



**14644-9 —  
2013**

**9**

**ISO 14644-9:2012  
Cleanrooms and associated controlled environments — Part 9:  
Classification of surface cleanliness by particle concentration  
(IDT)**



2014

27 2002 . Ns 184- « - 1.0—2004 « », 8  
»

1 «  
» ( 4 )

2 184 «  
»

3 22 2013 . 1657-

4 14644-9:2012 «  
9.  
» (ISO 14644-9:2012 «Cleanrooms and associated controlled  
environments — Part 9: Classification of surface cleanliness by particle concentration»)

5

1 ) « 1.0—2012 ( 8).  
(  
», -  
« -  
» -  
».  
( )  
».  
,  
-  
(*gost.ru*)

14644-9 / 209

« 14644 ».

14644 :

- 1. ;
- 2. ;
- 0 14644-1; ;
- 3. ;
- 4. ;
- 5. ;
- 6. ;
- 7. ( , , ) ;
- ) ;
- 8. ;
- 9. ;
- 10. .

14698

« , ».

:

- 1. ;
- 2. .

9

Cleanrooms and associated controlled environments. Part 9.  
Classification of surface cleanliness by particle concentration

— 2014-12-01

1

- D.

		(SCP)	
0,05	500		
-			
-			
-			
-			
-			
-			
	/		

2

14644-6:2007  
(ISO 14644-6:2007 Cleanrooms and associated controlled environments — Part 6: Vocabulary).

« », « 1 »

( ).

3

6:2007, 14644-3.1 (descriptor for specific particle size range): (SCP)

3.2 (direct measurement method):

3.3 (indirect measurement method):

3.4 (solid surface):

3.5 (surface particle): /

3.6 SCP (surface cleanliness by particle concentration, SCP):

( )

3.7 (surface cleanliness by particle concentration class, SCP class): ( / ) ( 1 8).

3.8 SCP (surface cleanliness by particle concentration classification, SCP classification): ( / )

SCP N.

3.9 (surface particle concentration):

4

- AFM - ;
CNC - ;
EDX - ;
ESCA - ;
ESD - ;
IR ( ) - ( );
SEM - ;
SPC - ;
UV ( ) - ;
WDX -

5

5.1 SCP

( SCP)

N.

, \$ > ( / 2 ),  
 $C_{SCP10} = fc^A$ , (1)

Cjcp.o -

D ( / 2 ). \$ £

( N- SCP 1 - SCP 8), SCP N (SCP) 1 8  
 - N 10 1

D- 1, ;

1. SCP.

2.

