

QC INTERNAL TRAINING DOCUMENT 27

# FIT UP DEFECTS

## 装配缺陷

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# **MOST COMMON STRUCTURAL FIT-UP DEFECTS**

**常见的装配缺陷**

# 缺陷清单

## DEFECTS LIST

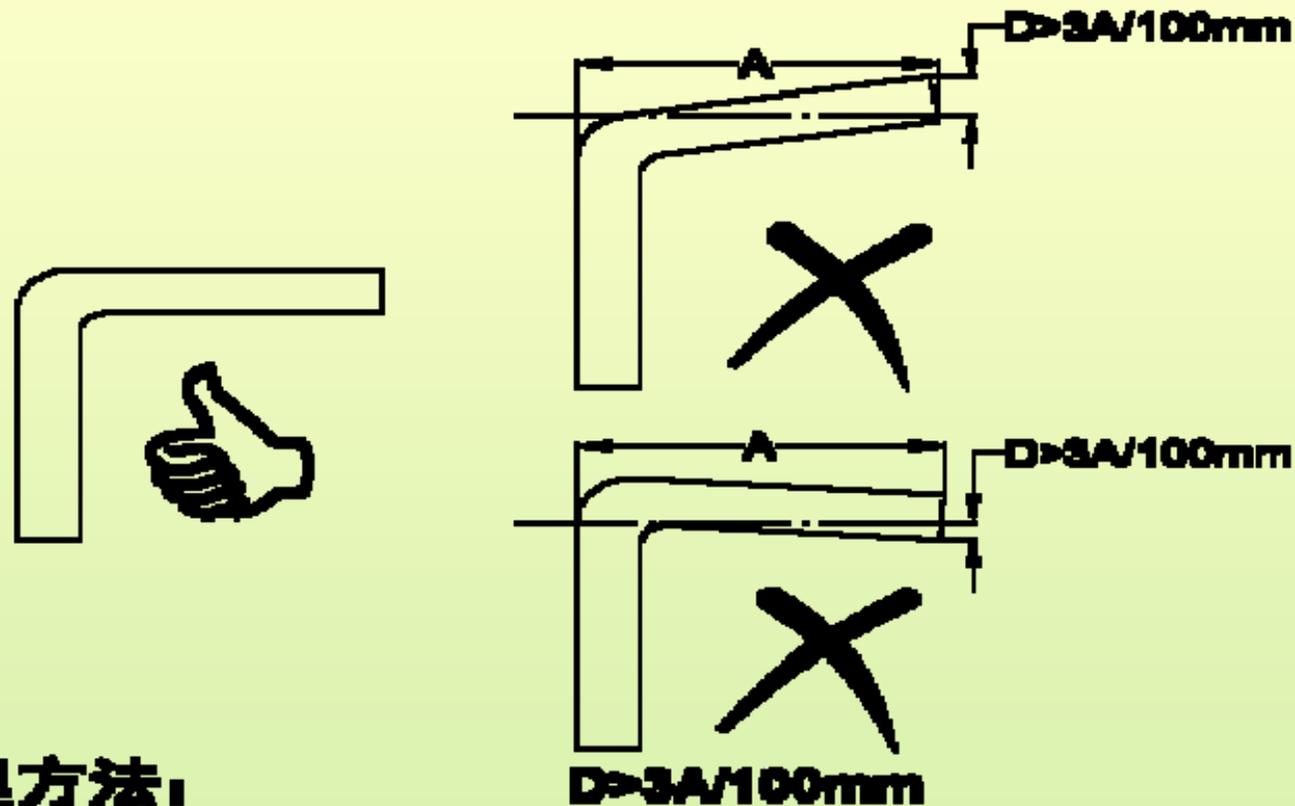
- 1 ---Angle between web and flange 面、腹板间角度
- 2 -----Straightness of web and flange 面腹板不直
- 3 -----Frame and longitudinal肋板与纵琦
- 4 -----Distortion of face plate面板变形
- 5 -----Distortion of girder 横梁变形
- 6 -----Distortion of bracket 肘板变形

- 7 ----- Snipe detail 端部削斜**
- 8 ----- Distortion for the whole length 全船变形**
- 9 ----- Bulkhead deformation 舱壁变形**
- 10 ----- Fore body cocking-up 艏部上翘**
- 11 ----- Aft body cocking-up 艉部上翘**
- 12 ----- Amidship raise 船舯底板上翘**
- 13 ----- Alignment of butt joint 对接板边对齐**
- 14 ----- Alignment of Fillet weld 十字角接对齐**
- 15 ----- Alignment of panel stiffener T形材面板对齐**
- 16 ----- Alignment of Tbar T形材对齐**

- 17 ---Alignment of panel 平板加强筋的对齐
- 18 -----Bracket gap 肘板间隙
- 19 -----Alignment of lap weld 搭接缝间隙
- 20 -----Gap between beam and frame 梁与肋的间隙
- 21 -----Position of scallop 过焊孔位置
- 22 -----Gap around stiffener cut-out 贯穿件与开孔的间隙
- 23 -----Butt & fillet dia. 对接与角接造间距
- 24 -----wrong hole  $D < 200\text{mm}$  误开孔  $D < 200\text{mm}$
- 25 -----wrong hole  $D > 200\text{mm}$  误开孔  $D > 200\text{mm}$
- 26 -----Tee fillet T形接头

- 27 ----- Single Bevel Tee 单面坡口T型角焊
- 28 ----- Single 'J' Tee 单面坡口J型角焊
- 29 ----- Double Bevel Tee Symmetrical 双面对称坡口T型角焊
- 30 ----- Double Bevel Tee Asymmetrical 双面非对称坡口T型角焊
- 31 ----- Double Vee Butt Non-Uniform Bevels 双V非对称坡口
- 32 ----- Double Vee Butt Uniform Bevels 双V对称坡口
- 33 ----- Double Bevel Butt 单V对称坡口
- 34 ----- Single Bevel Butt 单V单面坡口
- 35 ----- Square Butt 对接坡口
- 36 ----- Single vee butt one side beveling with backing strip 带衬垫的单面V型坡口
- 37 ----- Single vee butt 单面V型坡口

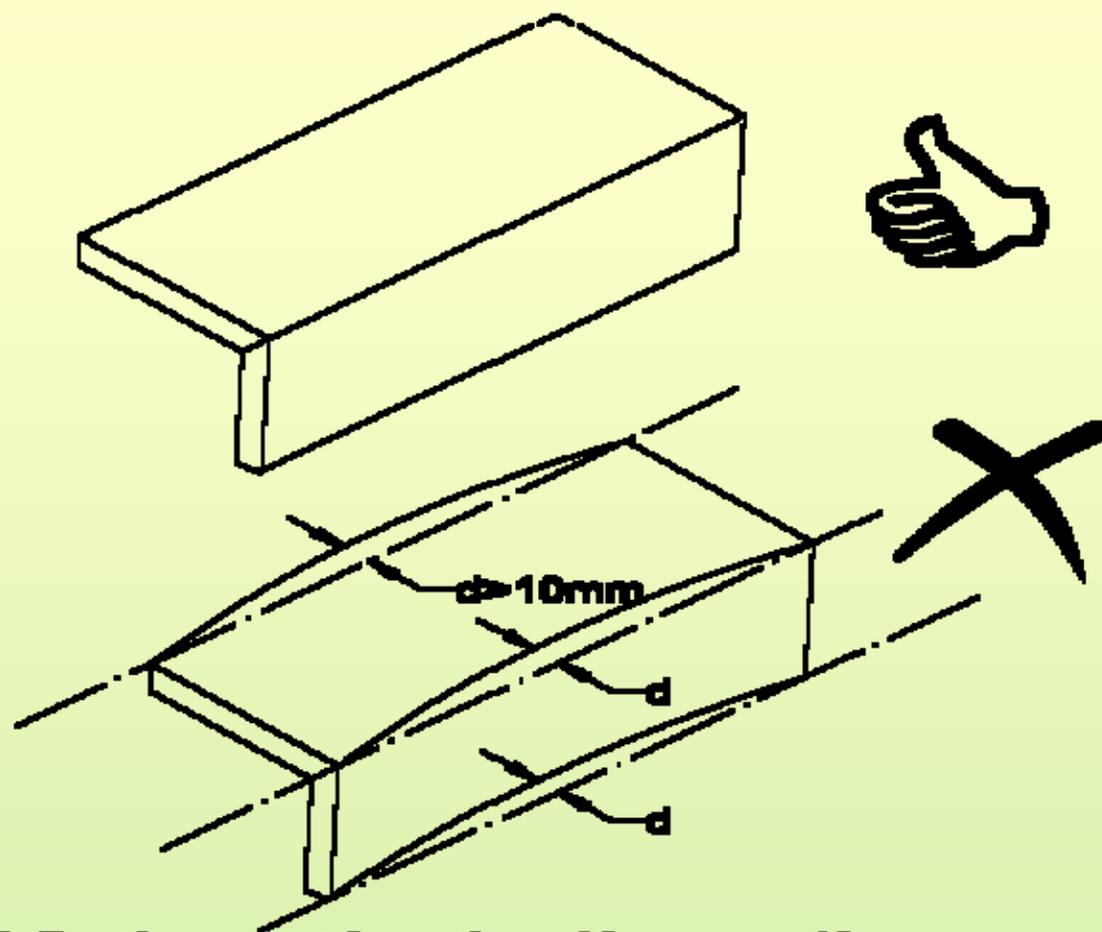
## Angle between flange and web 面板与腹板之间的角度



修理方法：  
Repair:

Fairing the angle between flange and web.  
调整面板与腹板之间的角度。

**Straightness In plane of flanges and web**  
**面板或腹板之间不直**

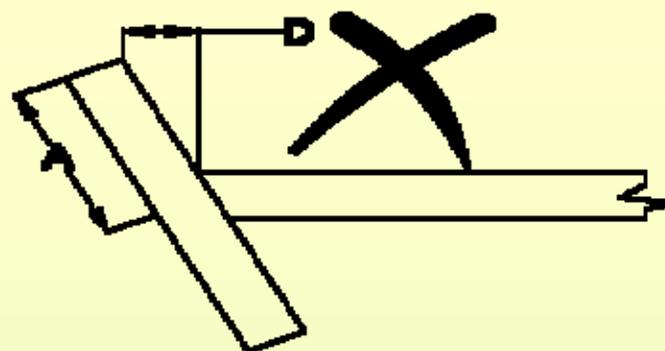
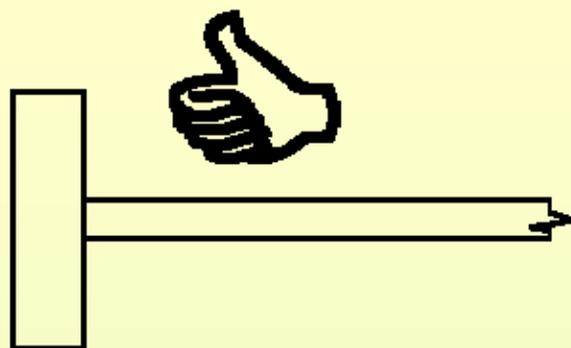


