LIGHTING STANDARDS FOR SHIP AND ALTERNATIVE SOLUTIONS FOR ENERGY EFFICIENCY
1 – DETERMINE AN ADEQUATE LIGHTING FOR CREW CONSIDERING MARITIME REGULATIONS
2 – BRING ENERGY EFFICIENCY AND FIND OUT AN ALTERNATIVE SOLUTION TO INDOOR LIGHTING
DETERMINE AN ADEQUATE LIGHTING FOR CREW CONSIDERING MARITIME REGULATIONS

LIGHTING STANDARDS REGARDING TO MARITIME REGULATIONS

1 – MLC & ILO 92/133
2 – SOLAS
3 – RO & FLAG REGULATIONS
<table>
<thead>
<tr>
<th>ILO 92</th>
<th>ILO 133</th>
<th>MLC 2006</th>
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<tr>
<td>Article 9</td>
<td>Article 11</td>
<td>Standard A.3.1 &amp; Guidelines B3.1.4</td>
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</table>
| 1. Subject to such special arrangements as may be permitted in passenger ships, sleeping rooms and mess rooms shall be properly lighted by natural light and shall be provided with adequate artificial light.  
2. All crew spaces shall be adequately lighted. The minimum standard for natural lighting in living rooms shall be such as to permit a person with a normal vision to read on a clear day an ordinary newspaper in any part of the space available for free movement. When it is not possible to provide adequate natural lighting, artificial lighting of the above minimum standard shall be provided.  
3. In all ships electric lights shall be provided in the crew accommodation. If there are not two independent sources of electricity for lighting, additional lighting shall be provided by properly constructed lamps or lighting apparatus for emergency use.  
4. Artificial lighting shall be so disposed as to give the maximum benefit to the occupants of the room.  
5. In sleeping rooms an electric reading lamp shall be installed at the head of each berth. | 1. Crew accommodation shall be properly lighted.  
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3. In all ships electric light shall be provided in the crew accommodation. If there are not two independent sources of electricity for lighting, additional lighting shall be provided by properly constructed lamps or lighting apparatus for emergency use.  
4. In sleeping rooms an electric reading lamp shall be installed at the head of each berth.  
5. Suitable standards of natural and artificial lighting shall be fixed by the competent authority. | 1. In all ships, electric light should be provided in the seafarer accommodation. If there are not two independent sources of electricity for lighting, additional lighting should be provided by properly constructed lamps or lighting apparatus for emergency use.  
2. In sleeping rooms an electric reading lamp should be installed at the head of each berth.  
3. Suitable standards of natural and artificial lighting should be fixed by the competent authority. |
• Chapter II/1 Part D Regulation 41.2.1, main lighting system shall provide illumination throughout those parts of the ship normally accessible to and by passengers or crew shall be supplied the main source of electrical power.
RO & FLAG REGULATIONS

• ABS (American Bureau of Shipping) issued a guide for Crew Habitability On Ships in December 2001
• Isle of Man - Maritime Labor Notice (MLN) 3.1 Accommodation and recreational facilities April 2013
BRIEF HISTORY OF LIGHTING TECHNOLOGIES

1878
Edison Begins Working on Incandescent Lights

1901
Precursor to Fluorescent Lights

1962
First Light Emitting Diode (LED) Is Invented
BRIEF HISTORY OF LIGHTING TECHNOLOGIES
ADOPTED “LIGHTING OF WORK PLACES - PART 1: INDOOR, ISO 8995-3:2006” FOR MERCHANT SHIPS

