

SNL's Fluorescent Lighting Choice-of-Component Policy

Policy Statement

The Facilities Management & Operations Center's Lighting Team's technical policy, for both new construction and for major renovations, is to standardize on the F32T8, 3500°K, rapid-start fluorescent lamp with an instant-start high-frequency electronic ballast for reasons that make good sense economically and from a maintenance efficiency and logistics simplification standpoint, and which provides a really good color rendition. Residents' acceptance in those buildings now using this lamp has been overwhelmingly positive, but there have been a small number of residents who are unable or unwilling to work under this lamp. The Team's policy to support that small number is:

- If, following a retrofit, a given workspace is believed to be "too bright," please wait a few weeks for new lamp burn-in and for you to become accustomed to the lighting level.
- If, after the burn-in period, the workspace remains "too bright," we (Facilities) will delamp it to whatever illumination level you (the residents) want, on your P/T.
- If a given workspace is the "wrong color," we will relamp it with lamps of the color temperature you want, on your P/T, but:
 - You will store the extra lamps and provide them to our spot-relamp crews as they restore individual failures,
 - The replacement lamps shall be UL-listed and compatible with our ballast and the fixture's mechanical and electrical characteristics, and
 - You may not "maintain" the fixtures yourselves.
 - The next group-relamp cycle for your building may replace your custom lamps with the standard lamp, and it will be your decision to accept or change the lamps again.

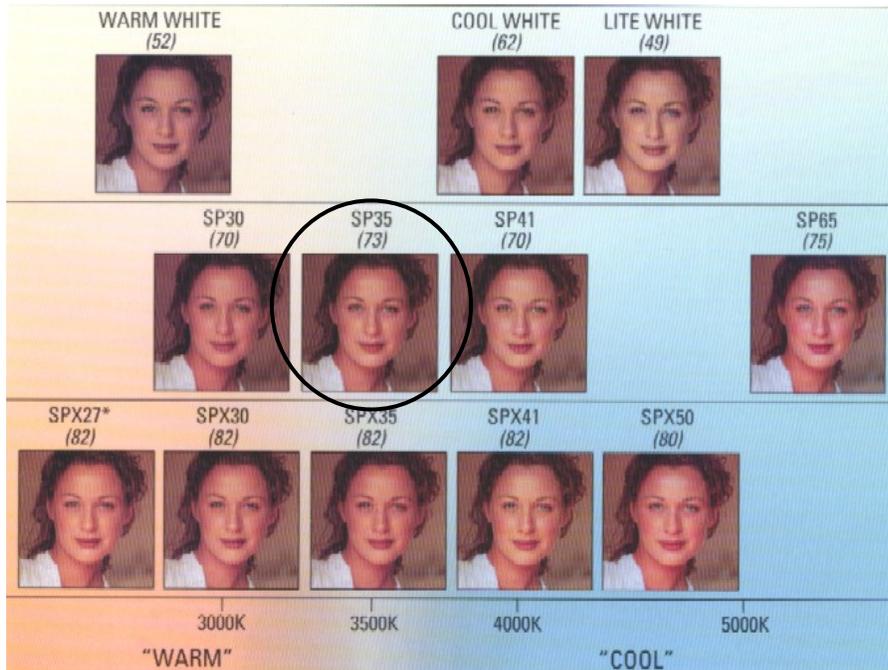
The Lighting Team will not support U-tube nor industrial 8-foot fixtures, however, unless there is a significant programmatic and/or architectural reason for doing so. Instead, we will gradually remove these fixture types, and - as resultant illuminations levels dictate - will restore them using fixtures containing the (new) standard ballast and lamps.

Therefore, if you wish to fund a carton(s) of lamps of a different color temperature, or if you wish your existing (new) illumination levels lowered, please put in a TELECON+ Request with a P/T to that effect. The Team is more than willing to serve our customers as best as we can while also fulfilling our responsibility to Sandia, and we will install for you the best lighting system we can afford, and after that - the best you can afford.