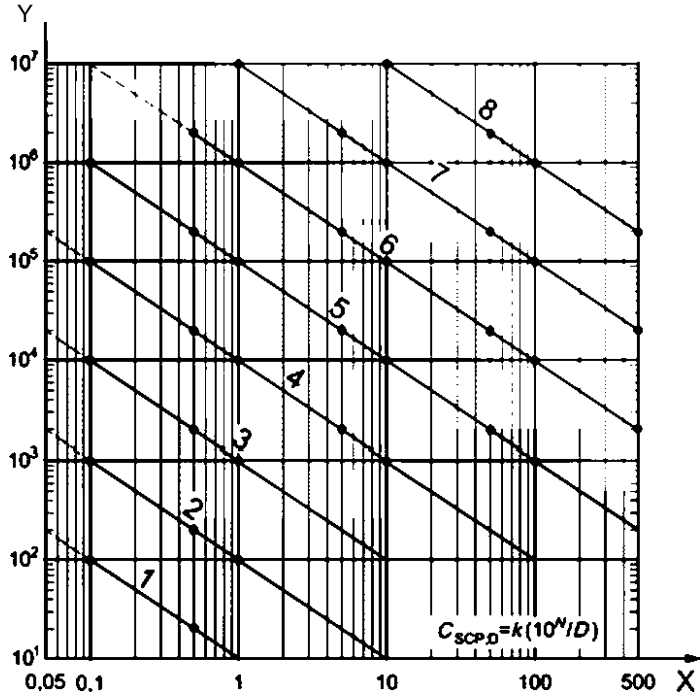
SCP \$ > (1) 1

1

1 - SCP

- / 2

SCP	0,05	.1	2 0,5	2 1	25	2 10	2 50	2 100	2 500
SCP 1	(200)	100	20	(10)					
SCP2	(2 000)	1 000	200	100	(20)	( )			
SCP3	(20 000)	10 000	2 000	1 000	(200)	(100)			
SCP4	(200 )	100 000	20 000	10 000	2 000	1 000	(200)	(100)	
SCP5		1 000 000	200 000	100 000	20 000	10 000	2 000	1 000	(200)
SCP6		(10000 000)	2 000 000	1 000 000	200 000	100 000	20 000	10 000	2 000
SCP7				10 000	2 000 000	1 000 000	200 000	100 000	20 000
SCP8						10 000	2 000 000	1 000 000	200 000
SCP	1, 1 2								
	(\$ . 0).								
	( . . ) SCP								



X -  $D, \text{ } \dots$ ; Y -  $2 D, \$, \dots / ^2,$   
 1 - SCP 1; 2 - SCP 2; 3 - SCP 3,4; 4 - SCP 4; 5 - SCP 5;  
 6 - SCP 6; 7 - SCP 7; 8 - SCP 8

SCP

SCP 5 (1)  $(D = 1)$ , SCP 5 (10)  $(D = 10)$ ,  $10^5$   
 $S 1$   $10^4$  £ 10

5.2

SCP  $N(D)$   
 SCP

- a)
- b)
- c)

SCP.

1 SCP 2 (0,1)

310  $^2$ ;

2 SCP 5 (0,5 );  
( )-

200 ;

5.3

( .2.4).

( ),  
( ).

**6**

6.1

SCP.

(6.3)

6.2

( ).

D.

( ).

( ),

6.3

SCP.

a)

-

•

-

b)

-

-

-

•

c)

-

-

•

14644-9-2013;

( , );

( , ),

( . . ) ;



d)

-

-

•

e)

-

-

-

0

-

-

-

)

-

-

-

-

-

-

-

-

-

-

-

-

-

-

-

-

-

-

-

-

-

-

-

-

-

-

-

-

-

-

-

-

-

-

-

-

-

-

-

-

-

-

-

-

-

-

-

SCP N;

( )

.1

( ),

.2

.2.1

.2.1.2

( 4287 4288).

.2.2

.2.2.1

0 1 ( 0 % 100 %).

( ) , > 50 , 2 50 , < 2

.2.2.2

( / ) ± 2 % ( )

:( )=( )-( )

( )=( )-( )

8

< 0,09

.2.3

ASTM 18-07

.2.4  
.2.4.1

(D.2.3.3.5)

.2.4.2

(IEC 61340-5-1, ISO 10015, IEST RP-CC022.2,

SEMI 43-0301, SEMI 78-0706).

.2.5  
.2.5.1

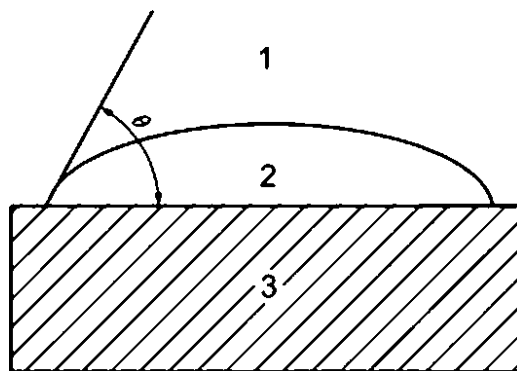
.2.5.2 ( / <sup>2</sup> ) ( / ).

( ) « » [22].

( ) 1).

( - 50)

« »



1 - ; 2 - ; 3 -  
< 90°

.1 -

( )

( )

.1

SCP.

.2

$N_a$  ( )

SCP.

$d_1$  Dy

Dy)c;b. ( .1)

$/^2$

$D_L-$   
 $Dy-$

$b-$

1:

1

5 - 10 000  $/^2$  (1,0  $/^2$ ).

