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Designated according to Article 29 of Regulation (EU) No 305/2011

Member of EOTA
www.eota.eu

# European Technical Assessment ETA 13/0432 of 13/03/2020

## I General Part

| | |
|---|---|
| **Technical Assessment Body issuing the ETA** | Eurofins Expert Services Oy |
| **Trade name of the construction product** | Taizhou Homer Joist Hangers |
| **Product family to which the construction product belongs** | Three-dimensional nailing plates |
| **Manufacturer** | Jiangsu Homer Hardware Manufacturing Co., Ltd<br>516 Keji Road, The Economic Development Zone,<br>Jiangyan District, Taizhou City, Jiangsu Province<br>China 225500 |
| **Manufacturing plant** | Jiangsu Homer Hardware Manufacturing Co., Ltd<br>516 Keji Road, The Economic Development Zone,<br>Jiangyan District, Taizhou City, Jiangsu Province<br>China 225500 |
| **This European Technical Assessment contains** | 36 pages including 2 Annexes which form an integral part of this assessment |
| **This European Technical Assessment is issued in accordance with regulation (EU) No 305/2011, on the basis of** | ETAG 015 used as EAD, 2012,<br>Three-dimensional nailing plates |
| **This version replaces** | ETA 13/0432, issued on May 14, 2019 |

## II Specific Part

## 1 Technical description of the product

Taizhou Homer Joist Hangers are one-piece non-welded three-dimensional nailing plates manufactured from hot-dip zinc coated steel sheet of grade S250 GD Z 275 MA according to EN 10346 or SS GR340 Z275 according to ASTM A653M or from cold rolled austenitic stainless steel plate of grade 1.4301 according to EN 10088-2 or AISI 304 (SS304) according to ASTM A240/A240M.

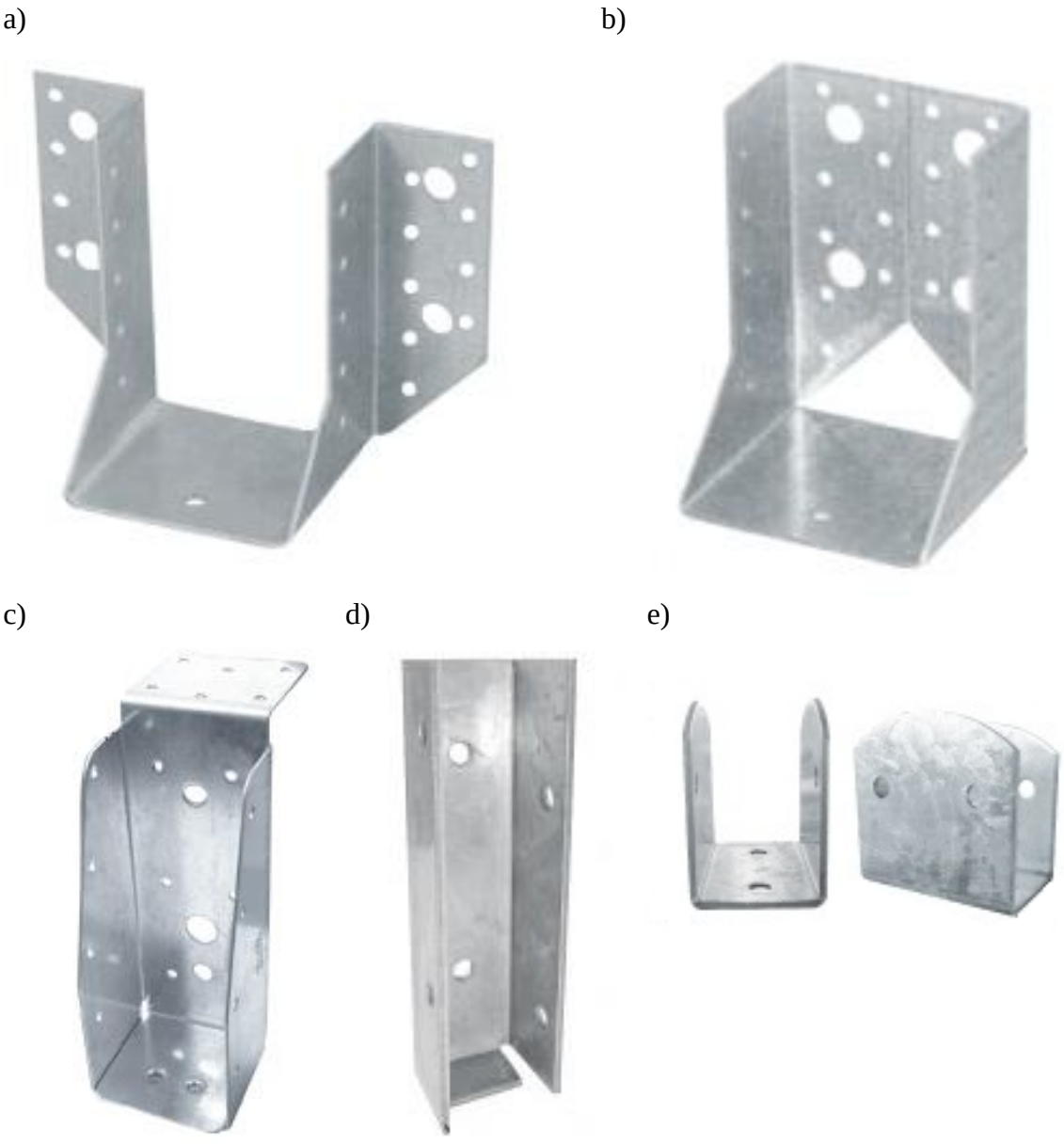



**Figure 1.** Different types of Taizhou Homer Joist Hangers: a) Out folded Joist Hanger, b) Inner folded Joist Hanger, c) Dutch Joist Hanger, d) Small Beam Shoe and e) U-Holder.

In the zinc coated connectors, the yield strength $R_{el}$ or $R_{02}$ of the steel is at least 250 N/mm², the tensile strength $R_m$ at least 330 N/mm² and elongation at failure $A_{80}$ at least 19 %. Amount of zinc coating is at least 275 g/m². In stainless steel connectors, the yield strength $R_{02}$ of the steel is at least 230 N/mm², the tensile strength $R_m$ at least 520 N/mm² and the elongation at failure $A_{80}$ at least 45 %.

The product drawings are presented in Annex 1 and the sizes of Taizhou Homer Joist Hangers are listed in tables of Annex 2. The steel material thickness of the zinc coated connectors is 2,00 ± 0,14 mm or 1,50 ± 0,12 mm. The material thickness of stainless steel connectors is 2,00 ± 0,10 mm. Tolerance for the position of the holes is within ± 1,00 mm.

## 2 Specification of the intended uses in accordance with the applicable EAD

### 2.1 Intended uses

Intended use of Taizhou Homer Joist Hangers are timber constructions, where the primary and secondary members are strength graded timber according to EN 14081-1, glulam according to EN 14080, softwood- or laminated logs, laminated veneer lumber (LVL) according to EN 14374, plywood according to EN 13986, cross laminated timber (CLT) with edge glued lamellas, or corresponding timber material. The characteristic density $\rho_k$ of the timber shall not be greater than 500 kg/m³. This ETA does not cover joist hangers fixed to the end of a timber member or to the edge face of a LVL member.

The joist hanger makes the end support of the secondary beam. The joist hanger is fixed to the both sides of the secondary beam with each many fasteners of similar type and size.

Taizhou Homer Joist Hangers shall be fixed to timber by anchor nails or anchor screws (see Figure 2) according to EN 14592. The diameter of the anchor nails shall be $d$ = 4,0 mm and the profiled length at least 24 mm. The diameter of the smooth part of the anchor screws shall be $d$ = 4,5…5,0 mm and the inner diameter of the threaded part $d_1 \geq$ 3,0 mm. The length of the threaded part of the screw shall be at least 6$d$.

a)

b)

**Figure 2.** Fasteners: a) anchor nail and b) anchor screw.

Connections with Taizhou Homer Joist Hangers shall fulfil the minimum spacing and end and edge distance requirements specified in EN 1995-1-1. Timber parts shall not be pre-drilled for the nails or screws. Fasteners shall be perpendicular to the grain of the timber.

For Taizhou Homer Joist Hangers made of hot-dip zinc coated steel, the intended service classes according to EN 1995-1-1 are classes 1 and 2. Joist Hangers made of stainless steel can also be used in service class 3.

In service class 2, the nails or screws shall have an electroplated zinc coating according to EN ISO 2081 at least of type and thickness Fe/Zn 12c, or they shall be hot dip zinc coated according to EN ISO 1461, thickness at least 39 μm. In service class 3, the nails or screws shall be made of stainless steel.

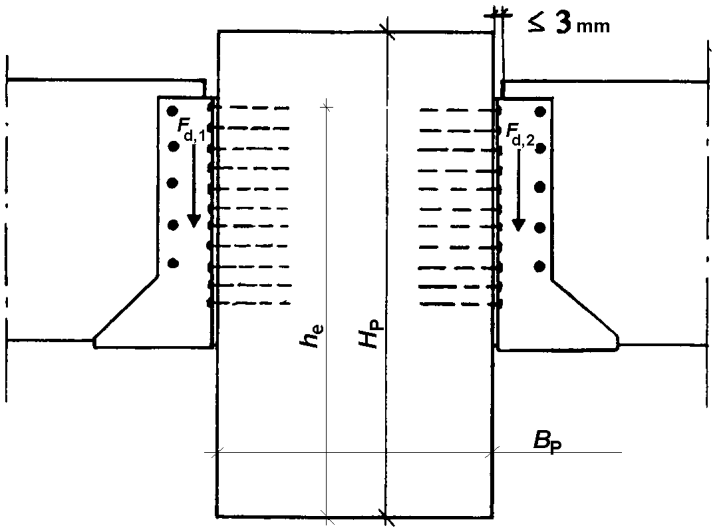



**Figure 3.** Typical use of Taizhou Homer Joist Hangers.

## 2.2 Working life

The provisions made in this European Technical Assessment are based on an assumed intended working life of Taizhou Homer Joist Hangers of 50 years[1].

## 2.3 Identification

Taizhou Homer Joist Hangers are identified having "TAIZHOU HOMER" stamped on each connector.

[1] This means that it is expected that when this working life has elapsed, the real working life may be, in normal use conditions, considerably longer without major degradation affecting the essential requirements of the works. The indications given as to the working life of a building kit cannot be interpreted as a guarantee given by the producer or the technical assessment body. They should only be regarded as a means for the specifiers to choose the appropriate criteria for building kits in relation to the expected, economically reasonable working life of the works.

## 3 Performance of the product and references to the methods used for its assessment

Table 1. Basic requirements for construction works and essential characteristics

| Basic requirement and essential characteristics | Performance |
|---|---|
| BWR 1. Mechanical resistance and stability | |
| Joint strength | Clause 3.1 |
| Joint stiffness | No performance assessed |
| Joint ductility | No performance assessed |
| Resistance to corrosion and deterioration | Clause 3.1 |
| Dimensional stability | No performance assessed |
| BWR 2. Safety in case of fire | |
| Reaction to fire | Clause 3.2 |
| Resistance to fire | No performance assessed |
| BWR 3. Hygiene, health and the environment | |
| Content, emission and/or release of dangerous substances | Clause 3.3 |
| BWR 7. Sustainable use of natural resources | |
| Sustainable use of natural resources | No performance assessed |

### 3.1 Mechanical resistance and stability, BWR 1

#### 3.1.1 Joint strength

Characteristic resistance values of Taizhou Homer Joist Hangers are given in Annex 2.

#### 3.1.2 Resistance to corrosion and deterioration

Taizhou Homer Joist Hangers have been assessed as having satisfactory durability and serviceability when used in timber structures when the timber species (including timbers preserved with organic solvent, boron diffusion and related preservatives) described in Eurocode 5 (EN 1995-1-1: 2004) are used and the structures are subject to the dry, internal conditions defined by service classes 1 and 2. Joist Hangers manufactured from stainless steel can also be used in service class 3 provided that also the nails and screws used together with them are made of stainless steel.

### 3.2 Safety in case of fire, BWR 2

#### 3.2.1 Reaction to fire

Taizhou Homer Joist Hangers are made of materials classified to have reaction to fire class A1 according to EN 13501-1.

### 3.3 Hygiene, health and environment, BWR 3

#### 3.3.1 Content, emission and/or release of dangerous substances

The product does not contain harmful or dangerous substances listed in EOTA TR 34 dated May 2014.

In addition to the specific clauses relating to dangerous substances contained in this European Technical Assessment, there may be other requirements applicable to the products falling within its scope (e.g. transposed European legislation and national laws, regulations and administrative provisions). In order to meet the provisions of the EU Construction Products Directive, these requirements need also to be complied with, when and where they apply.

## 4 Assessment and verification of constancy of performance (hereinafter AVCP) system applied, with reference to its legal base

According to the Decision 97/638/EC of the European Commission[2], the system of assessment and verification of constancy of performance (see Annex V to the regulation (EU) No 305/2011) is System 2+.

## 5 Technical details necessary for the implementation of the AVCP system, as provided for in the applicable EAD.

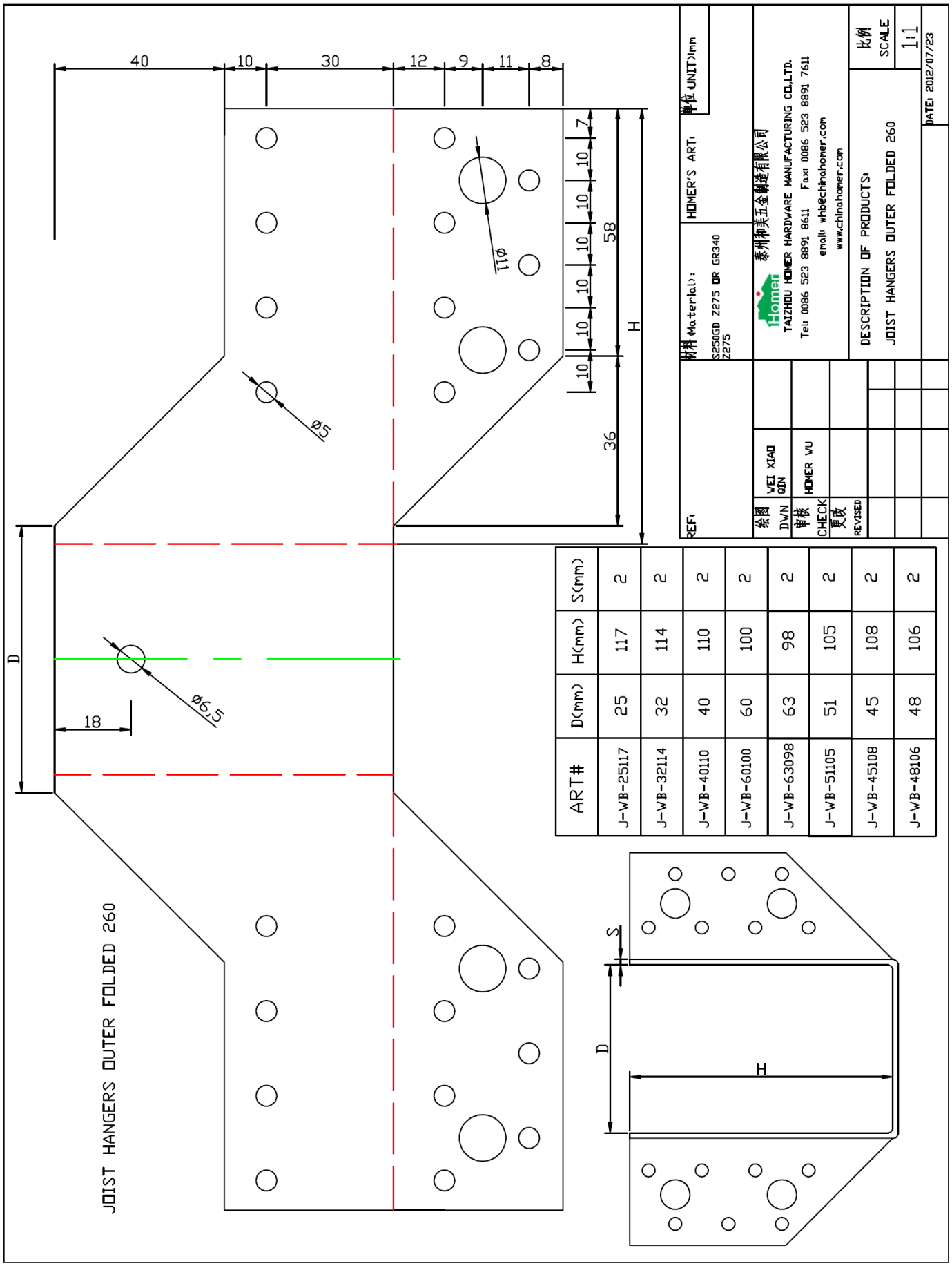
Technical details necessary for the implementation of the AVCP system are laid down in the control plan deposited at Eurofins Expert Services Oy.