Brief History and Metrics of this Policy

Sandia formerly had a plethora of fluorescent luminaires throughout the campus, primarily due to the historical lack of a preferred alternative in our Facilities Design Manual (now corrected). The cost to operate these on a lumens/watt basis, the cost to warehouse all the various brands and models, the varied maintenance skills for each, and the different expected lifetimes for each had become unmanageable. The Facilities Lighting Team decided to standardize things, and picked the equipment type that was compatible with the majority of our many fixture types -- the 4-foot, bi-pin, rapid-start, 32watt F32T8 lamp – and its 2-foot cousin the F17T8 lamp - run by a single electronic, energy-conserving, parallel-wired, instant-start ballast in a fused fixture. This is also the least expensive equipment, as the rest of the industry is moving in this direction and we are reaping the benefits of quantity production. We have outlawed all other types of fluorescent fixture except one - the compact fluorescent lamp as a replacement for low-power incandescent lamps - specifically eschewing the 8-foot F96T12VHO fixtures, the older T12 lamps of any size, all U-shaped lamps, and of course all incandescents. All these outlawed lamps draw more power per lumen and cost a lot more per lamp than the T8 models.

Sandia's original specification for a 4100°K cool-white lamp many years ago was based on cost, limited phosphor choices, and lumens per lamp. Newer technology has greatly improved the color possibilities and the lamp's efficiency, while reducing the cost. The choice of the rare-earth "735" phosphor running at 3500°K seemed to have the best match of color rendition faithfulness, best lumens output per watt input, best lifetime, least lumens lost over that lifetime, cheapest quantity order, best order availability, and less stray ultraviolet in the spectrum. Any lower color temperature appeared too pink (the old "warm white"). Any higher color temperature (the old "cool white") lost color rendition faithfulness, and the true daylight lamps hard-driven to a 5100°K color temperature often had a reduced life, more heat wasted, some extra UV, and a higher cost. Most customers seem to like the 3500°K model; however, the phosphor choice was somewhat subjective and might be revised as we gain experience.



Courtesy GE Corporation, 1999

Color Temperature Chart

SNL standard lamp choice circled

The ballast requires only four models, one for 1-3 lamps and one for 2-4 lamps, and each on 120volt or 277volt power. A model variant is used for dimming applications, and another for two-level switching with a single switch. The lamp requires only one model, supplied equally well from several manufacturers. We thus consume, on the average, 75% of our original power budget, get 9% more lumens back, through

a lamp with only 67% as much glass, which makes it look subjectively brighter per square inch than the older F34T12 lamps it replaces. The smaller-diameter lamp runs with a smaller arc inside, which reduces the required quantity of mercury in the envelope and allows us to dispose of dead lamps as cheap recycled glass and not as expensive hazardous waste. Finally, our warehouse space and JIT requirements are much reduced, saving overhead and eventually translating into reduced space-chargeback fees for you. *For this latter reason alone*, we are unwilling to warehouse custom-ordered lamps, but are willing to install the ones you warehouse for us.

Our standard interior design zonal-illumination levels follow the general recommendations of the IESNA Lighting Handbook and are:

- 10-20 foot-candles (fc) in halls,
- 30-40fc in non-display conference rooms and lobbies,
- 40-50fc in general offices, and
- 60-70fc in light labs.

A foot-candle (fc) is a lumen per square foot incident on the workplane, which is normally measured at a desktop height, and takes into account the height of the ceiling and fixtures, fixture type, the reflectance of the room surfaces and its furnishings, and any daylight contribution through windows. The average eye cannot discern a 10% variance in illumination level without a direct side-by-side comparison, so some variance between individual workstations is permitted, and is to be expected with the minor differences between offices. To increase these illumination levels and incur a continuing utility cost requires a programmatic or medical reason and manager support, to temporarily reduce them requires an employee request, to permanently reduce them by removing fixtures requires employee and manager support.

Paradoxically, the better color rendition of our standard lamp now has some customers seeing bright colors for the first time (specifically, red toolboxes, the yellow and orange Dowcraft™ doors in building 891, and Day-Glo™ file folders), and many are thereby disconcerted at first. The Lighting Team remains open to constructive criticism and to non-adversarial adjustments for a given workstation upon employee request and manager support, but we would like to gain some solid statistical data before we change this Policy.

Sandia stands to save a significant fraction of its Federally-mandated energy reduction goals from this Policy implementation alone, and to save several hundred thousand dollars annually in reduced maintenance costs and electricity consumption (read: space chargeback), if we continue this policy. As of the end of 2007, we have:

- Converted about 90% of the campus to this technology,
- Saved about 3,200 kilowatt-hours (\$446k per year) for every hour the lights are on,
- Reduced lighting maintenance and warehouse costs by about 25-30%, and
- Reduced our spot-relamping backlog from two weeks to about two days.