

**10816-21-2021**

**21**

-

**(18010816-21:2015, )**

**2022**

10816-21—2021

1 « - -  
 » ( « »)  
 , 4

2 183 « , -  
 »

3 29 2021 . 1638- -

4 10816-21:2015 « .  
 . 21.  
 - » (ISO 10816-21:2015 «Mechanical  
 vibration — Evaluation of machine vibration by measurements on non-rotating parts — Part 21: Horizontal  
 axis wind turbines with gearbox», IDT).  
 ISO/TC 108 « ,  
 », SC 2 «  
 , ».

5

29 2015 . 162- « 26  
 ) « ( » 1 -  
 — « », « ».  
 ( ) «  
 ».  
 ,  
 —  
 (www.rst.gov.ru)

© ISO, 2015  
 © « », 2022

1	.....	1
2	.....	2
3	.....	2
4	.....	2
4.1	.....	2
4.2	.....	3
4.3	.....	3
5	.....	4
5.1	.....	4
5.2	.....	4
5.3	.....	4
5.4	.....	5
5.5	.....	5
5.6	.....	5
5.7	.....	6
5.8	.....	6
6	.....	7
6.1	.....	7
6.2	.....	7
6.3	.....	8
7	.....	8
8	.....	8
8.1	.....	8
8.2	.....	8
8.3	.....	9
8.4	.....	9
9	.....	9
9.1	.....	9
9.2	.....	9
( )	.....	10
( )	.....	11
( )	.....	13
.....	.....	14

10816-21—2021

10816-1.  
10816-3.

( ) —

( , , ),

10816,

10816-3.

1. ( ) ,

2. ;

3. ;

4. ;

5. ;

6. ;

7. ;

8. ;

9. ;

10. ;

11. ;

12. ;

13. ;

14. ;

15. ;

16. ;

17. ;

18. ;

19. ;

20. ;

21. ;

22. ;

23. ;

24. ;

25. ;

26. ;

27. ;

28. ;

29. ;

30. ;

31. ;

32. ;

33. ;

34. ;

35. ;

36. ;

37. ;

38. ;

39. ;

40. ;

41. ;

42. ;

43. ;

44. ;

45. ;

46. ;

47. ;

48. ;

49. ;

50. ;

51. ;

52. ;

53. ;

54. ;

55. ;

56. ;

57. ;

58. ;

59. ;

60. ;

61. ;

62. ;

63. ;

64. ;

65. ;

66. ;

67. ;

68. ;

69. ;

70. ;

71. ;

72. ;

73. ;

74. ;

75. ;

76. ;

77. ;

78. ;

79. ;

80. ;

81. ;

82. ;

83. ;

84. ;

85. ;

86. ;

87. ;

88. ;

89. ;

90. ;

91. ;

92. ;

93. ;

94. ;

95. ;

96. ;

97. ;

98. ;

99. ;

100. ;

21

-

Mechanical vibration. Evaluation of machine vibration by measurements on non-rotating parts.  
Part 21. Horizontal axis wind turbines with gearbox

— 2022—06—01

1

200 , -

: ( ) / ;

) ;

) ;

d) ;

) ( -

);

f) (

) ;

h) .

1000

3

1 —

— . [9].

10816-21—2021

[8], [13], [15].

3 — [5] [10].

**2**

ISO 2041, Mechanical vibration, shock and condition monitoring — Vocabulary ( ):  
 ISO 2954, Mechanical vibration of rotating and reciprocating machinery — Requirements for instruments for measuring vibration severity ( )

**3**

2041, [11].

3.1 : <http://www.iso.org/obD> : <http://www.electropedia.org/> (assessment acceleration)  $a_{w0}$ :

3.2 (assessment velocity)  $v_{w0}$ :

**4**

**4.1**

[16] [20].

4.2

),

( . 4.3).

$a_{w0}$

$i'_{w0}$

$a_{w0}$

$$a_{w0} = \frac{1}{V_0} \int_{V_0} J_y J_e W^{df}$$

<1)

$a_w(0)$

( . );

5.

$u_{w0}$

$a_{w0} v_{w0}$

( . [1]).  
[4].

( . )

4.3

0,1

10

10

1

( . . )

10

1000

1

10

$a_{we}$



10816-21—2021

$a_{w0}$

$a_{we}$

-

$w_e 9^1$

(2)

$$0 \stackrel{\wedge}{=} \underset{=1}{=} \cdot$$

**5**

**5.1**

.1 .2

**5.2**

**5.2.1**

( )

**5.2.2**

)

, / 2;  
, / .

— 0,1 10

— 4.3.  
0,1

0,1

**5.2.3**

)

)

)

—

.1 .2

**5.2.4**

)

( ) ;

)

(

) ;

)

**5.3**

**5.3.1**

) , / <sup>2</sup>, 0,1 10 ( -  
 0,1 — .5.2.2); , / , 10 1000 .  
 ) — 4.3.

5.3.2 :  
 ) ( . .1 -  
 ); ) ( . .2 -  
 ).

5.3.3 :  
 ) ( );  
 ) ( );  
 ) .