Issued in Espoo on March 13, 2020
by Eurofins Expert Services Oy

Tiina Ala-Outinen
Business Development Manager

Ari Kevarinmäki
Leading Expert

[2] Official Journal of the European Communities L 268 of 1/10/1997

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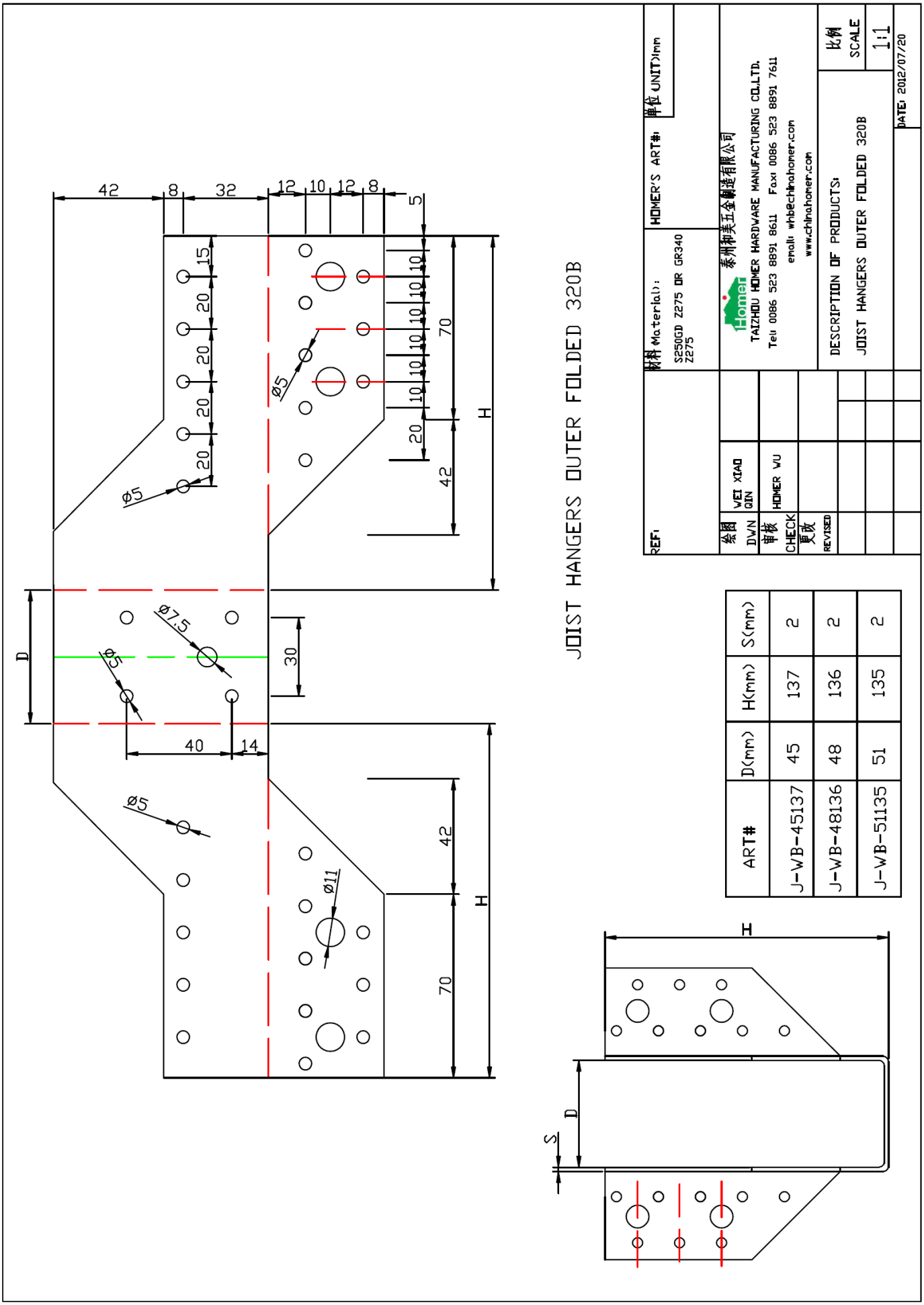
| J-WB-32114 | 32 | 114 | 2 |
| J-WB-40110 | 40 | 110 | 2 |
| J-WB-60100 | 60 | 100 | 2 |
| J-WB-63098 | 63 | 98 | 2 |
| J-WB-51105 | 51 | 105 | 2 |
| J-WB-45108 | 45 | 108 | 2 |
| J-WB-48106 | 48 | 106 | 2 |

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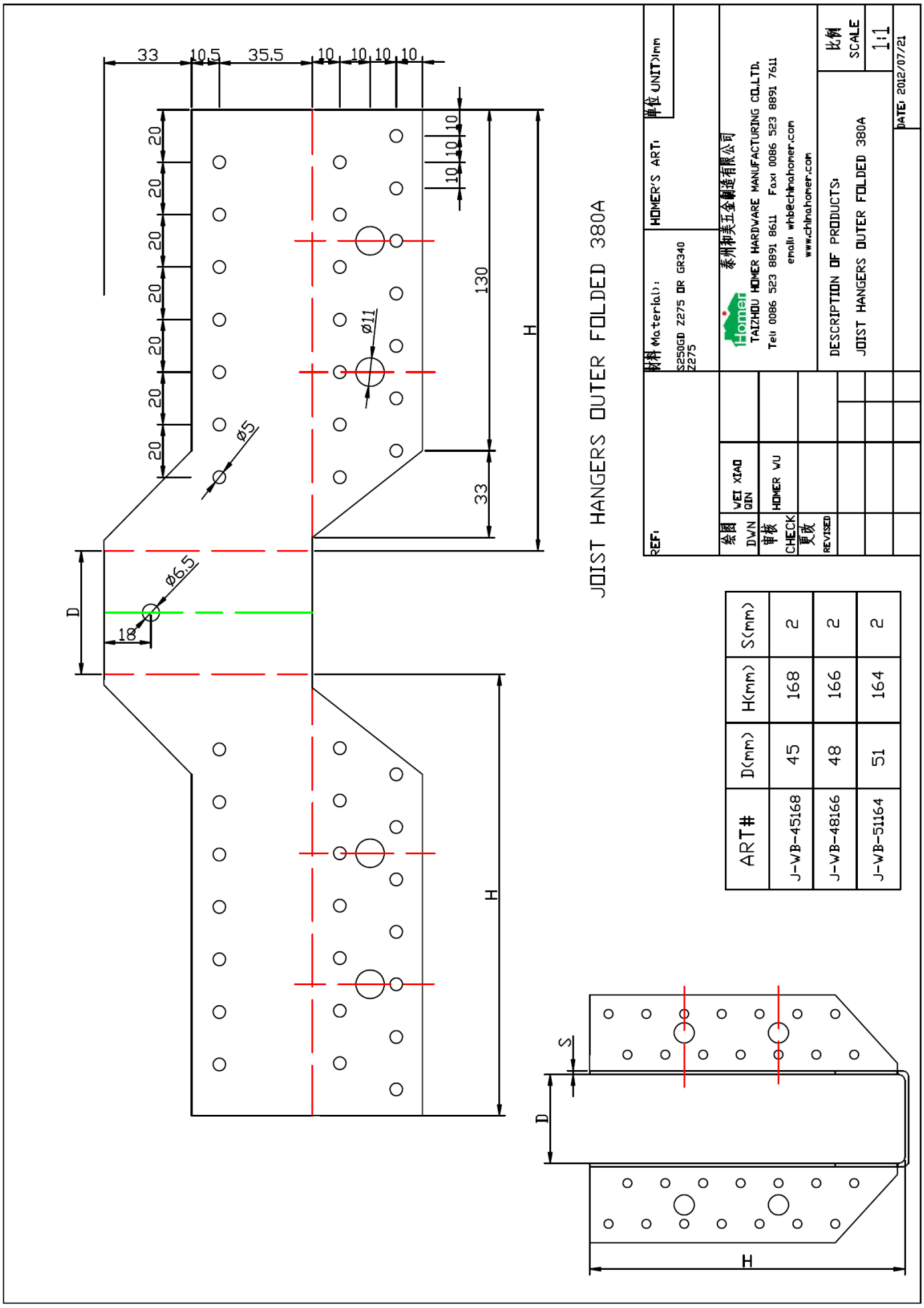
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S250GD Z275 OR GR340 Z275
HOMER'S ART:
单位 UNIT:mm
泰州和美五金制造有限公司
TAIZHOU HOMER HARDWARE MANUFACTURING CO.LTD.
Tel: 0086 523 8891 8611 Fax: 0086 523 8891 7611
email: whb@chinahomer.com
www.chinahomer.com
DESCRIPTION OF PRODUCTS:
JOIST HANGERS OUTER FOLDED 380A
比例 SCALE
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DATE: 2012/07/21
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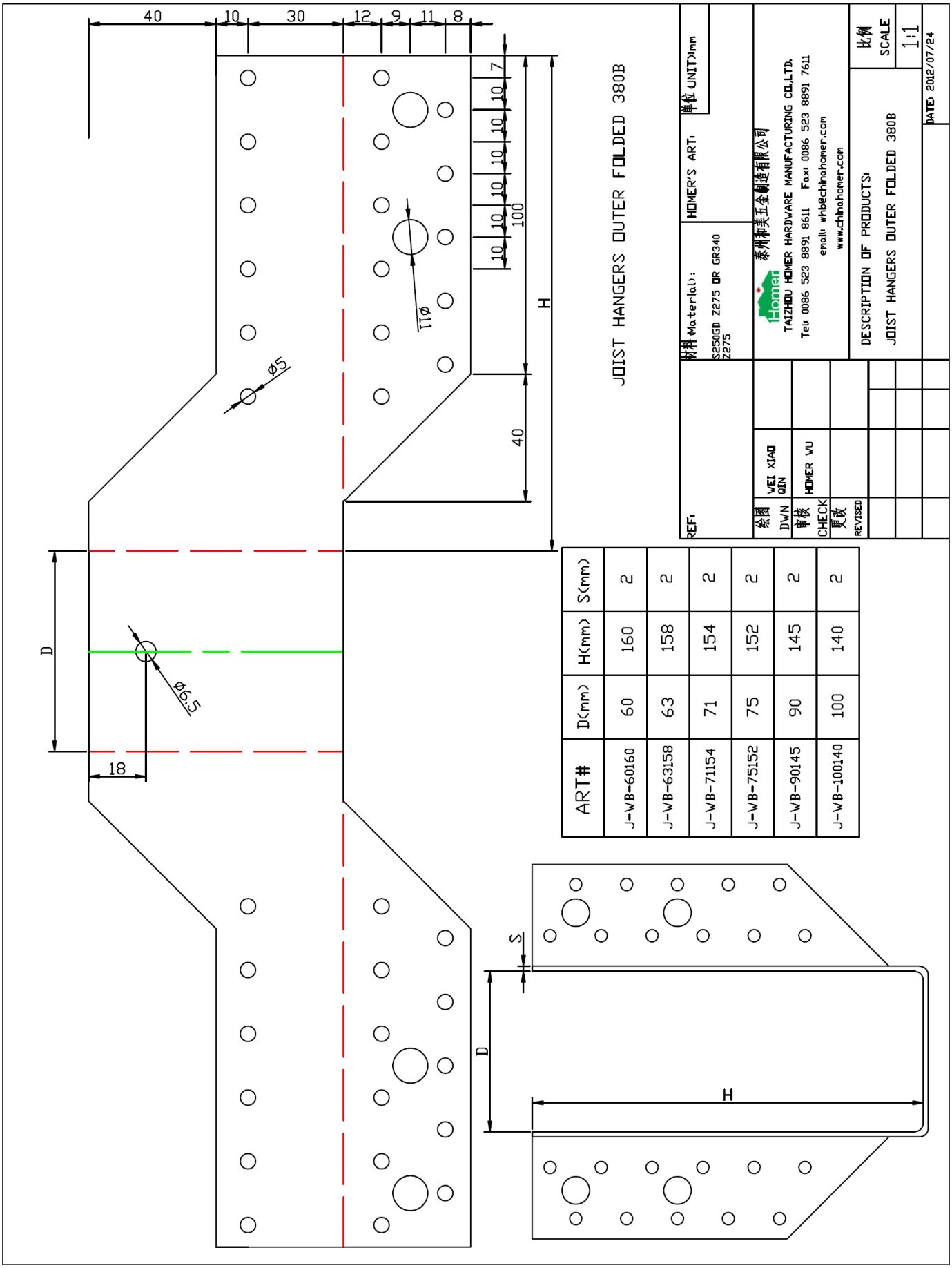
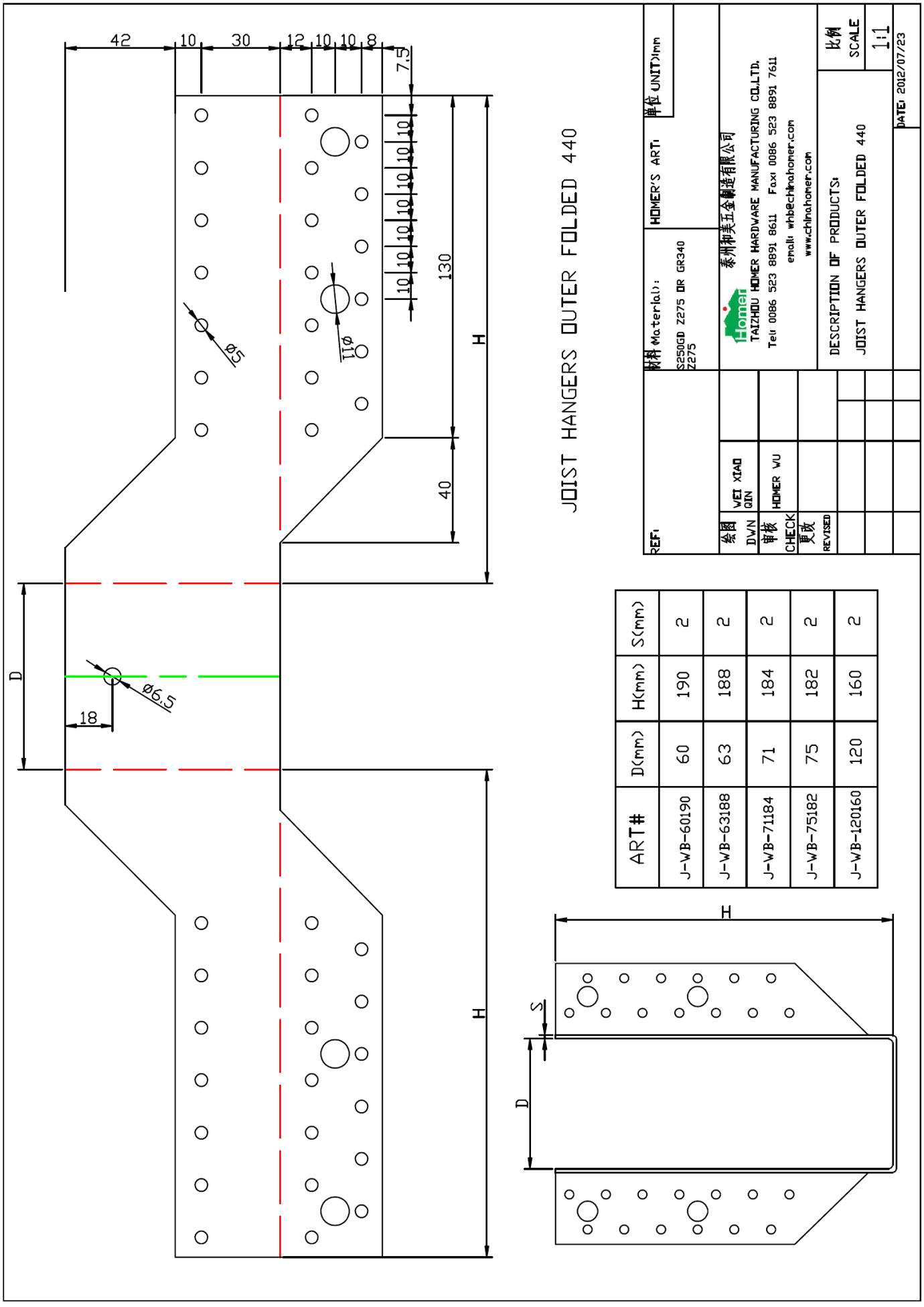
WEI XIAO QIN
审核 CHECK
HOMER WU
更改 REVISED

