



**SASKATCHEWAN
ENERGY MANAGEMENT
TASK FORCES**

TECHNOLOGY INFORMATION SHEET

**EFFICIENT FLUORESCENT FIXTURES
(Reflectors and Lenses)**

1. Background

Most fluorescent light fixtures incorporate some type of reflective surface and a lens, or a diffuser, or a louver to direct light into the space being illuminated. Proper choice of the reflector, lens, diffuser, and/or louver can greatly increase the overall efficiency of the lighting system. This efficiency is gained by improvements in the effectiveness of the fixture in directing light to where it is needed in the room and by reducing light losses within the fixture.

2. Reflectors

Whenever light strikes an opaque surface, not all light is reflected. Some light will be absorbed. The reflected light can either be directly reflected (i.e. "angle in" equals "angle out" -- specular reflectivity) or it can be diffused in all directions. The absorbed light is converted to heat and dissipated.

The key to efficient reflector design is to minimize absorbed light by maximizing surface reflectivity and minimizing the number of times the light is reflected before leaving the fixture.

Traditional fixtures use a metallic surface, often painted white, to reflect light out of the fixture. The white surface mostly diffuses

light; very little light is directly reflected. The result is an even light over all surfaces in the room, whether or not they need to be lit at that level. Mirrored reflectors, with either an aluminum or silver surface, increase the amount of light directly reflected out of a fixture. Mirrored reflectors are available in some factory-direct fixtures and as retrofits for various types of existing fixtures. By using mirrored reflectors instead of white painted reflective surfaces, the desired light level at the occupant level in a space can be achieved with fewer lights. For new construction, this may result in fewer fixtures in the space than has been assumed to be standard. For retrofit applications, this may be done in conjunction with delamping within the existing fixtures (see the Delamping and Reduced Wattage Technology Information Sheet). The table below provides a comparison of typical reflective characteristics for different reflector types.

3. Lenses, Diffusers, and Louvers

Lenses use a clear material where one side of the material is smooth while the other has an imbedded pattern of prismatic shapes. Lenses redirect light with little diffusion or absorption (as little as 5%). Lenses can be two-dimensional or three-dimensional if a

wider spread of light is required; they can also be made of polarizing material to minimize glare on glossy, horizontal surfaces.

Diffusers, as the name implies, diffuse light in all directions. Diffusers are usually made of a semi-translucent milky-white plastic that eliminates direct or specular reflected light but also absorbs a large amount of the light that strikes it (up to 30%). Diffusers result in a relatively uniform lighting level within a space.

Louvers are used primarily to eliminate glare on vertical surfaces such as computer screens. Most louvers limit the angle at which light can leave a fixture using a grid-type pattern with small 1 - 3 cm openings and a 1 - 2 cm thickness. Unfortunately, like diffusers, louvers can also absorb a great deal of light. Louvers can also result in dark spots within a space if not properly chosen.

4. Design Tips

Although the table shows the reflective characteristics of the different materials, reflector contour design is the primary factor governing reflector effectiveness, not the material. Further, the more effective a reflector is at increasing the amount of directly reflected light out of a fixture the more critical the fixture location becomes. A highly efficient fixture may result in glare or dark areas within a room if it is improperly positioned

Different reflector designs and materials provide different light patterns. Therefore, each light fixture must be analyzed individually to determine which reflector type would be best suited for it. Reflector retrofits are best suited to spaces that are overlit, have poor light distribution, degraded light fixtures, and where lamp/ballast retrofits are raising the average light output per lamp.

The selection of lenses, diffusers, and louvers is also critical to the effectiveness of fixtures and can counteract the desired effects of reflector additions if improperly chosen. For example, using a diffuser in conjunction with a high-specular silver reflector may negate the advantages of using the reflector by diffusing the directional light that the reflector is designed to produce.

Other information about reflectors, lenses, diffusers, and louvers is available from publications listed in the Efficient Lighting Reference List. Performance comparisons of fixture with and without reflectors is contained in *Combining Efficient Lighting Technologies* Information Sheet.

Typical Reflector Characteristics

Reflector Type	Direct Reflection	Diffuse Reflection	Absorption
Silver Reflector	95%	1%	4%
Aluminum Reflector	85%	2%	13%
White Painted Surface	5%	85%	10%