**The deflection must less than 10mm per 10m.**  
**每10米挠度不能大于10mm.**

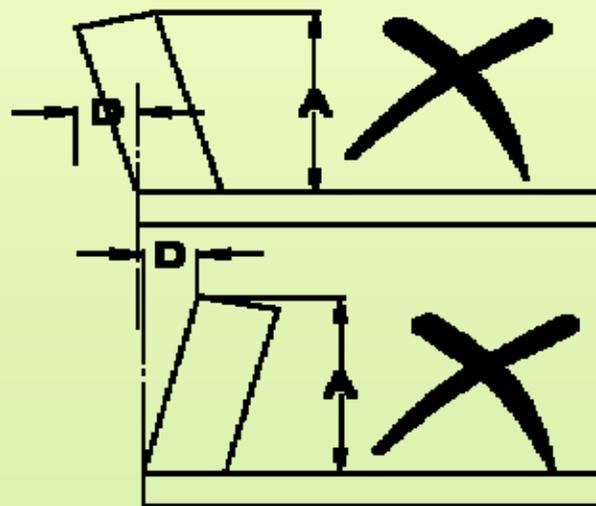
**修理方法:**  
**Repair:**

**Fabricating the member straight.**  
**校直.**

# Frame and longitudinal 肋板与纵桁



$D > 1.5A/100\text{mm}$

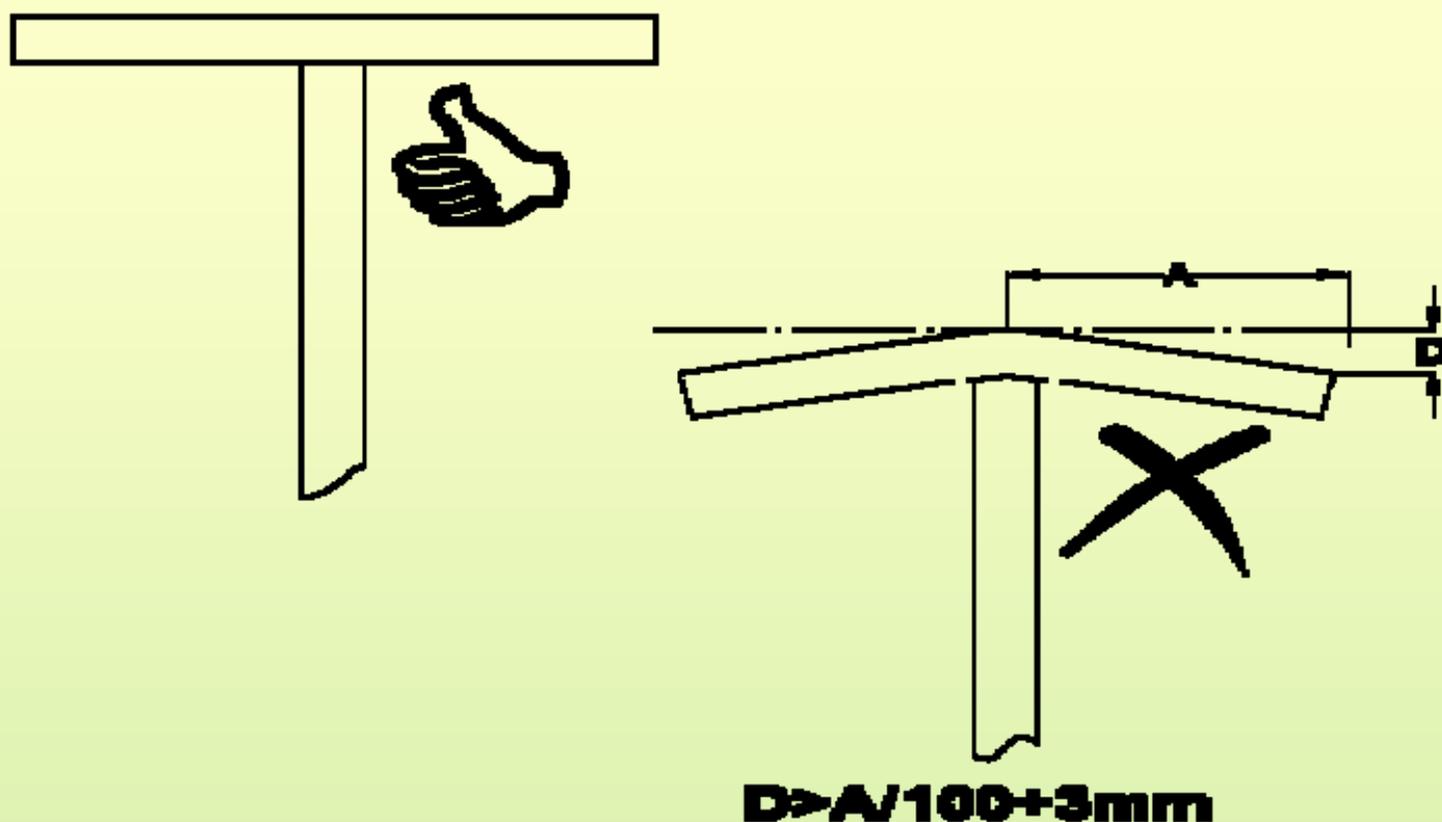


$D > 1.5A/100\text{mm}$

**修理方法:**  
**Repair:**

**Release and adjust.**  
**打开重调。**

## Distortion of face plate 面板变形

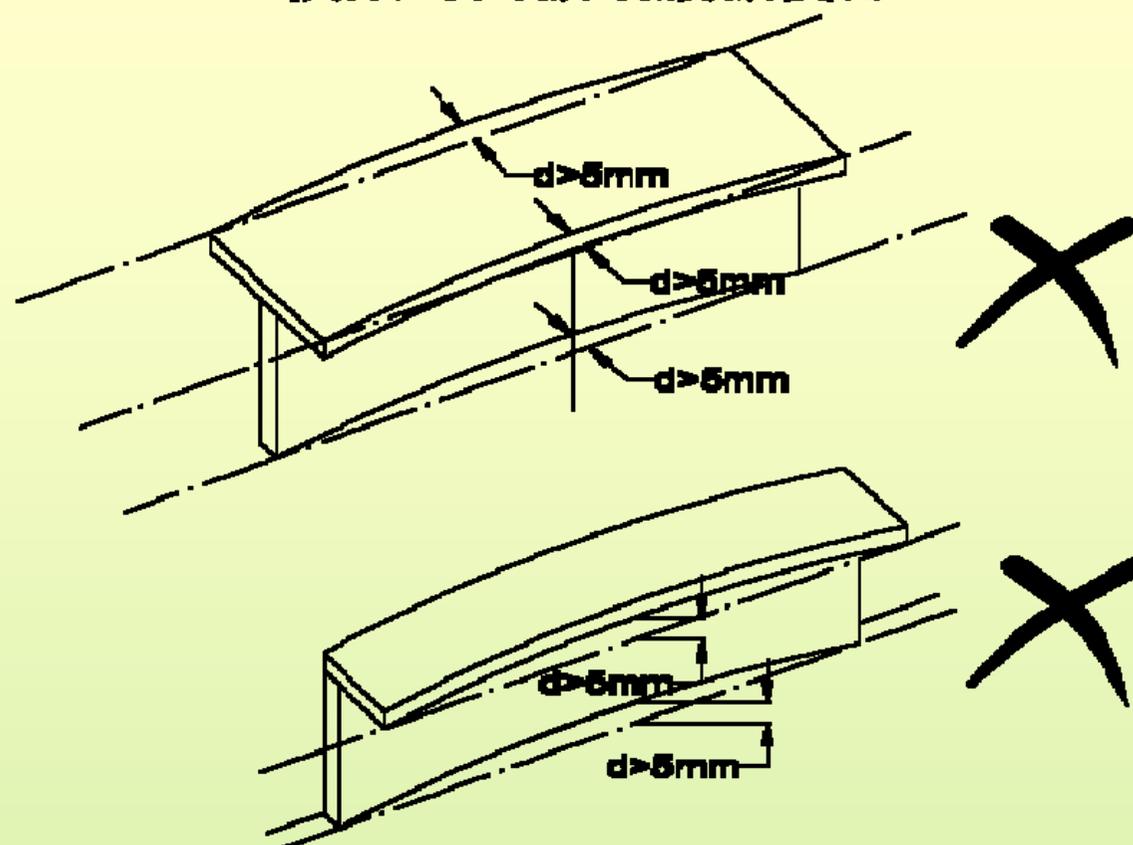


**修理方法：  
Repair:**

**Line heat fairing.  
火工调直。**

## Distortion of girder and tranverse at upper edge and flange

橫梁的面板或腹板变形



The distortion Per span between primary members must less than 5mm.