ANNEX 1: Product details and definitions



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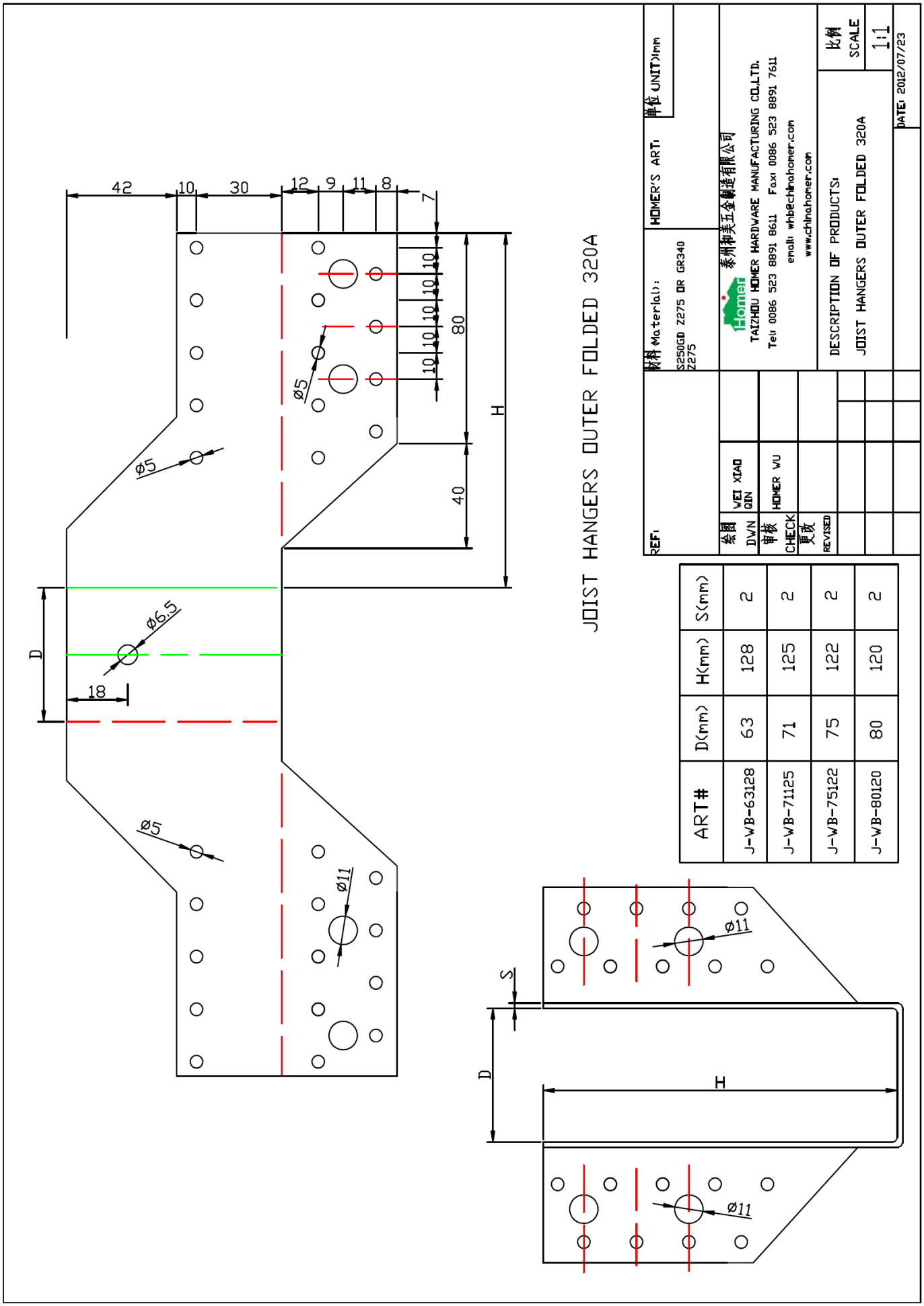


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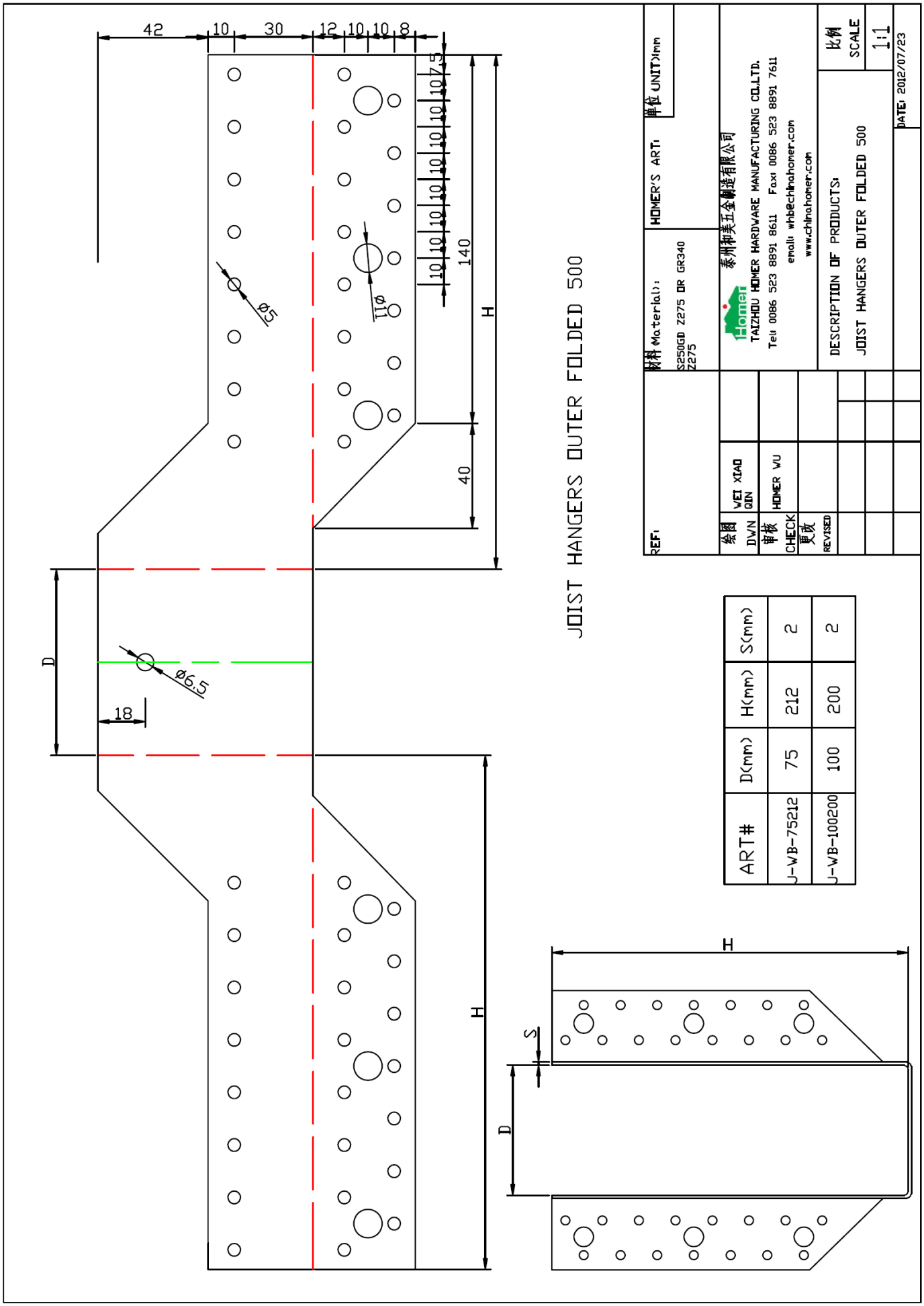
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材料 Material:
S250GD Z275 OR GR340
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单位 UNIT:mm
泰州和美五金制造有限公司
TAIZHOU HOMER HARDWARE MANUFACTURING CO.,LTD.
Tel: 0086 523 8891 8611 Fax: 0086 523 8891 7611
email: whb@chinahomer.com
www.chinahomer.com
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审核 CHECK
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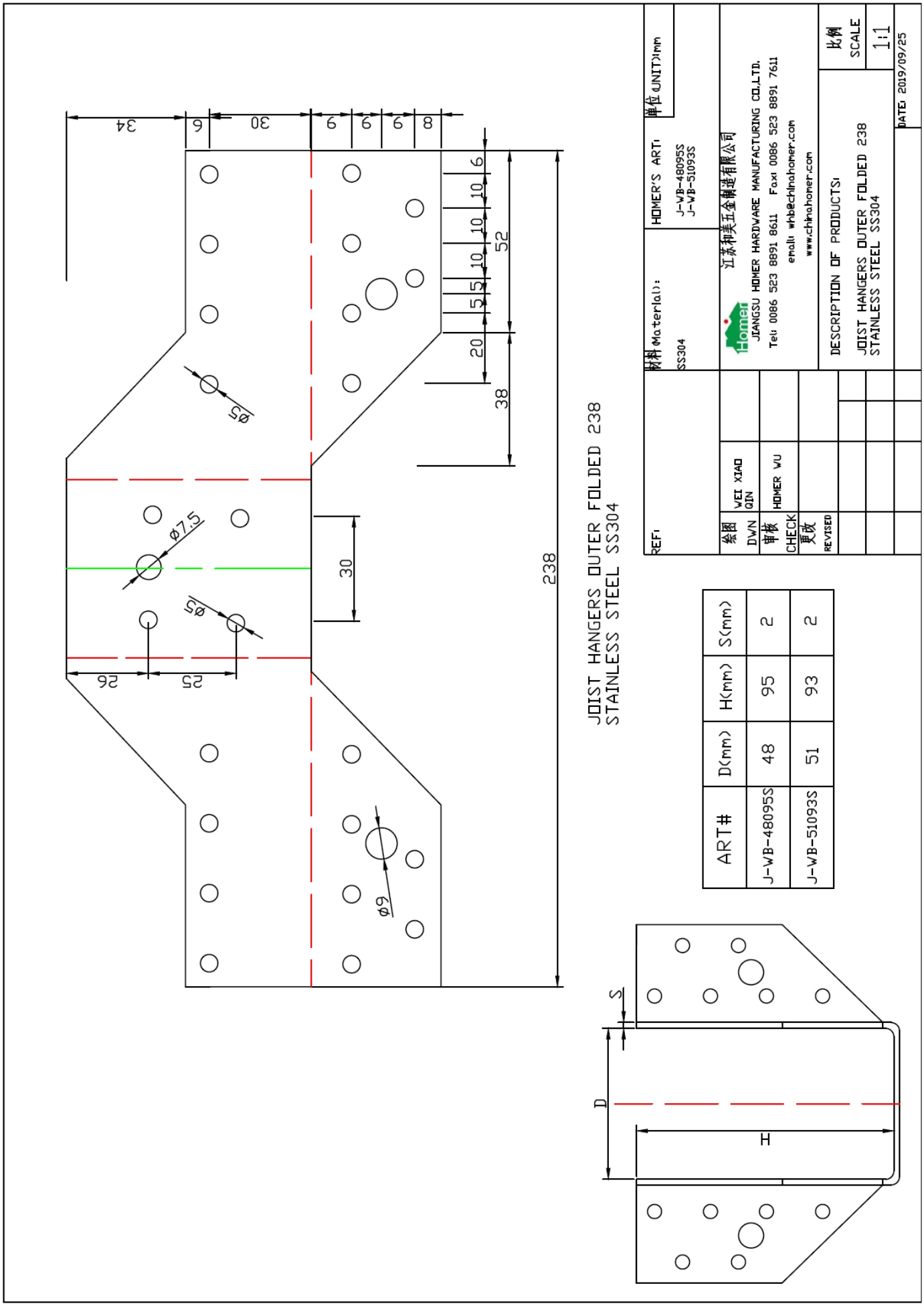
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江苏和美五金制造有限公司
JIANGSU HOMER HARDWARE MANUFACTURING CO.,LTD.
Tel: 0086 523 8891 8611 Fax: 0086 523 8891 7611
email: whb@chinahomer.com
www.chinahomer.com
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STAINLESS STEEL SS304
比例 SCALE
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DATE: 2019/09/25
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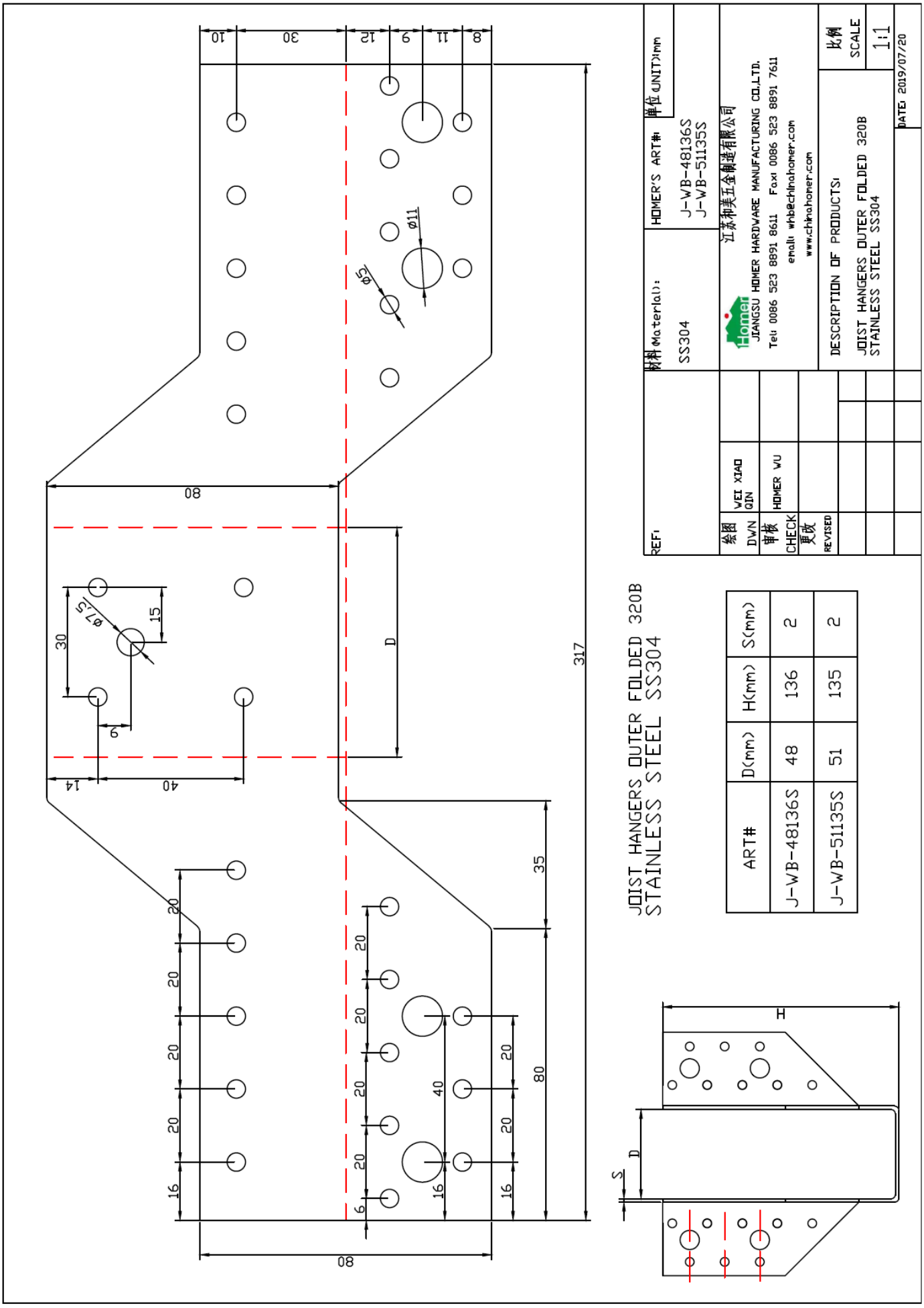
审核 CHECK
HOMER WU
更改 REVISED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JIANGSU HOMER HARDWARE MANUFACTURING CO.,LTD.
Tel: 0086 523 8891 8611 Fax: 0086 523 8891 7611
email: whb@chinahomer.com
www.chinahomer.com
DATE: 2019/07/20
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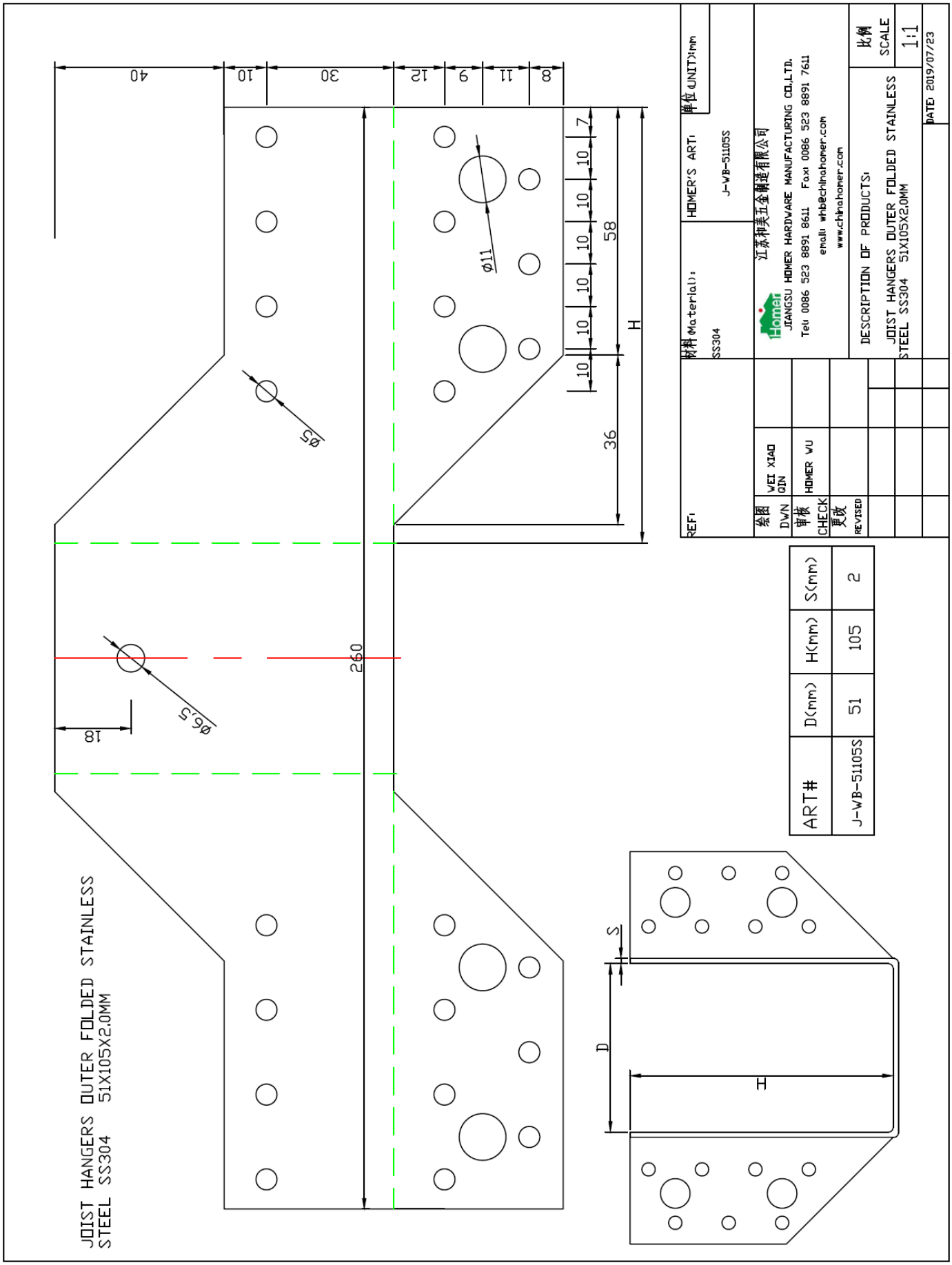
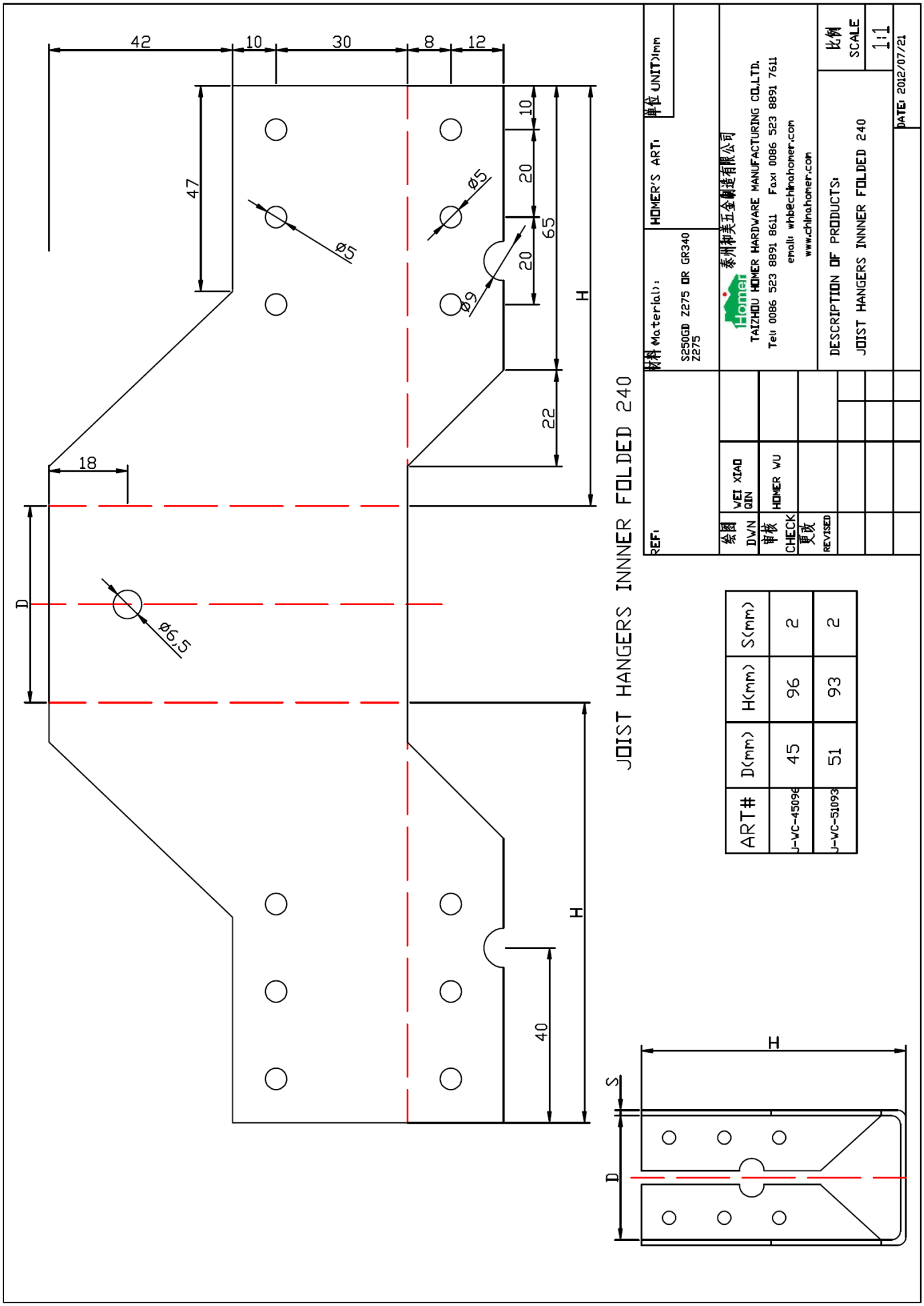
ANNEX 1: Product details and definitions

