ISO 14839-5:2022-08 (E)

Mechanical vibration - Vibration of rotating machinery equipped with active magnetic bearings - Part 5: Touch-down bearings

Contents

Page

Foreword v

1 Scope 1

2 Normative references 2

3 Termsanddefinitions 2

4 General structure and components 2

5 Functional targets 4
5.1 General 4
5.2 Design life 6
5.3 Clearance requirements 6
5.4 Life-cycle requirements 6

6 Touch-down bearing design considerations 7
6.1 General 7
6.2 Trigger events 7
6.2.1 Overload due to abnormal process conditions 7
6.2.2 AMB control instability 8
6.2.3 Loss of power 9
6.2.4 Failure in the AMB system 10
6.2.5 Misoperation 10
6.3 Transportation duty 10
6.3.1 General 10
6.3.2 AMBs without permanent magnets 11
6.3.3 AMBs with permanent magnets 11
6.4 Failure modes 12
6.4.1 General 12
6.4.2 Rolling element failure modes 12
6.4.3 Sliding bearing failure modes 13
6.5 Environmental factors 13
6.5.1 General 13
6.5.2 Corrosion resistance 13
6.5.3 Erosion resistance, particulate contamination 14
6.5.4 Liquid contamination 14
6.5.5 Operating temperature 14
6.5.6 Available cooling flow 14
6.6 Rotordynamic modelling considerations 14
6.6.1 General 14
6.6.2 Rotor and housing modelling requirements 14
6.6.3 Touch-down bearing soft mount design considerations 16
6.6.4 Touch-down bearing clearance design considerations 16
6.6.5 Friction between the rotor and touch-down bearing design considerations 16
6.7 Contact classification/severity 17
6.7.1 Contact duration 17
6.7.2 Types of motion 17
6.8 Control actions following touch-down bearing contact 19
6.8.1 General 19
6.8.2 AMB controller action 19

6.8.3 Plant/variable-frequency drive control actions 19

7 Designanddesignverification 19
7.1 General 19
7.2 Design process details 20
7.3 Documentation 30

8 Condition monitoring and damage estimation methods 30
8.1 General 30
8.2 Event detection and data capture 30
8.2.1 Contact detection 30
8.2.2 Contact event 30
8.3 Inspection 31
8.3.1 General 31
8.3.2 Common techniques in non-intrusive inspection 31
8.3.3 Intrusive inspection 32
8.4 Damage estimation 34
8.4.1 Event data 34
8.4.2 Inspection-based estimation 35
8.4.3 Criteria for further operation 36

9 Maintenance and life cycle factors 37
9.1 General 37
9.2 Inspection plan 37
9.2.1 General 37
9.2.2 Minimum intervention cycle 37
9.3 Interventions 37
9.3.1 Routine checks 37
9.3.2 Predicted excessive damage accumulation 38
9.3.3 Contamination 39
9.4 Maintenance actions 39
9.4.1 General 39
9.4.2 Touch-down-bearing refurbishment 39
9.4.3 Touch-down bearing replacement 40
9.5 Life-cycle factors 41
9.5.1 General 41
9.5.2 Spare part management 41
9.5.3 Decommissioning, recycling and disposal 42
9.5.4 Obsolescence management 42

Bibliography 43