

ISO 21940-12:2016-04 (E)

Mechanical vibration - Rotor balancing - Part 12: Procedures and tolerances for rotors with flexible behaviour

Contents		Page
Foreword		v
Introduction		vii
1	Scope	1
2	Normative references	1
3	Terms and definitions	1
4	Fundamentals of dynamics and balancing of rotors with flexible behaviour	2
4.1	General	2
4.2	Unbalance distribution	2
4.3	Mode shapes of rotors with flexible behaviour	2
4.4	Response of a rotor with flexible behaviour to unbalance	3
4.5	Aims of balancing rotors with flexible behaviour	4
4.6	Provision for correction planes	5
4.7	Coupled rotors	5
5	Rotor configurations	5
6	Procedures for balancing rotors with flexible behaviour at low speed	7
6.1	General	7
6.2	Selection of correction planes	8
6.3	Service speed of the rotor	8
6.4	Initial unbalance	8
6.5	Low-speed balancing procedures	8
6.5.1	Procedure A -- Single-plane balancing	8
6.5.2	Procedure B -- Two-plane balancing	8
6.5.3	Procedure C -- Individual component balancing prior to assembly	9
6.5.4	Procedure D -- Balancing subsequent to controlling initial unbalance	9
6.5.5	Procedure E -- Balancing in stages during assembly	9
6.5.6	Procedure F -- Balancing in optimum planes	10
7	Procedures for balancing rotors with flexible behaviour at high speed	10
7.1	General	10
7.2	Installation for balancing	10
7.3	Procedure G -- Multiple speed balancing	11
7.3.1	General	11
7.3.2	Initial low-speed balancing	11
7.3.3	General procedure	11
7.4	Procedure H -- Service speed balancing	13
7.5	Procedure I -- Fixed speed balancing	14
7.5.1	General	14
7.5.2	Procedure	14
8	Evaluation criteria	14
8.1	Choice of criteria	14
8.2	Vibration limits in the balancing machine	15
8.2.1	Overview	15
8.2.2	General	15

8.2.3	Special cases and exceptions	15
8.2.4	Factors influencing machine vibration	15
8.2.5	Critical clearances and complex machine systems	16
8.2.6	Permissible vibrations in the balancing machine	16
8.3	Residual unbalance tolerances	17
8.3.1	Overview	17
8.3.2	General	17
8.3.3	Limits for low-speed balancing	17
8.3.4	Limits for multiple speed balancing	18
9	Evaluation procedures	18
9.1	Evaluation procedures based on vibration limits	18
9.1.1	Vibration assessed in a high-speed balancing machine	18
9.1.2	Vibration assessed on a test facility	19
9.1.3	Vibration assessed on site	19
9.2	Evaluation based on residual unbalance tolerances	20
9.2.1	General	20
9.2.2	Evaluation at low speed	20
9.2.3	Evaluation at multiple speeds based on modal unbalances	20
9.2.4	Evaluation at service speed in two specified test planes	21
Annex A (informative) Cautionary notes concerning rotors when installed in-situ		23
Annex B (informative) Optimum planes balancing -- Low-speed three-plane balancing		24
Annex C (informative) Conversion factors		26
Annex D (informative) Example calculation of equivalent residual modal unbalances		27
Annex E (informative) Procedures to determine whether a rotor shows rigid or flexible behaviour ..		30
Annex F (informative) Method of computation of unbalance correction		32
Bibliography		33