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泰州和美五金制造有限公司
TAIZHOU HOMER HARDWARE MANUFACTURING CO.LTD.
Tel: 0086 523 8891 8611 Fax: 0086 523 8891 7611
email: whb@chinahomer.com
www.chinahomer.com
DESCRIPTION OF PRODUCTS:
JOIST HANGERS INNER FOLDED 240
HOMER'S ART:
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单位 UNIT:mm
SCALE 1:1
DATE: 2012/07/21
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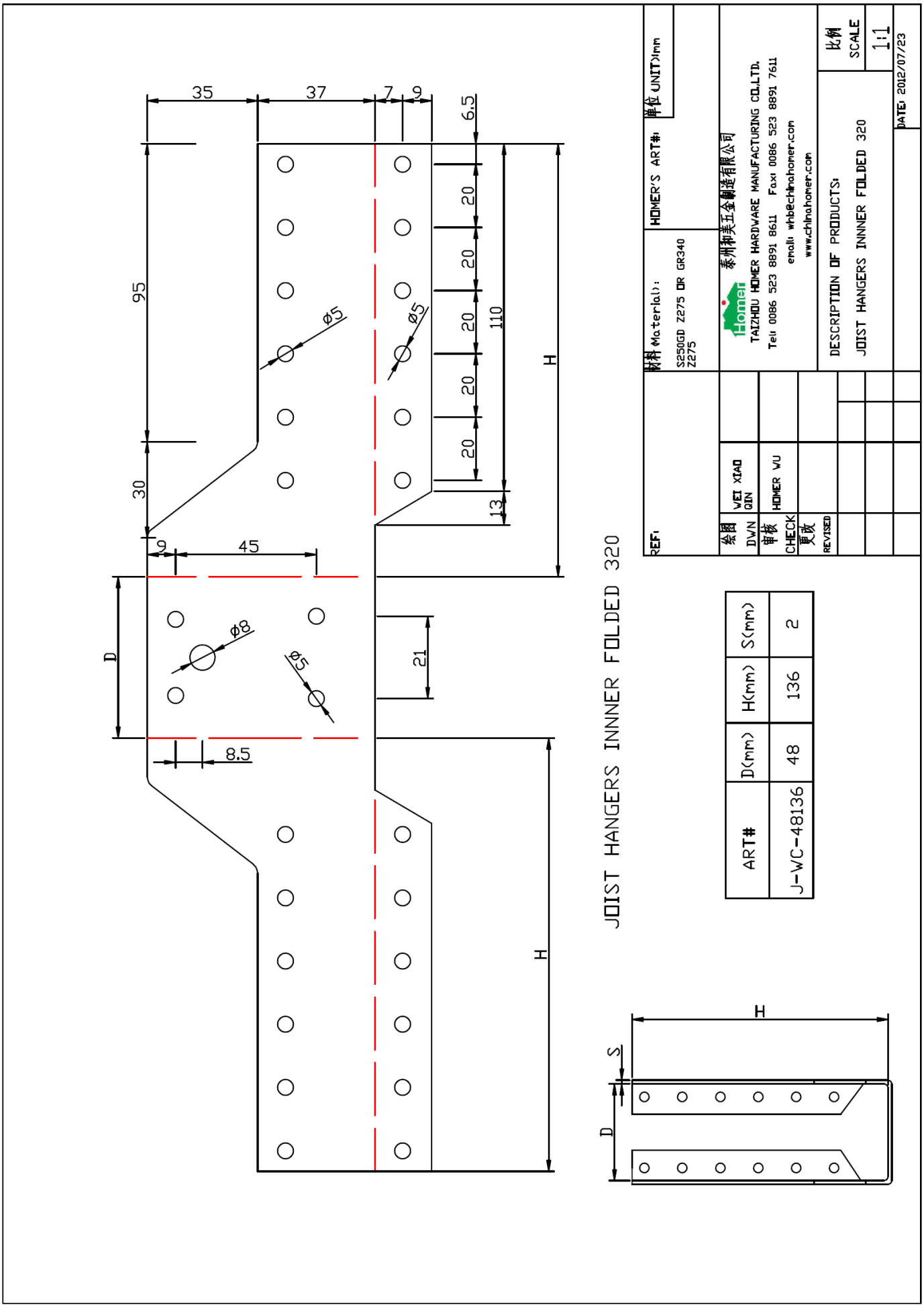
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泰州和美五金制造有限公司
TAIZHOU HOMER HARDWARE MANUFACTURING CO.LTD.
Tel: 0086 523 8891 8611 Fax: 0086 523 8891 7611
email: whb@chinahomer.com
www.chinahomer.com
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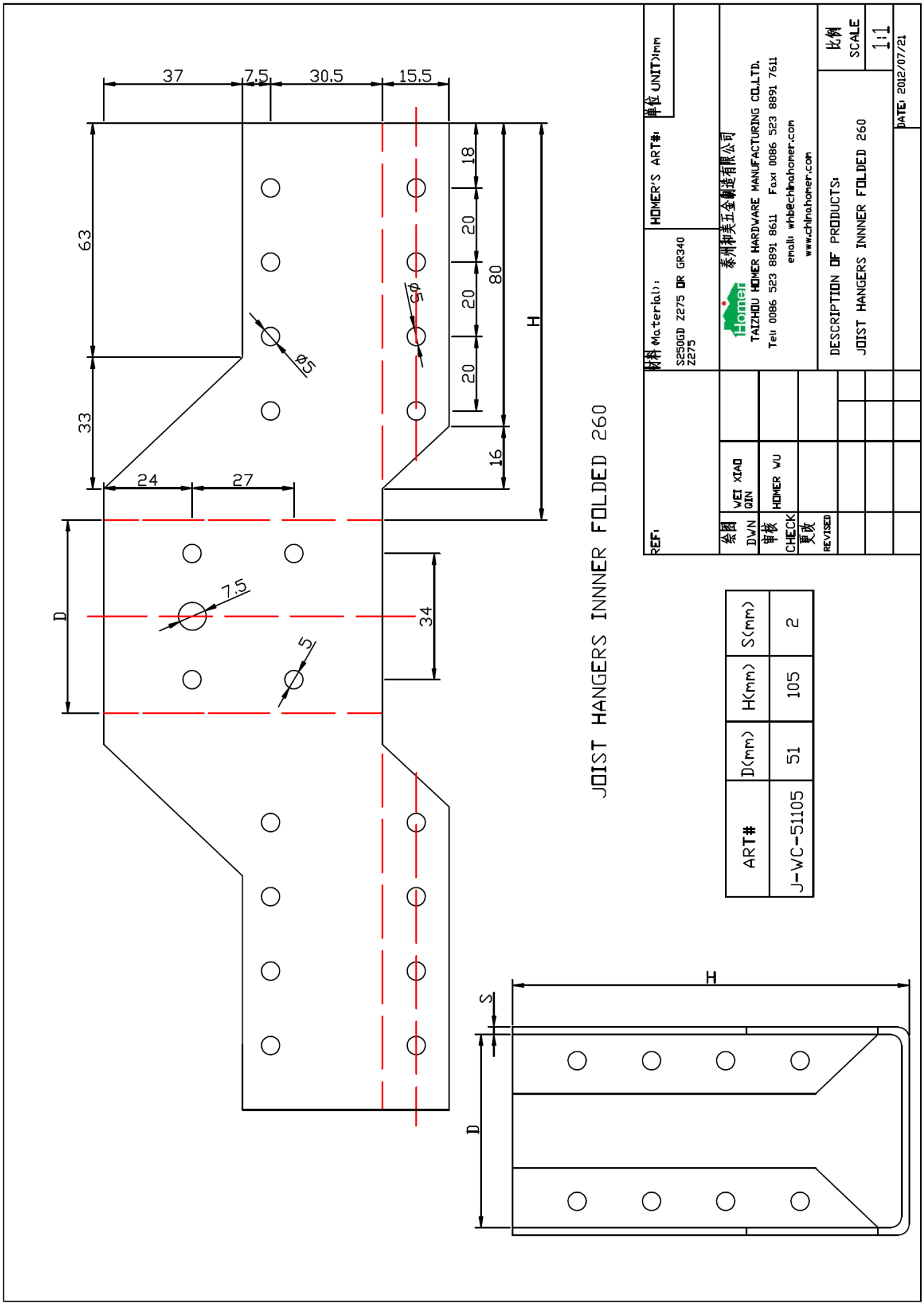
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单位 UNIT:mm
泰州和美五金制造有限公司
TAIZHOU HOMER HARDWARE MANUFACTURING CO.,LTD.
Tel: 0086 523 8891 8611 Fax: 0086 523 8891 7611
email: whb@chinahomer.com
www.chinahomer.com
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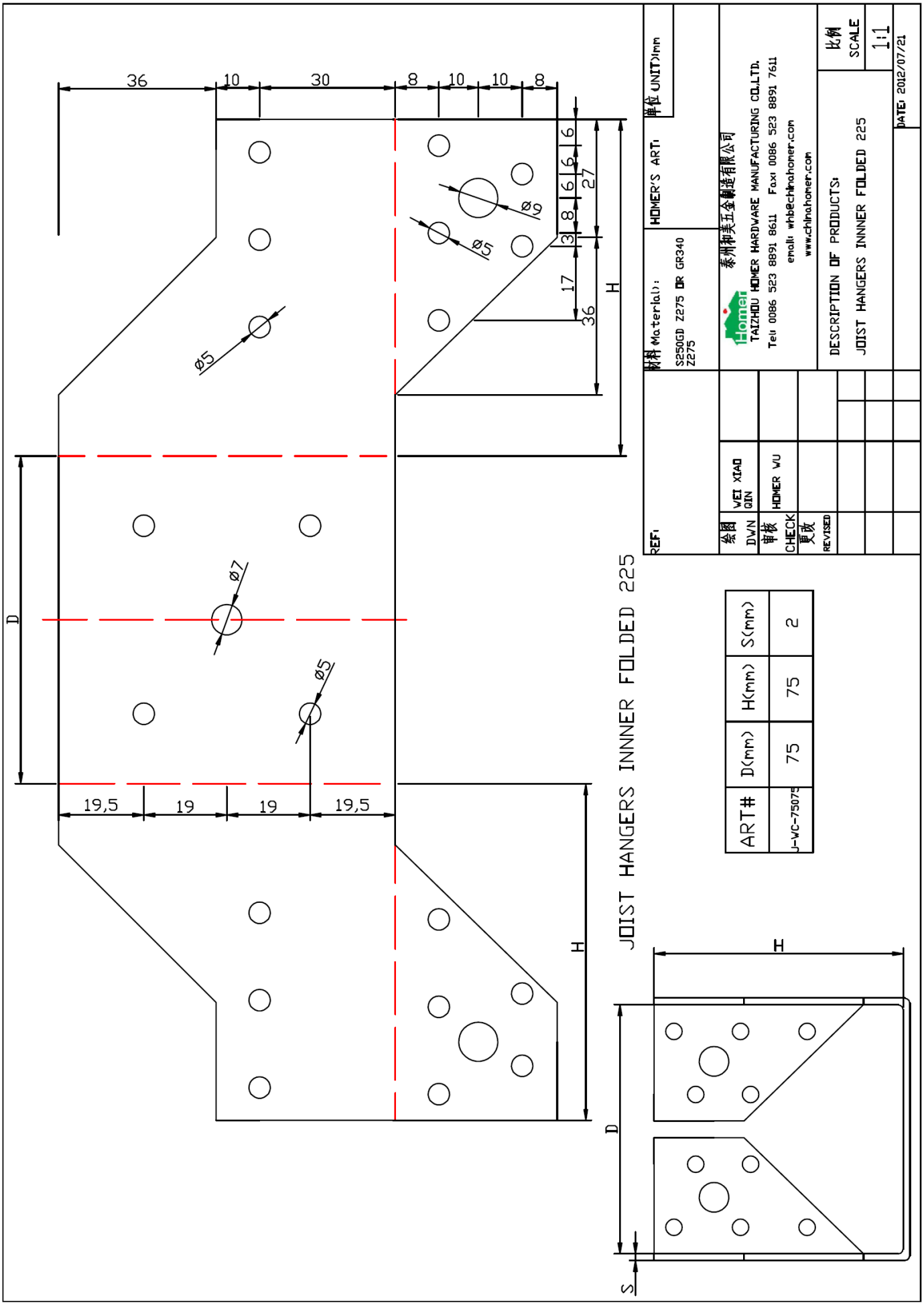
更改 REVISED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泰州和美五金制造有限公司
TAIZHOU HOMER HARDWARE MANUFACTURING CO.,LTD.
Tel: 0086 523 8891 8611 Fax: 0086 523 8891 7611
email: whb@chinahomer.com
www.chinahomer.com
绘图 DWN VEI XIAO QIN
审核 CHECK HOMER WU
更改 REVISED
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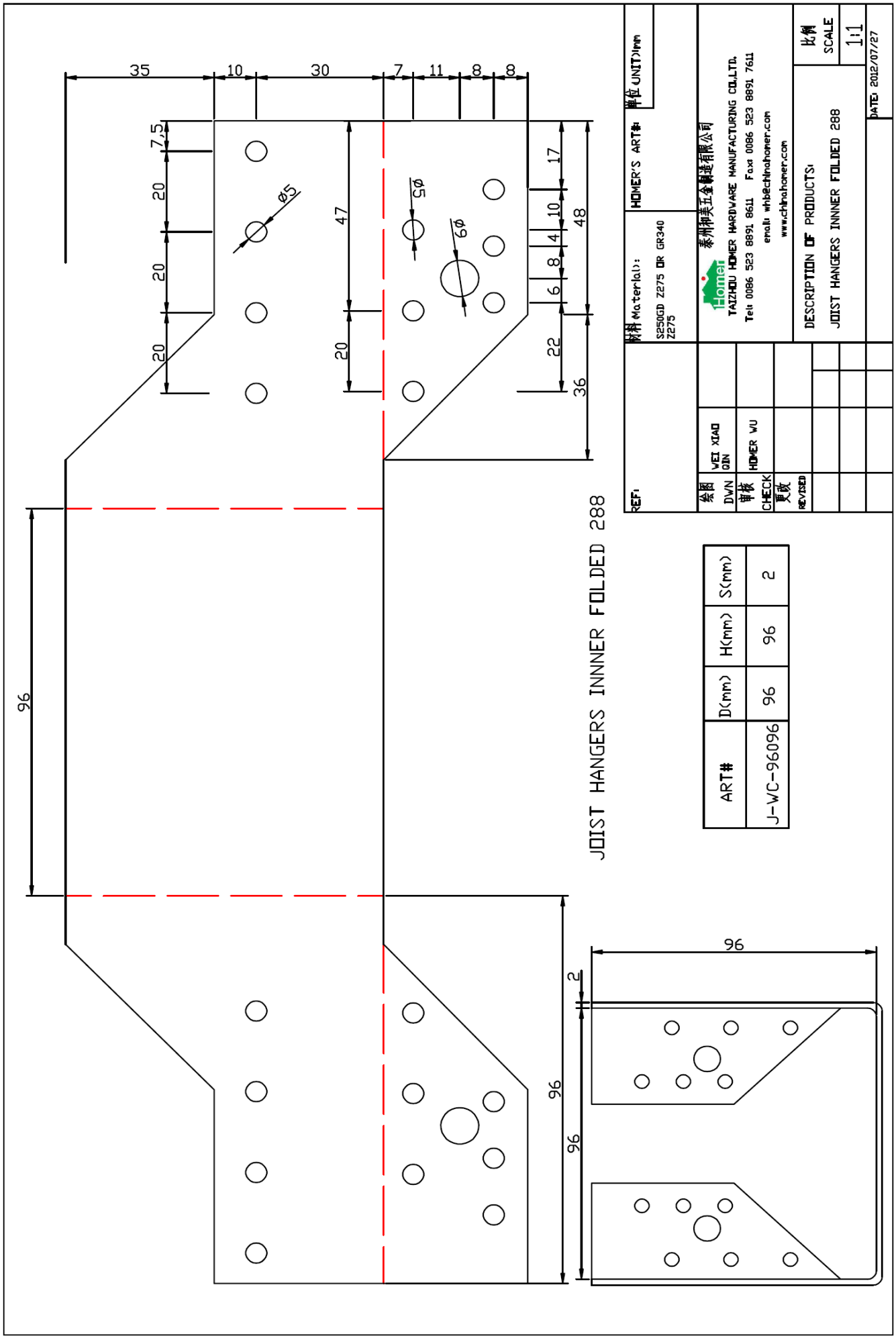
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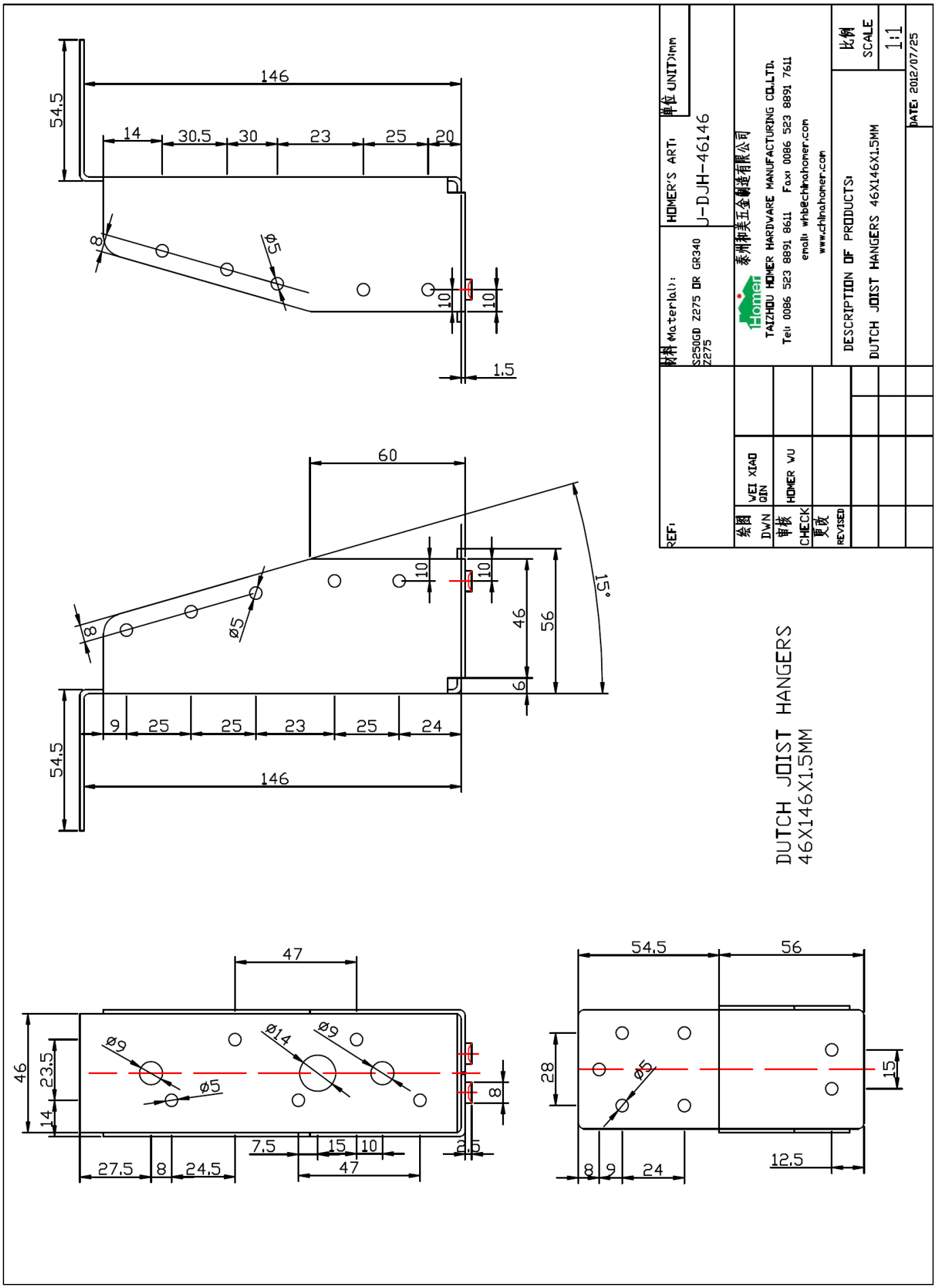
泰州市美工金属制造有限公司
TAIZHOU HOMER HARDWARE MANUFACTURING CO.,LTD.
Tel: 0086 523 8891 8611 Fax: 0086 523 8891 7611
email: whb@chinahomer.com
www.chinahomer.com
WEI XIAO QIN
HOMER WU
SCALE 1:1
DATE: 2012/07/27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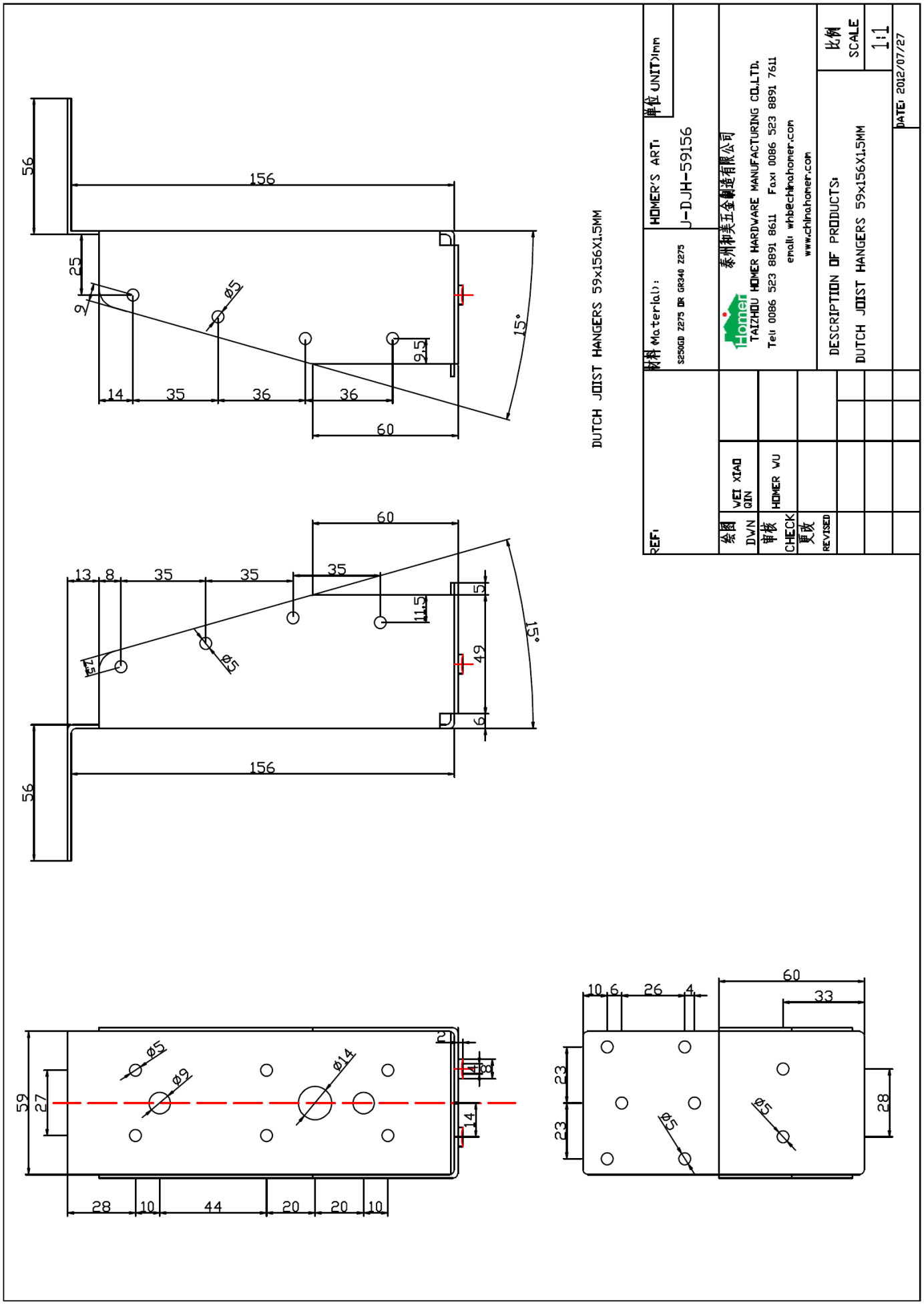
单位 UNIT:mm
材料 Materials: S250GD Z275 OR GR340 Z275
TAIZHOU HOMER HARDWARE MANUFACTURING CO.,LTD.
Tel: 0086 523 8891 8611 Fax: 0086 523 8891 7611
email: whb@chinahomer.com
www.chinahomer.com
DESCRIPTION OF PRODUCTS: DUTCH JOIST HANGERS 46X146X1.5MM
比例 SCALE 1:1
DATE: 2012/07/25
REF:
绘图 DWN WEI XIAO QIN
审核 CHECK HOMER WU
更改 REVISED