在兩主要受力构件之間的部分變形不能大於5mm。

**修理方法：**

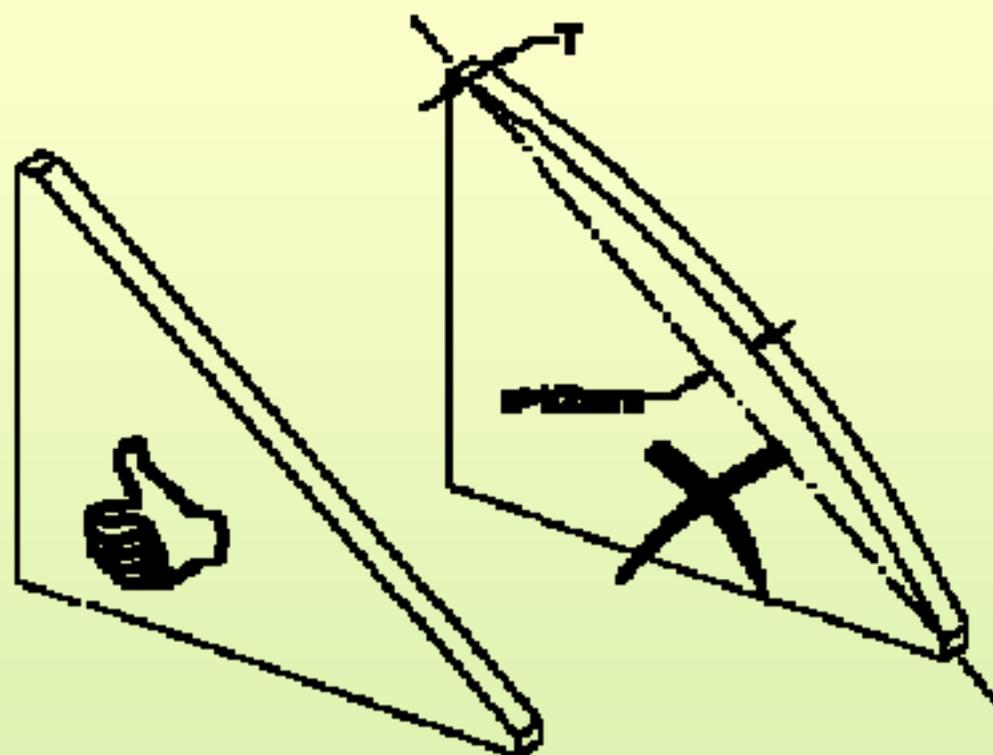
**Repair:**

**Line heat fairing.**

**火工調直。**

**Tripping bracket and small stiffener,  
distortional the part of free edge**

**肘板及小加勁筋自由边变形**



**修理方法:**

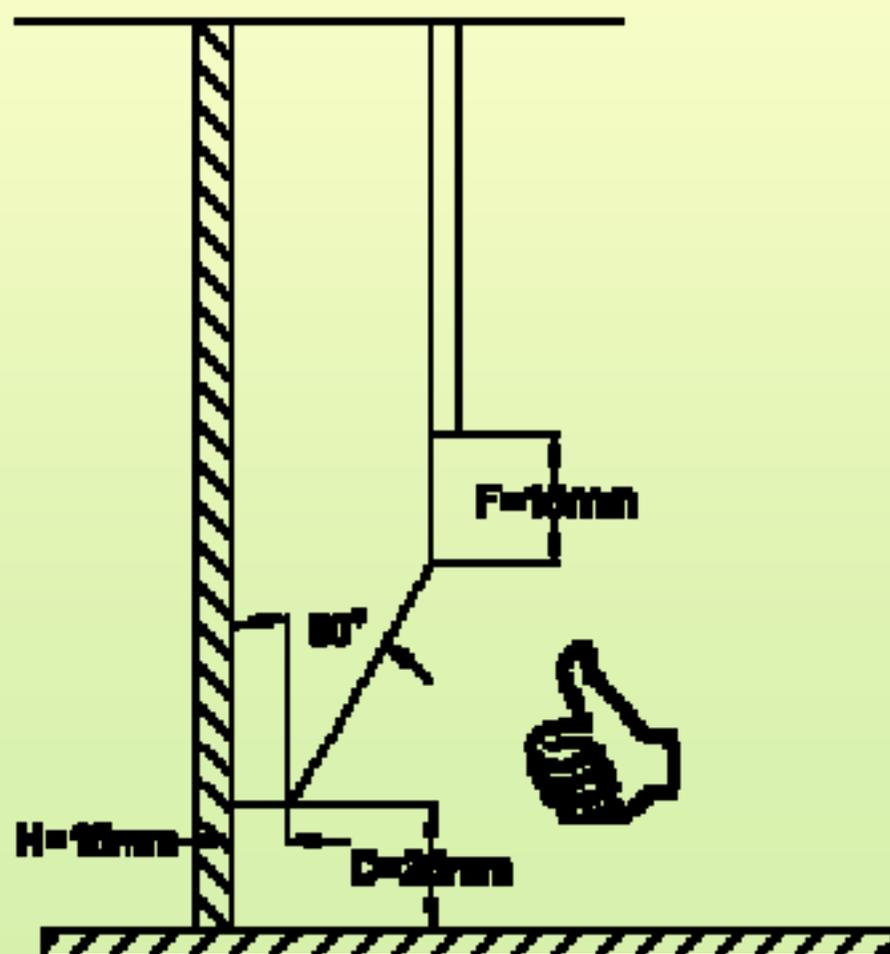
**Repair:**

**Fairing or change a new bracket.**

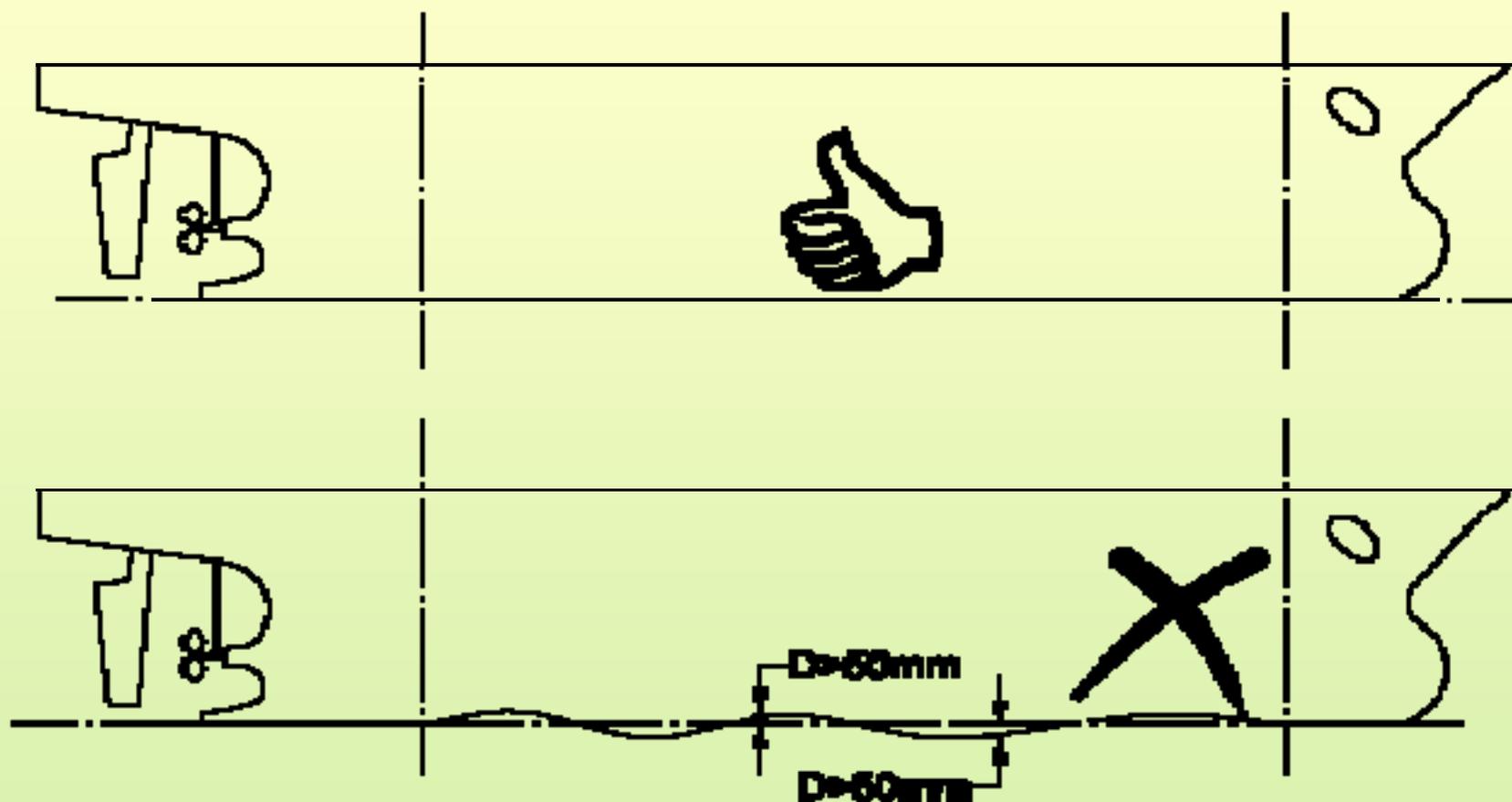
**火工调平或换一块肘板。**

## Snipe end of secondary face plates and stiffeners

### 角钢或T形材端部削斜细节

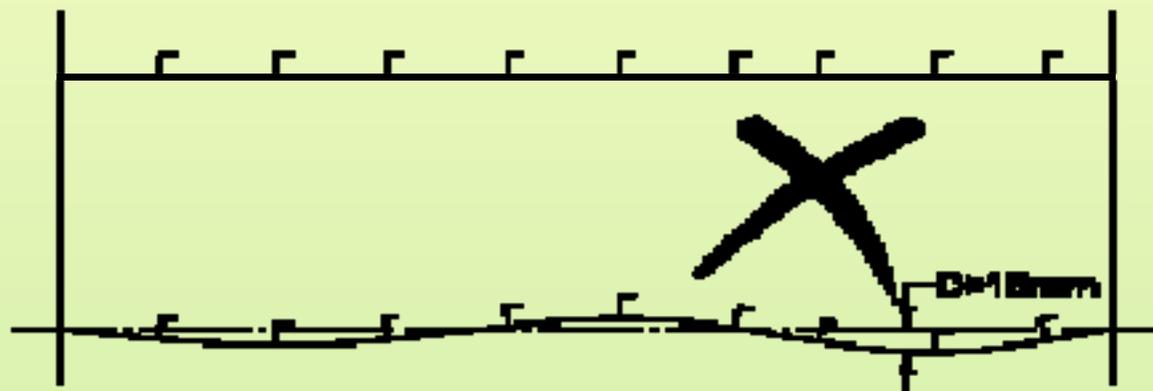
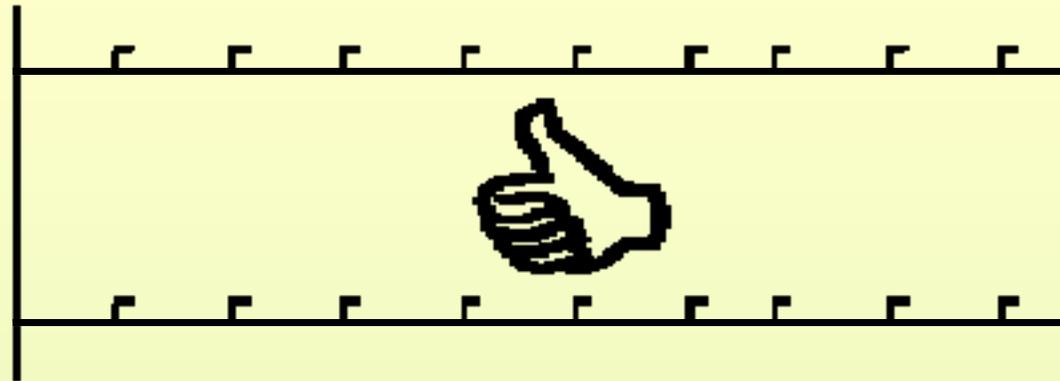


## Deformation for the whole length 整船龙骨线变形



Deformation must less than 50mm per  
100m against the line of keel sighting .  
每100米龙骨线变形不能大于50mm.

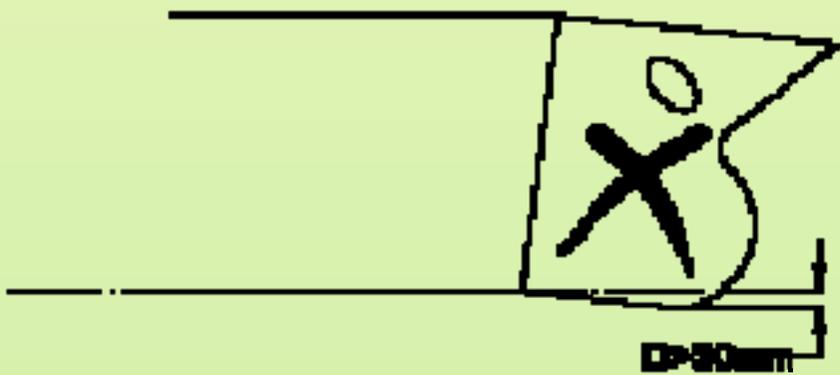
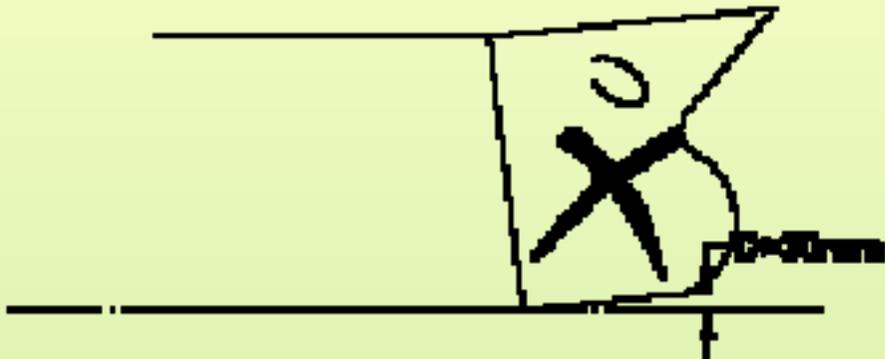
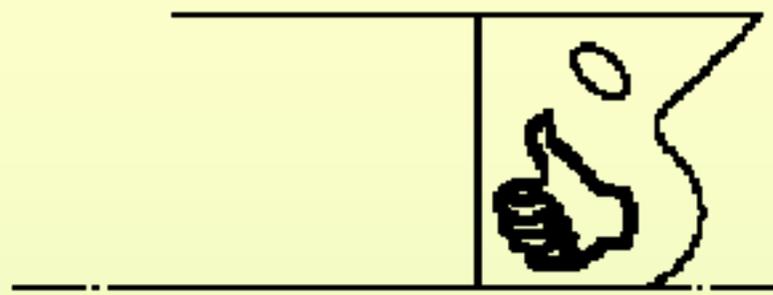
**Deformation for the distance between  
two adjacent bulkheads**  
相邻舱壁之间间距



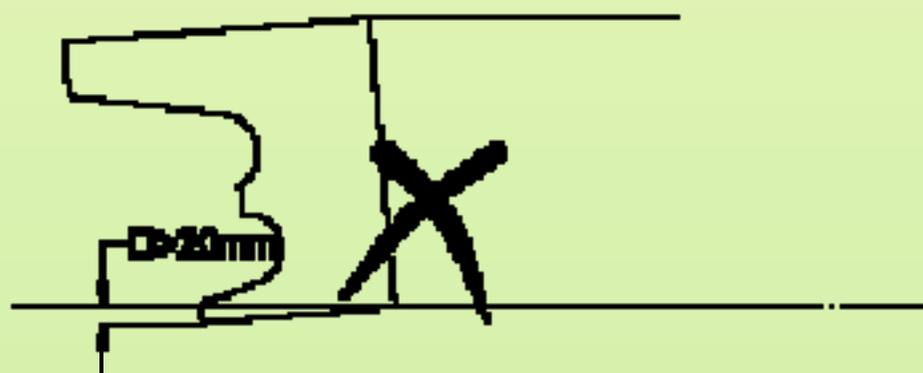
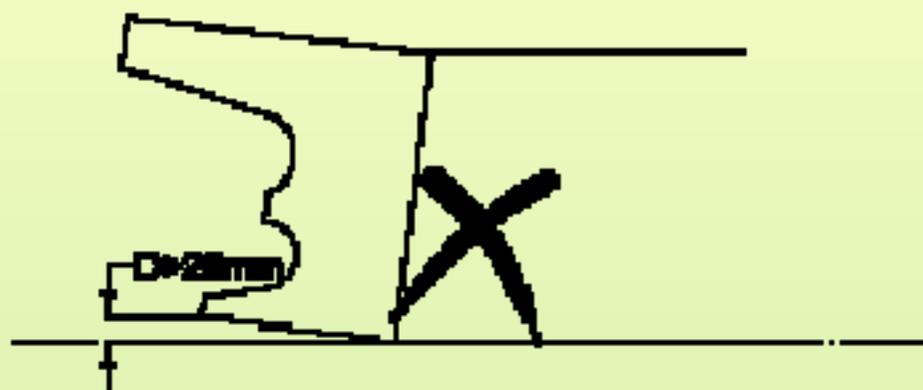
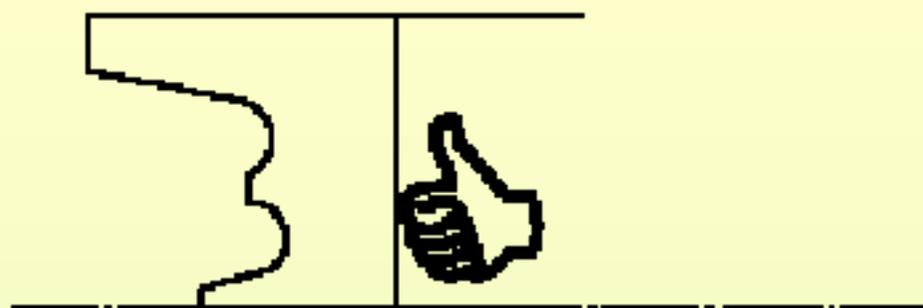
**修理方法:**  
**Repair:**

**release and adjust.**  
**打开重调.**

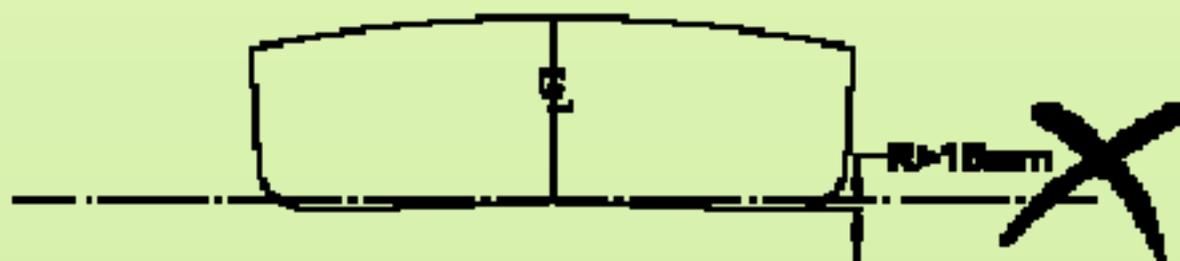
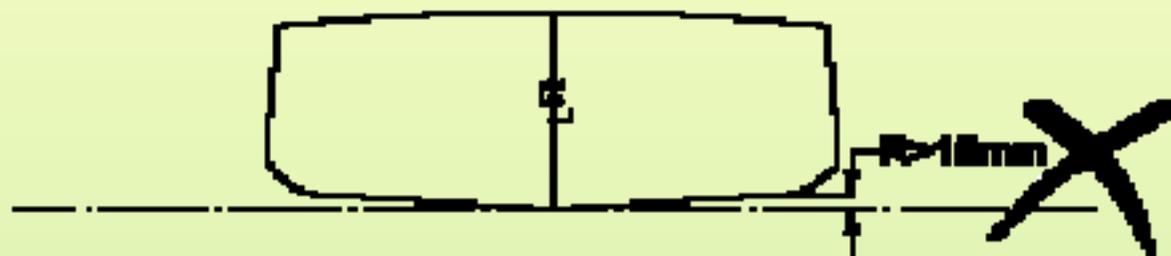
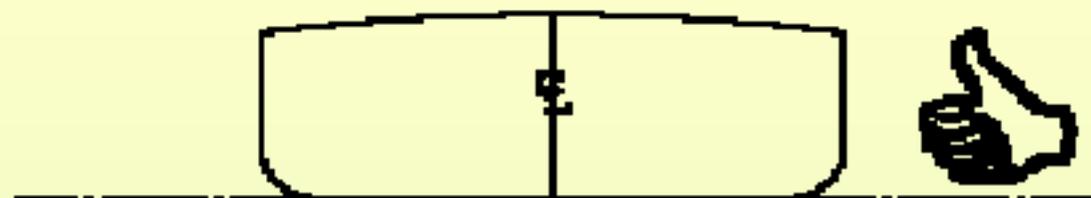
# Cocking-up of fore body 胴部上翘或下沉



