

[ 하수관 응집시 발생가능한 수소지연크랙 방지책 ]

2013. 6. 19

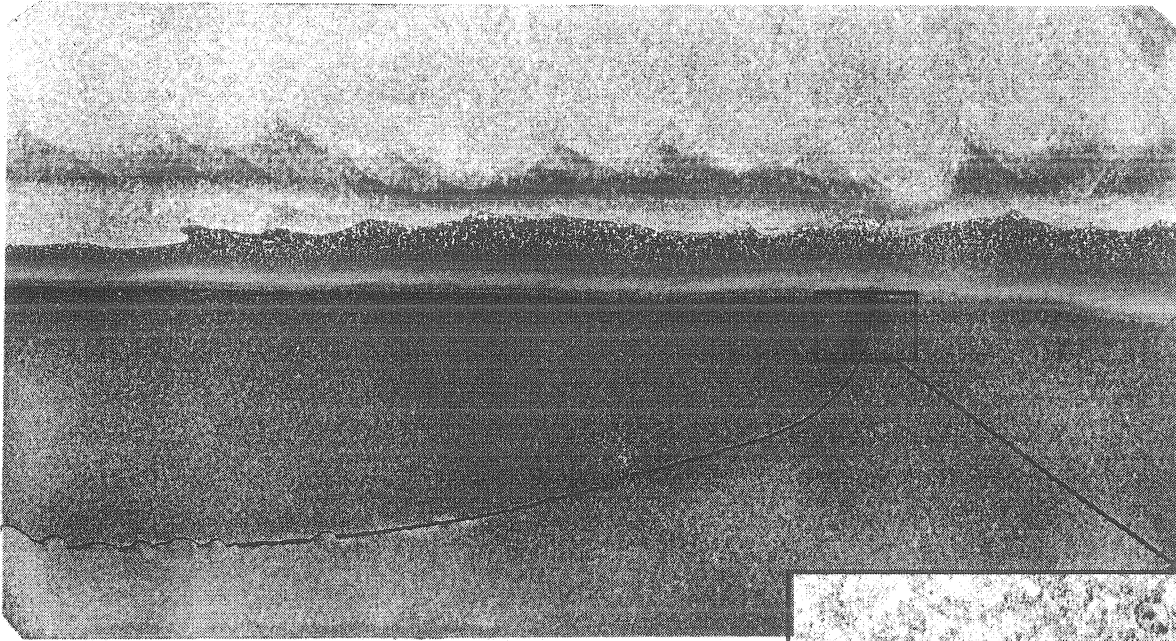
# HYDROGEN CRACKING 수소균열

3가지 요인이 있다

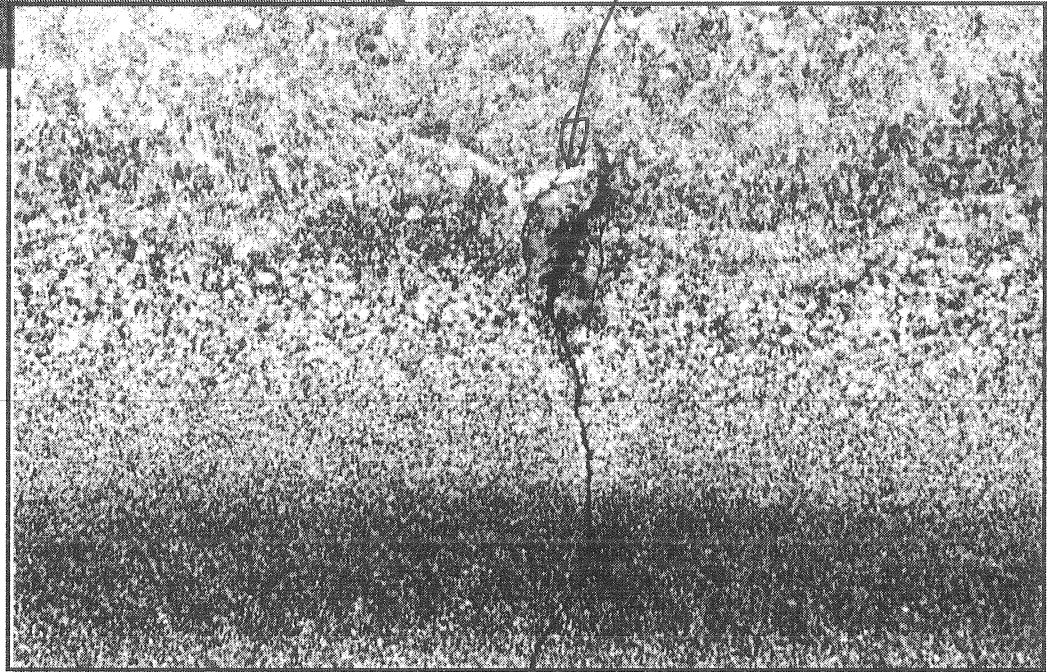
- Hydrogen — 수소에 의한 균열
- Tensile stresses — 내수응력이 의한 균열
- Sensitive microstructure — 재료의 균열 민감성

