HJ/T 75-2007

SO_2 NO_X

Specifications for continuous emissions monitoring of SO_2, NO_X, and particulate matter in the flue gas emitted from stationary sources

..... II
1 1
2 1
3 1
4 3
5 3
6 3
7 4
8 8
9 8
10 14
11 15
12 17
A 19
B .29
C 31
D 35
E 44
F 46
G 47
H 60

SO_2 NO_X

HJ/T 75—2007

2001 2007

——

——

—— CEMS

——

——

A C H B D E F G

HJ/T 75—2007

2017 12 29

2018 3 1

SO_2 NO_X

SO_2 NO_X LJfi me

ø

/

SO_2 NOx m" –

SO_2

NOx

GB 4208

GB 50057

CEMS

。

CEMS

CEMS

1h 45min

CEMS

CEMS

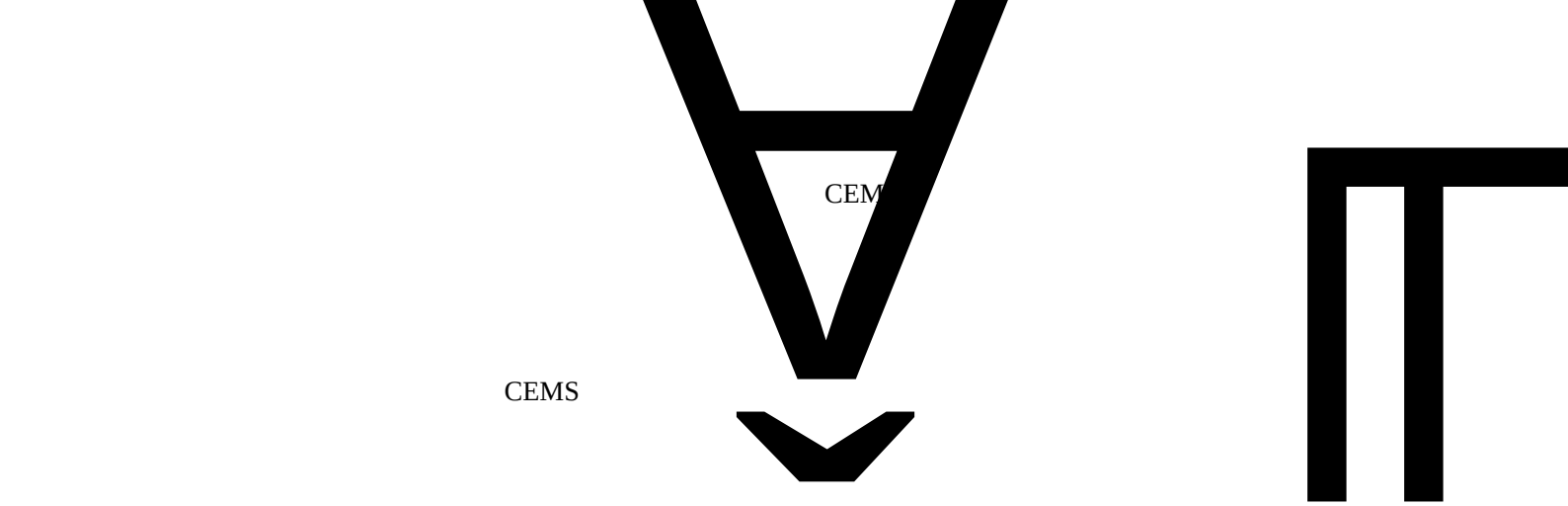
CEMS 168h CEMS

CEMS

CEMS

90%

CEMS



CEM

CEMS

CEMS

CEMS

CEMS

CEMS

CEMS

CEMS

CEMS SO_2 NO_X

C

NO_2 NO

NO NO_2 NO HJ 76

HJ 76 0

≤ 0.1μmol/mol ≥ 99.999% ≤ 400μmol/mol CEMS SO_2 NO_X O_2

≤ 1%

CEMS

CEMS 2 10A

≥ 2m ≥ 2m 1m 1.2m

≥ 2m

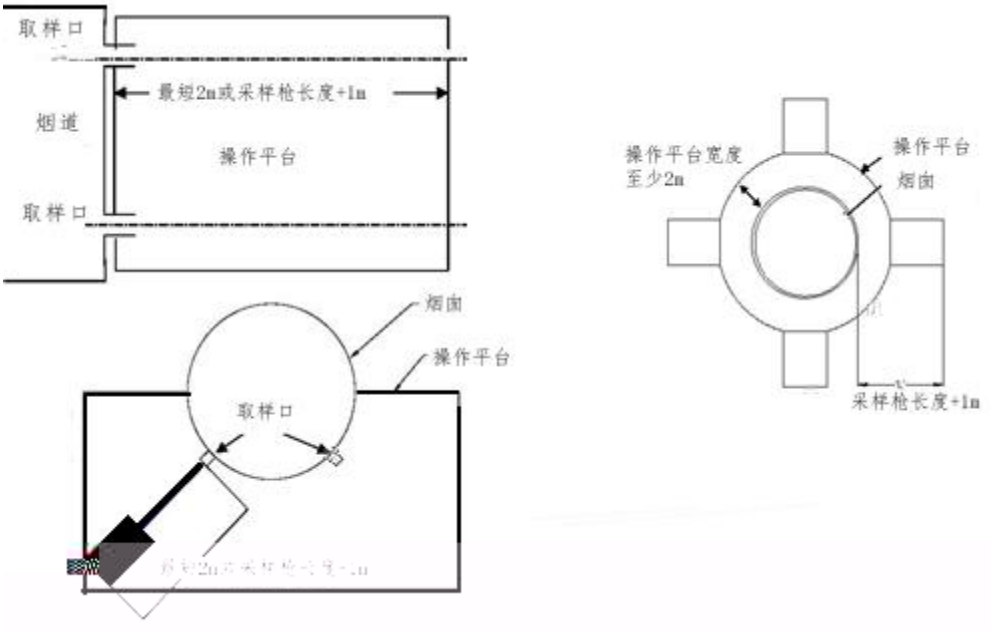
Z ≥ 0.9m

≥ 20m

CEMS 4m

4m

CEMS GB/T 16157 ≥ 80mm



1

CEMS

CMS ≥ 4

≥ 2 CEMS

≥ 2 ≥ 0.5

1

