DIN ISO 21940-11:2023-04 (E)

Mechanical vibration - Rotor balancing - Part 11: Procedures and tolerances for rotors with rigid behaviour (ISO 21940-11:2016 + Amd 1:2022)

Contents

Page

National foreword ... 4
National Annex NA (informative) Bibliography ... 6
Foreword ... 7
Introduction ... 8
1 Scope ... 9
2 Normative references ... 9
3 Terms and definitions ... 9
4 Pertinent aspects of balancing ... 9
4.1 General ... 9
4.2 Representation of the unbalance ... 9
4.3 Unbalance effects ... 10
4.4 Reference planes for unbalance tolerances ... 10
4.5 Correction planes ... 12
4.5.1 General ... 12
4.5.2 Rotors which need one correction plane only ... 12
4.5.3 Rotors which need two correction planes ... 12
4.5.4 Rotors with more than two correction planes ... 12
4.6 Permissible residual unbalance ... 13
5 Similarity considerations ... 13
5.1 General ... 13
5.2 Permissible residual unbalance and rotor mass ... 13
5.3 Permissible residual specific unbalance and service speed ... 14
6 Specification of unbalance tolerances ... 14
6.1 General ... 14
6.2 Derivation of the unbalance tolerances ... 14
6.3 Balance quality grade G ... 15
6.3.1 Classification ... 15
6.3.2 Special designs ... 15
6.3.3 Permissible residual unbalance ... 18
6.4 Experimental evaluation ... 18
6.5 Unbalance tolerances based on bearing forces or vibrations ... 18
6.5.1 Bearing forces ... 18
6.5.2 Vibrations ... 19
6.6 Methods based on established experience ... 19
7 Allocation of permissible residual unbalance to tolerance planes ... 19
7.1 Single plane ... 19
7.2 Two planes ... 19
7.2.1 General ... 19
7.2.2 Limitations for inboard rotors ... 20
7.2.3 Limitations for outboard rotors ... 20
8 Allocation of unbalance tolerances to correction planes ... 21
8.1 General ... 21
8.2 Single plane ... 22
8.3 Two planes ... 22

9 Assembled rotors 22
9.1 General 22
9.2 Balanced as a unit 22
9.3 Balanced on component level 22

10 Accounting for errors in the verification of permissible residual unbalances 23
10.1 General 23
10.2 Unbalance tolerance 23
10.3 Combined error of unbalance measurements 23
10.4 Verification of the permissible residual unbalance 23
10.4.1 General 23
10.4.2 Unbalance readings within tolerance 24
10.4.3 Unbalance readings out of tolerance 24
10.4.4 Region of uncertainly 24

〉A1〈 11 Notification of necessary balancing information at the design stage 〉A1〈 24

Annex A (informative) Example of the specification of permissible residual unbalance based on balance quality grade G and allocation to the tolerance planes 25
A.1 Rotor data 25
A.2 Specification of U_{per} based on Formula (6) 26
A.3 Specification of U_{per} based on Figure 2 26
A.4 Allocation to tolerance planes (bearing planes) 28
A.5 Check on limitations in accordance with 7.2.2 for inboard rotors 28
A.6 Result 28

Annex B (informative) Specification of unbalance tolerances based on bearing force limits 29
B.1 General 29
B.2 Example 29
B.2.1 Assumption 29
B.2.2 Calculation 29

Annex C (informative) Specification of unbalance tolerances based on established experience 31
C.1 General 31
C.2 Similar rotors 31
C.2.1 General 31
C.2.2 Extrapolation from known rotors 31
C.2.3 Calculation 31
C.3 Dissimilar rotors 32

Annex D (informative) Rules for allocating unbalance tolerances from tolerance planes to correction planes 33
D.1 General 33
D.2 Correction planes in-between tolerance planes 33
D.3 Correction planes outside tolerance planes 34
D.4 More complex geometry 35

〉A1〈 Annex E (informative) Notification of unbalance tolerances on technical drawings 36
E.1 General 36
E.2 Example 〉A1〈 36

Bibliography 38