



• in this issue

We bring you technology update on the state of fluorescent lighting, complete with a comparison of energy, light and life for major types of lamps. Shaun Darragh takes a fresh look at the need to include commissioning services into the design of buildings. LDL Alumnus Barbara Erwine provides some guidelines for choosing the best glazing for daylighting your buildings.

• sustainable lighting classes

The Lighting Design Lab is offering a series of lighting classes that focus on creating more sustainable lighting in buildings. This series of 6 classes continues through next spring quarter. The series begins with *Human Interaction with Light and Design Considerations for Energy-Effective Lighting*. See class descriptions on page 4 or page 6 for registration details. Secure on-line registration for all of our events is at our website — www.lightingdesignlab.com. All classes are eligible for continuing education credit.

• commercial windows initiative events

The Commercial Windows Initiative, sponsored by the NW Energy Efficiency Alliance is developing a series of presentations around the region. Called "Design Intent", these present the latest developments in window and glazing technology. Joel Loveland of the BetterBricks Daylighting Lab will assist with several sessions in Montana. Check page 5 for more information.

• AIA Seattle daylighting seminars

The Seattle chapter of the American Institute of Architects is sponsoring a pair of daylighting classes. The first is on schematic design of daylighting and the second focuses on daylight modeling. These classes are eligible for continuing education credits through the AIA. See page 5 for more information.

• ldl open house

Mark your calendars now for the annual LDL Open House on December 10th. See page 5 for more information.

• new advanced lighting guidelines

The New Buildings Institute has released the first update to the Advanced Lighting Guidelines since the new version came out in 2001. The 2003 version provides a large update and expansion to the lighting applications section. You may purchase copies of the ALG 2003 through the IESNA or download a PDF at www.newbuildings.org.

• new articles section on website

Visitors to www.lightingdesignlab.com in the past few months may have noticed a new navigation button - **articles**. This section is a consolidation of all the different articles previously located around of the website. We will be posting 3-4 new articles every month to this area, so visit often.

tech
update



Above: growing concern about mercury and lead in lighting products is bringing about new labeling requirements for lamps. The National Electrical Manufacturers Association is implementing a new labeling standard by the end of 2003.

Photo courtesy Philips Lighting

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News

cutting-edge fluorescent.

by Randy Smith



Above: new compact fluorescent products produce enough light to be considered as replacements for smaller HID sources. Other advances in fluorescent lamps extend light output and rated life far beyond earlier technologies.

Photo courtesy Phillips Lighting

Since the LDL opened in 1989 we have seen fluorescent lighting continually advance in terms of efficacy and lamp life. Today's linear and compact fluorescent lamps provide more and better lighting than ever before. Here are some highlights of advances in today's fluorescent lamps and electronic ballasts:

- “Super” and “Premium” T8s are the new buzz words floating around the Northwest. What exactly are these T8s? The basic definition is 3100 or higher initial lumens and 2915 or greater mean lumens with a Color Rendering Index (CRI) of at least 85 and a rated life of 20,000 hours or greater.

GE-Starcoat HL, Osram/Sylvania-Octron 800 XPS and Philips-Advantage T8 are the lamps from the major manufacturers that comply. As a quick comparison the 70 series lamps produce around 84.5 mean lumens per watt, the 80 series lamps produce around 87.5 mean lumens per watt and the super/premium lamps produce around 92 mean lumens per watt. This is a 9% increase in light output with the same wattage. The purpose of using these lamps is to produce the most light per lamp with the least lumen depreciation.

Some energy conservation organizations, such as the Energy Trust of Oregon (www.energytrust.org), offer greater monetary incentives for using the Super/Premium T8 systems over standard lamps.

- High Performance CFLs begin to blur the line between fluorescent and lower wattage HID lamps. Beginning with the 50W “biax” lamps of a few years ago, CFLs now have light output that rivals 250W+ incandescent and 70W Metal Halide lamps. The “biax” style of lamps are longer than incandescent

and HID (22” or more) requiring fixtures specifically designed for them. 55W—80W lamps of this type can produce up to 6000 lumens. These are useful for exterior wall washing applications or interior high ceiling applications. All major lamp manufacturers make these lamps: GE-Biax, Osram/Sylvania Dulux L, and Philips PL-L.