$$D \quad \frac{2AB}{A \quad B} \text{……..} \quad 1$$

D——

A

5mm

24h

1.5

GB 4208

IP24 IP54

4 mm^2

4Ω

1%

± 2

CEMS

80%　100%

50%　60%

20%　30%

3　　A　　A19　　A20

CEMS

T_1

90%

אp　T_2

T_1　T_2　　3

$$\overline{d_{vi}} \quad \frac{1}{n} \sum_{i\ 1}^{n} V_{CEMS} \quad V_i) \text{.....} \quad 5$$

$$_{ev} \quad \frac{\overline{vi}}{} \quad 100\% \quad \text{」.....} \quad \hat{O}$$

11

e)

f)

			<20μmol/mol 57mg/m³ ± 6μmol/mol 17mg/m³
			≥ 250μmol/mol 513mg/m³ ≤ 15%
			50μmol/mol 103mg/m³ ≤ <250μmol/mol 513mg/m³ ± 20μmol/mol 41mg/m³
			20μmol/mol 41mg/m³ ≤ <50μmol/mol 103mg/m³ ± 30%
			<20μmol/mol 41mg/m³ ± 6μmol/mol 12mg/m³
			≤ 15%
CMS	O_2		>5.0% ≤ 15%
			≤ 5.0% ± 1.0%
CEMS			200mg/m³ ± 15%
			100 mg/m³< ≤ 200mg/m³ ± 20%
			50 mg/m³< ≤ 100mg/m³ ± 25%
			20 mg/m³< ≤ 50mg/m³ ± 30%
			10 mg/m³< ≤ 20mg/m³ ± 6 mg/m³
			≤ 10mg/m³ ± 5 mg/m³
CMS			>10m/s ± 10%
			≤ 10m/s ± 12%
CMS			± 3
CMS			>5.0% ± 25%
			≤ 5.0% ± 1.5%
	NO_2		

