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Marine Signal Lights Service Conditions Factor

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IALA recommendation on service conditions factor

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- In practical installations, the degradation of luminous intensity under service conditions, due to light source degradation, dirt and salting of lanterns etc., should be taken into consideration.
- It is recommended that the intensity used to calculate the nominal range for publication should include a service factor.
- It is recommended that this service factor be taken as 0.75 (corresponding to a reduction in intensity of 25%).

Extracts from: IALA Recommendation E-200-2 On Marine Signal Lights Part 2 – Calculation, Definition and Notation of Luminous Range, International Association of Marine Aids to Navigation and Lighthouse Authorities (IALA), Edition 1, December 2008.

Is the Factor of 0.75 still appropriate?

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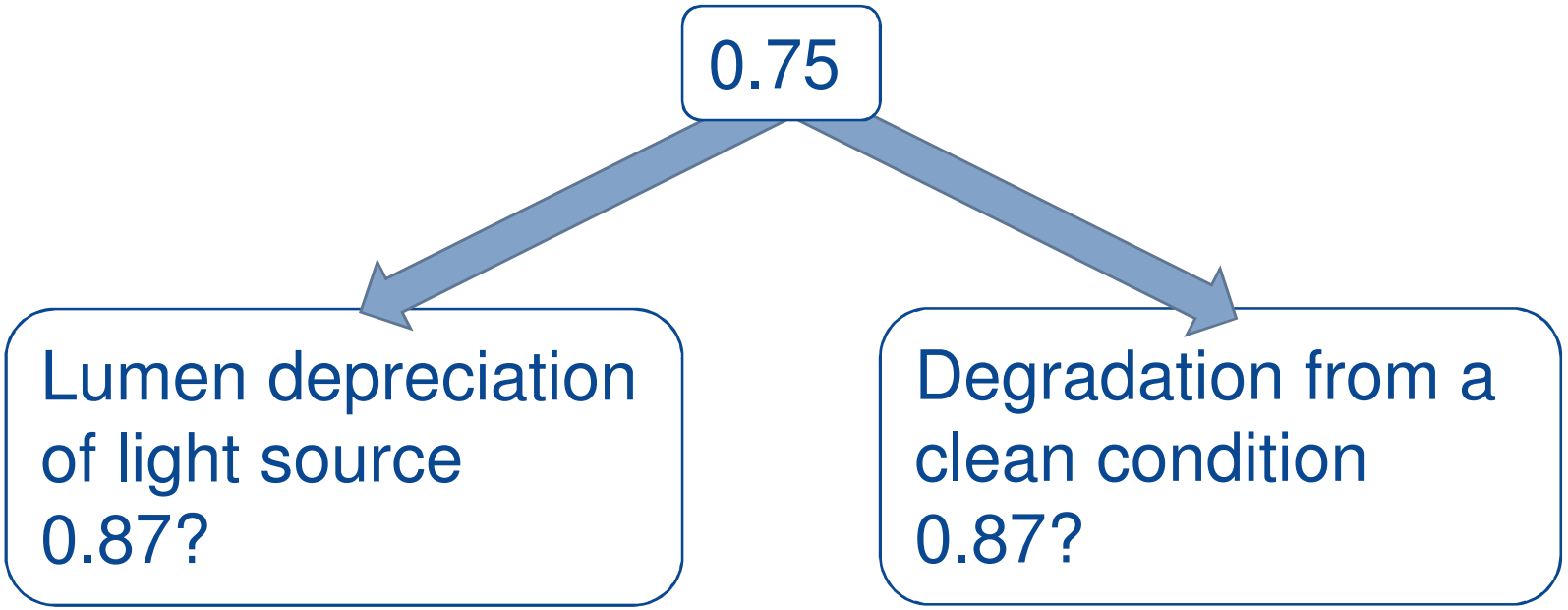
- The recommended value of 0.75 has been in use for some decades, at least since 1977 where it appears in “Recommendations on the Determination of the Luminous Intensity of a Marine Aid-to-Navigation Light”

- Is the value still relevant to the lumen depreciation curves of modern light sources?

- Is the value still relevant to the maintenance frequency of modern stations?