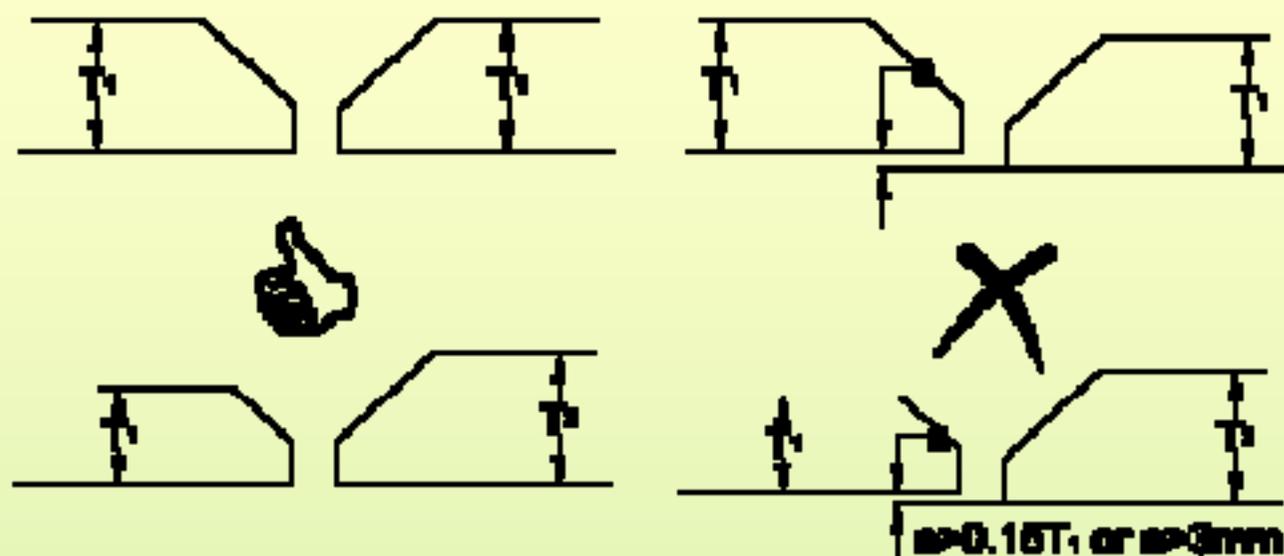
## Cocking-up of slit body 側部上翘或下沉



# Raise of floor amidship 舯部船底上翘或下沉



## Alignment of butt joint 对接板边对齐

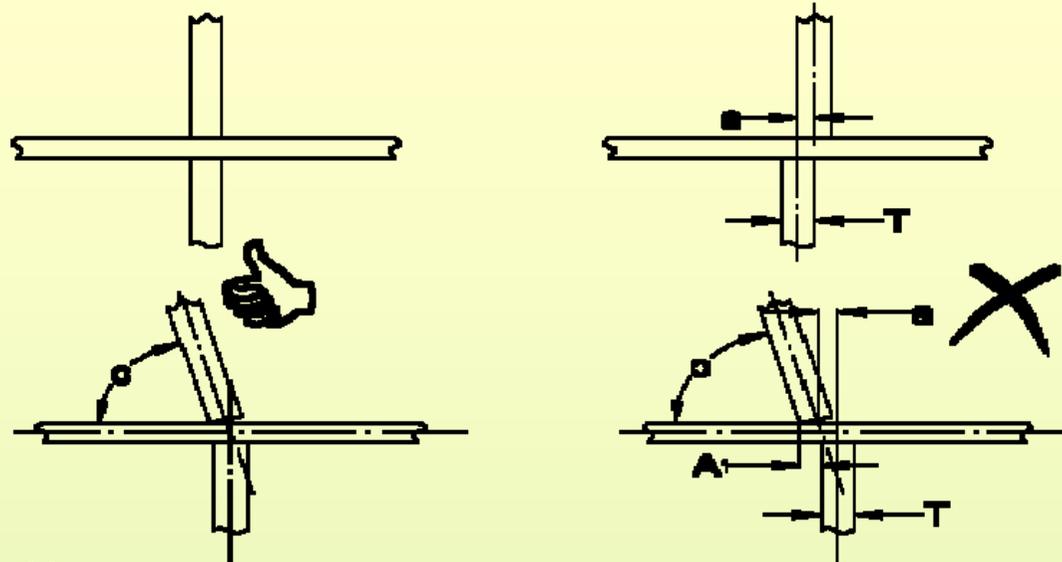


## Repair:

When  $a > 0.15T_1$ , or  $a > 3\text{mm}$ . Release  
and adjust!!!!

当  $a > 0.15T_1$ . 打开重拼!!!

## Alignment of Fillet weld 十字角接对齐



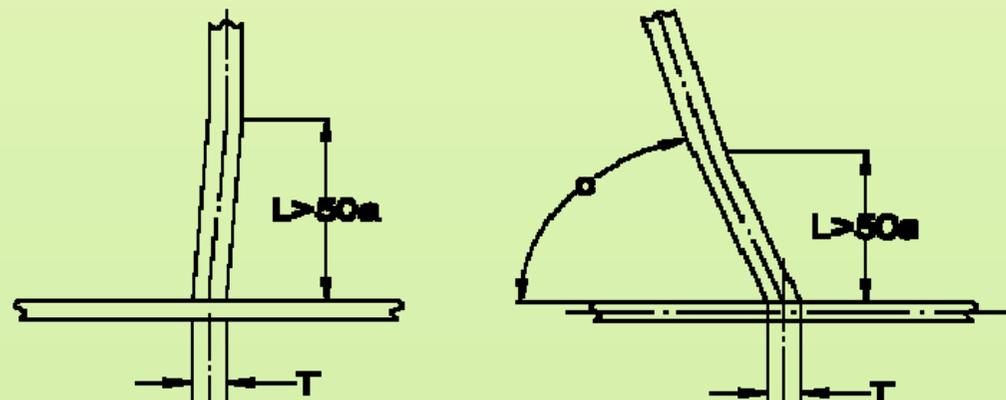
修理方法:  
Repair:

$T/3 < a < t/2$  generally increase weld throat by 10%

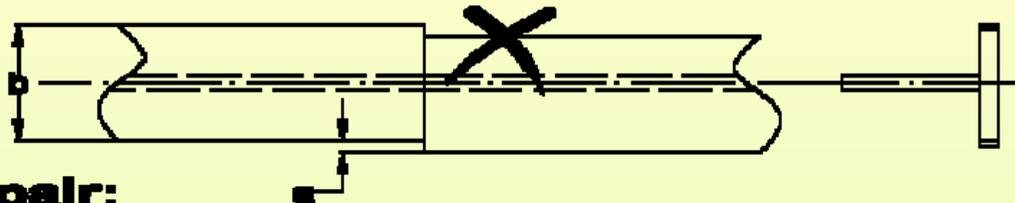
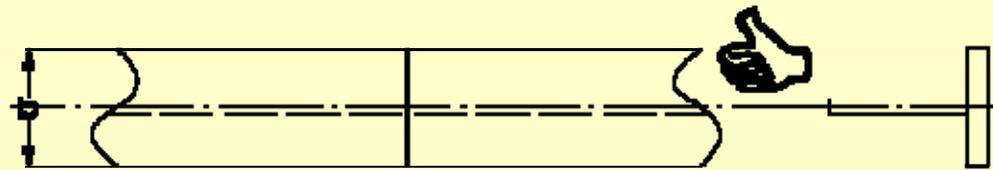
当  $T/3 < a < t/2$  焊喉尺寸增大 10%

$a > T/2$  release and adjust over a min of 50a

当  $a > T/2$  打开重拼, 调整距离大于 50a



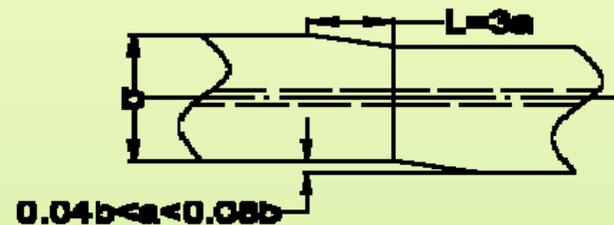
## Alignment of panel stiffener T形材面板对齐



### Repair:

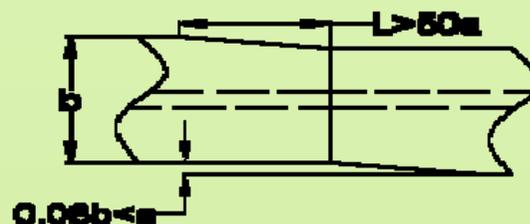
When  $0.04b < a < 0.08b$ , max 8mm grind corners to smooth taper over a min distance  $L=3a$

当  $0.04b < a < 0.08b$ , (小于 8mm) 打磨过波。  
最小过渡尺寸  $L=3a$

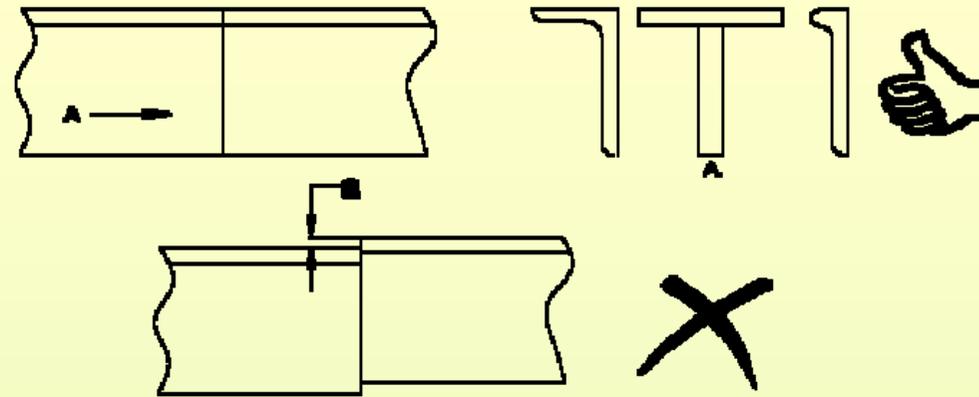


When  $0.08b < a$ , or 8mm grind corners to smooth taper over a min distance  $L=50a$

当  $0.08b < a$ , (或大于 8mm) 打磨过波。最小过渡尺寸  $L=50a$



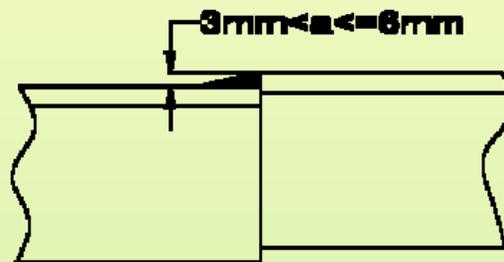
## Alignment of height of T-bar, Langle bar or bulb T型材、角钢或球扁钢对齐



### Repair:

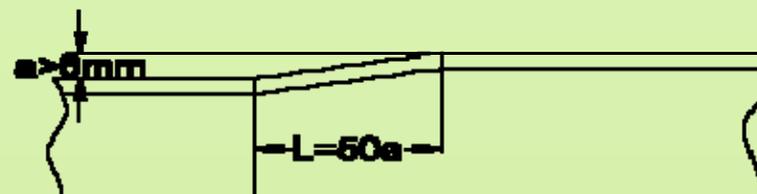
When  $3\text{mm} < a \leq 6\text{mm}$ , building up with welding.

当  $3\text{mm} < a \leq 6\text{mm}$ , 电焊长肉过渡.



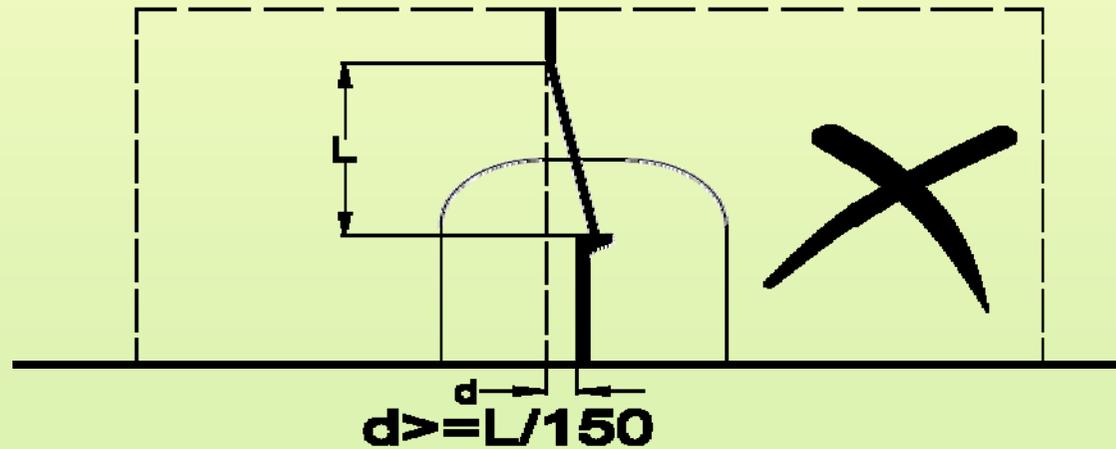
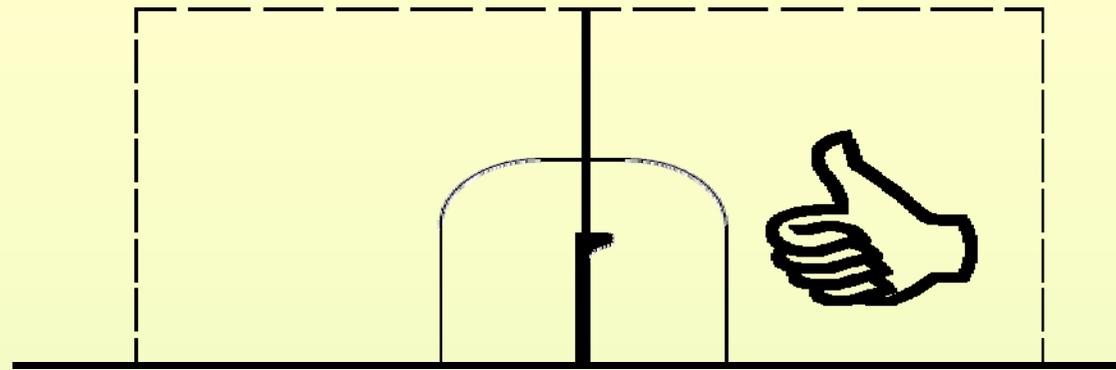
When  $a > 6\text{mm}$ . Release and adjust over min  $L = 50a$  for primary structure and  $L = 30a$  elsewhere.

当  $a > 6\text{mm}$ . 重调过度, 主要构件  $L = 50a$  其它构件  $L = 30a$ .



## Alignment of panel stiffener

### 平板加强筋的对齐



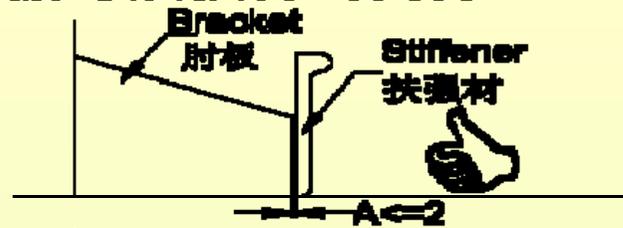
### Repair:

$A > L/150$  release and adjust

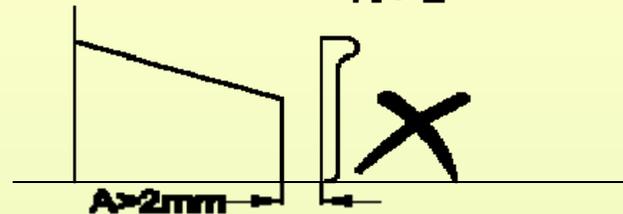
如果  $A > L/150$  则打开重调

## Gap between bracket / Intercoastal and stiffener

### 肘板与扶强材的间隙



### Repair:



when  $2\text{mm} < A < 5\text{mm}$  weld leg length to be increased by increase in gap.