• Even though there are various ship types with specific spaces such as cargo control rooms, cages for livestock carriers, etc., majority of the ships have spaces in common
<table>
<thead>
<tr>
<th>Ships Place</th>
<th>Lux Value for a River - Type Ship (Adopted ISO Standards)</th>
<th>Lux Value for Merchant Ships (Isle of Man Circular)</th>
<th>Lux Value for Naval Ships (Military Handbook)</th>
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<tbody>
<tr>
<td>Bridge General</td>
<td>200 (in port)</td>
<td>-</td>
<td>75.3</td>
</tr>
<tr>
<td>Passages</td>
<td>100</td>
<td>50 in general</td>
<td>75.3</td>
</tr>
<tr>
<td>Stairs</td>
<td>150</td>
<td>50 in general</td>
<td>75.3</td>
</tr>
<tr>
<td>Sanitary Areas</td>
<td>200</td>
<td>100 in general</td>
<td>150.6</td>
</tr>
<tr>
<td>Cabins</td>
<td>100</td>
<td>50 in general</td>
<td>75.3</td>
</tr>
<tr>
<td>Hospital</td>
<td>500</td>
<td>50 in general</td>
<td>301.3</td>
</tr>
<tr>
<td>Ships Office</td>
<td>300</td>
<td>100 in general – 200 at desk</td>
<td>301.3 in general – 451.9 at desk</td>
</tr>
<tr>
<td>Laundry Spaces</td>
<td>300</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>Galley</td>
<td>300</td>
<td>300</td>
<td>301.3</td>
</tr>
<tr>
<td>Ships stores</td>
<td>100</td>
<td>100</td>
<td>32.3</td>
</tr>
<tr>
<td>Mess Rooms</td>
<td>150</td>
<td>50 in general – 150 on tables</td>
<td>150.6</td>
</tr>
<tr>
<td>Provision Store</td>
<td>100</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>Steering Gear Room</td>
<td>200</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Engine Control Room</td>
<td>200</td>
<td>-</td>
<td>226</td>
</tr>
<tr>
<td>Engine Room General</td>
<td>200</td>
<td>-</td>
<td>150.6</td>
</tr>
<tr>
<td>Engine Workshop</td>
<td>300</td>
<td>-</td>
<td>301.3</td>
</tr>
<tr>
<td>Paint Room</td>
<td>100</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Bow &amp; Stern Thruster Room</td>
<td>200</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>CO₂ Room</td>
<td>200</td>
<td>-</td>
<td></td>
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</table>
BRING ENERGY EFFICIENCY AND FIND OUT AN ALTERNATIVE SOLUTION TO INDOOR LIGHTING

1\textsuperscript{ST} STEP – ENERGY EFFICIENCY STARTS WITH CREW CONSCIOUS

2\textsuperscript{ND} STEP – OPTIMAL FITTED EQUIPMENTS
EFFECTS OF INADEQUATE AND OVER LIGHTING
Circadian clock alters and may cause performance, alertness, sleep and metabolic disorders. Below remarks cause lighting pollution that effects human health (Falchi, et al., 2011).

- Luminaires that light directly at and above the horizontal;
- Wasted downward light flux outside the area to be lit;
- Over lighting;
- Lights that lit every time;
- Growth of the total installed flux;
- Short wavelength ‘blue’ light
ENERGY EFFICIENCY PRACTICES WITH COMBINATION OF NATURAL AND ARTIFICIAL LIGHTING
ENERGY EFFICIENCY PRACTICES WITH COMBINATION OF NATURAL AND ARTIFICIAL LIGHTING

• In this case, with a help of glass made skylight, the mess room could illuminate same lux value with using less fluorescent light.

• A standard 18 Watt T8 fluorescent lamp consumes at least 18 Watt per hour (excluding ballast).
ENERGY EFFICIENCY PRACTICES WITH COMBINATION OF NATURAL AND ARTIFICIAL LIGHTING

• If it is considered that ships’ delivery date is early 1986 and by the end of 2016, she is about 30 years old.

• A never turned off common 18 Watt T8 fluorescent light (such as mess room light, or a passageway light) consumes 4.733 kW (excluding ballast).

• For this ship, mess room have 6 pieces’ fluorescent light that will consume 28.400 kW for 30 years.

• This ship has 3 main generators with each 105 kW and consumes 200 liters MGO (Marine Gas Oil) per day.

• When we assume that the generator consumes 200 liters of MGO constantly, a single generator should work for 270 hours and consume 2250 liters of MGO for this 6 lamps during ships life.
ENERGY EFFICIENCY PRACTICES WITH COMBINATION OF NATURAL AND ARTIFICIAL LIGHTING

• The general lux value of the mess room table is 140 lx with 6 pieces 18 Watt T8 type fluorescent lamp and one active skylight.

• While lights are switched off, one skylight provides 30 lx illuminance on table in general for mess room and provides enough lighting at least visibility in general.

• Without skylight, another minimum 18 Watt fluorescent lamp would be necessary for mess room on the center.
ENERGY EFFICIENCY PRACTICES WITH COMBINATION OF NATURAL AND ARTIFICIAL LIGHTING

• If all light fixtures would be supported with an additional skylight, 18 fixtures (1 for steering gear room, 1 for galley, 1 for CO2 room, 1 for officer mess room, 1 for office, 1 for provision room, 1 for engine room store, 1 for deck store, 1 for crew mess room and 1 for common shower area plus 8 cabins) could be closed at daytime (calculated around 8 hours) that could save 28,382.4 kW during vessel’s economic life for 30 years and supports crew motivation and health.

• Besides, a skylight supported with artificial light on top could increase effective time.
“There is a crack in everything. That's how the light gets in.”

Thank You...