Component Values of the Factor are Not Specified



Lumen Depreciation of light source

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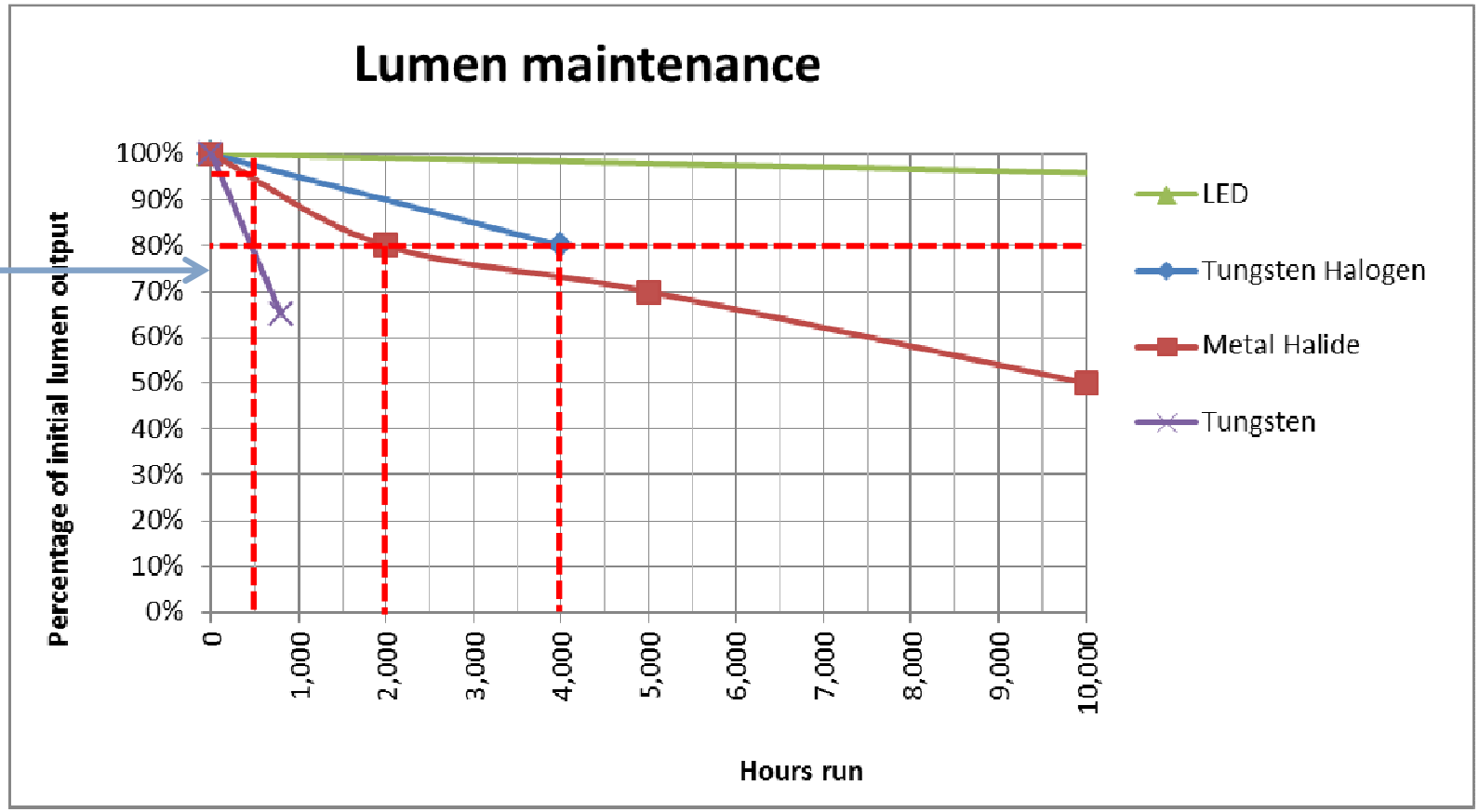
If using existing factor of 0.75, this should not be 0.75. There would be no allowance for dirt/salt losses



Sources: LED – Cree XM-L TM21 data
Tungsten Halogen - Philips Capsuleline 100W GY6.35 12V CL datasheet
Metal Halide – Phillps MASTERColour CDM-T 35W/830 G12 datasheet
Tungsten – Measurement of BSL L24 1500 W 100 V.

Degradation from Clean Condition - Salt Deposits at St Ann's Head

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- Glazing at St Ann's Head suffered a 10 % loss in transmittance approximately 6 months after cleaning.

This was the worst spot on glazing and is not ideally suited to determining service conditions factor (data was collected for another purpose)

Degradation from clean condition - Guano Deposits at Eddystone

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- Glazing at Eddystone suffered a 57 % loss in transmittance approximately 6 months after cleaning.

This was the worst spot on glazing and is not ideally suited to determining service conditions factor (data was collected for another purpose)

Degradation from clean condition - Dirt/Dust Deposits at Ardnakinna

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- We measured Ardnakinna lighthouse before and after cleaning the lens. - The dirt/dust deposits caused a 45 % reduction in intensity.

- The following year the test was repeated - The dirt/dust deposits caused a 20 % reduction in intensity.