(10 000; 1;5)

$N_u$

( .2).

$$\begin{matrix} /; \\ \vdots \\ \cdot \\ \backslash \dots \end{matrix} \begin{matrix} / \ll i; \\ \oplus i \\ / \end{matrix} \begin{matrix} b \\ / \end{matrix}$$

( .2)

Cji -

$D_{[i} -$   
 $Dy(-$

$b-$

2:

0,1 0,5  
9 000  $/^2$  (0,9  $/^2$ )  
10 000

500  $/^2$  (0,05  $/^2$ ).

$N/10\ 000; 0,1; 0,5 \backslash$   
"V 500; 5; 20/

$b$

$N_u(C_j D_0 Dy)$ , ( . )

$D_{[-$   
 $Dy-$

( . )

3:

5

- 200  $/^2$  (0,02  $/^2$ ).

$$N_u(20054,5:5,5) := 4zS, = 5z5$$

$$\frac{b}{\dots}$$

$$\frac{1}{\dots} \quad ( .4)$$

$$4 \quad 9 \ 000 \quad / \ ^3 \ (0,9 \quad / \ ^3) \quad 500 \quad 0.1-0,5 \quad / \ ^3 \ (0,05 \quad 5-20 \quad / \ ^3)$$

$$\frac{10 \ 000}{000: 0, \ 0,5 \backslash} \quad / \ ^3 \ 500 \quad / \ ^2$$

$$\frac{5}{20} J.$$

( )

SCP

.1

.2.

D.

.2

.2.1

-

-

-

-

-

-

-

.2.2

-

-

-

-

-

-

-

-

-

-

-

-

-

-

-

-

-

-

-

-

-

-

-

10

.2.3

-

-

-

-

-

-

-

-

-

-

-

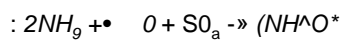
-

-

-

-

-



SCP.

.8

( D )

D.

5.

D.

D.2.1

D.2.2

D.2.3,

D.2.3

D.2.3.1

TM

( TM )

TM

D.2.3.2

TM

TM

( )

D.1.

D.1-

	>25	+	+	+	+	+	++	+	+	++	++	++
( )	>1.0	++	++	+	++	++	+	+	+	+4	++	+
( )	>0,5	++	++	+	+	++	++	+	+	++	++	++
	>0,07	++	+	-	++	++	-	-	-	++	-	++
(SEM)	>0,01	+	+	++	++	++	-	-	-	-	+	+
( )	>0,01	+	+	++	+	++	+	+	+	-	+	+
, * - ; - / : ++												

D.2.3.3  
D.2.3.3.1

( ) / ( ) / ( IEST-STD-CC1246D).



D.2.3.3.2

(  
:  
(ASTM 1216-06, ASTM F312-08);  
( ) (ASTM F24-09).  
( )  
10 %  
( 16232-2, 16232-3, 16232-4, 16232-5).

D.2.3.3.3

(D.2.7.4).  
> 3

D.2.3.3.4

(  
(0.2.7.7) (0.2.6.2, D.2.7.2);

D.2.3.3.5

( D.2)  
( > 1 )  
(  
(  
(EDX), (ESCA),

D.2 -

( / ) ( > 1 )	0.2	> 1	++	++	-	-	-	++	++	++	+	++	-
( > 0,5 )	0.2	> 1	++	++	+	++	-	+	++	++	-	++	-
( ) ( > 0,05 )	0.2	> 0.2	++	++	-	-	-	++	++	++	+	++	-
( ) ( > 0,05 )	0.3	> 0.3	++	++	-	-	-	++	++	++	+	++	-

D2

												5	
			++	-	-	-	-	++	++	++	-	++	-
( > 0,1 )													
1									++				+
2													
16232-4,	16232-5).		3	(			47	)	(	16232-2,	16232-3,		
1													

0.2.4

( , , , ), ( , 5725-2, /TS 21748, 10576-1).