At LightFair 2003 Philips Lighting announced a new CFL product family - the PL-H - which is a size and shape similar to the 4-pin 42W CFL. The PL-H comes in 60W, 85W, and 120W versions with lumen output of 4000, 6000, and 9000 lumens respectively.

- T5HO lamps produce 5000 lumens using 54W in the nominal 4-foot model. This has created a market of indirect linear pendant luminaire using 1 lamp instead of 2. It has also created a new type of popular industrial luminaire for low bay applications—a 4 lamp, 20,000 lumen fluorescent. This is instant-on, instant-restrike, low lumen depreciation high-CRI lighting for industrial spaces.

- Energy-Saving T8 lamps are designed to provide similar lighting performance to the full-wattage lamp, but using a watt or two less energy per lamp. GE-Watt Miser Ultra, Osram/Sylvania Supersaver and Philips Energy Advantage lamps use 28W-30W to produce approximately 2900 lumens. Some of these lamps are intended exclusively for use on instant-start ballasts and have less than 20,000 hours of rated life.

- Long-Life T8 lamps are engineered to lower relamping costs by extending the rated burn hours beyond the typical 20,000 hour level. Also, some new lamps are designed to provide 20,000 hours of life whether the ballast is rapid start or instant start. Many longer-life lamps are rated at 24,000 hours, and some are rated as high as 30,000 hours.

When you see a linear fluorescent lamp rated at higher burn hours make sure the rating is based on a standard 3 hour operation cycle. Some less reputable lamp manufacturers claim long life ratings, but base those claims on 10-, 12- or 24 hour burning cycles. The industry standard for testing fluorescent lamp life uses a 3 hour operation cycle.

common lamp comparisons.

F25T12 (aka shoplight)

25W / 1860 lumens / 12,000 hrs

F40T12

40W / 3000 lumens / 20,000 hrs

F40T12ES

34W / 2650 lumens / 20,000 hrs

F32T8RE80

32W / 2950 lumens / 20,000 hrs

F96T8

59W / 5770 lumens / 15,000 hrs

F28T5

28W / 2900 lumens / 20,000 hrs

F54T5HO

54W / 5000 lumens / 20,000 hrs

FEA30CIR (aka CircLite)

30W / 1900 lumens / 10,000 hrs

FC9T5HO (aka T5 CircLite)

55W / 3300 lumens / 16,000 hrs

F282D (aka 2D)

28W / 2050 lumens / 10,000 hrs

FT39 (aka “Biax”)

39W / 2850 lumens / 12,000 hrs

FT40 (aka “Biax”)

40W / 3150 lumens / 20,000 hrs

CFQ13W

13W / 860 lumens / 10,000 hrs

CFTR26W

26W / 1800 lumens / 10,000 hrs

CFTR32W

32W / 2400 lumens / 10,000 hrs

CFTR42W

42W / 3200 lumens / 10,000 hrs

A19 100W

100W / 1600 lumens / 750 hrs

QL85W (Induction)

85W / 6000 lumens / 100,000 hrs

lighting

by Shaun Darragh L C

commissioning.

Among the most frequently overlooked elements of any lighting design project is how the lighting system will be controlled. This has been true for many reasons; cost, requisite design time, confusion over contract scope, aversion to the perceived risk of implementing new technologies. As we move forward with the practice of lighting design, these issues will need to be overcome if we are to best serve our clients needs and meet existing and emerging energy code requirements.

The two principal reasons to use advanced lighting controls in our projects are energy savings and user satisfaction. Devices like occupancy sensors and daylight harvesting systems have been shown to be capable of providing energy savings of 25%-50% or more.

Providing manual dimming controls increases user satisfaction, and hence productivity, by allowing each user to modulate the lighting according to their individual needs and preferences. Whatever lighting control solution is ultimately chosen for each project we design, our task as designers does not end with the specification, or even installation, of the lighting controls hardware. As designers, we must ensure that our systems are properly commissioned and operational before occupancy.

Commissioning has been well defined by Florida Power and Light as "a systematic process of ensuring that all building systems perform interactively according to documented design intent and the owner's operational needs."

Outside agent commissioning has been done for years on other building components such as HVAC systems. When lighting control meant switches and contractors, commissioning lighting control systems was simply not an issue. Considering today's ever more complex lighting control systems, we must ensure that the controls we have specified function optimally in order to provide our clients with the best possible value.

