

Comparison:

**EMICODE EC1^{PLUS}, EMICODE EC1,
Blue Angel RAL UZ 113, AgBB,
CDPH Section 1350**

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1) Background

Volatile organic compounds (VOC) may be released into indoor air when applying flooring adhesives or other installation products to a floor. VOC emissions are limited by several rating systems. Specifications of following rating systems (as valid in April 2013) are compared in this paper:

- EMICODE classes EC1 and EC1^{PLUS} (see www.emicode.com)
- Blue Angel RAL UZ 113 (see www.product-testing.eurofins.com/blue-angel.aspx)
- AgBB evaluation (see www.product-testing.eurofins.com/agbb-en.aspx),
(German task force for health-related evaluation of construction products)
 - With some modifications, these specifications are in use by German authority Deutsches Institut für Bautechnik (DIBt) for approval of construction products for interior use, see www.product-testing.eurofins.com/dibt-adhesives.aspx
- CDPH Section 01350, see www.product-testing.eurofins.com/section-1350.aspx,
(California Department of Public Health, Standard method for the testing and evaluation of volatile organic chemical emissions from indoor sources using environmental chambers)

2) Summary and conclusions

EMICODE EC1^{PLUS} includes the strongest requirements on low VOC emissions. EMICODE EC1 and Blue Angel are on same level. Specifications in California (Section 01350) are much easier to fulfill. EMICODE products are monitored continuously by market controls, performed by independent test houses.

3) Common elements

All rating systems analyzed here are testing emissions of emissions of VOC and of volatile aldehydes after 3 and after 28 days storage of a sample in a continuously ventilated test chamber in a standardized climate (23 °C, 50% relative humidity, ½ air change per hour - this will mean that whole air inside test chamber is replaced with clean fresh air every 2 hours). The old EMICODE test, valid until mid 2010, had worked with a test already after 10 days.

Results are calculated with a loading factor of 0.4 m² floor surface per m³ room air volume - this corresponds to a 2.50 meter high room. Testing is in compliance with ISO 16000 standard series (parts 3, 6, 9 and 11). EMICODE and AgBB use so-called European Reference room for calculations. Californian CDPH Section 1350 specification requires testing under slightly different, but similar conditions after 14 days storage in a ventilated test chamber.

Test specimens are prepared by applying an adhesive or another product onto a glass support. Application amount of adhesives is either 300 g/m² for EMICODE and Blue Angel, or as specified by manufacturer for AgBB and CDPH Section 01350. Other specifications are applied for leveling compounds (3 mm layer after mixing with water) and for primers (100 g/m²).

4) Comparison of specifications

Maximum allowable values

Parameter	EMICODE EC1 ^{PLUS}	EMICODE EC1	Blue Angel RAL UZ 113	AgBB / DIBt	Strictest requirement
Continuous monitoring / market control	Yes	Yes	No	No	EMICODE EC1, EC1 ^{PLUS} , DIBt
TVOC after 3 days, µg/m ³	750	1,000	1,000	10,000	EMICODE EC1 ^{PLUS}
TVOC after 28 days, µg/m ³	60	100	100	1,000	EMICODE EC1 ^{PLUS}
TSVOC after 28 days, µg/m ³	40	50	50	100	EMICODE EC1 ^{PLUS}
R value after 28 days	1	–	1	1	EMICODE EC1 ^{PLUS} , Blue Angel, AgBB
VOC without LCI value after 28 days, µg/m ³	40	–	40	100	EMICODE EC1 ^{PLUS} , Blue Angel
Carcinogenic compounds (C1A, C1B), after 3 days, µg/m ³	10 (sum)	10 (sum)	10 (sum)	10 (each VOC)	EMICODE EC1, EC1 ^{PLUS} , Blue Angel
Carcinogenic compounds (C1A, C1B), after 28 days, µg/m ³	1 (each VOC)	1 (each VOC)	1 (each VOC)	1 (each VOC)	identical
Formaldehyde after 3 days, µg/m ³	50	50	–	120 * (after 28 days)	EMICODE EC1 EC1 ^{PLUS} , CDPH
Acetaldehyde after 3 days, µg/m ³	50	50	–	–	EMICODE EC1 EC1 ^{PLUS}
Sum of Formaldehyde and Acetaldehyde after 3 days, ppb	50	50	50	–	EMICODE EC1 ^{PLUS} , Blue Angel

* There is no AgBB formaldehyde limit value, but DIBt specifies maximum 120 µg/m³ formaldehyde after 28 days.

CDPH Section 01350: In a test after 14 days ½ CREL value must not be exceeded for none of 35 listed VOC (CREL = Chronic Respiratory Exposure Levels).

The most critical limit value is the one of formaldehyde (9 µg/m³).

There are no further specifications.