DUTCH JOIST HANGERS 59x156X1.5MM
HOMER'S ART: J-DJH-59156
單位 UNIT:mm
材料 Material: S250GD Z275 OR GR340 Z275
泰州和美五金制造有限公司
TAIZHOU HOMER HARDWARE MANUFACTURING CO.LTD.
Tel: 0086 523 8891 8611 Fax: 0086 523 8891 7611
email: whb@chinahomer.com
www.chinahomer.com
DESCRIPTION OF PRODUCTS: DUTCH JOIST HANGERS 59x156X1.5MM
比例 SCALE 1:1
DATE: 2012/07/27
REF:
绘图 DWN WEI XIAO QIN
审核 CHECK HOMER WU
更改 REVISED
156
56
25
9.7
Ø5
9.5
14
35
36
36
60
15°
60
13
8
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35
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11.5
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156
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28
10
44
20
20
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10
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26
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60
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23
23
Ø5
Ø5
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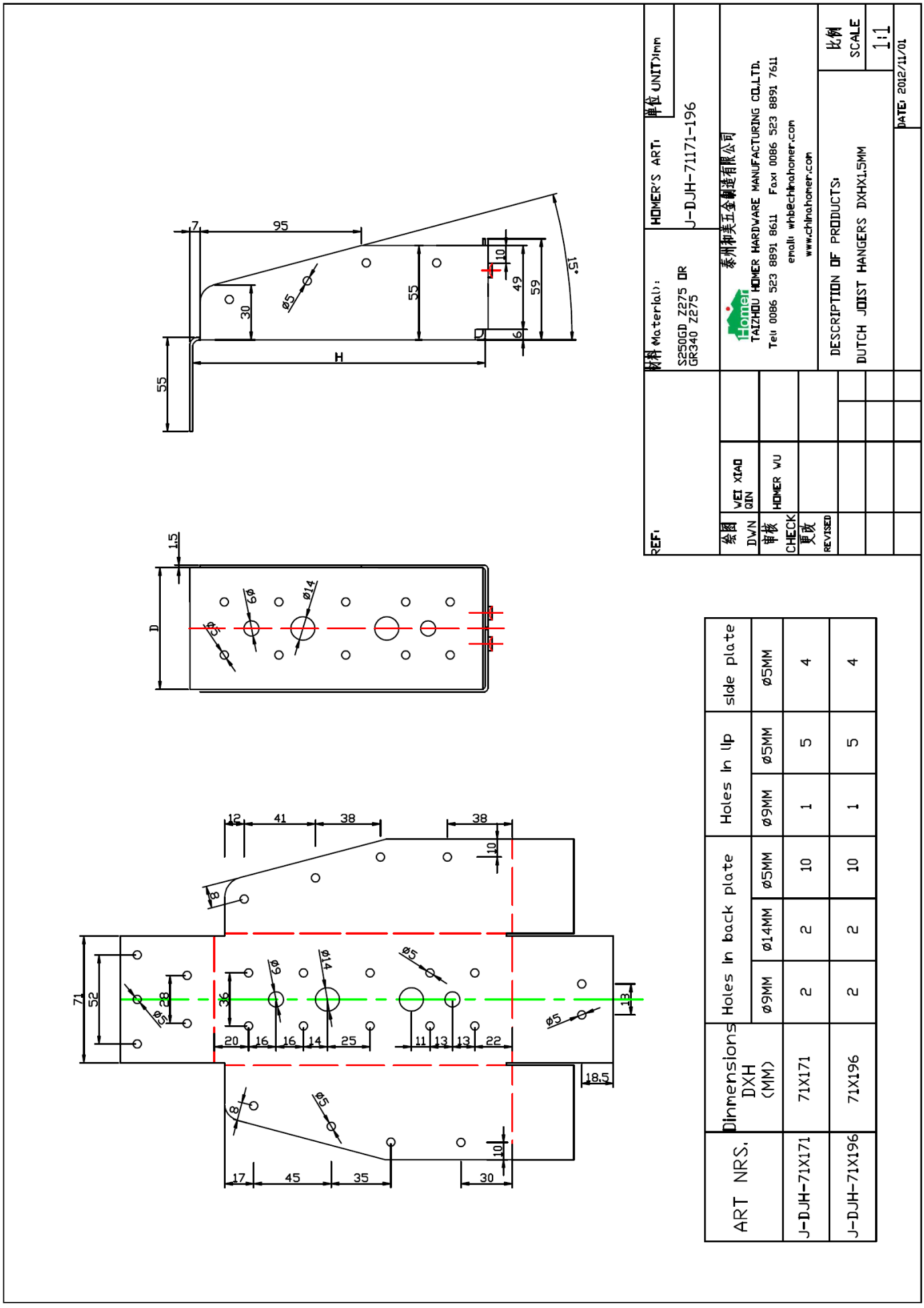
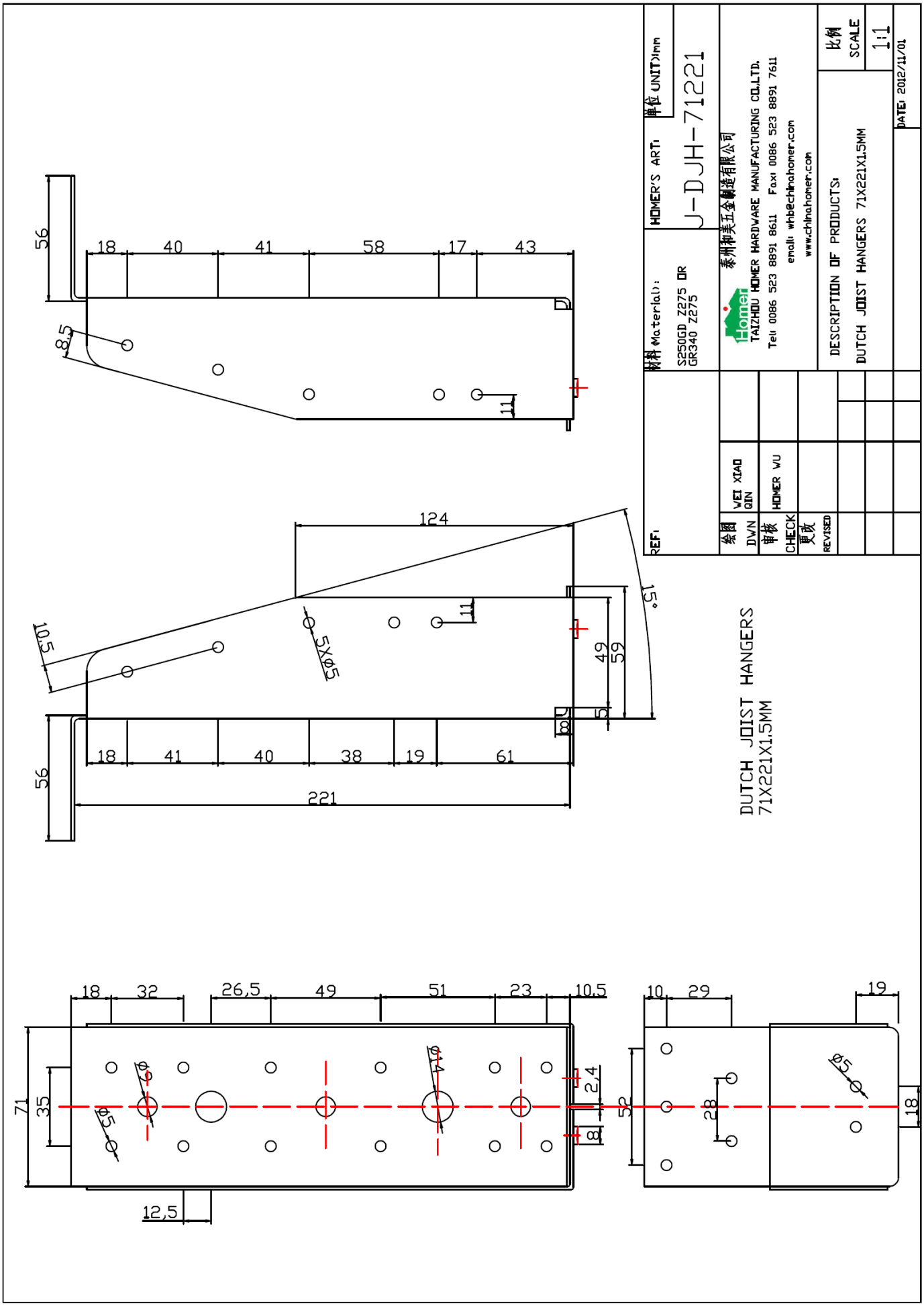