The actual steps required for proper commissioning will be somewhat different for each type of system, building, and end

user type. That said, there are some steps that we can all take that will be help the process.

• System design:

During the design process, be very clear about system performance expectations. This information may include items such as time out settings for occupancy sensors, control group schedules, and threshold light levels for daylight harvesting systems. Include this information in conspicuous locations within the contract documents.

• System Programming:

As part of the finish out process on each project, any microprocessor based controls, such as dimming or relay systems, must be programmed and tested. Time of day, override, and event scheduling must be programmed and tested as well.

• Calibration:

Any sensors used on the project must be properly calibrated for optimal performance. This may include sensitivity on all occupancy sensors or setting light level thresholds for photo sensors.

• Maintenance Staff Training:

The staff that will maintain the lighting system should be provided with complete training on all elements of that system. In particular, device calibration and system programming should be stressed. Maintenance staff should also be provided with a complete Operations and Maintenance manual documenting all major system elements.

• End User Training:

End users should be acquainted with the functioning of major system elements and why they are installed. This is particularly true of occupancy sensors and daylight harvesting controls. This type of training can do away with the dixie cup over the photo-sensor phenomenon and may eliminate costly service calls for occupancy sensor that are functioning properly.

Check list of items to consider:

- Calibrate Occupancy / Daylight Sensors
- Calibrate Lumen Maintenance Levels
- Program Time of Day Scheduling
- Program Preset Dimming Scenes
- Interface with BMS / Fire / Security
- Interface with AV systems
- Program User PC Controls
- Explain and Demonstrate System Functions and Programming to Owner

A final word, in case I wasn't clear, a lighting control system that isn't properly commissioned is generally a waste of your design time and your client's money.

An expanded, downloadable PDF of this article is available at www.lightingdesignlab.com/articles/

Commissioning Resources

National Conference on Building Commissioning
www.peci.org/ncbc/index.html

Commissioning and O&M Resources
<http://www.peci.org/cx/index.html>

Minnesota Sustainable Design Guide Commissioning Checklist (PDF)
www.msdc.umn.edu:16080/MSDC/text/commissioning.pdf

LBL Daylighting Commissioning Tips (PDF)
windows.lbl.gov/pub/designguide/section9.pdf

Seattle City Light Building Commissioning Assistance and Handbook
www.cityofseattle.net/light/conserves/business/bdgcama/cv6_bcam.htm

fall 2003

Registration on Page 6

events.

did you know?

Members of professional design organizations (AIA, NCQLP/LC, ALA, BOC, and others) may be able to receive continuing education credits for attending events offered by the LDL.

To self-certify your credits (sometimes called learning units) make sure you keep the Certificate of Completion that we distribute at each event.

Learning unit credits are almost always issued at a rate equal to the contact hours. So a 2 hour class would be worth 2 credits.

For information about how your organization works with continuing education credits visit their website at:

AIA
aia.org

ALA
americanlightingassoc.com

ASID
asid.org

BOC
nec.net/boc.htm

BOMA
boma.org

IFMA
ifma.org

IIDA
iida.com

NCQLP
ncqlp.org

All Registration **must be in advance**. All fees must be **paid in advance**. No registrations or fees will be accepted at the door. On-line registration is available at <http://www.lightingdesignlab.com/classes>

sustainable lighting classes

1 • human interaction with light. \$30

Eugene:	Tuesday 9/9	• 2:00pm - 5:00pm
Portland:	Wednesday 9/10	• 2:00pm - 5:00pm
Boise:	Wednesday 9/17	• 2:00pm - 5:00pm
Pocatello:	Thursday 9/18	• 2:00pm - 5:00pm
Billings:	Monday 9/22	• 1:00pm - 4:00pm
Missoula:	Thursday 9/25	• 1:00pm - 4:00pm
Seattle:	Tuesday 9/30	• 2:00pm - 5:00pm
Spokane:	Thursday 10/23	• 2:00pm - 5:00pm