**5.4**

5.4.1 , :  
 ) , / <sup>2</sup>, : 0,1 10 ( -  
 0,1 — .5.2.2) 10 2000 ; 10 1000 .  
 ) , / , — 4.3.

5.4.2 , ,  
 ,  
 —  
 .1 .2 .

5.4.3 :  
 ) ( );  
 ) ( );  
 ) .

**5.5**

5.5.1 , :  
 ) , / <sup>2</sup>, 10 5000 ;  
 ) , / , 10 1000 .  
 ) — 4.3.

5.5.2 :  
 ) ;  
 ) ;  
 ) — , , ,

[21, 1].

.1 .2 .  
 5.5.3 :  
 ) ( );  
 ) ( );  
 ) .

**5.6**

;  
 ) ;  
 ) ;



— ( ) .  
— ( )  
— )

**6**

**6.1**

[20]. [2], [14]

5.8.  
1, :  
)  
)  
) ;  
d) ;  
) ( ) ;  
f) ( )  
) ( ) .

**6.2**

: ) :  
: ;  
: ;  
: ;

**D:**

1 —

2 —

( ) .

10816-21—2021

6.3

7

1000

8

8.1

( — « » « » [6]. )

8.2

25 %

1,25 ( ) -

**8.3**

-

1,25 D, -

**8.4**

-

**9**

**9.1**

[9]. -

**9.2**

-

( ) [18] [19].

[7]—[9].

10816-21—2021

( )

.1  
,  
, 1000 -  
-  
, 3  
, 5.8.  
, .1,  
-  
— .1 -  
3  
.1  
, 5.2—5.5, 5.8. -  
-

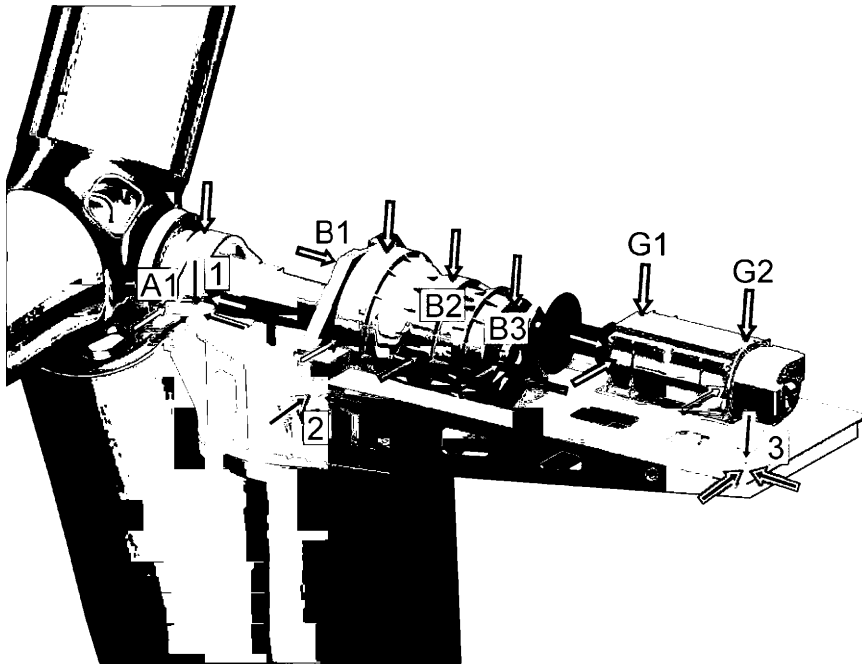
.1 —

3

	'	/, / <sup>2</sup>	/D, / <sup>2</sup>	'	/, /	/D, /
	0,1 10	0,3	0,5	0,1 10	60	100
-	0,1 10	0,3	0,5	10 1000	2,0	3,2
-	0,1 10	0,3	0,5	10 1000	3,5	5,6
	10 2000	7,5	12			
- -	10 5000	10	16	10 1000	6,0	10,0

( )

.1 .2 ( . 5).

