

# DIN ISO 21940-12:2016-09 (E)

## Mechanical vibration - Rotor balancing - Part 12: Procedures and tolerances for rotors with flexible behaviour (ISO 21940-12:2016)

---

### Contents

	Page
National foreword .....	3
National Annex NA (informative) Bibliography .....	5
Foreword .....	8
Introduction .....	9
1 Scope .....	10
2 Normative references .....	10
3 Terms and definitions .....	10
4 Fundamentals of dynamics and balancing of rotors with flexible behaviour .....	11
4.1 General .....	11
4.2 Unbalance distribution .....	11
4.3 Mode shapes of rotors with flexible behaviour .....	11
4.4 Response of a rotor with flexible behaviour to unbalance .....	12
4.5 Aims of balancing rotors with flexible behaviour .....	13
4.6 Provision for correction planes .....	14
4.7 Coupled rotors .....	14
5 Rotor configurations .....	14
6 Procedures for balancing rotors with flexible behaviour at low speed .....	16
6.1 General .....	16
6.2 Selection of correction planes .....	17
6.3 Service speed of the rotor .....	17
6.4 Initial unbalance .....	17
6.5 Low-speed balancing procedures .....	17
6.5.1 Procedure A — Single-plane balancing .....	17
6.5.2 Procedure B — Two-plane balancing .....	17
6.5.3 Procedure C — Individual component balancing prior to assembly .....	18
6.5.4 Procedure D — Balancing subsequent to controlling initial unbalance .....	18
6.5.5 Procedure E — Balancing in stages during assembly .....	18
6.5.6 Procedure F — Balancing in optimum planes .....	19
7 Procedures for balancing rotors with flexible behaviour at high speed .....	19
7.1 General .....	19
7.2 Installation for balancing .....	19
7.3 Procedure G — Multiple speed balancing .....	20
7.3.1 General .....	20
7.3.2 Initial low-speed balancing .....	20
7.3.3 General procedure .....	20
7.4 Procedure H — Service speed balancing .....	22
7.5 Procedure I — Fixed speed balancing .....	23
7.5.1 General .....	23
7.5.2 Procedure .....	23

<b>8</b>	<b>Evaluation criteria .....</b>	<b>23</b>
8.1	Choice of criteria .....	23
8.2	Vibration limits in the balancing machine .....	24
8.2.1	Overview .....	24
8.2.2	General .....	24
8.2.3	Special cases and exceptions .....	24
8.2.4	Factors influencing machine vibration .....	24
8.2.5	Critical clearances and complex machine systems .....	25
8.2.6	Permissible vibrations in the balancing machine .....	25
8.3	Residual unbalance tolerances .....	26
8.3.1	Overview .....	26
8.3.2	General .....	26
8.3.3	Limits for low-speed balancing .....	26
8.3.4	Limits for multiple speed balancing .....	27
<b>9</b>	<b>Evaluation procedures .....</b>	<b>27</b>
9.1	Evaluation procedures based on vibration limits .....	27
9.1.1	Vibration assessed in a high-speed balancing machine .....	27
9.1.2	Vibration assessed on a test facility .....	28
9.1.3	Vibration assessed on site .....	28
9.2	Evaluation based on residual unbalance tolerances .....	29
9.2.1	General .....	29
9.2.2	Evaluation at low speed .....	29
9.2.3	Evaluation at multiple speeds based on modal unbalances .....	29
9.2.4	Evaluation at service speed in two specified test planes .....	30
<b>Annex A (informative) Cautionary notes concerning rotors when installed <i>in-situ</i> .....</b>		<b>31</b>
<b>Annex B (informative) Optimum planes balancing — Low-speed three-plane balancing .....</b>		<b>32</b>
<b>Annex C (informative) Conversion factors .....</b>		<b>34</b>
<b>Annex D (informative) Example calculation of equivalent residual modal unbalances .....</b>		<b>35</b>
<b>Annex E (informative) Procedures to determine whether a rotor shows rigid or flexible behaviour .....</b>		<b>38</b>
<b>Annex F (informative) Method of computation of unbalance correction .....</b>		<b>40</b>
<b>Bibliography .....</b>		<b>41</b>