

# DIN EN 16985:2019-04 (E)

## Spray booths for organic coating material - Safety requirements

---

<b>Contents</b>		<b>Page</b>
European foreword .....		6
<b>1</b>	<b>Scope .....</b>	<b>8</b>
<b>2</b>	<b>Normative references .....</b>	<b>9</b>
<b>3</b>	<b>Terms, definitions, variables and abbreviations .....</b>	<b>11</b>
<b>3.1</b>	<b>Terms and definitions .....</b>	<b>11</b>
<b>3.2</b>	<b>Variables .....</b>	<b>15</b>
<b>3.3</b>	<b>Abbreviations .....</b>	<b>17</b>
<b>4</b>	<b>Safety requirements and/or -measures .....</b>	<b>18</b>
<b>4.1</b>	<b>General .....</b>	<b>18</b>
<b>4.2</b>	<b>Mechanical .....</b>	<b>18</b>
<b>4.2.1</b>	<b>Moving or rotating elements .....</b>	<b>18</b>
<b>4.2.2</b>	<b>Falling objects .....</b>	<b>18</b>
<b>4.2.3</b>	<b>Height from the ground .....</b>	<b>19</b>
<b>4.2.4</b>	<b>Slippery surface .....</b>	<b>19</b>
<b>4.3</b>	<b>Electrical .....</b>	<b>19</b>
<b>4.4</b>	<b>Thermal .....</b>	<b>19</b>
<b>4.5</b>	<b>Noise .....</b>	<b>19</b>
<b>4.6</b>	<b>Radiation .....</b>	<b>20</b>
<b>4.7</b>	<b>Contact with and inhalation of hazardous material .....</b>	<b>21</b>
<b>4.7.1</b>	<b>General .....</b>	<b>21</b>
<b>4.7.2</b>	<b>Automatic application .....</b>	<b>22</b>
<b>4.7.3</b>	<b>Manual application .....</b>	<b>22</b>
<b>4.8</b>	<b>Fire .....</b>	<b>26</b>
<b>4.8.1</b>	<b>General .....</b>	<b>26</b>
<b>4.8.2</b>	<b>Spray booth construction .....</b>	<b>27</b>
<b>4.8.3</b>	<b>Filter media .....</b>	<b>27</b>
<b>4.8.4</b>	<b>Fire detection .....</b>	<b>27</b>
<b>4.8.5</b>	<b>Fire extinguishing equipment .....</b>	<b>28</b>
<b>4.9</b>	<b>Explosion .....</b>	<b>28</b>
<b>4.9.1</b>	<b>General .....</b>	<b>28</b>
<b>4.9.2</b>	<b>Spray booth for liquid coating material .....</b>	<b>29</b>
<b>4.9.3</b>	<b>Spray booth for powder coating material .....</b>	<b>31</b>
<b>4.10</b>	<b>Safety devices and control systems .....</b>	<b>34</b>
<b>4.11</b>	<b>Trapping .....</b>	<b>36</b>
<b>4.11.1</b>	<b>General .....</b>	<b>36</b>
<b>4.11.2</b>	<b>Manual spray booth .....</b>	<b>36</b>
<b>4.11.3</b>	<b>Automatic spray booth .....</b>	<b>37</b>
<b>4.12</b>	<b>Ergonomics .....</b>	<b>37</b>
<b>4.12.1</b>	<b>General .....</b>	<b>37</b>
<b>4.12.2</b>	<b>Access .....</b>	<b>37</b>
<b>4.12.3</b>	<b>Working area .....</b>	<b>37</b>
<b>4.12.4</b>	<b>Climatic environment .....</b>	<b>37</b>
<b>4.12.5</b>	<b>Luminous environment .....</b>	<b>38</b>
<b>4.12.6</b>	<b>Maintenance .....</b>	<b>38</b>
<b>4.13</b>	<b>Environment in which the machinery is used .....</b>	<b>38</b>
<b>5</b>	<b>Verification of the safety requirements .....</b>	<b>38</b>