Because we spend 90% of our time indoors, it is important to understand the way humans perceive and are affected by light. This class covers how we see color and contrast to interpret and experience our environment, and how light can affect health. Night vision will be addressed and how low-light seeing differs from daytime seeing. We will review historic and current research on the effect of lighting and daylighting on learning and human performance, to help guide informed energy effective lighting applications. (3 CEU contact hours)



2 • design considerations for energy—effective lighting. \$30

Seattle:	Tuesday 10/28	• 2:00pm - 5:00pm
Eugene:	Tuesday 11/4	• 2:00pm - 5:00pm
Boise:	Tuesday 11/4	• 2:00pm - 5:00pm
Portland:	Wednesday 11/5	• 2:00pm - 5:00pm
Pocatello:	Wednesday 11/5	• 2:00pm - 5:00pm
Billings:	Monday 11/17	• 1:00pm - 4:00pm
Missoula:	Thursday 11/20	• 1:00pm - 4:00pm
Spokane:	Thursday 12/4	• 2:00pm - 5:00pm

To reduce environmental impacts associated with excessive energy use, and provide the best quality lighting projects, energy effective lighting design is critical. This overview class introduces the latest considerations in lighting design for new or retrofit projects. We will discuss issues including appropriate illumination level selection, color quality selection for visual task performance, glare control, and effective access to natural light. We will review available lighting and daylighting tools as well as economic considerations and the need for life cycle analysis. The goal is to provide information critical to creating comfortable, interesting, and efficient work spaces. (3 CEU contact hours)



• project design reviews. no cost.

The lighting specialist is available to provide schematic design review of proposed lighting strategies on your commercial and industrial lighting projects. Please contact the specialist for your territory to directly set up an appointment in your office.

3 • daylighting measurement and meaning. \$50

Seattle: Quarter begins 9/29 • 13 weeks • Tues. & Thurs. 3:30 - 5:00PM

University of Washington Class — Arch 498. A detailed investigation of Seattle's new City Hall. The class will measure and understand how the building performs in a range of environmental areas with an emphasis on daylight. Class builds on the experiences and lessons learned from the Vital Signs project. Students will leave with an understanding of how daylighting performance is measured and evaluated. Class meets twice a week for the quarter. Classes will be at Gould Hall at the UW and on the project site.



= basic = intermediate = expert



NORTHWEST
ENERGY
EFFICIENCY
ALLIANCE
www.nweea.org

4 • principles & practices of environmental lighting. \$50 by Shaun Darragh

Seattle: Quarter begins 9/29 • 13 weeks • Mon. & Wed. • 11:30 - 1:00PM



University of Washington Class — Arch 435. This course provides an introduction to the design of architectural lighting through lectures, field trips, physical modeling, and calculation assignments. Class discussions will include daylighting and electric lighting design strategies, luminaires and lighting equipment, lighting controls, calculations, and evaluation tools.

5 • Idl open house. no charge.

Seattle: Wednesday 12/10 • 9:00am - 3:00pm



Join us in our yearly celebration of lighting in our region. We kick off the day with our New Products Trade Show at 10 AM, where the best new lighting products are on display, and local manufacturer representatives will answer all of your questions. Our keynote speaker (to be announced) will talk from 11 - Noon. The buffet lunch from 12 - 1 will give you a chance to catch up with old friends and discuss the stimulating topic addressed by the keynote speaker, and revisit the trade show. Our What's New in Lighting seminar will be held from 1 - 2. The trade show ends at 3.

events offered by others organizations in collaboration with the Idl

Note: Registration for these events is NOT through the Lighting Design Lab. Please call the number listed or visit the registration website for more information.

• AIA Seattle — daylighting 101 & 102

<http://www.alaseattle.org> or 206-448-4938

Seattle: Tuesday 9/23 • 12:00pm - 2:00pm

Daylighting 101 — Schematic Design Daylighting.

Introduces the idea of using daylight as a primary source of illumination, and rules of thumb for quick and easy use in sizing windows and skylights.

Seattle: Thursday 9/25 • 12:00pm - 2:00pm

Daylighting 102 — Daylight Modelling.

Introduces the various ways of using the physical models for understanding how an architectural project attains its daylighting design goals.

• Commercial Windows Initiative

Call CWI at 503-587-8528 for details

Design Intent - an entertaining and informative gathering about the latest in glazing technology. We invite you to come "break bread with us and discover the latest happenings in the world of window and glazing technology. You will learn about: regional Utility programs to assist you with glazing designs; the latest Low Emissivity glass technology; and ways to handle questions about first cost.