| ART NRS. | Dimensions DXH (MM) | Holes in back plate | | | Holes in lip | | side plate |
|---|---|---|---|---|---|---|---|
| | | ø9MM | ø14MM | ø5MM | ø9MM | ø5MM | ø5MM |
| J-DJH-71X171 | 71X171 | 2 | 2 | 10 | 1 | 5 | 4 |
| J-DJH-71X196 | 71X196 | 2 | 2 | 10 | 1 | 5 | 4 |


HOMER'S ART: J-DJH-71221
单位 UNIT:mm
材料 Material: S250GD Z275 OR GR340 Z275
泰州和美五金制造有限公司
TAIZHOU HOMER HARDWARE MANUFACTURING CO.,LTD.
Tel: 0086 523 8891 8611 Fax: 0086 523 8891 7611
email: whb@chinahomer.com
www.chinahomer.com
DESCRIPTION OF PRODUCTS: DUTCH JOIST HANGERS 71X221X1.5MM
比例 SCALE 1:1
DATE: 2012/11/01
REF:
绘图 DWN WEI XIAO QIN
审核 CHECK HOMER WU
更改 REVISED
DUTCH JOIST HANGERS
71X221X1.5MM
56
18
40
41
58
17
43
8.5
11
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15°
10.5
5XΦ5
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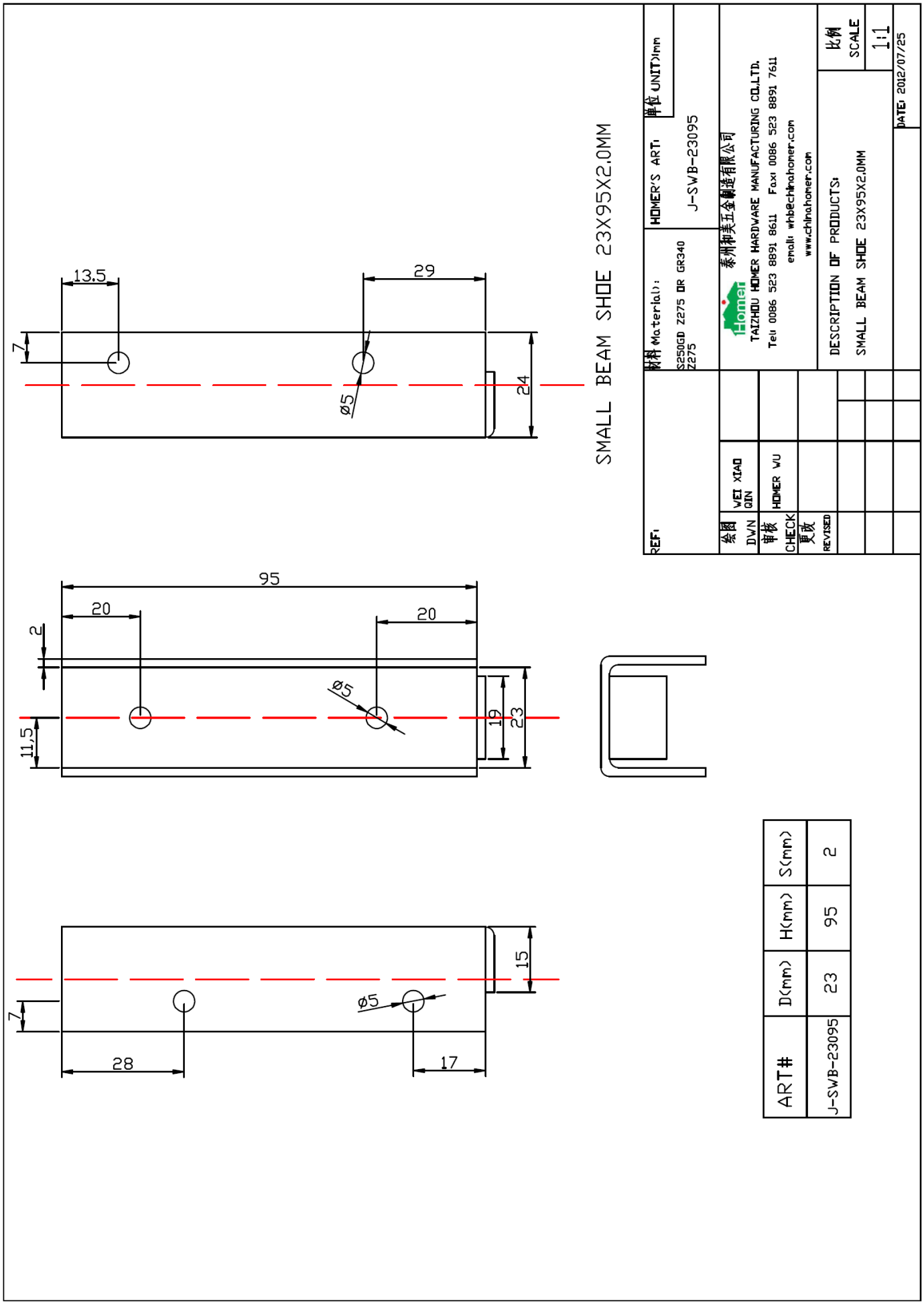
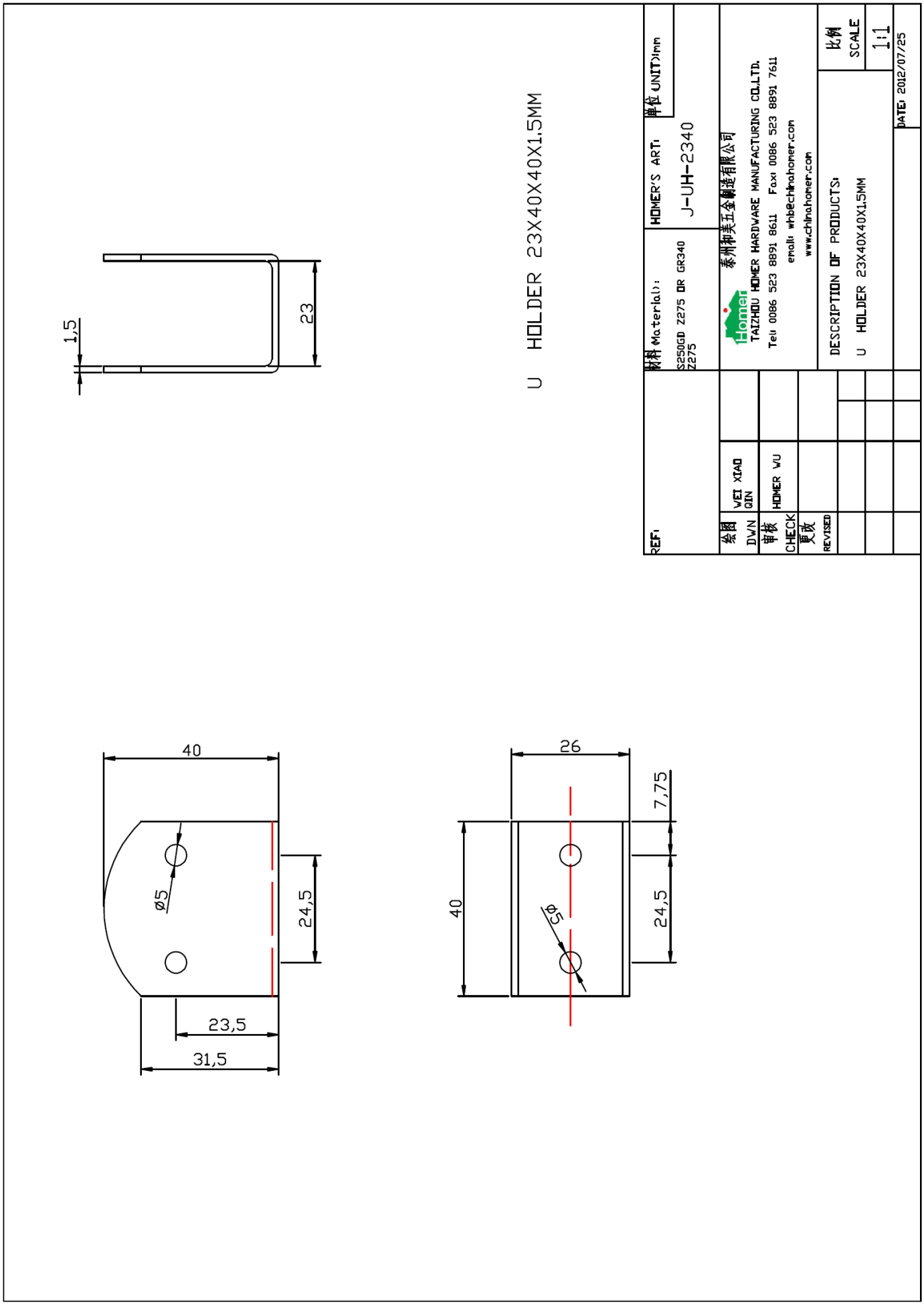
59
6
8
18
41
40
38
19
61
221
71
35
Φ9
Φ5
Φ14
12,5
18
32
26,5
49
51
23
10.5
2,4
10
29
19
52
28
Φ5
18