	1. 95 2. 5min 3. 3 4. 99
	1. HJ/T 212 2.
	HJ/T 212 100%
	100%

CEMS CEMS

CEMS

CEMS

CEMS 7d

G G.1 G.3

CEMS CEMS

CEMS G

11 CEMS

CEMS CEMS

CEMS

CEMS

CEMS

CEMS CEMS 24h

CEMS 15d

9.3

4 CEMS

/

	CMS	6				5

صد

	N		
$\alpha \geq 90\%$	$N \leq 24$		180
	N 24		720
75% ≤ α 90%	—		2160

CEMS /

غ

CEMS CEMS 168 h

CEMS 168 h 72h

8

$$S_d \quad \frac{S_{\max}}{R} \quad 100\% \ldots\ldots \quad \text{A4}$$

S_{0i}—— i

S_i—— i

S_d——

ΔS_i—— i

$\Delta S_{\max}$——

CEMS D D.1

a.

Z_{0i} 24h Z_i

3d A1 A2 Z_d

b.

80% 100%

S_{0i} 24 h S_i

3d A3 A4 S_d

CEMS D D.3

CEMS

5

CEMS CEMS

15

$$Y \quad Y_s \quad \frac{273}{273 \quad t} \quad \frac{B_a \quad P_s}{101325} \quad (1 \quad X_{sw}) \ldots\ldots\ldots\

b_0—— A7

b_1—— A9

X—— CEMS

$$b_0 \quad \overline{Y} \quad b_1 \overline{X} \quad \text{..... A7}$$

$\overline{X}$ —— CEMS A8

$\overline{Y}$ —— mg/m^3 A8

$$\overline{X} \quad \frac{1}{n} \sum_{i\ 1}^{n} X_i \qquad \overline{Y} \quad \frac{1}{n} \sum_{i\ 1}^{n} Y_i \quad \text{..... A8}$$

X_i—— i CEMS

Y_i—— i mg/m^3

n——

$$b_1 \quad \frac{S_{xy}}{S_{xx}} \quad \text{..... A9}$$

S_{xy} S_{xx} A10

$$S_{xx} \quad \sum_{i\ 1}^{n} (X_i \quad \overline{X})^2 \qquad S_{xy} \quad \sum_{i\ 1}^{n} (X_i \quad \overline{X})(Y_i \quad \overline{Y}) \quad \text{..... A10}$$

A11 CEMS 95%

± 10%

$$CI \quad t_{df} S_E \sqrt{\frac{1}{n}} \quad \text{..... A11}$$

CI—— X 95%

$t_{df\ 1-a/2}$—— $df=n-2$ A.1 student t

S_E—— (خه

A14 CEMS 95%

75%

± 25%

$$TI \quad k_t S_E \quad \text{A14}$$

TI—— *X* 95%

k_t—— A15

S_E—— A12

$$k_t \quad u_n \; V_{df} \quad \text{A15}$$

u_n —— A.1 75% *X* $n'=n$

V_{df} —— $df=n-2$ A.1

X A16

$$TI \quad \frac{TI}{EL} \quad 100\% \quad \text{A16}$$

A17

$$r \quad \sqrt{1 \quad \frac{S_E^2}{S_y^2}} \quad \text{A17}$$

r ——

S_y—— (A18)

$$S_Y \quad \sqrt{\frac{\sum_{i\ 1}^{n} (Y_i \quad \overline{Y})^2}{n \quad 1}} \quad \text{(A18)}$$

