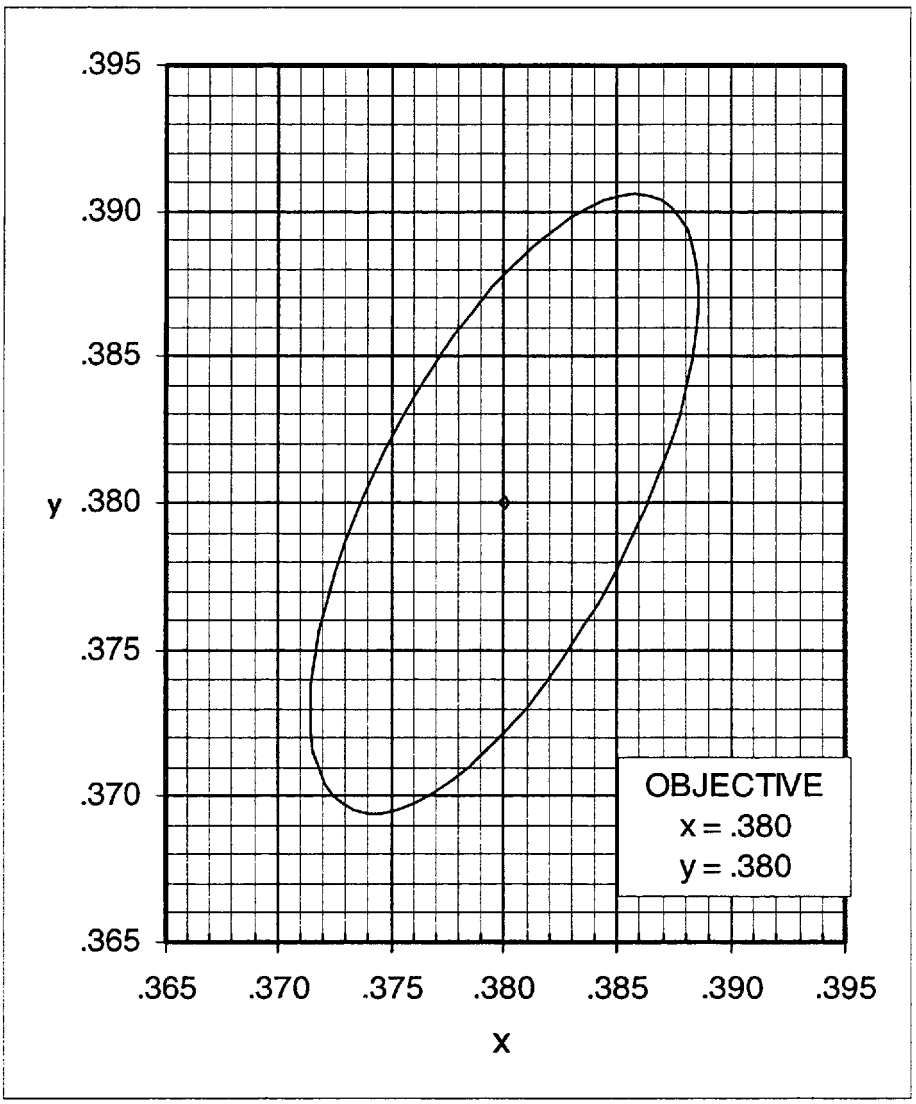

Figure 3 – 4000K/4100K/Cool White Chromaticity Limits (4 MacAdam Color Steps)

Copyright © 1997 by National Electrical Manufacturers Association
1300 North 17th Street, Suite 1847, Rosslyn, VA 22209

Copyright National Electrical Manufacturers Association
Provided by IHS under license with NEMA
No reproduction or networking permitted without license from IHS
Not for Resale