SMALL BEAM SHOE 23X95X2.0MM
13.5
29
7
24
Ø5
95
20
20
2
11.5
19
23
15
28
17
HOMER'S ART: J-SWB-23095
单位 UNIT)mm
材料 Material): S250GD Z275 OR GR340 Z275
泰州和美五金制造有限公司
TAIZHOU HOMER HARDWARE MANUFACTURING CO.,LTD.
Tel: 0086 523 8891 8611 Fax: 0086 523 8891 7611
email: whb@chinahomer.com
www.chinahomer.com
DESCRIPTION OF PRODUCTS:
SMALL BEAM SHOE 23X95X2.0MM
比例 SCALE 1:1
DATE: 2012/07/25
REF:
绘图 DWN WEI XIAO QIN
审核 CHECK HOMER WU
更改 REVISED
ART# J-SWB-23095
D(mm) 23
H(mm) 95
S(mm) 2


U HOLDER 23X40X40X1.5MM
1,5
23
40
ø5
24,5
23,5
31,5
26
7,75
40
24,5
材料 Material:
S250GD Z275 OR GR340 Z275
HOMER'S ART:
J-UH-2340
单位 UNIT:mm
泰州和美五金制造有限公司
TAIZHOU HOMER HARDWARE MANUFACTURING CO.LTD.
Tel: 0086 523 8891 8611 Fax: 0086 523 8891 7611
email: whb@chinahomer.com
www.chinahomer.com
DESCRIPTION OF PRODUCTS:
U HOLDER 23X40X40X1.5MM
比例 SCALE
1:1
DATE: 2012/07/25
REF:
绘图 DWN
VEI XIAO QIN
审核 CHECK
HOMER WU
更改 REVISED

## ANNEX 2: CHARACTERISTIC LOAD-CARRYING CAPACITIES

### 1 Load-carrying capacity of Outer and Inner folded joist hangers

General design method

The load acting on the fastener group in the secondary beam shall fulfil the condition

$$F_{y,v,d} \leq \frac{R_{T,d}}{2} \tag{1}$$

Correspondingly, the load acting on the primary beam fasteners in one flange shall fulfil the condition

$$F_{v,d} \leq \frac{R_{P,d}}{2} \tag{2}$$

Design value of the resistance of the connection in the secondary beam

$$R_{T,d} = k_{\text{mod}} \frac{n_T F_{T,v,Rk}}{\gamma_M} \tag{3}$$

and design value of the resistance of the connection in the primary beam

$$R_{P,d} = k_{\text{mod}} \frac{n_P F_{P,v,Rk}}{\gamma_M} \tag{4}$$

when

$F_{T,v,Rk}$ is the characteristic lateral load-carrying capacity of one fastener in the secondary beam
$F_{P,v,Rk}$ is the characteristic lateral load-carrying capacity of one fastener in the primary beam
$n_T$ is the total number of the fasteners in the secondary beam
$n_P$ is the total number of the fasteners in the primary beam
$k_{\text{mod}}$ is the modification factor according to Eurocode 5 taking into account the effect of the duration of the load and moisture content of timber,
$\gamma_M$ is the partial factor for the resistance of connections according to the relevant National annex of EN1995-1-1.

Lateral load-carrying capacities $F_{T,v,Rk}$ and $F_{P,v,Rk}$ of the fasteners are calculated according to the relevant equation according to EN 1995-1-1, equation (5) for steel plate thickness $t$ less than or equal to $d$/2, and (6) for steel plates of thickness greater than or equal to $d$:

$$F_{v,Rk} = \min \begin{cases} 0{,}4\, f_{h,k} t_1 d & \text{(a)} \\ 1{,}15\sqrt{2 M_{y,Rk} f_{h,k} d} + \dfrac{F_{ax,Rk}}{4} & \text{(b)} \end{cases} \tag{5}$$

$$F_{v,Rk} = \min \begin{cases} f_{h,k} t_1 d & \text{(a)} \\ f_{h,k} t_1 d \left[ \sqrt{2 + \dfrac{4 M_{y,Rk}}{f_{h,k} d\, t_1^2}} - 1 \right] + \dfrac{F_{ax,Rk}}{4} & \text{(b)} \\ 2{,}3\sqrt{M_{y,Rk} f_{h,k} d} + \dfrac{F_{ax,Rk}}{4} & \text{(c)} \end{cases} \tag{6}$$

where $t_1 = L - t$ when $L$ is the length of the fastener, $t$ is the thickness of steel plate, $M_{y,Rk}$ is according to standards EN 14952 and EN 409 experimentally determined characteristic value of the yield moment of the fastener, $F_{ax,Rk}$ is the withdrawal resistance of the fastener according to Eq. (8) limited at maximum to 1/3 with nails and ½ with screws from the load-carrying capacity $F_{v,Rk}$ and the characteristic value of the embedding strength

$$f_{h,k} = 0{,}082\rho_k d^{-0,3} \qquad \text{N/mm}^2 \qquad (7)$$

The characteristic withdrawal resistance of the nail

$$F_{ax,Rk} = f_{ax,k} d\, t_{pen} \le f_{tens,k} \qquad (8a)$$

and for the screw

$$F_{ax,Rk} = n^{-0,1} f_{ax,k} d\, l_{ef} \left(\frac{\rho_k}{\rho_a}\right)^{0,8} \le n^{-0,1} f_{tens,k} \qquad (8b)$$

where $f_{ax,k}$ is the withdrawal parameter determined by testing according to standards EN 14592 and EN 1382 for the actual timber material with density $\rho_a$, $f_{tens,k}$ is the experimentally determined tensile resistance of the fastener together with a steel plate, $t_{pen}$ is the penetration depth of the profiled part of the nail in timber, $n$ is the number of the screws in the flange of connector, $l_{ef}$ is the length of threaded part of the screw and $\rho_k$ is the characteristic density of timber in the actual connection. If the penetration depth for an anchor nail is less than $t_{pen} \le 8d = 32$ mm, the resistance according to Eq. (8a) is reduced by ($t_{pen}$/8mm - 3).

Eq. (6) may be used for the angular ring shank nails with the steel plate thickness of 2 mm, if the length of the conical part is at least 4 mm and the diameter of the cone at the head of the nail is at least 5,2 mm.

The fasteners in the secondary beam are loaded by a force of

$$F_{y,v,d} = \frac{F_{0,d}}{2} + \frac{H_T - H + a}{B} F_{90,d} \qquad (9)$$

and the resultant of the fastener group force of the primary beam is

$$F_{v,d} = \sqrt{F_{y,v,d}^2 + F_{x,v,d}^2} \qquad (10)$$

when the force component

$$F_{x,v,d} = F_{90,d} - F_{x,o,d} = F_{90,d} \pm \frac{e}{H - a}\left(\frac{F_{0,d}}{2} + \frac{H_T - H + a}{B} F_{90,d}\right) \qquad (11)$$

where

plus sing (+) is used for Inner folded joints hangers and minus sign (-) for Outer folded joist hangers

$F_{0,d}$ design value of the support reaction of the secondary beam at the symmetry line of the joist hanger in the vertical direction of the joist hanger

$F_{90,d}$ design value of the support reaction of the secondary beam in the width direction of the joist hanger

$H$ height of the joist hanger

$B$ inner width of the joist hanger

$H_T$ height of the secondary beam

$a$ distance of the mass centre of the fasteners in the primary beam from the upper edge of the joist hanger (see Figures and Tables A2.1 and A2.2)

$e$ distance of the centroid of the fastener group in the primary beam from the inner edge of the joist hanger (see Figures and Tables A2.1 and A2.2)

**Table A2.1** Outer folded joist hangers – nominal dimensions, number of fasteners in full nailing/screwing and the measurements for centroids of fastener groups; $n_T$ is the number of fasteners in the secondary beam and $n_P$ is the number of fasteners in the primary beam; *B*, *H*, *a* and *e* are defined in Figure A1.2.

| Art. No. | size (mm) | fasteners | | | |
|---|---|---|---|---|---|
| | *B* x *H* x *t* | $n_T$ | $n_P$ | *a* (mm) | *e* (mm) |
| J-WB-25117 | 25x117x2.0 | 8 | 14 | 37,0 | 20,6 |
| J-WB-32114 | 32x114x2.0 | 8 | 14 | 37,0 | 20,6 |
| J-WB-40110 | 40x110x2.0 | 8 | 14 | 37,0 | 20,6 |
| J-WB-45096 | 45x96x2.0 | 8 | 12 | 32,7 | 15,0 |
| J-WB-45108 | 45x108x2.0 | 8 | 14 | 37,0 | 20,6 |
| J-WB-45137 | 45x137x2.0 | 10 | 16 | 41,3 | 19,5 |
| J-WB-45168 | 45x168x2.0 | 14 | 28 | 75,0 | 20,0 |
| J-WB-48095 | 48x95x2.0 | 8 | 12 | 32,7 | 15,0 |
| J-WB-48095S | 48x95x2.0 | 8 | 12 | 32,7 | 15,0 |
| J-WB-48106 | 48x106x2.0 | 8 | 14 | 37,0 | 20,6 |
| J-WB-48136 | 48x136x2.0 | 10 | 16 | 41,3 | 19,5 |
| J-WB-48136S | 48x136x2.0 | 10 | 16 | 42,3 | 19,5 |
| J-WB-48166 | 48x166x2.0 | 14 | 28 | 75,0 | 20,0 |
| J-WB-51093 | 51x93x2.0 | 8 | 12 | 32,7 | 15,0 |
| J-WB-51093S | 51x93x2.0 | 8 | 12 | 32,7 | 15,0 |
| J-WB-51105 | 51x105x2.0 | 8 | 14 | 37,0 | 20,6 |
| J-WB-51105S | 51x105x2.0 | 8 | 14 | 37,0 | 20,6 |
| J-WB-51135 | 51x135x2.0 | 10 | 16 | 41,3 | 19,5 |
| J-WB-51135S | 51x135x2.0 | 10 | 16 | 42,3 | 19,5 |
| J-WB-51164 | 51x164x2.0 | 14 | 28 | 75,0 | 20,0 |
| J-WB-60100 | 60x100x2.0 | 8 | 14 | 37,0 | 20,6 |
| J-WB-60160 | 60x160x2.0 | 12 | 22 | 57,0 | 21,1 |
| J-WB-60190 | 60x190x2.0 | 14 | 26 | 67,5 | 21,2 |
| J-WB-63098 | 63x98x2.0 | 8 | 14 | 37,0 | 20,6 |
| J-WB-63128 | 63x128x2.0 | 10 | 18 | 47,0 | 20,9 |
| J-WB-63158 | 63x158x2.0 | 12 | 22 | 57,0 | 21,1 |
| J-WB-63188 | 63x188x2.0 | 14 | 26 | 67,5 | 21,2 |
| J-WB-71125 | 71x125x2.0 | 10 | 18 | 47,0 | 20,9 |
| J-WB-71154 | 71x154x2.0 | 12 | 22 | 57,0 | 21,1 |
| J-WB-71184 | 71x184x2.0 | 14 | 26 | 67,5 | 21,2 |
| J-WB-75122 | 75x122x2.0 | 10 | 18 | 47,0 | 20,9 |
| J-WB-75152 | 75x152x2.0 | 12 | 22 | 57,0 | 21,1 |
| J-WB-75182 | 75x182x2.0 | 14 | 26 | 67,5 | 21,2 |
| J-WB-75212 | 75x212x2.0 | 16 | 30 | 77,5 | 21,3 |
| J-WB-80120 | 80x120x2.0 | 10 | 18 | 47,0 | 20,9 |
| J-WB-90145 | 90x145x2.0 | 12 | 22 | 57,0 | 21,1 |
| J-WB-100140 | 100x140x2.0 | 12 | 22 | 57,0 | 21,1 |
| J-WB-100200 | 100x200x2.0 | 16 | 30 | 77,5 | 21,3 |
| J-WB-120160 | 120x160x2.0 | 14 | 26 | 67,5 | 21,2 |

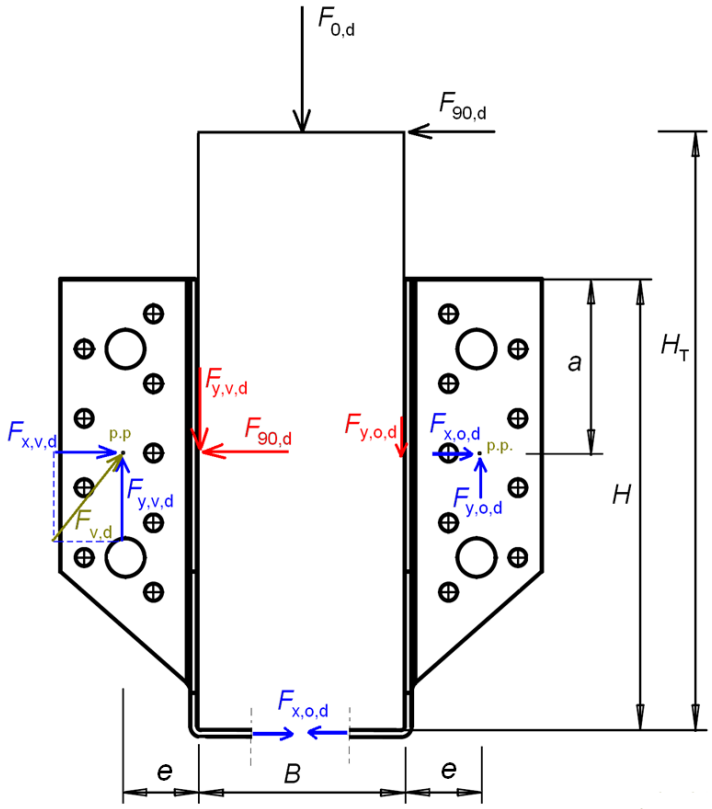



**Figure A2.1** Definition of symbols used and the model for forces acting in Outer folded joist hanger. pp indicates centroid for the group of fasteners.