K

CEMS D D.2

f	t_{df}	V_{df}	***n***	u_n **75**
7	2.365	1.7972	7	1.233
8	2.306	1.7110	8	1.223
9	2.262	1.6452	9	1.214
10	2.228	1.5931	10	1.208
11	2.201	1.5506	11	1.203
12	2.179	1.5153	12	1.199
13	2.160	1.4854	13	1.195
14	2.145	1.4597	14	1.192
15	2.131	1.4373	15	1.189
16	2.120	1.4176	16	1.187
17	2.110	1.4001	17	1.185
18	2.101	1.3845	18	1.183
19	2.093	1.3704	19	1.181
20	2.086	1.3576	20	1.179
21	2.080	1.3460	21	1.178
22	2.074	1.3353	22	1.177

f	t_{df}	V_{df}	n	u_n 75
23	2.069	1.3255	23	1.175
24	2.064	1.3165	24	1.174
25	2.060	1.3081	25	1.173
30	2.042	1.2737	30	1.170
35	2.030	1.2482	35	1.167
40	2.021	1.2284	40	1.165
45	2.014	1.2125	45	1.163
50	2.009	1.1993	50	1.162
$f=n-1$				

A.3.8 CEMS

CEMS

CEMS CEMS CEMS

mg/m^3

≥ 5m/s

a. 2.5 5m/s

b. 2.5m/s 2.5m/s 9

K /CEMS K

CEMS $=K\cdot$CEMS 。

c. K

a)

b) 80% 100%

c) 50% 60%

20% 30%

3

A A19 A20

SO_2 100μmol/mol

NO_X 200μmol/mol

A19

$$L_{ei} \quad \frac{\overline{C_{di}} \quad C_{si}}{C_{si}} \quad 100\% \quad \text{……} \quad \text{A19}$$

L_{ei}——

$\overline{C_{di}}$ ——

C_{si}——

i—— i

SO_2

NO_X 200μmol/m

A20

$$C_{ei} \quad \frac{\overline{C_{di}} \quad C_{si}}{\text{F.S.}} \quad 1 \quad \cdots\cdots\cdots\cdots \quad \text{A20}$$

F.S——

CEMS

T_1

90%

T_2

T_1 T_2 3 A.10

D D.4

CEMS CMS 1

5 15min

CEMS CEMS

9

3d

$$RA \quad \frac{\left|\overline{d}\right| \quad |cc|}{\overline{RM}} \quad 100\% \quad \cdots\cdots\cdots\cdots\cdots\cdots\cdots\ldots \quad \text{A21}$$

RA——

$\overline{RM}$ ——

$\overline{d}$ ——CEMS

cc—— 1

$$\overline{d_i} \quad \frac{1}{n} \sum_{i\ 1}^{n} d_i \quad \text{.....} \quad \text{A23}$$

d_i=CEMS$_i$-RM_i……..（A2

CMS

A29

$$K_V = \frac{F_s}{F_p} \frac{\overline{V_s}}{\overline{V_p}} \quad \text{……} \quad \text{A29}$$

K_v——

Fs—— m^2

Fp—— CMS m^2

$\overline{V_s}$—— m/s

$\overline{V_p}$—— CMS m/s

5

3d A30 A31

$$CV\% = \frac{S}{\overline{K_v}} 100\% \quad \text{……} \quad \text{A30}$$

$$S = \sqrt{\frac{\sum_{i=1}^{n} (\overline{K_{vi}} - \overline{K_v})^2}{n-1}} \quad \text{……} \quad \text{A31}$$

CV—— %

S——

$\overline{K_v}$——

$\overline{K_{vi}}$——

n——

CMS D D.6

CMS

3

CMS X

D D.8

CMS 1

CEMS 5

3d 8

9 D D.8

≥ 100μmol/mol 286mg/m^3
± 5%
<100μmol/mol 286mg/m^3 J

CEMS

≤ 15%

±5%

≤ 200s

CMS O_2 ± 2.5%

>5.0% ≤ 15%

≤ 5.0% ± 1.0%

±

CEMS

CEMS A.10

± 2% 1.