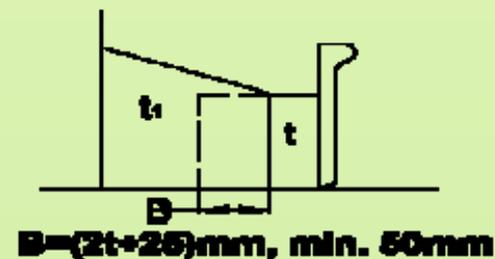
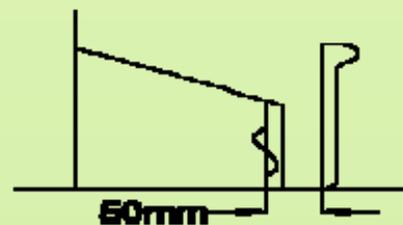
当  $2\text{mm} < A < 5\text{mm}$  焊脚尺寸增大  $(A-2)\text{mm}$ .

when  $5\text{mm} < A < 10\text{mm}$  chamfer  $30-40^\circ$  and build up with welding.

当  $5\text{mm} < A < 10\text{mm}$  将肘板开  $30-40^\circ$  坡口电焊长肉.

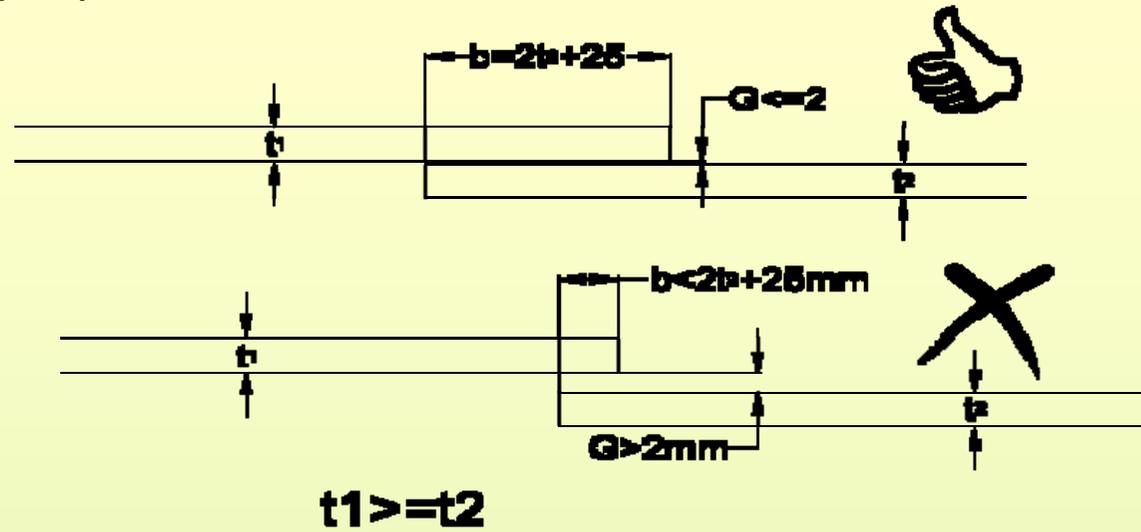
when  $A > 10\text{mm}$  increase gap to  $50\text{mm}$  and fit collar plate.

当  $A > 10\text{mm}$  切肘板将间隙增大至  $50\text{mm}$  并加一块复板.



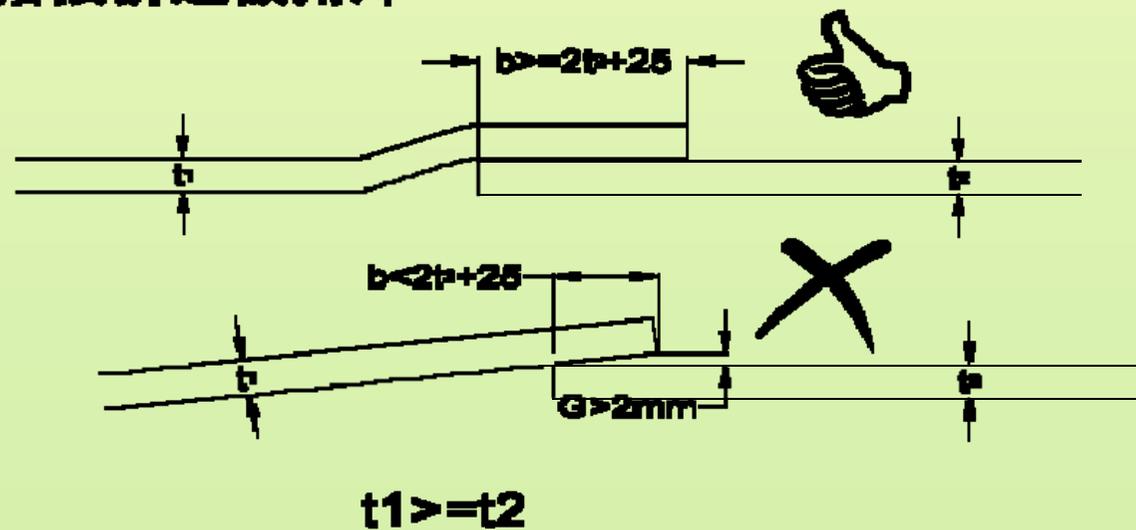
## Fillet joint In lap joint

### 搭接角焊

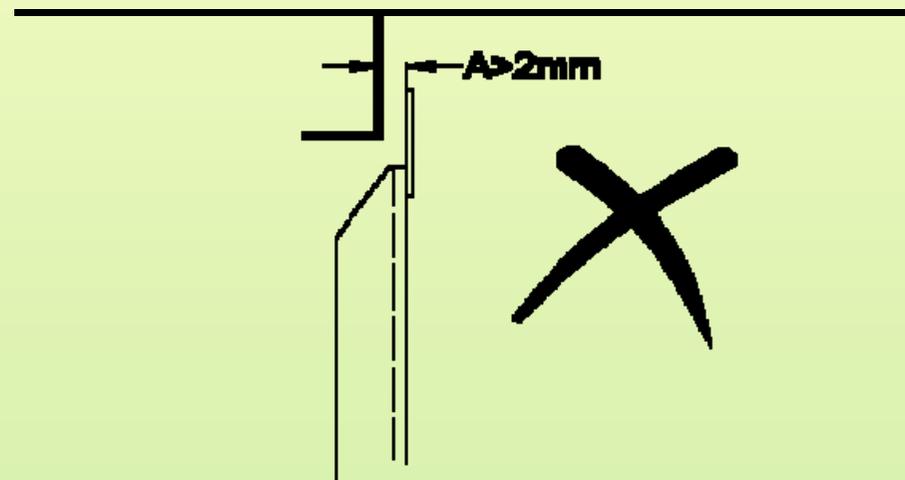
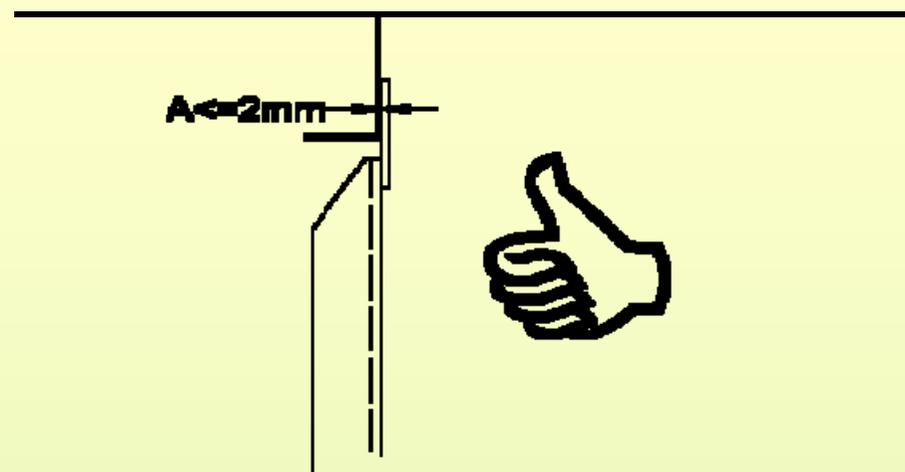


## Fillet joint In joggled joint

### 搭接折边板角焊



## Gap between beam and frame 梁与肋的间隙

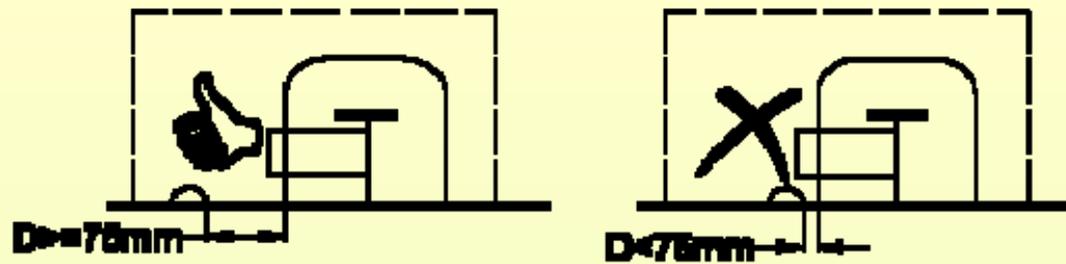


**Repair:**

**$A > 2\text{mm}$  release and adjust**

**当  $A > 2\text{mm}$  打开重调**

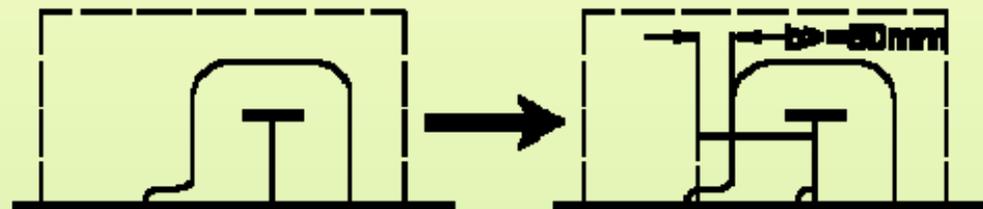
## Position of scallop 过焊孔的位置



### Repair:

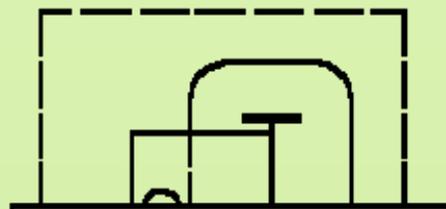
when  $d < 75\text{mm}$ , web plate to be cut between scallop and slot, and collar plate to be fitted.

当  $d < 75\text{mm}$ , 将两孔割通, 并加复板.



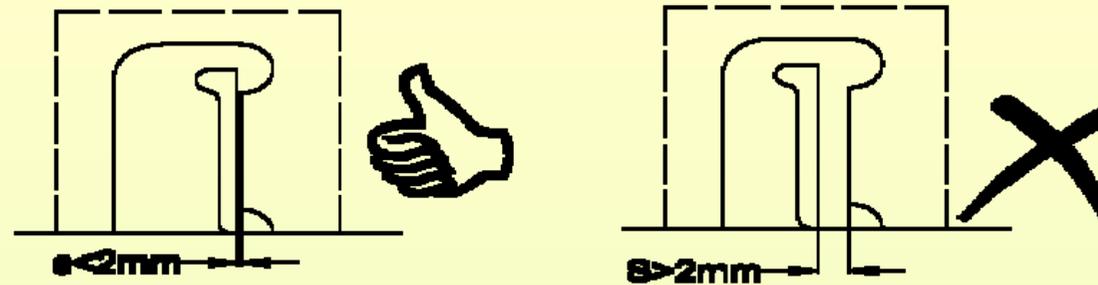
OR fit collar plate over scallop.

或者, 用复板将开孔堵住.



## Gap around stiffener cut-out

### 贯穿件与开孔的间隙



### Repair:

When  $2\text{mm} < s \leq 5\text{mm}$ , weld leg length to be increased as much as increase in gap opening over 2mm.

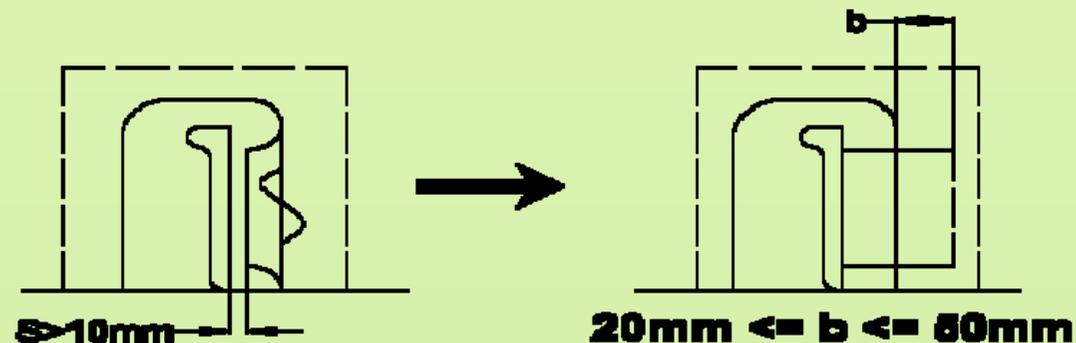
当  $2\text{mm} < s \leq 5\text{mm}$ , 焊脚尺寸增加  $s$ .

When  $5\text{mm} < s \leq 10\text{mm}$ , nib to be chamfered and build up by welding.