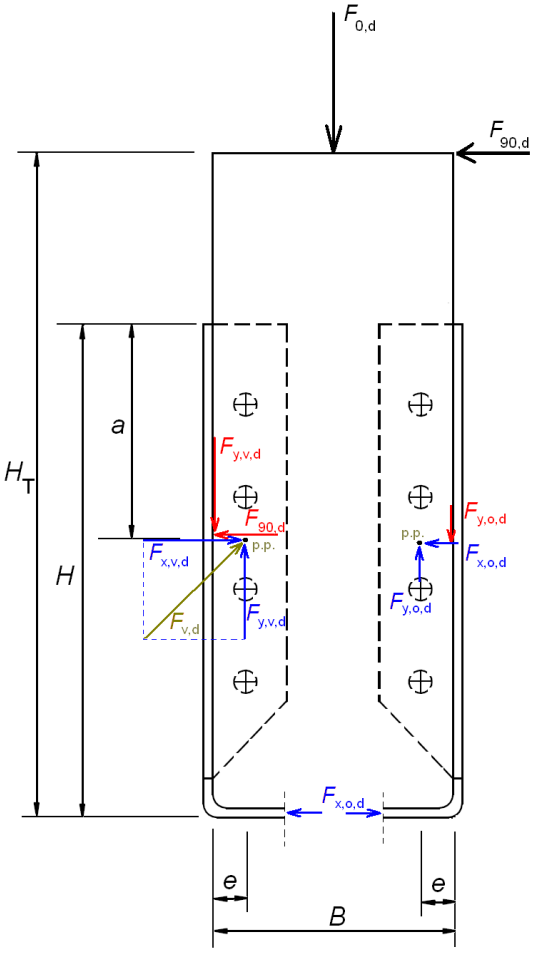



**Figure A2.2** Definition of symbols used and the model for forces acting in Inner folded Joist Hanger. pp indicates centroid for the group of fasteners.

**Table A2.2** Inner folded joist hangers – nominal dimensions, number of fasteners in full nailing/screwing and the measurements for centroids of fastener groups; $n_T$ is the number of fasteners in the secondary beam and $n_P$ is the number of fasteners in the primary beam; *B*, *H*, *a* and *e* are defined in Figure A2.2.

| Art. No. | size (mm) | fasteners | | | |
|---|---|---|---|---|---|
| | *B* x *H* x *t* | $n_T$ | $n_P$ | *a* (mm) | *e* (mm) |
| J-WC-45096 | 45x96x2.0 | 6 | 6 | 30,0 | 8,0 |
| J-WC-48136 | 48x136x2.0 | 12 | 12 | 56,5 | 7,0 |
| J-WC-51093 | 51x93x2.0 | 6 | 6 | 30,0 | 8,0 |
| J-WC-51105 | 51x105x2.0 | 8 | 8 | 48,0 | 7,8 |
| J-WC-75075 | 75x75x2.0 | 6 | 10 | 23,8 | 16,0 |
| J-WC-96096 | 96x96x2.0 | 8 | 12 | 39,0 | 16,5 |

Simplified method for Outer folded joist hangers

Simplified design method can be used for Outer folded Joist Hangers when the depth of the secondary beam is in the range 1,0..1,5*H,* where *H* is the height of the joist hanger, and when the connection resistance to the primary beam is at least 20 % higher than the connection resistance to the secondary beam.

The design resistance $R_{0,d}$ of the joist hanger in vertical direction

$$R_{0,d} = k_{\text{mod}} \frac{n_T F_{T,v,Rk}}{\gamma_M} \tag{12}$$

and in the direction of the width *B* of the joist hanger

$$R_{90,d} = 0{,}8 \cdot \frac{B}{H_T} \cdot R_{0,d} \tag{13}$$

where

$k_{\text{mod}}$ is the modification factor according to Eurocode 5 taking into account the effect of the duration of the load and moisture content of timber,

$\gamma_M$ is the partial factor for the resistance of connections according to the relevant National annex of EN1995-1-1,

$n_T$ is the total number of the fasteners in the secondary beam

$F_{T,v,Rk}$ is the characteristic load-carrying capacity of the fastener in the secondary beam

*B* is the width of the joist hanger as given in Table A2.1

$H_T$ is the depth of the secondary beam, less than 1,5*H* and

*H* is the depth of the joist hanger as given in Table A2.1.

The following equation shall be satisfied:

$$\frac{F_{0,d}}{R_{0,d}} + \frac{F_{90,d}}{R_{90,d}} \le 1 \tag{14}$$

where

$F_{0,d}$ is the design value of the support reaction component of the secondary beam acting along the vertical symmetry line of the joist hanger and

$F_{90,d}$ is the design value of the support reaction component of the secondary beam acting parallel to the width direction *B*. $F_{90,d}$ may act eccentric with regard to the secondary beam, however not higher than at the upper edge of the secondary beam.

## 2 Load-carrying capacity of Dutch Joist Hanger and Small Beam Shoe connections

The upper flange of the Dutch Joist Hangers is used only as assembly connection that do not utilized in the ultimate bearing capacity of the joist hanger. The Dutch Joist Hangers and the Small Beam Shoe are fixed to the primary beam from the fastener holes of end flange and to the faces of the secondary beam symmetrically from the both vertical flanges of the joist hanger. Dutch Joist Hangers and Small Beam Shoe are used as beam end connection subjected to a load $F_{0,d}$ parallel to the height of the secondary beam and $F_{90,d}$ perpendicular to it (see Figure A2.3).

The load acting on the fastener group in the secondary beam shall fulfil the condition (1).

For the fixing to the primary beam the following condition shall be satisfied

$$\left(\frac{F_{0,d}}{R_{0,d}}\right)^2 + \left(\frac{F_{90,d}}{R_{90,d}}\right)^2 \leq 1 \qquad (15)$$

where the design capacity parallel to the height direction of the joist hanger

$$R_{0,d} = k_{\text{mod}} \frac{n_P \cdot F_{P,v,Rk}}{\gamma_M} \qquad (16)$$

and the design capacity parallel to the width direction of the secondary beam

$$R_{90,d} = k_{\text{mod}} \frac{k_m \cdot F_{P,v,Rk}}{\gamma_M} \qquad (17)$$

when

$F_{P,v,Rk}$ is the characteristic lateral load-carrying capacity of one fastener in the primary beam calculated according to the actual expression (5) or (6),

$n_P$ is the number of the fasteners in the primary beam,

$k_{\text{mod}}$ is the modification factor according to Eurocode 5 taking into account the effect of the duration of the load and moisture content of timber,

$\gamma_M$ is the partial factor for the resistance of connections according to the relevant National annex of EN1995-1-1

and factor

$$k_m = \min(k_1, k_2, \ldots, k_{\text{np}}) \qquad (18)$$

where factor $k_i$ for fastener $i$

$$k_i = \left(\frac{1}{n_P} + \frac{H_T - H + a}{\sum r_i} \cdot \frac{y_i}{r_i}\right)^{-1} \qquad (19)$$

when

$H$ height of the joist hanger

$H_T$ height of the secondary beam

$a$ distance of the mass centre of the fasteners in the primary beam from the upper edge of the joist hanger (see Figure A2.3 and Table A2.3)

$r_i$ the distance between the fastener $i$ and the centroid of the fastener group in the primary beam

$y_i$ the distance parallel to the height direction of the secondary beam between the fastener $i$ and the centroid of the fastener group in the primary beam.

The values of $k_m$ factors calculated for full nailing/screwing with joist height of $H_T = H$ and $H_T = 1{,}5H$ are presented in Table A2.3.

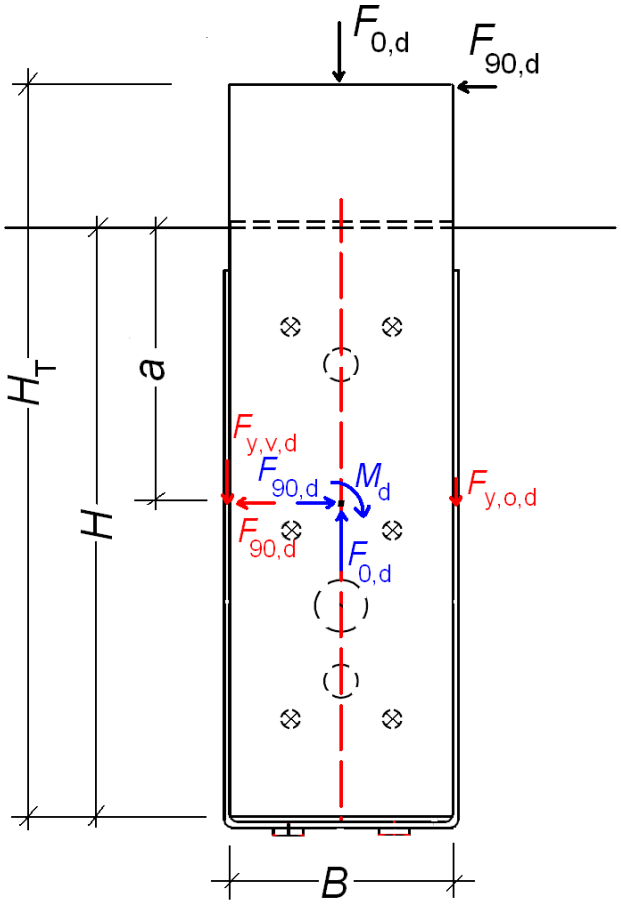



**Figure A2.3** Definition of symbols used and the model for forces acting in Dutch Joist Hangers and Small Beam Shoe.

**Table A2.3** Dutch Joist Hangers, Small Beam Shoe and U-holder – dimensions, number of fasteners in full nailing/screwing and $k_m$-factors for full nailing/screwing; $n_T$ is the number of fasteners in the secondary beam and $n_P$ is the number of fasteners in the primary beam; $B$, $H$ and $a$ are defined in Figure A2.3.

| Art. No. | Size (mm) *BxHxt* | $n_T$ | $n_P$ | $a$ (mm) | $k_m$ $H_T=H$ | $k_m$ $H_T=1{,}5H$ |
|---|---|---|---|---|---|---|
| Dutch Joist Hangers | | | | | | |
| J-DJH-46146 | 46X146X1.5 | 10 | 5 | 83,7 | 1,42 | 0,87 |
| J-DJH-59156 | 59X156X1.5 | 8 | 6 | 80,7 | 2,72 | 1,78 |
| J-DJH-71171 | 71X171X1.5 | 8 | 10 | 87,0 | 3,56 | 2,18 |
| J-DJH-71196 | 71X196X1.5 | 8 | 10 | 97,0 | 3,72 | 2,28 |
| J-DJH-71221 | 71X221X1.5 | 10 | 12 | 116,0 | 4,43 | 2,77 |
| Small Beam Shoe | | | | | | |
| J-SWB-23095 | 23X95X2.0 | 4 | 2 | 47,5 | 0,73 | 0,45 |
| U-Holder | | | | | | |
| J-UH-2340 | 23X40X40X1.5 | 2 | 2 | - | - | - |

## 3 Load-carrying capacity of U-Holder connection

The U-Holder is not assumed to have any load-carrying capacity for lateral forces parallel to the width direction of the secondary beam. The U-Holder connection is fixed to the main girder from both of fastener holes and to the secondary beam from the both flanges by one or two fasteners.

For the connection load parallel to the height direction of the joist the following condition shall be satisfied:

$$F_d \leq \min(R_{T,d}; R_{P,d}) \tag{20}$$

where the design capacity of the connection to the secondary beam $R_{T,d}$ and to the primary beam $R_{P,d}$ are calculated according to the expressions (3) and (4).

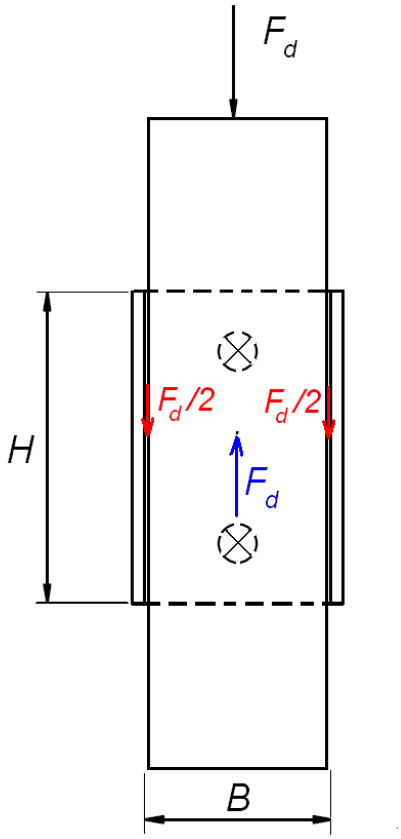



**Figure A2.4** Forces acting in the U-Holder.

## 4 Connection forces perpendicular to the grain direction

The tension stresses perpendicular to the grain of the primary beam caused by a joint hanger connection shall be taken into account by checking the following condition fulfils

$$F_{d,1} + F_{d,2} \leq \frac{k_{\mathrm{mod}} \cdot 14 \cdot B_{\mathrm{P}}}{\gamma_M} \cdot \sqrt{\frac{h_e}{\left(1 - \frac{h_e}{H_{\mathrm{P}}}\right)}} \tag{21}$$

where

$F_{d,1}$ and $F_{d,2}$ are the design force components of the joist hanger connection acting perpendicular to the grain of the primary beam (see Figure 3),

$k_{mod}$ is the modification factor according to Eurocode 5 taking into account the effect of the duration of the load and moisture content for the secondary beam;

$\gamma_M$ is the partial safety factor for the resistance of connections according to the actual National annex of EN 1995-1-1;

$B_P$ is the thickness of the primary beam (see Figure 3);

$h_e$ is the loaded edge distance to the centre of the most distant fastener of the joist hanger connection (see Figure 3);

$H_P$ is the height of the primary beam.

## 5 Torsion of primary beam

The torsion stresses caused by joint hanger connections shall be taken into account in design of the primary beam and its lateral supporting**.** A single side joist hanger connection causes to the primary beam the following a torsional moment

$$M_{V,d} = F_{d,1} \cdot \frac{B_P}{2} \qquad (22)$$

where

$F_{d,1}$ is the design force of the joist hanger connection acting in the height direction of the main beam (see Figure 3);

$B_P$ is the thickness of the primary beam.

The torsional moment shall be taken into account also with the double sided joist hanger connections, if the difference of the design forces of opposite sides of connections

$$\left|F_{1,d} - F_{2,d}\right| > 0{,}2 \max(F_{d,1}; F_{d,2}) .$$

## 6 Structural requirements

Joist Hanger is an end support for the secondary joist. It is fixed from its flanges to primary header using anchor nails or anchor screws. If joist hangers are placed on both sides of the primary header the length of the fastener shall be at most $B_P$ - 14 mm, where $B_P$ is the thickness of the primary header.

Joist hangers shall be fixed to secondary beam from both sides with same amount of identical fasteners. If the distance from opposite timber surface is less than 16 mm the fasteners shall be fixed from every second hole staggered from the opposing sides.

Connections with Joist Hangers shall fulfil the minimum spacing and edge distance requirement specified in EN 1995-1-1. The minimum spacings $a_1$ and $a_2$ in table 8.2 of EN 1995-1-1 can be multiplied by a factor of 0,7 (nailed steel-to-timber connections).

The gap between joist and header shall be max 3 mm (see Figure 3). The width of the secondary beam shall be max 3 mm less than the nominal width *B* and the height of the secondary beam shall be at least equal to joist hanger nominal height *H*.