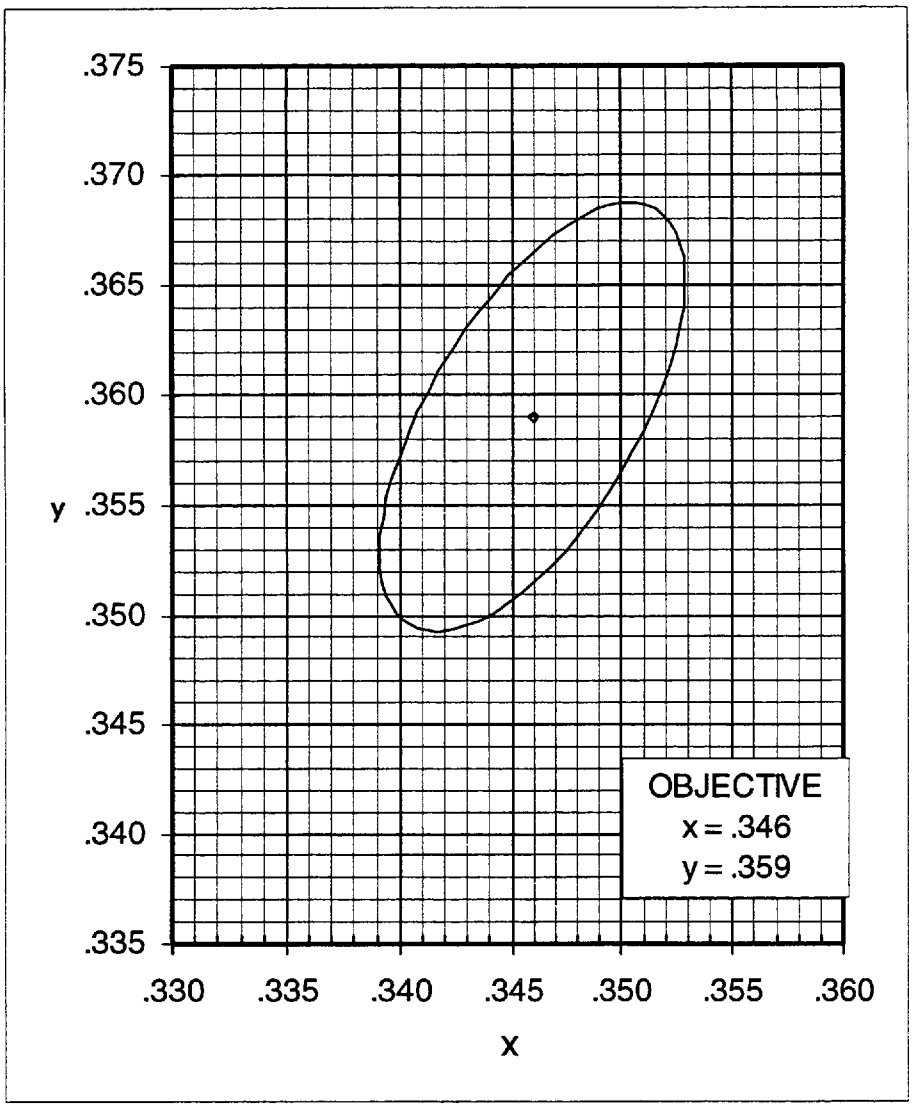

Figure 4 – 5000K Chromaticity Limits (4 MacAdam Color Steps)

Copyright © 1997 by National Electrical Manufacturers Association
1300 North 17th Street, Suite 1847, Rosslyn, VA 22209

Copyright National Electrical Manufacturers Association
Provided by IHS under license with NEMA
No reproduction or networking permitted without license from IHS
Not for Resale

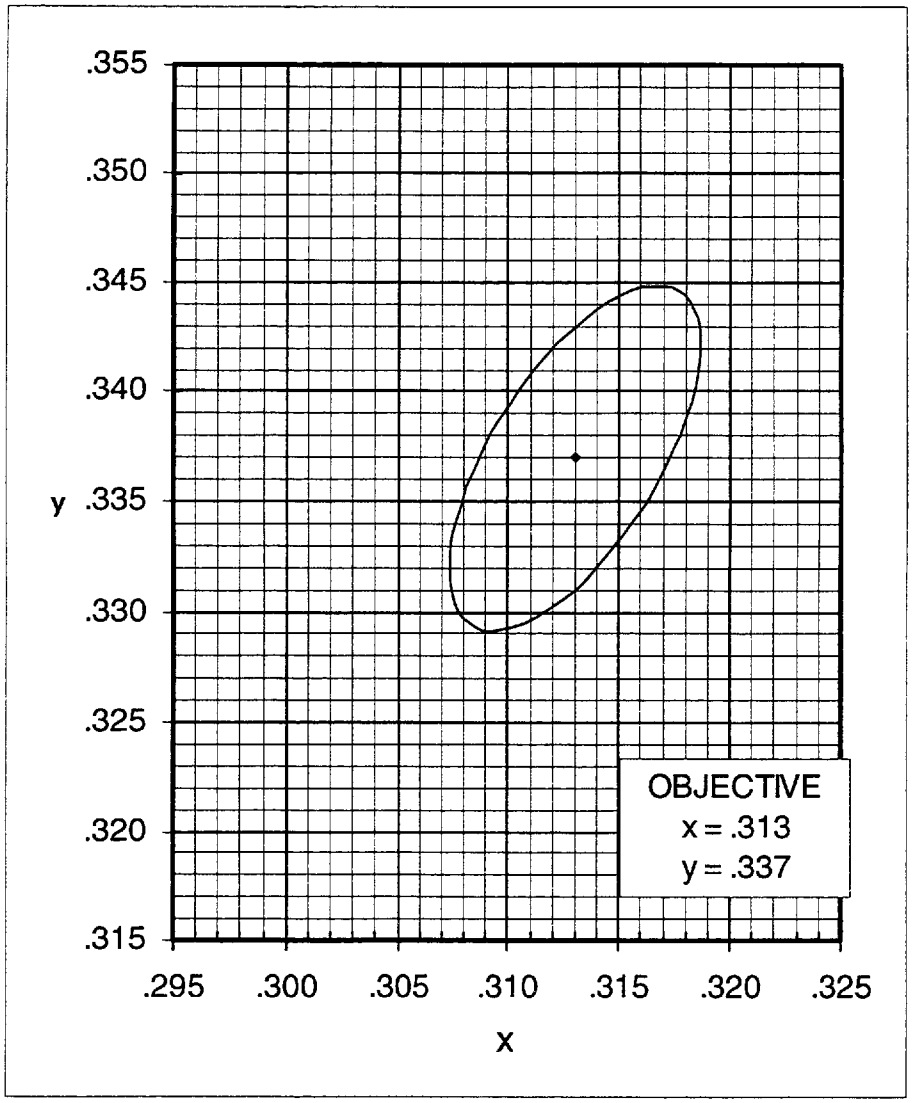

Figure 5 – 6500K/Daylight Chromaticity Limits (4 MacAdam Color Steps)

Copyright © 1997 by National Electrical Manufacturers Association
1300 North 17th Street, Suite 1847, Rosslyn, VA 22209

Copyright National Electrical Manufacturers Association
Provided by IHS under license with NEMA
No reproduction or networking permitted without license from IHS
Not for Resale

ANSI C78.376-1996
Revision of ANSI C78.376-1969 (R1991)

THIS PAGE INTENTIONALLY LEFT BLANK

Copyright © 1997 by National Electrical Manufacturers Association
1300 North 17th Street, Suite 1847, Rosslyn, VA 22209

First Edition
April 1997

Copyright National Electrical Manufacturers Association
Provided by IHS under license with NEMA
No reproduction or networking permitted without license from IHS

Not for Resale