Dim-to-warm, *tunable white* and RGBW: how they work and when to specify them

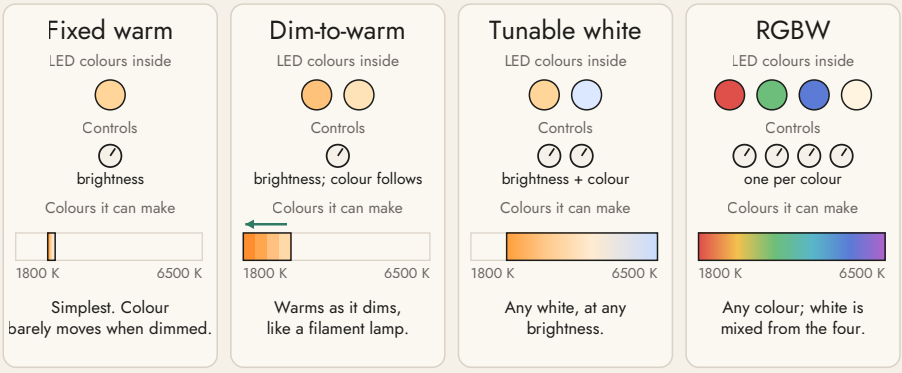
How dim-to-warm, tunable white and RGBW work, what each needs in controls and testing, what the UK rules say, and wording that fixes the end points, the curve and the controls.

Compliance guidance. Rules are quoted from SI 2021/1095 and Approved Document L (England, 2026 edition), read on 6 November 2026. Descriptions of the technologies come from US Department of Energy and DALI Alliance documents. IEC 62386-209 was named, not read. No health or circadian claim is made. Figures in square brackets are examples. Guidance, not legal or electrical advice.

AT A GLANCE

Option	LED colours inside	Controls	Colours it can make	Where it suits
Fixed warm white	One white	1: brightness	One colour, for example 2700 K. An ordinary LED barely changes colour when dimmed	The baseline for most rooms
Dim-to-warm	Two or more	1: brightness; colour follows	2700 to 3000 K at full output, down to as low as 1800 K (US DOE). Products tested ended at 1800 to 2200 K	Restaurants, hotel lobbies and guestrooms, ballrooms (DOE)
Tunable white	Two (warm about 2700 K, cool 5000 to 6500 K) or three or more (DOE)	2: brightness and colour	Any white between the ends. Two LED colours stray from the black-body line mid-range; three or more track it more closely	Rooms that change use, finish or time of day
RGBW, RGBA and other full colour	Red, green, blue and white or amber	3 to 6 channels, or a colour type on DALI	Any colour, and white mixed or added	Coloured effects; decorative or ambient use (DiiA)

From US DOE and DiiA documents read on 6 November 2026. Ranges are the DOE's. The dim-to-warm end points are those of the products the DOE tested, not a promise for any fitting.



Fixed warm, dim-to-warm, tunable white and RGBW: the LED colours inside, how many controls, and the colours each can make on a scale from 1800 to 6500 K. Schematic. Original drawing by Make Bespoke Studio.

SPECIFICATION WORDING

DIM-TO-WARM

Fittings in [space] to be dim-to-warm. Colour temperature [2700] K at 100 per cent output, falling to [1900] K at the lowest level (not warmer than [1800] K, not cooler than [2200] K), measured on a sample at [100, 50, 25, 10 and the lowest] per cent and recorded; each point within [ ] K of the approved curve. Ra not less than [90] and R9 not less than [50] at 100 and 50 per cent, and Ra not less than [80] at the lowest level, measured. One control signal for each dimming group: [DALI-2 / 0-10V / trailing-edge phase-cut].

TUNABLE WHITE

Range [2200 or 2700] K to [4000 or 5000] K at any brightness from [100] to [1] per cent. Distance from the black-body line (Duv) within [ ] at [2700], [3000] and [4000] K. Ra and R9 as above at each of those points. Control by [DALI-2 device type 8, colour type Tc / two 0-10V signals / DMX512]; number of independently controlled outputs for each fitting [ ], stated on the shop drawing. Scenes set out in the schedule as [name, kelvin, per cent].

RGBW OR FULL COLOUR

RGBW to be used only for [effect lighting in space], on its own circuit and control, apart from the white lighting that carries [ ]. White points used: [2700] and [3000] K, with Ra and R9 measured at those points. Colour repeatable from fitting to fitting within [ ] of the approved setting [state the colour type, for example xy, or none]. Programming and any reprogramming by [party], with the settings sheet in the handover pack.

MOCK-UP AND APPROVAL

One of each fitting family to be run on the final controls through every scene and the whole dimming and tuning range, with colour temperature, Duv, Ra, R9 and flicker recorded at the stated levels, and approved in writing by [lighting designer]. Any later change of driver, module or control product to be tested again.

TERMS USED

Dim-to-warm

An LED product whose colour temperature falls as it is dimmed, imitating incandescent dimming. UK Regulations define it as a light source that shifts its white output to a lower colour temperature when dimmed (SI 2021/1095 Sch 1).

Tunable white

A product with two or more white LED colours that lets the user or a scene choose a white across a range, independently of brightness. Also called Kelvin changing (US DOE).

Colour-tuneable light source

In SI 2021/1095, a light source that can emit a large variety of colours outside the white range as well as white. It excludes tuneable-white and dim-to-warm sources.

Duv

How far a light's colour lies from the black-body line. Two whites of the same colour temperature can differ in Duv, one looking greenish and the other pinkish (US DOE).

STANDARDS AND SOURCES

- SI 2021/1095, Lighting Products Regulations 2021 (Sch 1, Sch 3, Sch 4): revised text, read 6 Nov 2026.
- Approved Document L, Vol 1 (2026) para 5.57 and Table 5.7; Vol 2 (2026) para 5.65: England; takes effect 24 Mar 2027.
- US DOE, Understanding LED Color-Tunable Products: undated page, read 6 Nov 2026.
- US DOE and RTI, Dim-to-Warm LED Lighting: Stress Testing Results for Select Products (January 2020): small sample.
- DALI Alliance colour page; DiiA Specifying with DALI (SE001a); BS EN 62386-209:2011: colour types Tc, RGBWAF, xy; BSI lists the 2011 edition as current; IEC 62386-209 not read.

Full guide: https://makebespoke.com/trade/technical/dim-to-warm-tunable-white-and-rgbw. Make Bespoke Studio coordinates manufacture through its partner workshops. Figures are guidance only and your specification governs; some may be superseded, so contact the studio to verify.