두눈자이코백  
(용래주 별사코주  
사라비)



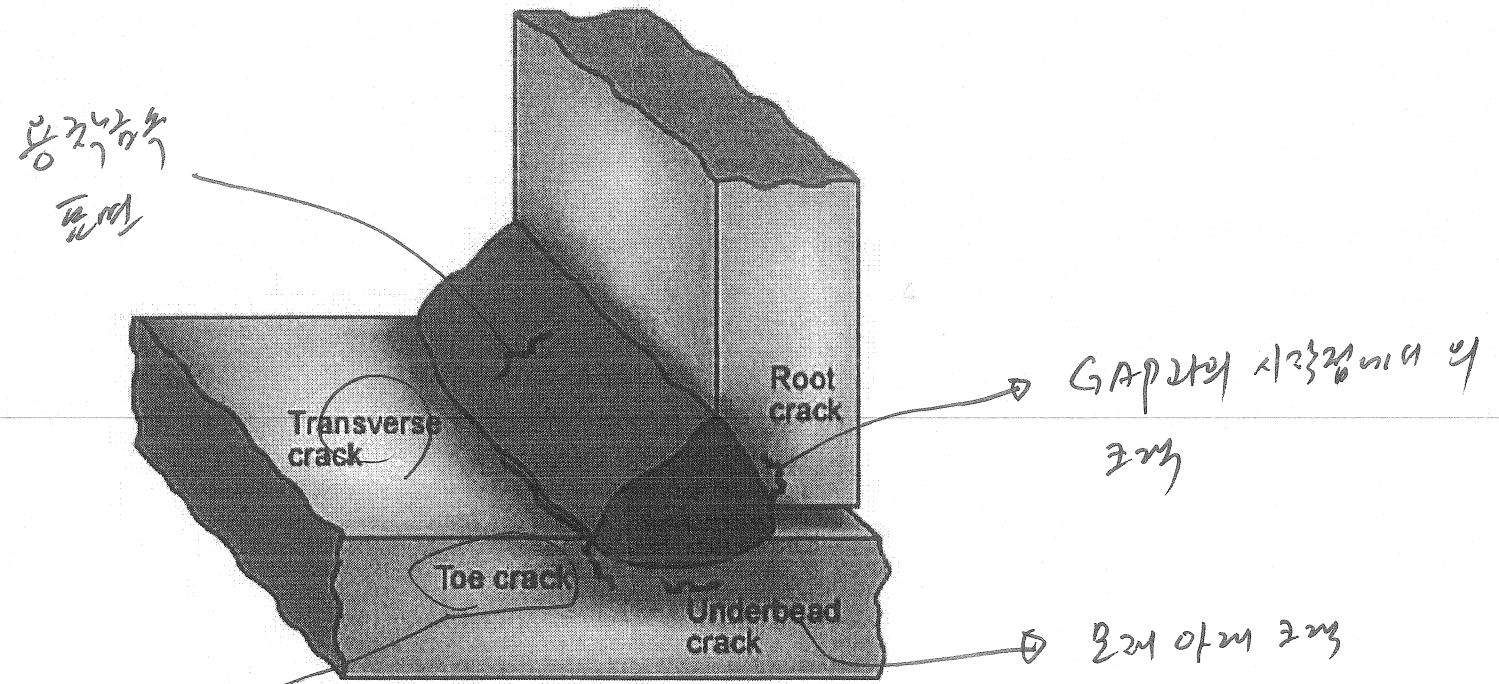


수온가늌가 원인이 되어  
크백 시작



# The risk for hydrogen cracks can *always* be minimized

Potential appearance of hydrogen cracks: 수소균열의 현상



A240-S32760-8.24  
A240-S31803-7.88



# Hydrogen cracks are avoided by... (방지와 예방)

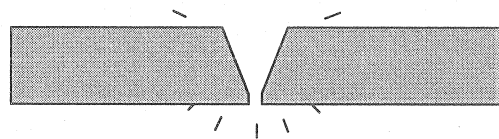
- H<sub>2</sub> 500의 경우 12T 이상은 피해야
- 예외는 175°C ~ 200°C