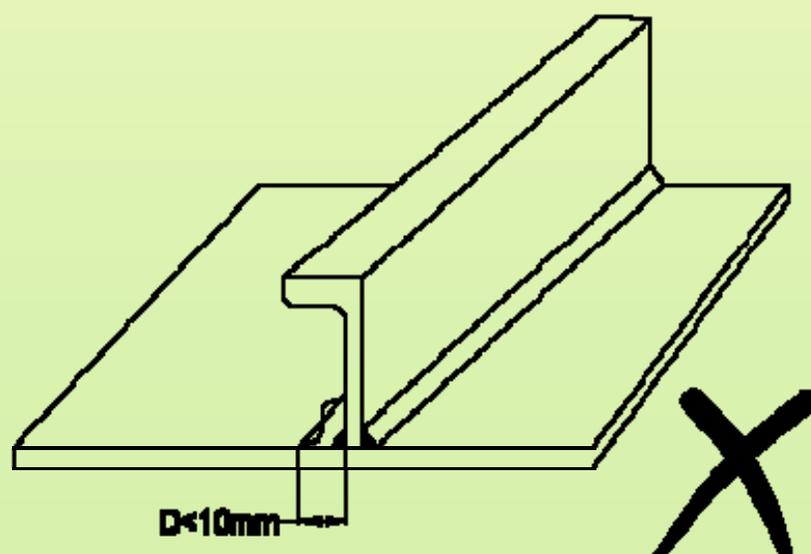
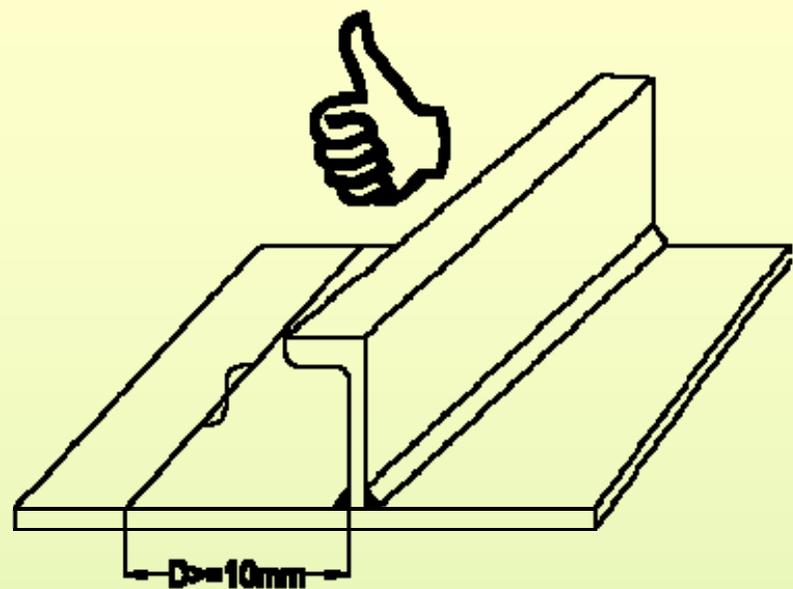
当  $5\text{mm} < s \leq 10\text{mm}$ , 将开孔的凸缘开坡口, 电焊长肉.

When  $s > 10\text{mm}$  cut off nib and fit collar plate with same height as nib.

当  $s > 10\text{mm}$  将凸缘切掉, 加与凸缘等高的复板.



# Distance between butt weld and fillet weld 对接焊缝与角接焊缝的间距



# Holes made erroneously $D < 200\text{mm}$ 误开孔 ( $D < 200\text{mm}$ )

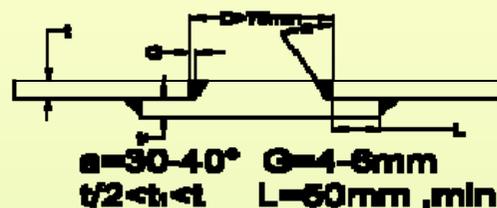
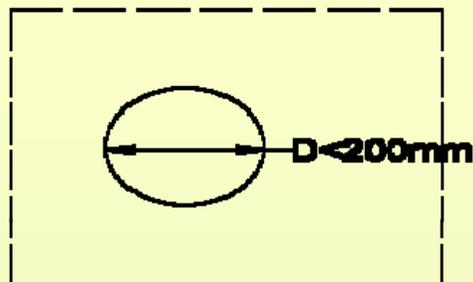
## Repair:

**Strength members:**

**受力构件:**

open hole to minimum 75mm dia. fit and weld spigot piece.

将孔加大到最小75mm (直径). 焊入塞板. (塞板尺寸如下.)



**OR:**

open hole to over 300mm and fit insert plate.

**或者:**

将孔加大到300mm用堵板封住.

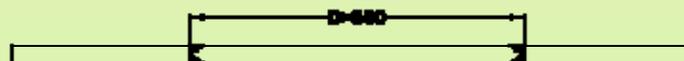


**Other members:**

**非受力构件:**

open hole to over 300mm and fit insert plate.

将孔加大到300mm用堵板封住.



**OR:**

fit lap plate plate.

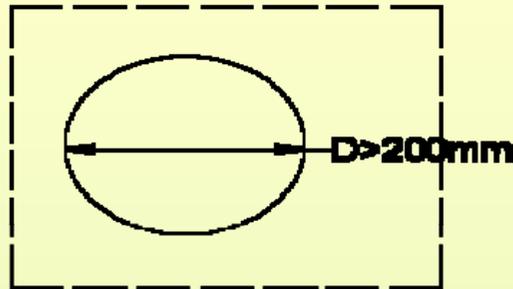
**或者:**

用复板堵住. (尺寸如下.)



# Holes made erroneously $D > 200\text{mm}$

## 误开孔 ( $D > 200\text{mm}$ )



### Repair:

**Strength members:**

**受力构件:**

open hole to over 300mm and fit insert plate.  
将孔加大到300mm用增板封住.



**Other members:**

**非受力构件:**

open hole to over 300mm and fit insert plate.  
将孔加大到300mm用增板封住.

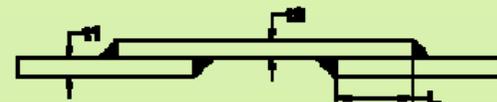


**OR:**

fit lap plate plate.

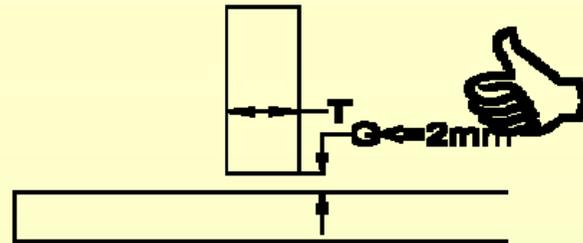
**或者:**

用复板增住. (尺寸如下: )

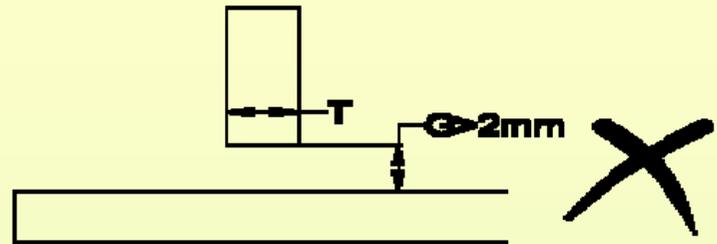


$t_1 = t_2$   $L = 50\text{mm, min}$

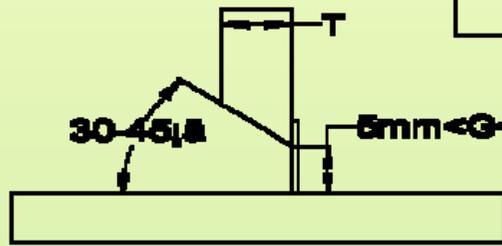
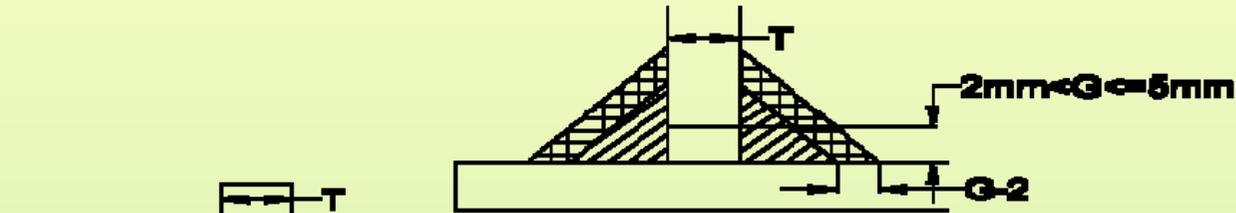
**Tee Fillet:**  
**T型角焊:**



**修理方法:**  
**Repair:**

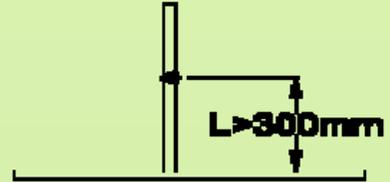


**2mm <math>G \le 5\text{mm}</math> leg length increased to Rule leg + (G-2).  
如果  $2\text{mm} < G < 5\text{mm}</math> 焊脚增大为: 工艺规定焊脚 + (G-2)$**

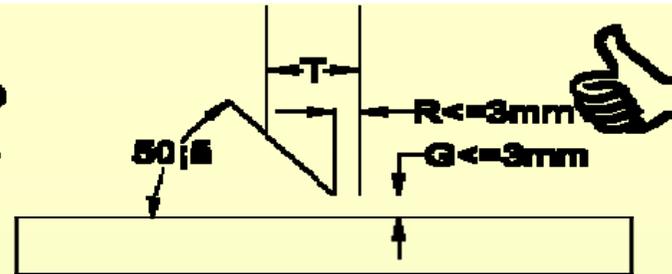


**5mm <math>G \le 16\text{mm}</math> chamfer to 30 to 45  
build up with welding on one side with  
or without backing, grind and weld.  
如果  $5\text{mm} < G \le 16\text{mm}</math> 将板边开30-45° 的  
坡口, 电焊长肉 (用或不用衬垫) 然  
后打磨至规定尺寸。$**

**$G > 16\text{mm}$  or  $G > 1.5t$ —new plate to be inserted (min.300mm).  
 $G > 16\text{mm}$  或  $G > 1.5t$ —换板, 换板尺寸不得小于300mm**

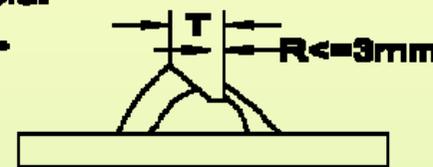
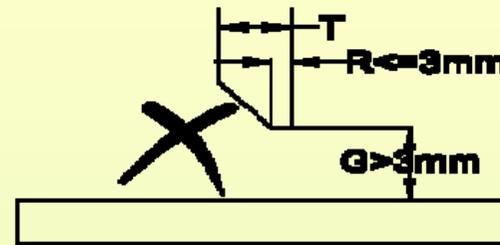


**Single Bevel Tee**  
**单面坡口T型角焊:**



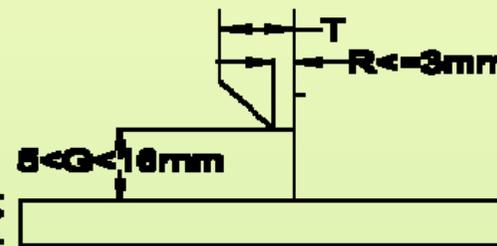
**修理方法:**  
**Repair:**

3mm < G <= 5mm build up weld.  
 如果 3mm < G <= 5mm 电焊长肉。



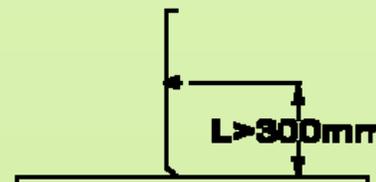
5mm < G <= 10mm—build up with welding, with or without back strip, remove backing strip if used, back gouge and back weld.

如果 5mm < G <= 10mm 电焊长肉 (用或不用衬垫) 如果用衬垫则长肉后去掉, 反面碳刨, 焊接。



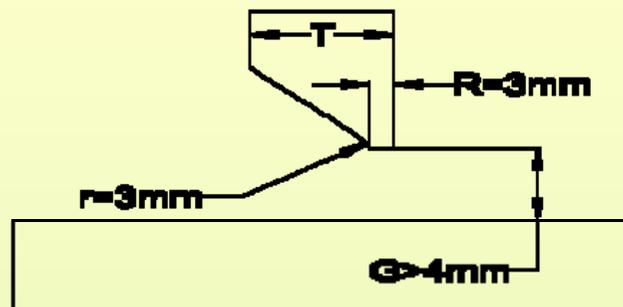
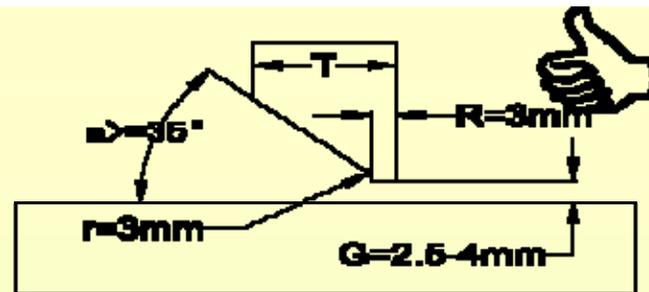
G > 10mm or G > 1.5t—new plate to be inserted (min.300mm).

G > 10mm 或 G > 1.5t—换板, 换板尺寸不得小于300mm

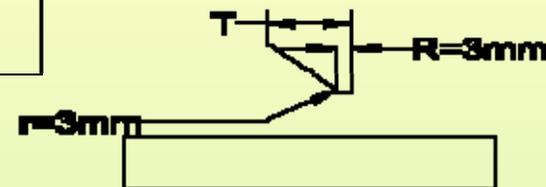


# Single 'J' Tee

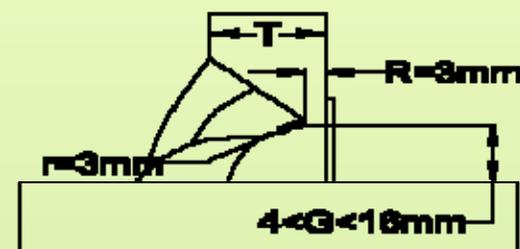
## 单面坡口J型角焊:



**修理方法:**  
**Repair:**  
 $4mm < G <= 5mm$  build up weld.  
 如果  $3mm < G <= 5mm$  电焊长肉.

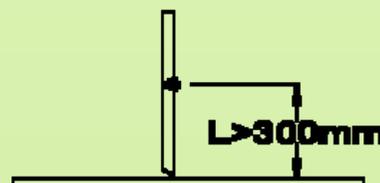


$5mm < G <= 16mm$ —build up with welding, with or without back strip, remove backing strip if used, back gouge and back weld.  
 如果  $5mm < G <= 16mm$  电焊长肉 (用或不用衬垫) 如果用衬垫则长肉后去掉, 反面敲削, 焊接.