<b>6</b>	<b>Information for use</b> .....	<b>44</b>
<b>6.1</b>	<b>General</b> .....	<b>44</b>
<b>6.2</b>	<b>Instruction handbook</b> .....	<b>44</b>
<b>6.2.1</b>	<b>General</b> .....	<b>44</b>
<b>6.2.2</b>	<b>Information related to installation</b> .....	<b>45</b>
<b>6.2.3</b>	<b>Information related to operation</b> .....	<b>46</b>
<b>6.2.4</b>	<b>Information related to maintenance</b> .....	<b>46</b>
<b>6.3</b>	<b>Marking</b> .....	<b>47</b>
<b>Annex A (informative) Hazards</b> .....		<b>49</b>
<b>Annex B (informative) Examples of classification of hazardous zones</b> .....		<b>53</b>
<b>B.1</b>	<b>Example 1</b> .....	<b>53</b>
<b>B.2</b>	<b>Example 2</b> .....	<b>54</b>
<b>B.3</b>	<b>Example 3</b> .....	<b>56</b>
<b>B.4</b>	<b>Example 4</b> .....	<b>58</b>
<b>B.5</b>	<b>Example 5</b> .....	<b>60</b>
<b>B.6</b>	<b>Example 6</b> .....	<b>62</b>
<b>Annex C (normative) Calculated average concentration of flammable substances</b> .....		<b>65</b>
<b>C.1</b>	<b>General</b> .....	<b>65</b>
<b>C.2</b>	<b>Spray booths for liquid coating material containing organic solvents</b> .....	<b>65</b>
<b>C.2.1</b>	<b>General</b> .....	<b>65</b>
<b>C.2.2</b>	<b>Example for the calculation of concentration of flammable substances on the basis of a given air flow velocity (manual spray booth)</b> .....	<b>65</b>
<b>C.2.3</b>	<b>Example for the calculation of required minimum fresh air flow (automatic spray booth)</b> ..	<b>66</b>
<b>C.3</b>	<b>Spray booths for organic powder coating material</b> .....	<b>67</b>
<b>C.3.1</b>	<b>General</b> .....	<b>67</b>
<b>C.3.2</b>	<b>Example for the calculation of coating powder concentration</b> .....	<b>67</b>
<b>C.3.3</b>	<b>Example for the calculation of maximum coating powder input</b> .....	<b>68</b>
<b>C.4</b>	<b>Filters for powder coating booths</b> .....	<b>69</b>
<b>C.4.1</b>	<b>General</b> .....	<b>69</b>
<b>C.4.2</b>	<b>Example for the calculation of coating powder concentration in the clean air part of the filter</b> .....	<b>69</b>
<b>Annex D (normative) Air flow velocity measurement</b> .....		<b>71</b>
<b>D.1</b>	<b>Measurement equipment</b> .....	<b>71</b>
<b>D.2</b>	<b>Measurement procedure</b> .....	<b>71</b>
<b>D.2.1</b>	<b>Measurement conditions</b> .....	<b>71</b>
<b>D.2.2</b>	<b>Air flow velocity components</b> .....	<b>71</b>
<b>D.3</b>	<b>Measurement points</b> .....	<b>72</b>
<b>D.3.1</b>	<b>Vertically ventilated spray booth (liquid and powder, internal working area)</b> .....	<b>72</b>
<b>D.3.2</b>	<b>Vertically ventilated spray booth with designated workpiece (liquid and powder, internal working area)</b> .....	<b>73</b>
<b>D.3.3</b>	<b>Vertically ventilated segmented spray booth</b> .....	<b>73</b>
<b>D.3.4</b>	<b>Horizontally ventilated spray booth (liquid and powder)</b> .....	<b>75</b>
<b>D.3.5</b>	<b>Openings of a spray booth</b> .....	<b>76</b>
<b>D.3.6</b>	<b>Summary of air flow velocity parameters</b> .....	<b>76</b>
<b>Annex E (informative) Ignitability of water-based paint</b> .....		<b>79</b>
<b>Annex F (normative) Energy-efficiency and reduction of environmental impact</b> .....		<b>80</b>
<b>F.1</b>	<b>General</b> .....	<b>80</b>
<b>F.2</b>	<b>Spray booths for liquid coating material</b> .....	<b>80</b>
<b>F.2.1</b>	<b>Acquisition</b> .....	<b>80</b>
<b>F.2.2</b>	<b>Production</b> .....	<b>80</b>
<b>F.2.3</b>	<b>Use</b> .....	<b>80</b>
<b>F.2.3.1</b>	<b>Input</b> .....	<b>80</b>

F.2.3.1.1	Material .....	80
F.2.3.1.2	Water .....	80
F.2.3.1.3	Energy .....	81
F.2.3.2	Output .....	81
F.2.3.2.1	Emissions to air .....	81
F.2.3.2.2	Waste .....	81
F.2.3.2.3	Noise .....	81
F.2.4	End of life .....	82
F.3	Spray booths for powder coating .....	82
F.3.1	Acquisition .....	82
F.3.2	Production .....	82
F.3.3	Use .....	82
F.3.3.1	Input .....	82
F.3.3.2	Output .....	82
F.3.3.2.1	Emissions to air .....	82
F.3.3.2.2	Waste .....	82
F.3.3.2.3	Noise .....	82
F.3.4	End of Life .....	83
Annex G (informative) Examples for safety related controls .....		84
G.1	General .....	84
G.2	Interlocking of forced ventilation system with interface to spray application .....	84
Annex H (informative) Determination of the spray booth clearance time using smoke .....		86
H.1	General .....	86
H.2	Procedure .....	86
Annex I (informative) Estimation of the spray booth purge time .....		87
I.1	General .....	87
I.2	Example .....	87
Annex J (informative) Examples for ventilation of spray booths with working pits .....		89
J.1	Ventilation of working pits .....	89
J.2	Measurement of air flow velocity in working pits .....	93
Annex ZA (informative) Relationship between this European Standard and the essential requirements of Directive 2006/42/EC aimed to be covered .....		95
Bibliography .....		98