2.

± 2% 3.
4.

1.

2.

3.

A.10

1. CEMS (1) (2)

1.

2.

1. 2.

3.

4. CEMS

A.10 5. 6.

7.

8.

$\overline{V}_S$ C1

$$\overline{V}_S = {}_v \overline{V}_p \quad \text{……..……} \quad \text{C1}$$

K_v ——

$\overline{V}_p$ —— CMS m/s

$\overline{V}_S$ —— m/s

Qs C2

$$Q_S \quad 3600 \quad F \quad \overline{V}_S \quad \text{……..} \quad \text{C2}$$

Q_s—— m^3/h

F—— m^2

Q_{sn} C3

$$Q_{Sn} \quad Q_S \quad \frac{273}{273 \quad t_s} \quad \frac{B_a \quad P_s}{101325} \quad (1 \quad X_{SW}) \quad \text{…….(C3)}$$

Q_{sn}—— m^3/h

B_a—— Pa

P_s—— Pa

t_s——

X_{sw}——

C4

$$C \quad bx \quad a \quad \text{…….. (C4)}$$

C —— mg/ m^3 CEMS

C =x

x——CEMS

b——

a—— mg/ m^3

μmol/mol SO_2 NO NO_2 mg/ m^3

SO_2 1μmol/mol=64/22.4 mg/ m^3

NO 1μmol/mol=30/22.4 mg/ m^3

NO_2 1μmol/mol=46/22.4 mg/ m^3

C5

$$C_d \quad \frac{C_W}{1 \quad X_{SW}}$$

$$G = \overline{C} \ Q_{sn} \ 10^{-6} \quad \text{.....(C10)}$$

G—— kg/h

Q_{sn}—— m^3/h

C.3

C11 C13

$$G_d = \sum_{i=1}^{24} G_{hi} \ 10^{-3} \quad \text{……..…… C11}$$

$$G_m = \sum_{i=1}^{D_m} G_{di} \quad \text{…… C12}$$

$$G_y = \sum_{i=1}^{D_y} G_{di} \quad \text{…… C13}$$

G_d—— t/d

G_{hi}—— i kg/h

G_m—— t/

G_{di}—— i t/d .

G_y—— t/a

G_{di} —— i t/d

D_m——

D_y——

CEMS CMS C14 CO_2

$$C_{co_2} = C_{co_2 max} \left(1 - \frac{C_{O_2}}{20.9 / 100}\right)$$

CEMS

CEMS

CEMS

			(Z_0)	(Z_i)	$\Delta Z = Z_i - Z_0$	(S_0)	(S_i)	$\Delta S = S_i - S_0$	

CEMS

CEMS

CEMS

		CEMS	CEMS	%	s				
					T_1	T_2	$T=T_1+T_2$		

_____CEMS _____

_____CEMS _____

_____CEMS _____

_____ _____ _____

_____ _____ _____

		A	CEMS B	= B−A
				%

_____CMS _____
_____CMS _____
_____CMS _____
_____ _____ _____
_____CMS _____

		1	2	3	4	5	6	7	8	9	$\overline{K_{vi}}$		(%)
	CMS												
	CMS												
	CMS												
	CMS												
$\overline{\overline{K_v}}$											(%)		

_____CMS _____
_____CMS _____
_____CMS _____
_____ _____ _____
_____CMS _____

	CMS			CMS			CMS	
1			6			11		
2			7			12		
3			8			13		
4			9			14		
5			10			15		

_____CEMS _____

_____CEMS _____

_____CEMS _____

_____ _____ _____

										CEMS					
				(mg)	L	mg/m^3	m/s		%	mg/m^3	m/s		%		
mg/m^3															
(m/s)															
%															
%															
%															
% ≤ 5%															
% 5%															

