ISO 21940-21:2022-11 (E)

Mechanical vibration - Rotor balancing - Part 21: Description and evaluation of balancing machines

Contents

Page

Foreword vi

Introduction vii

1 Scope 1

2 Normative references 1

3 Termsanddefinitions 1

4 Capacity and performance data of the balancing machine 1
4.1 General 1
4.2 Data for horizontal balancing machines 1
4.2.1 Rotor mass and unbalance limitations 1
4.2.2 Production efficiency 2
4.2.3 Rotor dimensions 3
4.2.4 Balancing machine drive data 4
4.2.5 Torque 4
4.2.6 Type of rotor drive 5
4.2.7 Brake 5
4.2.8 Motor and controls 5
4.2.9 Speed regulation 5
4.2.10 Couple moment interference ratio, Isc 5
4.2.11 Air pressure requirements 5
4.3 Data for vertical balancing machines 5
4.3.1 Rotor mass and unbalance limitations 5
4.3.2 Production efficiency 6
4.3.3 Rotor dimensions 6
4.3.4 Balancing machine drive data 8
4.3.5 Torque 8
4.3.6 Type of drive to rotor 8
4.3.7 Brake 8
4.3.8 Motor and controls 8
4.3.9 Speed regulation 8
4.3.10 Couple moment interference ratio 8
4.3.11 Air pressure requirements 8

5 Machine features 8
5.1 Principle of operation 8
5.2 Machine arrangement 8
5.3 Measuring system 9
5.3.1 General 9
5.3.2 Unbalance indicators 9
5.3.3 Additional features 9
5.3.4 Operation of the indicating system 10
5.4 Plane separation system 10
5.4.1 Multi-plane balancing machines 10
5.4.2 Single-plane horizontal or vertical balancing machines 10
5.5 Setting and calibration of the measuring system 10
5.5.1 General 10
5.5.2 Soft-bearing machines 11

5.5.3 Hard-bearing machines 11

6 Productionefficiency 11
6.1 General 11
6.2 Time per balance cycle 12
6.3 Unbalance reduction ratio, RUR 13

7 Performance qualifying factors 14

8 Installation requirements 14

8.1 General 14
8.2 Supply requirements 14
8.3 Foundation 15

9 Proving rotors and test masses 15
9.1 General 15
9.2 Standardized proving rotors 15
9.3 User defined proving rotors 17
9.4 Test masses 17
9.4.1 General 17
9.4.2 Umar test masses 24
9.4.3 RUR test masses 25
9.4.4 Permissible test mass errors 26
9.4.5 Material 27

10 Balancemachineverificationtests 27
10.1 General 27
10.2 Requirements for evaluating balance machine performance 28
10.3 Test speed 29
10.4 Test for establishing the minimum achievable residual unbalance, Umar 29
10.4.1 General 29
10.4.2 Initial balancing machine setting 29
10.4.3 Unbalance added 31
10.4.4 Readings 32
10.4.5 Correction 32
10.4.6 Reference change 32
10.4.7 Plane setting for Umar test 32
10.4.8 Test runs 32
10.4.9 Umar evaluation 32
10.5 Test for unbalance reduction ratio, RUR 33
10.5.1 RUR tests on single-plane balancing machines 33
10.5.2 RUR tests on two-plane balancing machines 33
10.5.3 General 33
10.5.4 Test data sheet completion 36
10.5.5 Plane setting 36
10.5.6 RUR test runs 36
10.5.7 Plotting RUR test data 37
10.5.8 Evaluation 41
10.6 Test for couple moment interference on single-plane machines 42
10.6.1 Starting point 42
10.6.2 Procedure 42
10.6.3 Evaluation 42
10.7 Compensator test 42
10.7.1 Initial point 42
10.7.2 Procedure 42
10.7.3 Evaluation 43
10.8 Simplified tests 43
10.8.1 General 43
10.8.2 Simplified Umar test 43
10.8.3 Simplified RUR test 44

Annex A (informative) Information provided by the user to the balancing machine manufacturer 45

Annex B (informative) RUR limit diagrams 51

Annex C (informative) Shafts of outboard Type C proving rotors 54

Annex D (informative)Userdefinedprovingrotorsforspecialcasesincludingusingauser production part 56

Annex E (informative) Modifications to proving rotors prepared in accordance with ISO 2953 to this document 57

Annex F (informative) Optional repeatability test 59

Annex G (informative) Optional speed range test 61

Bibliography 62