Service Conditions Factor for Lens and Glazing

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Cleaning period (months)
1
3
6
9
12
18
24

- These figures are based on limited data and are used to demonstrate concept
- Figures will not be the same for all geographical areas

Combined Service Conditions Factor Metal Halide

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Example Lamp: Philips MASTERColour CDM-T 35 W/830 G12.

Life to 10% failures 10,000 h

Lamp replacement period (months)	3	6	7	12	18	24
Burning hours in period (if 14 h per night)	1,278	2,557	2,983	5,114	7,670	10,227
Factor for lumen depreciation of lamp	0.86	0.78	0.75	0.70	0.60	0.50

Cleaning period (Months)	Factor for degradation from clean condition	Required service conditions factor					
1	0.97	0.83	0.75	0.73	0.68	0.58	0.48
3	0.90	0.78	0.70	0.68	0.63	0.54	0.45
6	0.81	0.70	0.63	0.61	0.57	0.49	0.41
9	0.72	0.62	0.56	0.54	0.51	0.43	0.36
12	0.64	0.55	0.50	0.48	0.45	0.38	0.32

Nominal Range is Typically Rounded to the Nearest Nautical Mile

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Table 1 Night time nominal range table (rounded off to the nearest nautical mile)

Luminous intensity	Nominal range (rounded)	Luminous intensity	Nominal range (rounded)	Luminous intensity	Nominal range (rounded)
candelas	nautical miles (M)	kilocandelas (10^3 cd)	nautical miles (M)	Megacandelas (10^6 cd)	nautical miles (M)
1 - 2	1	0.633 – 1.06	9	0.927 – 1.35	26
3 - 9	2	1.07 – 1.75	10	1.36 – 1.96	27
10 - 23	3	1.76 – 2.84	11	1.97 – 2.84	28
24 - 53	4	2.85 – 4.53	12	2.85 – 4.11	29
54 - 107	5	4.54 – 7.13	13	4.12 – 5.93	30
108 - 203	6	7.14 – 11.1	14	5.94 – 8.53	31
204 - 364	7	11.2 – 17.1	15	8.54 – 12.2	32

Extract from: IALA Recommendation E-200-2

Should the Factor be Applied to Field Measurements?