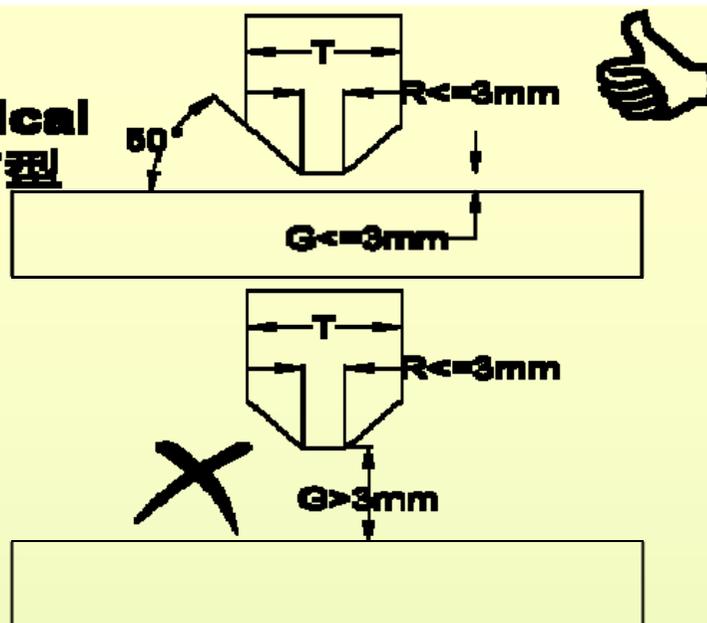


$G > 16mm$  or  $G > 1.5t$ —new plate to be inserted (min.300mm).

$G > 16mm$  或  $G > 1.5t$ —换板, 换板尺寸不得小于300mm



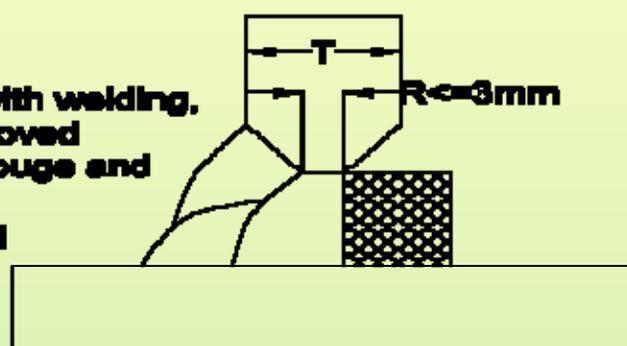
**Double Bevel  
Tee Symmetrical  
双面对称坡口T型  
角焊**



**Repair:**

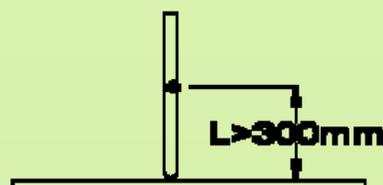
5mm <math>G \leq 16\text{mm}</math>—build up with welding, using ceramic or other approved backing bar, remove, back gouge and back weld.

如果 5mm <math>G \leq 16\text{mm}</math> 电焊长肉 (用陶瓷衬垫) 长肉层去掉衬垫, 反面碳刨, 焊接.

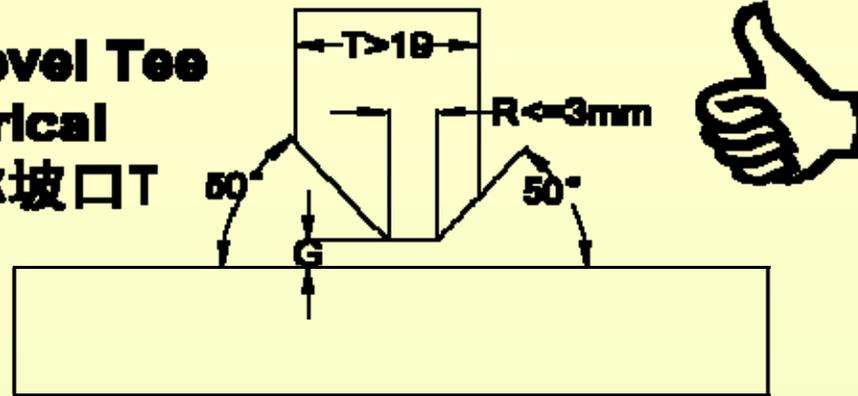


$G > 16\text{mm}$  or  $G > 1.5t$ —new plate to be inserted (min.300mm).

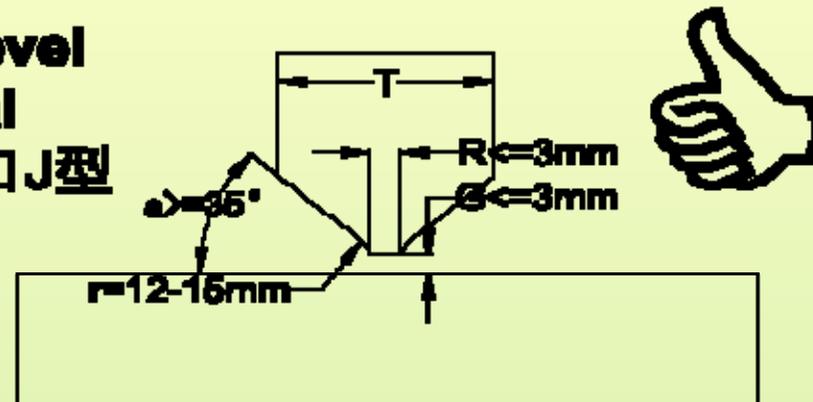
$G > 16\text{mm}$  或  $G > 1.5t$ —换板, 换板尺寸不得小于300mm



**Double Bevel Tee  
Asymmetrical  
双面非对称坡口T  
型角焊**



**Double J Bevel  
Symmetrical  
双面对称坡口J型  
角焊**

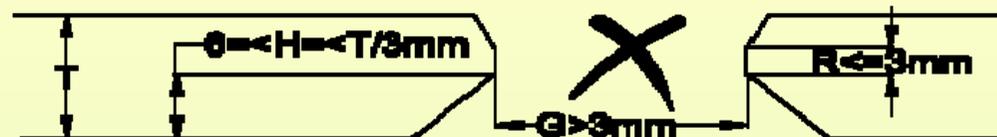
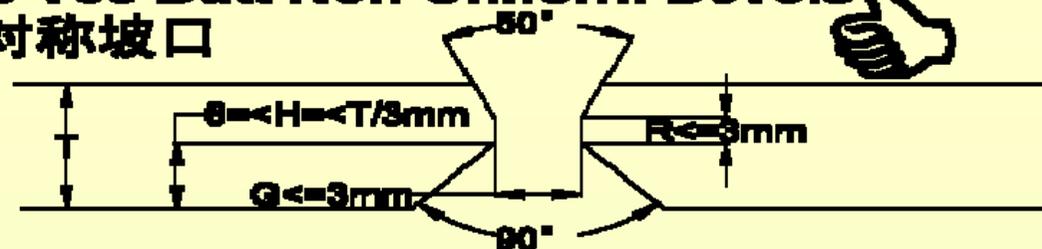


The pictures show the correct dimension of Double bevel tee asymmetrical joint and Double J bevel symmetrical joint. The Repair standard of these joint same with Double bevel tee symmetrical joint.

本图所示为双面非对称坡口T角焊，双面对称J型角焊的正确尺寸，其修理方法与双面对称坡口T角焊相同。

# Double Vee Butt Non-Uniform Bevels

## 双V非对称坡口

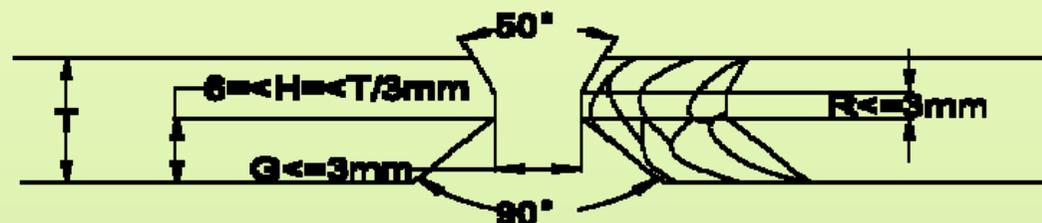


**Repair:** When  $3\text{mm} < G \le 1.5T$  (but less than  $25\text{mm}$ )

**修理方法:** 如果  $3\text{mm} < G < 1.5T$  (但小于  $25\text{mm}$ )

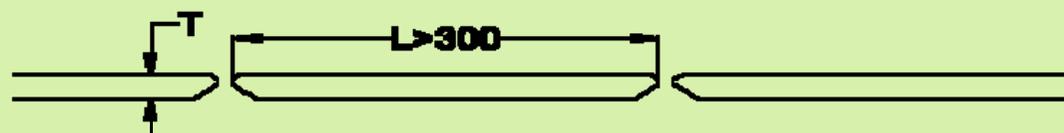
Build up with welding on one or both side of preparation, Where backing strip is used the backing is to be removed, the weld back gouged, and sealing weld made.

在坡口的单面或双面长肉，如果用衬垫则长肉后去掉，反面破削，焊接，打磨至要求尺寸。

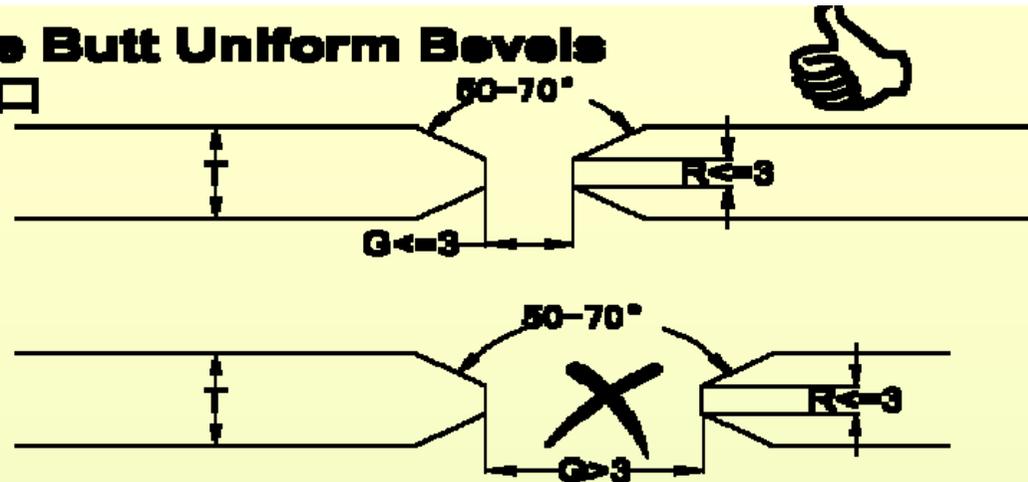


When  $G \ge 25\text{mm}$  or  $1.5T$  an insert plate, of min. width of  $300\text{mm}$ , to be welded in place.

如果  $G \ge 25\text{mm}$  或  $1.5T$  换板，但尺寸不小于  $300\text{mm}$ 。



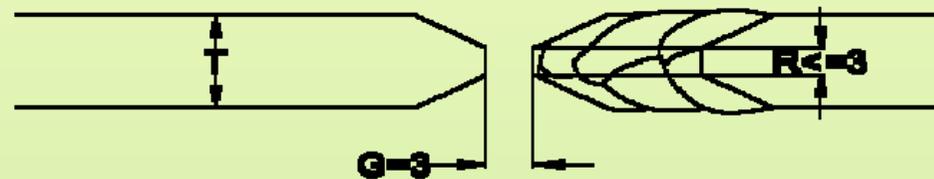
## Double Vee Butt Uniform Bevels 双V对称坡口



**Repair:** When  $3\text{mm} < G \leq 1.5T$  (but less than 25mm)  
**修理方法:** 如果  $3\text{mm} < G < 1.5T$  (但小于25mm)

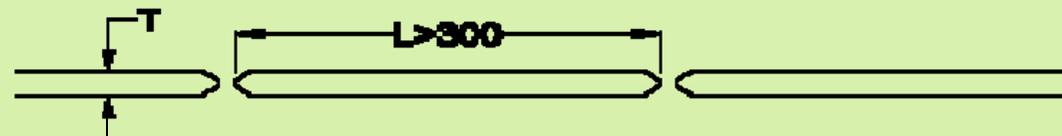
Build up with welding on one or both side of preparation, Where backing strip is used the backing is to be removed, the weld back gouged, and sealing weld made.

在坡口的单面或双面长肉，如果用衬垫则长肉后去掉，反面碳刨，焊接，打磨至要求尺寸。

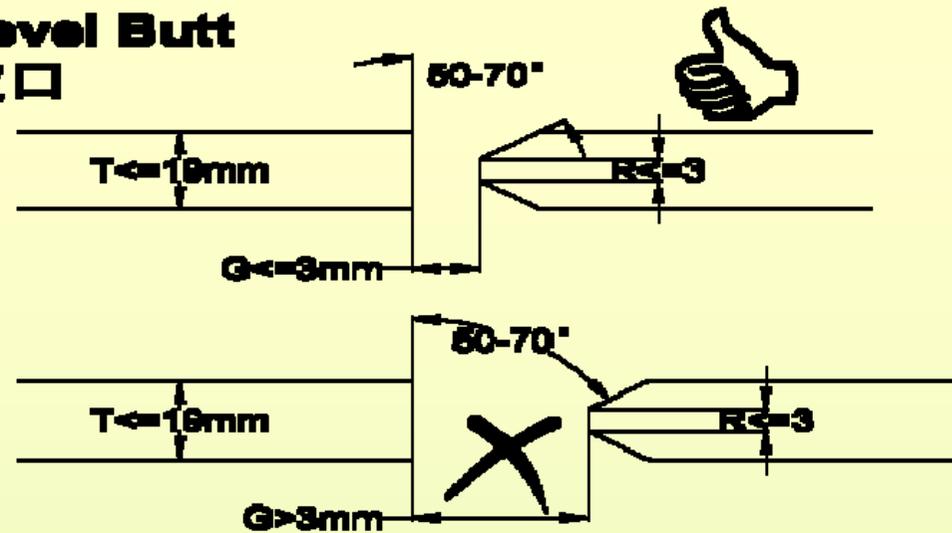


When  $G \geq 25\text{mm}$  or  $1.5T$  an insert plate, of min. width of 300mm, to be welded in place.

