

Appendix C4 Flow Accelerated Corrosion (FAC)

1. Outline of FAC

FAC is a phenomenon in which carbon steel piping is exposed to high-temperature water in a turbulent state, leading to accelerated wall thinning.

2. Thinning rate by FAC

Thinning rate is estimated by equation (1).

Thinning rate mm/y = $0.01 \times A_s$ (Shape factor) $\times T_a$ (Temperature factor) $\times O_a$ (oxygen content factor) $\times P_f$ (pH factor) $\times f_f$ (FAC case factor) $\times c_c$ (Injection and mixing factor) $\times D_L$ (Dead leg factor) ---- (1)

(1) Shape factor

Table 1 Shape factor (As)

Shape	Shape factor (As)
Reducer, Orifice, Downstream of valve	8
Bending pipe (elbow etc)	5

(2) Temperature factor

Table 2 Temperature factor (Ta)

Temperature (°C)	Temperature factor (Ta)
100 以下	1
100~125	3
125~175	10
175~225	3

(3) Oxygen factor

Table 3 Oxygen factor (Oa)

Solved oxygen in water	Oxygen factor (Oa)
Over 10ppb	1
Less than 10ppb or unknown	1.3

(4) pH factor

Table 4 pH of water and pH factor

pH of water		pH factor (Pf)
Is pH over than 9 ?	Yes	0.5
	No or unknown	1

(5) Corrosion case factor

Table 5 Factor for experience of FAC

Corrosion case	FAC case factor (ff)
No FAC occur	1
FAC has been experienced in the plant	2
FAC has been experienced on the location anticipated	3

(6) Injection and mixing factor

Table 6 Injection and mixing factor

Inspection	Factor (cc)
Effective inspection for corrosion was done at injection and mixing points	1
Thinning is possible at injection and mixing points/ No effective inspection was done.	3

(7) Dead leg factor

Table 7 Dead leg factor

Inspection	係数 DL
Effective inspection for local corrosion was done in dead leg.	1
Thinning is possible at dead leg/ No effective inspection was done.	3

3. Reference

- 1) F. Umemura, "Thinning of carbon steel piping in high temperature water (Mechanism and measures)" 38th Technical seminar, Society for Corrosion Engineer, Oct, 2005
- 2) <http://www.meti.go.jp/committee/materials/g41213aj.html>

- 3) Kupinski, M.et.al.,Pressure Vessels and Piping Codes and Standards, 338,ASME(1996)
- 4) Kastner,W.et.al.,IAEA Report : IWG-RRPC-88-1、 Vienna,1990