D.2.5  
D.2.5.1

- a)
- b)
- c)
- d)
- e) 80 ( . d).
- f) ( . d).
- g)
- h)
- i)

j) . d. ( . f)

D.2.5.2

D.2.6  
D.2.6.1

) ( 25

D.2.6.2

( ( , , ) )

F312-08). ( , 1,0 ASTM F303-08 no ASTM

D.2.7  
D.2.7.1

D.2.7.2 (SEM) (SEM)

SEM SEM

( )

SEM

D.2.7.3 SEM (EDX)

(EDX). EDX (WDX)

D.2.7.4 ( , )

2500 (2,5 ).

0,05

(CNC).

0,005

> 0,05

( )

D.2.7.5

( )

« 1 »

D.2.7.6

( , , ).

D.2.7.7

> 0,05

( ).

D.2.7.8

- (AFM) (AFM)  
( ), 1000

0,1

( )

. AFM

D.2.7.9

( )

D.3

6.3,

( )

. 1

14644-6:2007	IDT	14644-6-2010 « 6. »
- IDT -		

- [1] ISO 4287:1997 Geometrical Product Specifications (GPS) — Surface texture: Profile method — Terms, definitions and surface texture parameters
- [2] ISO 4288:1996 Geometrical Product Specifications (GPS) — Surface texture: Profile method — Rules and procedures for the assessment of surface texture
- [3] ISO 5725-2:1994 Accuracy (trueness and precision) of measurement methods and results — Part 2: Basic method for the determination of repeatability and reproducibility of a standard measurement method
- [4] ISO 10015:1999 Quality management — Guidelines for training
- [5] ISO 10576-1:2003 Statistical methods — Guidelines for the evaluation of conformity with specified requirements — Part 1: General principles
- [6] ISO 16232-2:2007 Road vehicles — Cleanliness of components of fluid circuits — Part 2: Method of extraction of contaminants by agitation
- [7] ISO 16232-3:2007 Road vehicles — Cleanliness of components of fluid circuits — Part 3: Method of extraction of contaminants by pressure rinsing
- [8] ISO 16232-4:2007 Road vehicles — Cleanliness of components of fluid circuits — Part 4 Method of extraction of contaminants by ultrasonic techniques
- [9] ISO 16232-5:2007 Road vehicles — Cleanliness of components of fluid circuits — Part 5: Method of extraction of contaminants on functional test bench
- [10] ISO/TS 21748:2004 Guidance for the use of repeatability, reproducibility and trueness estimates in measurement uncertainty estimation
- [11] IEC 61340-5-1:2007 Electrostatics — Part 5-1: Protection of electronic devices from electrostatic phenomena — General requirements
- [12] ASTM E18-07 Standard Test Methods for Rockwell Hardness of Metallic Materials
- [13] ASTM E1216-06 Standard Practice for Sampling for Particulate Contamination by Tape Lift
- [14] ASTM F312-08 Standard Test Methods for Microscopical Sizing and Counting Particles from Aerospace Fluids on Membrane Filters
- [15] ASTM F24-09 Standard Method for Measuring and Counting Particulate Contamination on Surfaces
- [16] ASTM F303-08 Standard Practice for Sampling for Particles in Aerospace Fluids and Components
- [17] CLC/TR 61340-5-2:2008 Electrostatics — Part 5-2: Protection of electronic devices from electrostatic phenomena; User guide
- [18] IEST-RP-CC022.2-2004 Electrostatic charge in cleanrooms and other controlled environments
- [19] IEST-STD-CC1246D Product Cleanliness Levels and Contamination Control Program
- [20] SEMI E43-0301 Guide for Measuring Static Charge on Objects and Surfaces
- [21] SEMI E78-0706 Guide to Assess and Control Electrostatic Discharge (ESD) and Electrostatic Attraction (ESA) for Equipment
- [22] Adamson, A.W. Physical Chemistry of Surfaces. John Wiley & Sons, New York, 1976

14644-9 — 2013

543.275.083:628.511:006. 354

13.040.01;  
19.020

58

63 1000  
94 1000

: , , , ,

01.04.2014. 60x84%.  
. . . 2,79. 31 . . 942

« ,  
123995 , , 4.  
www.gostinfo.ru info@gostinfo.ru