## 1. Preheat: Diffusion of hydrogen

	3	10	20	30	40	50	60	70	80	90	120	130
HARDOX 400				75°C		100°C	175°C			200°C		
HARDOX 450				125°C	150°C							
HARDOX 500			175°C	200°C								

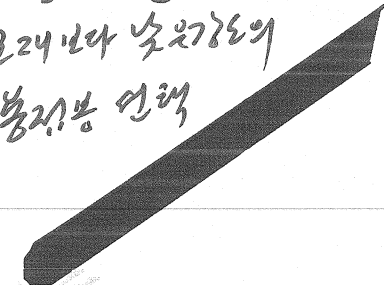
## 2. Weld preparation: Keep clean

(반드시 표면의 수기, 기름, paint 등 제거)



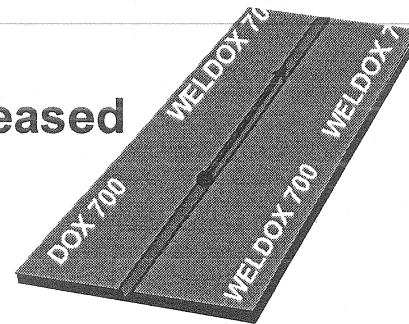
## 4. Filler material with low hydrogen content

Ⓢ 모재보다 낮은 H<sub>2</sub>의 용해능 선택



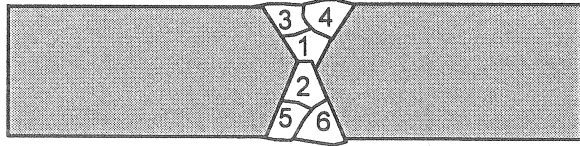
## 3. Good fit & weld sequence: Decreased distortion & residual stresses

부품의 좌우



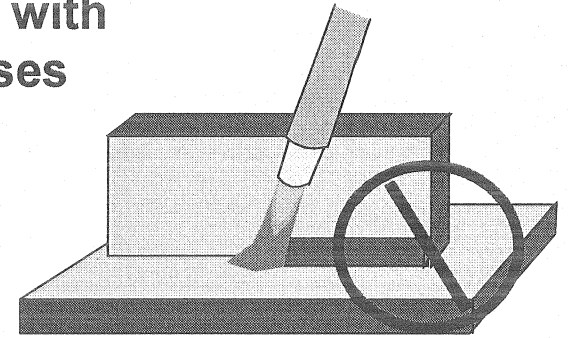
# Minimize the weld deformations and the residual stresses by... (변형 방지 중요 필요)

...balance the welding sequence  
 → decreased risk for angular distortion



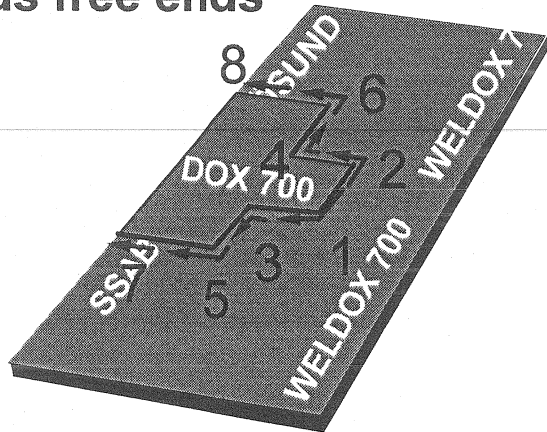
1, 2번 각 1/3씩 3, 4, 5, 6 각 1/3씩

...avoiding start & stop in corners and areas with high stresses

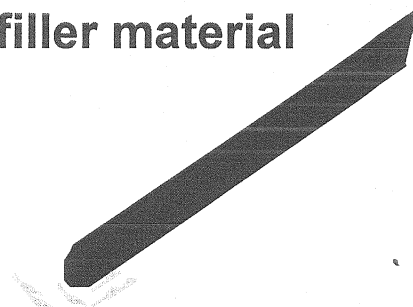


...weld towards free ends

배치



...use a ductile & low-strength filler material



연성이 좋은, 강도가 낮은  
 용접봉의 용접부  
 저수소성 ER 705-G/6

사용