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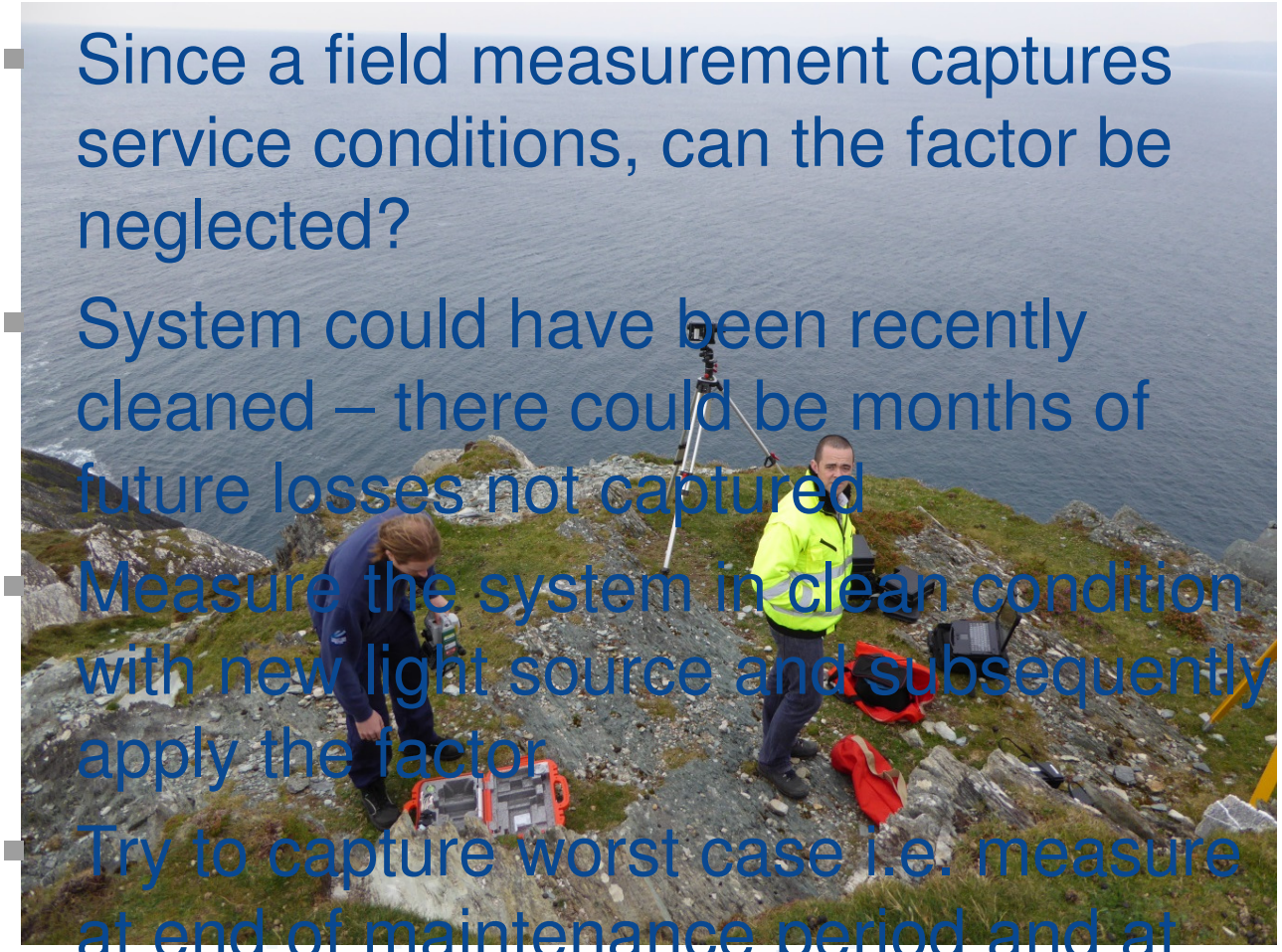
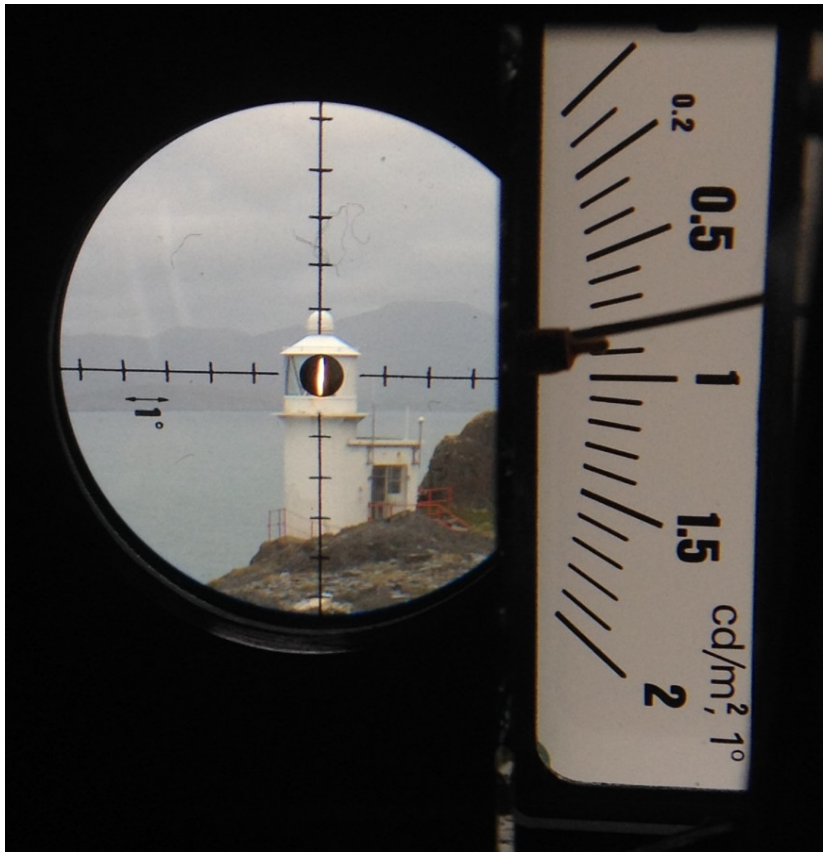
- Since a field measurement captures service conditions, can the factor be neglected?
- System could have been recently cleaned – there could be months of future losses not captured
- Measure the system in clean condition with new light source and subsequently apply the factor
- Try to capture worst case i.e. measure at end of maintenance period and at end of lamp's service life





Conclusions

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- It is important to apply a service conditions factor
- A value of 0.75 is a good start but may be insufficient for some scenarios
- Using an insufficient factor could mean a light does not meet it's published nominal range
- As responsible lighthouse authorities we should make an effort to ensure an adequate factor is applied
- However, further work is required to accurately assess the required factor

Further Work

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- Be more vigilant in considering and applying the service conditions factor.
- Place a high importance on maintaining a clean system

- Conduct measurements to understand typical degradation of system from clean condition.
- Where necessary conduct measurements on lamps to understand lumen depreciation.

Thank You

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