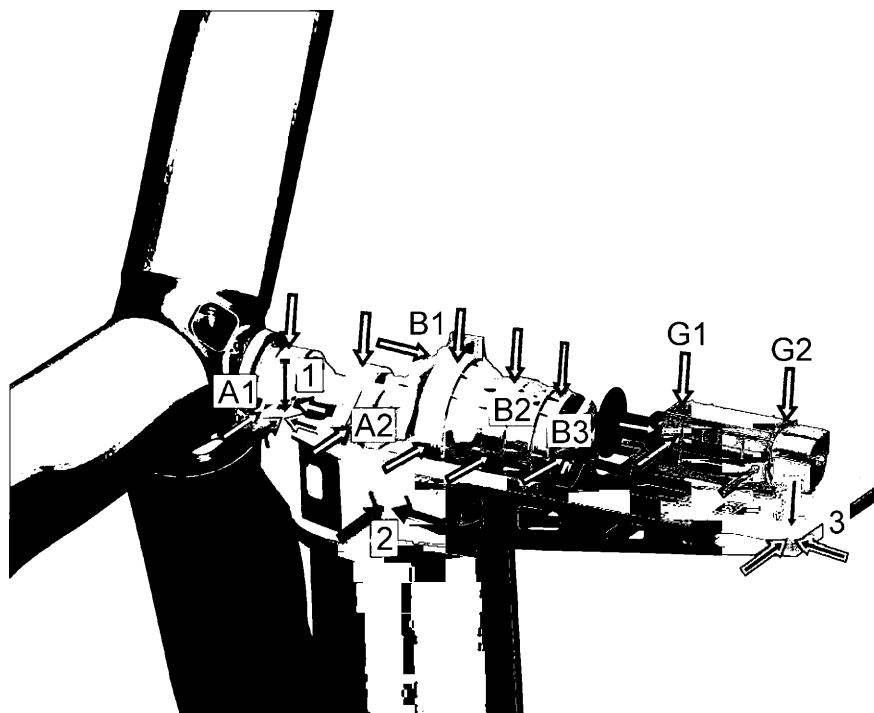


1— ; G1, G2— ; 1, 2, — ; 1— ; 2— ; 3—

.1—



10816-21—2021



1, 2 —

; G1, G2 —

; 1, 2, —  
; 1 —  
; 2 —

; 3 —

.2 —

( )

. 1

ISO 2041	IDT	2041—2012 « , » -
ISO 2954	IDT	2954—2014 « . » .
<p>— : -</p> <p>- IDT — .</p>		

## 10816-21—2021

- [1] ISO 2631-1, Mechanical vibration and shock — Evaluation of human exposure to whole-body vibration — Part 1: General requirements
- [2] ISO 4866, Mechanical vibration and shock — Vibration of fixed structures — Guidelines for the measurement of vibrations and evaluation of their effects on structures
- [3] ISO 5348, Mechanical vibration and shock — Mechanical mounting of accelerometers
- [4] ISO 8041, Human response to vibration — Measuring instrumentation
- [5] ISO 8579-2, Acceptance code for gears — Part 2: Determination of mechanical vibrations of gear units during acceptance testing
- [6] ISO 13372, Condition monitoring and diagnostics of machines — Vocabulary
- [7] ISO 13373-1, Condition monitoring and diagnostics of machines — Vibration condition monitoring — Part 1: General procedures
- [8] ISO 13373-2, Condition monitoring and diagnostics of machines — Vibration condition monitoring — Part 2: Processing, analysis and presentation of vibration data
- [9] ISO 16079 (all parts), Condition monitoring and diagnostics of wind turbines
- [10] IEC 60034-14, Rotating electrical machines — Part 14: Mechanical vibration of certain machines with shaft heights 56 mm and higher— Measurement, evaluation and limits of vibration severity
- [11] IEC 60050-415, International Electrotechnical Vocabulary — Part 415: Wind turbine generator systems
- [12] IEC 61400-4, Wind turbines — Part 4: Design requirements for wind turbine gearboxes
- [13] IEC/TS 61400-13, Wind turbine generator systems — Part 13: Measurement of mechanical loads
- [14] DIN 4150-3, Vibration in buildings — Part 3: Effects on structures
- [15] VDI 3832, Measurement of structure-borne sound of rolling element bearing in machines and plants for evaluation of state condition
- [16] VDI 3839 part 1:2001-03, Instructions on measuring and interpreting the vibrations of machines — General principles
- [17] VDI 3839 part 2, Instructions on measuring and interpreting the vibrations of machines — Vibration patterns for excitation arising from unbalance, incorrect assembly, bearing faults and damage to rotating components
- [18] Gellermann Th., & Walter G. Anforderungen an Condition-Monitoring-Systeme für Windenergieanlagen. Allianz-Zentrum für Technik, 2003
- [19] Steingrover K., & Dalhoff P. Richtlinie für die Zertifizierung von Condition-Monitoring-Systemen für Windenergieanlagen. Germanischer Lloyd Industrial Services, 2013, Available at [www.dnvgl.com](http://www.dnvgl.com)
- [20] ISO 10816-1, Mechanical vibration — Evaluation of machine vibration by measurements on non-rotating parts — Part 1: General guidelines
- [21] ISO 10816-3:2009, Mechanical\* vibration — Evaluation of machine vibration by measurements on non-rotating parts — Part 3: Industrial machines with nominal power above 15 kW and nominal speeds between 120 r/min and 15000 r/min when measured in situ

\* ISO 20816-1 «Mechanical vibration — Measurement and evaluation of machine vibration — Part 1: General guidelines».

\*\* ISO 20816-3 «Mechanical vibration — Measurement and evaluation of machine vibration — Part 3: Industrial machinery with a power rating above 15 kW and operating speeds between 120 min<sup>-1</sup> and 30000 min<sup>-1</sup>».

534.322.3.08:006.354

17.160

: , , , ,

02.12.2021. 11.01.2022. 60 \* 84<sup>1/8</sup>.  
. . . 2,79. . . 2,37.

117418  
www.gostinfo.ru info@gostinfo.ru