如果  $G \geq 25\text{mm}$  或  $1.5T$  换板，但尺寸不小于300mm。



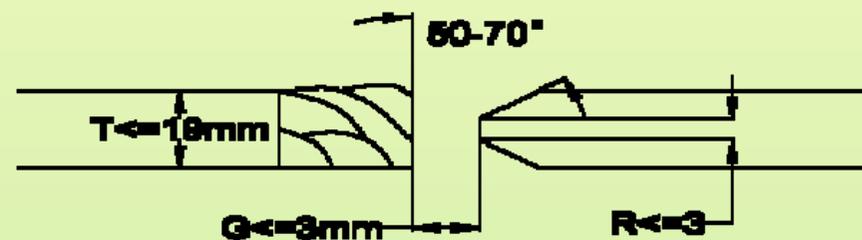
## Double Bevel Butt 单V对称坡口



**Repair:** When  $3\text{mm} < G \leq 1.5T$  (but less than 25mm)  
**修理方法:** 如果  $3\text{mm} < G < 1.5T$  (但小于 25mm)

Build up with welding on both side of preparation, Where backing strip is used the backing is to be removed, the weld back gouged, and sealing weld made.

在坡口的单面或双面长肉, 如果用衬垫则长肉后去掉, 反面破刨, 焊接, 打磨至要求尺寸。

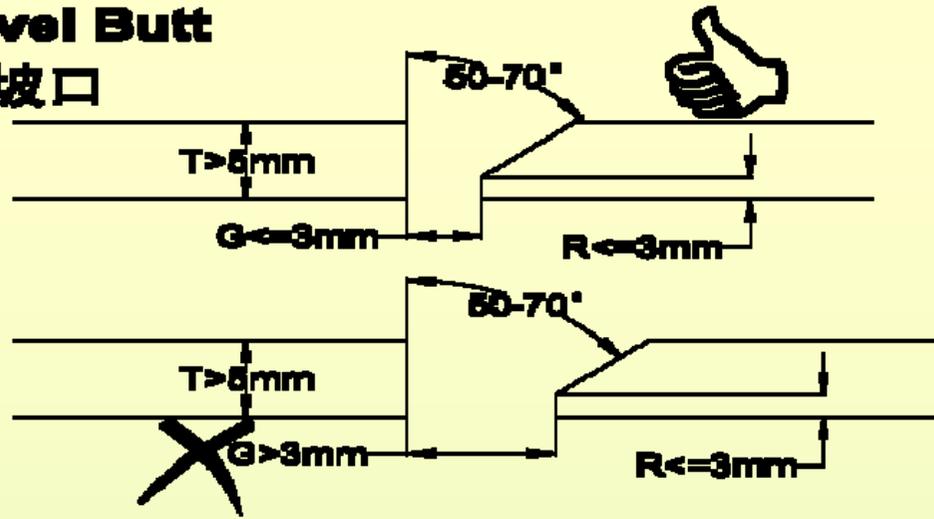


When  $G \geq 25\text{mm}$  or  $1.5T$  an insert plate, of min. width of 300mm, to be welded in place.

如果  $G \geq 25\text{mm}$  或  $1.5T$  换板, 但尺寸不小于 300mm.



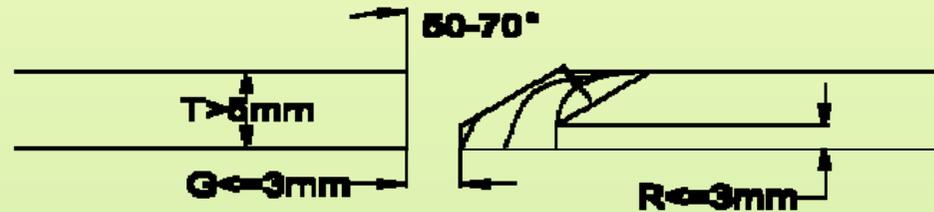
# Single Bevel Butt 单V单面坡口



**Repair:** When  $3\text{mm} < G \leq 1.5T$  (but less than 25mm)  
**修理方法:** 如果  $3\text{mm} < G < 1.5T$  (但小于25mm)

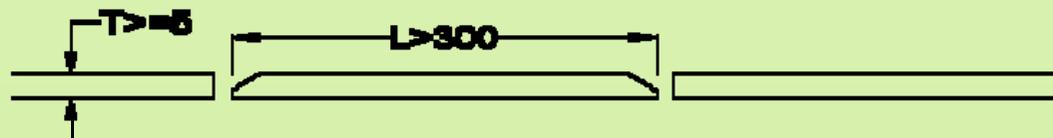
Build up with welding on preparation, Where backing strip is used, the backing is to be removed, the weld be gouged, and sealing weld made.

在坡口上长肉, 如果用衬垫则长肉要去掉, 反面破削, 焊接, 打磨至要求尺寸。



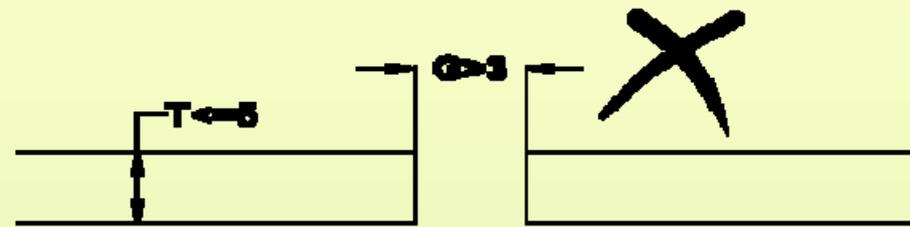
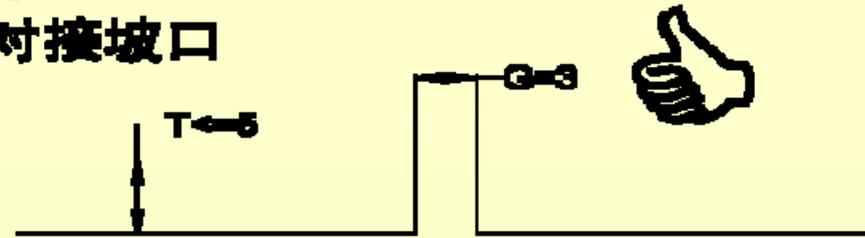
When  $G \geq 25\text{mm}$  or  $1.5T$  an insert plate, of min. width of 300mm, to be welded in place.

如果  $G \geq 25\text{mm}$  或  $1.5T$  换板, 但尺寸不小于300mm。



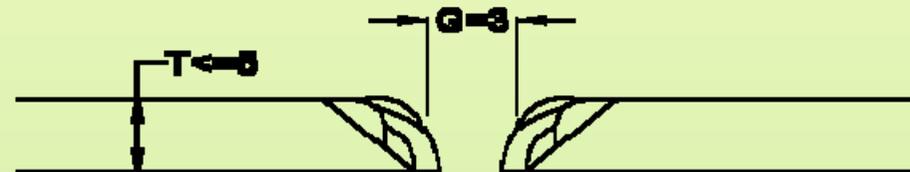
# Square Butt

对接坡口

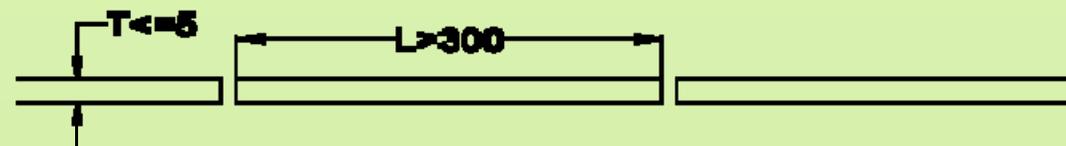


## Repair:

When  $G \leq 10\text{mm}$  chamfer to  $45^\circ$  and build up by welding.  
如果  $G \leq 10\text{mm}$  开  $45^\circ$  坡口, 电焊长肉.

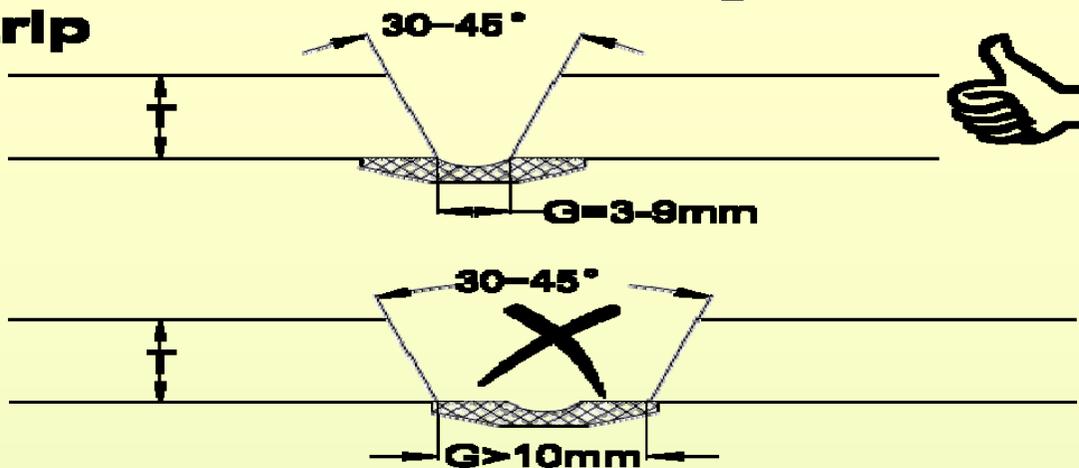


When  $G > 10\text{mm}$  use an insert plate, min. with  $300\text{mm}$ .  
如果  $G > 10\text{mm}$  换板, 但尺寸不小于  $300\text{mm}$ .



# Single vee butt one side welding with backing strip

带衬垫的单面V型坡口

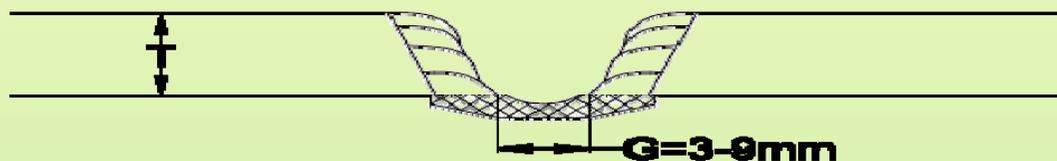


**Repair:** When  $10\text{mm} < G \leq 25\text{mm}$

**修理方法:** 如果  $10\text{mm} < G < 25\text{mm}$

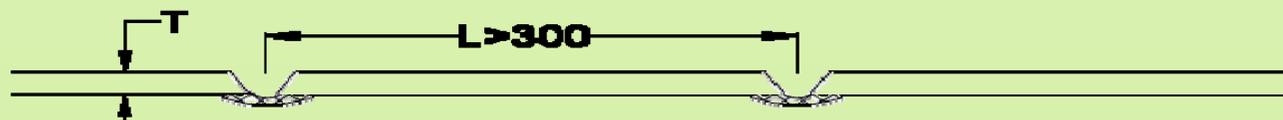
Build up with welding on both side of preparation, grind edge preparation Where backing strip is used the backing is to be removed, the weld back gouged, and back weld.

在坡口的单面或双面长肉，如果用衬垫则长肉后去掉，反面碳刨，焊接，打磨至要求尺寸。



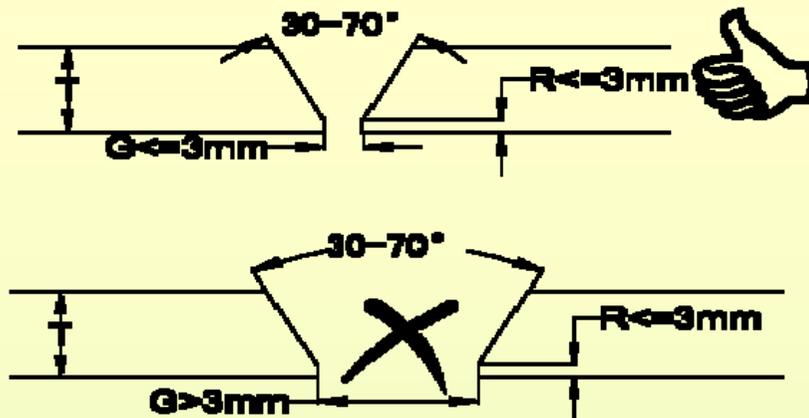
When  $G \geq 25\text{mm}$  or  $1.5T$  an insert plate, of min. width of 300mm, to be welded in place.

如果  $G \geq 25\text{mm}$  或  $1.5T$  换板，但尺寸不小于300mm。



## Single vee butt

### 单面V型坡口

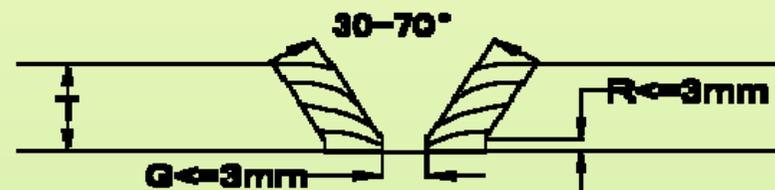


**Repair:** When  $10\text{mm} < G \leq 25\text{mm}$

**修理方法:** 如果  $10\text{mm} < G < 25\text{mm}$

Build up with welding on both side of preparation, grind edge preparation  
Where backing strip is used the backing is to be removed, the weld back gouged, and back weld.

在坡口的单面或双面长肉，如果用衬垫则长肉层去掉，反面碳刨，焊接，打磨至要求尺寸。



When  $G \geq 25\text{mm}$  or  $1.5T$  an insert plate, of min. width of 300mm, to be welded in place.

如果  $G \geq 25\text{mm}$  或  $1.5T$  换板，但尺寸不小于300mm。



EVERYBODY SHOULD BE  
LEARN IT EVERYDAY



END