	SO_2			NO_x					O_2		%
	mg/m³	mg/m³	kg/h	mg/m³	mg/m³	kg/h	mg/m³	mg/m³	kg/h	m³/h	%	%	
00~01													
01~02													
02~03													
03~04													
04~05													
05~06													
06~07													
07~08													
08~09													
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21~22													
22~23													
23~24													
t	—			—			—				—		
	×10⁴m³/d												

				SO_2			NO_X								
	mg/m³	mg/m³	t/d	mg/m³	mg/m³	t/d	mg/m³	mg/m³	t/d	×10⁴m³/d	O_2 %		%	%	
1															
2															
3															
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27															
28															
29															
30															
31															
t	—			—			—				—				
×10⁴m³/															

	SO_2	NO_x		O_2				
t/	t/	t/	$\times 10^4$ m^3/	%		%	%	

	t/	SO_2 t/	NO_x t/	$\times 10^4$ m^3/	O_2 %		%	%	
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									
t					—				
$\times 10^4 m^3/a$									

CEMS

CEMS

± 2.0%

± 2.0%

— —

≥ 250µmol/mol 513mg/m^3

≤ 15%

50µmol/mol 103mg/m^3 ≤ <250µmol/mol 513mg/m^3

± 20µmol/mol 41mg/m^3

20µmol/mol 41mg/m^3 ≤ <50µmol/mol 103mg/m^3

± 30%

<20µmol/mol 41mg/m^3

± 6µmol/mol 12mg/m^3

≤15%

± 2.5%

CEMS

CEMS

CEMS	CEMS
CEMS	CEMS

	1		
	1		
	1		
	1		
	UPS 1		
	1		
	1		
	1		
	1		
	3		
	3		
	1		
	1		
	1		
	1		
	1		
	1		
	1		
	1		
	1		
	1		
	2		
	1		
	4		
	5		

	3		
	3		
	1		
	3		
	4		
	3		
	3		
	1		
	1		
	1		
	1		
	1		
	1		

1 “ √ ” “ × ”

2 “ 1 ” 7d “ 2 ” 15d “ 3 ” 30d

“ 4 ” 90d “ 5 ” 90d 180d

	1		
	1		
	1		
	1		
	1		

1 “ √ ” “ × ”

2 “ 1 ” 7d “ 2 ” 15d “ 3 ” 30d

“ 4 ” 90d “ 5 ” 90d 180d

CEMS	CEMS
CEMS	CEMS

1

1

1

1

UPS 1

1

1

1

1

1

1

1

3

3

5

1

3

3

3

1

3

3

4

1

	1		
	1		
	1		
	1		
1 “ √ ” “ × ” 2 “ 1 ” 7d “ 2 ” 15d “ 3 ” 30d “ 4 ” 90d “ 5 ” 90d 180d			

CEMS		CEMS			
CEMS		CEMS			

SO_2

			%F.S.		
			%F.S.		

NO_X

			%F.S.		
			%F.S.		

O_2

			%F.S.		
			%F.S.		

			%F.S.		
			%F.S.		

CEMS					
CEMS					
CEMS					
	mg/m³	CEMS mg/m³	□ □		
SO_2					
	□ µmol/mol □ mg/m³	CEMS □ µmol/mol □ mg/m³	□ □ □		
NOx					
	□ µmol/mol □ mg/m³	CEMS □ µmol/mol □ mg/m³	□ □ □		

O_2

% CEMS % □
□

m/s CEMS m/s

HJ 76

“ N ” “ F ” “ St ”

“ Sd ” “ B ” “ C ”

“ M ” “ Md ” “ T ” “ D ”

N—— 45min

F—— 45min

St—— 45min

Sd—— 45min

B—— 45min

T——

C—— 15min

M—— 15min

D—— 15min

Md——

N F St Sd B T

C M D Md

F→D→M→C→T→St Sd B→N

1h

1h

HJ 76

1h

1min