

# DIN EN ISO 5840-2:2021-05 (E)

## Cardiovascular implants - Cardiac valve prostheses - Part 2: Surgically implanted heart valve substitutes (ISO 5840-2:2021)

---

Contents	Page
European foreword .....	4
Foreword .....	5
Introduction .....	6
1 Scope .....	7
2 Normative references .....	7
3 Terms and definitions .....	7
4 Abbreviations .....	9
5 Fundamental requirements .....	10
6 Device description .....	10
6.1 General .....	10
6.2 Intended use .....	10
6.3 Design inputs .....	10
6.3.1 Operational specifications .....	10
6.3.2 Performance specifications .....	10
6.3.3 Packaging, labelling, and sterilization .....	11
6.4 Design outputs .....	11
6.5 Design transfer (manufacturing verification/validation) .....	11
6.6 Risk management .....	12
7 Design verification and validation .....	12
7.1 General requirements .....	12
7.2 In vitro assessment .....	12
7.2.1 General .....	12
7.2.2 Test conditions, sample selection, and reporting requirements .....	12
7.2.3 Material property assessment .....	12
7.2.4 Hydrodynamic performance assessment .....	12
7.2.5 Structural performance assessment .....	13
7.2.6 Design- or procedure-specific testing .....	14
7.2.7 Device MRI compatibility .....	14
7.2.8 Simulated use .....	14
7.2.9 Human factors/usability assessment .....	14
7.2.10 Implant thrombogenic and haemolytic potential assessment .....	14
7.3 Preclinical in vivo evaluation .....	14
7.3.1 General .....	14
7.3.2 Overall requirements .....	14
7.3.3 Methods .....	15
7.3.4 Test report .....	16
7.4 Clinical investigations .....	17
7.4.1 General .....	17
7.4.2 Study considerations .....	18
7.4.3 Study endpoints .....	19
7.4.4 Ethical considerations .....	20
7.4.5 Pivotal studies: Distribution of subjects and investigators .....	20

7.4.6	Statistical considerations including sample size and duration .....	21
7.4.7	Patient selection criteria .....	22
7.4.8	Valve thrombosis prevention .....	23
7.4.9	Clinical data requirements .....	23
<b>Annex A (informative) Surgical heart valve substitute hazard analysis example .....</b>		<b>28</b>
<b>Annex B (informative) In vitro procedures for testing unstented or similar valves in compliant chambers .....</b>		<b>30</b>
<b>Annex C (informative) Preclinical in vivo evaluation .....</b>		<b>32</b>
<b>Annex D (informative) Description of the surgical heart valve substitute and system .....</b>		<b>35</b>
<b>Annex E (informative) Examples of components of some surgical heart valve substitutes and systems .....</b>		<b>37</b>
<b>Annex F (informative) Guidelines for verification of hydrodynamic performance-- Pulsatile flow testing .</b>		<b>43</b>
<b>Annex G (informative) Examples of design specific testing .....</b>		<b>47</b>
<b>Annex H (informative) Fatigue assessment .....</b>		<b>49</b>
<b>Annex I (normative) Methods of evaluating clinical data against objective performance criteria .....</b>		<b>51</b>
<b>Annex J (normative) Adverse event classification during clinical investigation .....</b>		<b>52</b>
<b>Bibliography .....</b>		<b>57</b>