Idl class locations:

Billings:	Prudential Floberg Realtors 1550 Poly Drive Billings MT	Missoula:	Univ. of Montana Continuing Education, Room 203 32 Campus Drive Missoula MT
Boise:	(9/17) Albertsons West Plaza Training Room 1 220 Parkcenter Blvd Boise ID	Pocatello:	To Be Announced
	(11/4) Idaho Power Headquarters 1221 W Idaho St, 1st Floor Auditorium East Boise ID	Portland:	BetterBricks Daylighting Lab U. of Oregon Portland Ctr, Rm 100 722 SW 2nd Ave Portland, OR
Eugene:	(9/9) EWEB Community Room (11/4) EWEB Training Center 500 E 4th Ave Eugene, OR	Seattle:	Lighting Design Lab 400 E Pine St Suite 100 Seattle WA
		Spokane:	Avista Auditorium 1411 E. Mission St. Rooms A& B Spokane WA

registration form.

Fall 2003 Classes

PAYMENT POLICY: Fees MUST BE PAID IN ADVANCE before attending class. Purchase Orders, checks, and credit cards are accepted. A credit toward future LDL classes will be issued for unused registration fees. Complete and fax this form to 206-329-9532. Class fees are waived for university students.

NO PAYMENT OR REGISTRATION WILL BE ACCEPTED AT THE DOOR.

Secure On-line registration is available at <http://www.lightingdesignlab.com/classes>

registration fee paid by. (circle one)

credit card • enclosed check • purchase order • credit from previous LDL event • university student fee waiver

registration information.

Name • _____

Company • _____

Profession • _____

I Pay My Electric Bill To • _____

billing information. (must be complete to process card transactions)

Phone • _____

Fax • _____

E-Mail • _____

Address • _____

City, State, Zip • _____

Credit Card Number (**VISA & MasterCard ONLY**) • Please include your CVV Code - last 3 digits of the number on the back of your card near your signature

Expiration Date • _____

**please check the circles of the class(es) and event(s) you wish to attend (on-line registration available).
event locations on page 5.**

1 • human interaction with light. \$30

- Eugene: Tues 9/9 • 2:00pm - 5:00pm
- Portland: Wed 9/10 • 2:00pm - 5:00pm
- Boise: Wed 9/17 • 2:00pm - 5:00pm
- Pocatello: Thurs 9/18 • 2:00pm - 5:00pm
- Billings: Mon 9/22 • 1:00pm - 4:00pm
- Missoula: Thurs 9/25 • 1:00pm - 4:00pm
- Seattle: Tues 9/30 • 2:00pm - 5:00pm
- Spokane: Thurs 10/23 • 2:00pm - 5:00pm

**2 • design considerations for energy—
effective lighting. \$30**

- Seattle: Tues 10/28 • 2:00pm - 5:00pm
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- Spokane: Thurs 12/4 • 2:00pm - 5:00pm

**3 • daylight measurement
& meaning. \$50**

- UW Campus: 13 wks • T/Th • 3:30 - 5 PM

**4 • principles & practices of
environmental lighting. \$50**

- Seattle: 13wks • M/W • 11:30 - 1 PM

5 • Idl open house. no charge.

- Seattle: Wed 12/10 • 9:00am - 3:00pm

**You can register instantly and securely on-line. Payment is accepted by credit card, check and purchase order.
www.lightingdesignlab.com/classes**

which glass should I use?

by Barbara Erwine



This reflective glass facade shows a whimsical view of the surrounding cityscape.
Photo courtesy Barbara Erwine

Windows, the eyes of our buildings, let our imaginations soar with their views and brighten our interiors with natural light. But they also represent major holes in our buildings through which energy (and money) pours. Each year, Americans spend over \$25 billion on summer air conditioning and winter heating. Although a wealth of new glazing products promises to reduce this energy drain, the challenge of finding the right product for each building can boggle the most adept architect.

So how do you sort through the myriad of products and specifications to pick the right glazing for the job? The energy specifications that describe glazing performance are key indicators of which glazing is best for each application.

• Let the daylight in

Solar energy is composed of Ultraviolet (UV), Visible and Infrared (IR) radiation. Glazing types differ in how much they transmit in each of these regions. Bringing in daylight through windows and skylights counts on the transmission of energy in the visible part of the spectrum.

• Visible light transmission

This specification indicates the percentage of visible light that is transmitted through the window. Visible transmission is rela-

tively high for clear glass (about 81% for a single pane) but can be reduced by adding a tint to the body of the glazing, or by applying a colored or reflective film or coating to the surface. Most architectural glass already has a slight greenish tint from the iron impurities in it. The clearest glass with the highest transmission is achieved by reducing the iron, resulting in a "high white" product at an increased price. High white glass is usually only specified for specialty applications, like high-end retail displays.

Most products that reduce visible transmission will also reduce heat gains from the UV and IR portions of the spectrum. So choosing a glazing with a lower visible transmission may be done either to achieve an architectural effect (color, reflection, etc.) or to reduce glare or heat gain through the window. Some "selective" tints, like Azurelite and Evergreen reduce the UV and IR transmission significantly but leave the visible transmission high. Other tints, like gray and bronze, and some reflective coatings have the opposite performance and reduce the visible transmission more than the IR and UV.

• Cool glazing — keep the heat out.

Solar gains from direct sunlight through a window can represent either a wonderfully warm and cozy interior in a cold climate or a stiflingly hot oven in a warmer climate. The glazing's Solar Heat Gain Coefficient describes whether the glazing will welcome or reject solar heat.

Solar Heat Gain Coefficient (SHGC):

This specification shows the percentage of solar heat that is transmitted through a window (both directly transmitted and absorbed and re-emitted). Keep this value lower than 0.4 (the lower, the better) on unshaded windows to minimize air conditioning costs. To maximize solar gains for a passive solar building, use glazing with a high SHGC. (Note: SHGC is the new industry standard specification to replace the Shading Coefficient (SC). You can convert from one to the other with the formula $SC = 1.15 \text{ SHGC}$.)

• What's the best color?

Although tinted glazing affects the color of daylight transmitted, our eyes adapt to color rapidly, and we rarely notice it unless we see a section of clear glass adjacent to the tinted window. We may however, notice that exterior colors appear "muddy" from the effects of a tint. Gray tints have the least distortion on colors viewed through the glass. But this isn't the only concern. As we noted above, gray

tints are not very efficient. For best overall performance, choose a tint or coating with efficient performance (high VLT/SHGC ratio) and visually inspect it to ensure it does not distort colors viewed through it.

• Smart windows.

Also new in the market are some amazing new glazing products that can change their transmission properties based on an electric signal (electrochromic), temperature (thermo-chromic) or amount of available light (photochromic). Currently available in Europe and soon to be introduced into the US, electrochromic "smart" windows turn from light to dark (like photogray sunglasses) to adjust the visible light and heat transmission through the glass.

• Clear or diffuse?

Clear glazing preserves the views, but diffuse glazing spreads daylight evenly through the space. Low vertical glazing within normal viewing angles should not be diffusing because it can be a strong source of glare. Most skylights should be diffusing to provide soft, even working light across the space. But there are some exceptions to these rules of thumb.

High vertical glazing outside of normal viewing angles may be diffusing (check first to ensure that direct views of this bright glazing will not cause glare). And sometimes, clear skylights are used in residences and public areas of commercial buildings to enliven the space with the dynamic play of direct sunlight.

• NFRC ratings.

The National Fenestration Rating Council is an industry organization that established a standardized, voluntary rating system to compare the performance of windows. An NFRC rated window comes with a window sticker that shows the whole window performance (not just the center of glass) for U Factor, Solar Heat Gain Coefficient, Visible Light Transmission, and Air Leakage. When you buy a rated window, you are guaranteed getting the performance you need. Many building codes encourage the use of rated windows (If you don't use a rated window, they assign default values that represent a worst case scenario). For more information on NFRC ratings, check their website at www.nfrc.org/

An expanded, downloadable PDF of this article is available at www.lightingdesignlab.com/articles/glazing/glazing.pdf

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The Northwest Energy Efficiency Alliance is a nonprofit group of electric utilities, state governments, public interest groups, and industry representatives committed to bringing affordable, energy-efficient products to the marketplace.

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