



European Technical Assessment + Evaluation report

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 516 Keji Road, The Economic Development Zone, Jiangyan District, Taizhou City, Jiangsu Province China 225500
Manufacturing plant	Jiangsu Homer Hardware Manufacturing Co., Ltd 516 Keji Road, The Economic Development Zone, Jiangyan District, Taizhou City, Jiangsu Province China 225500
This European Technical Assessment contains	38 pages including 3 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, Three-dimensional nailing plates
This version replaces	ETA 13/0432, issued on May 14, 2019

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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.

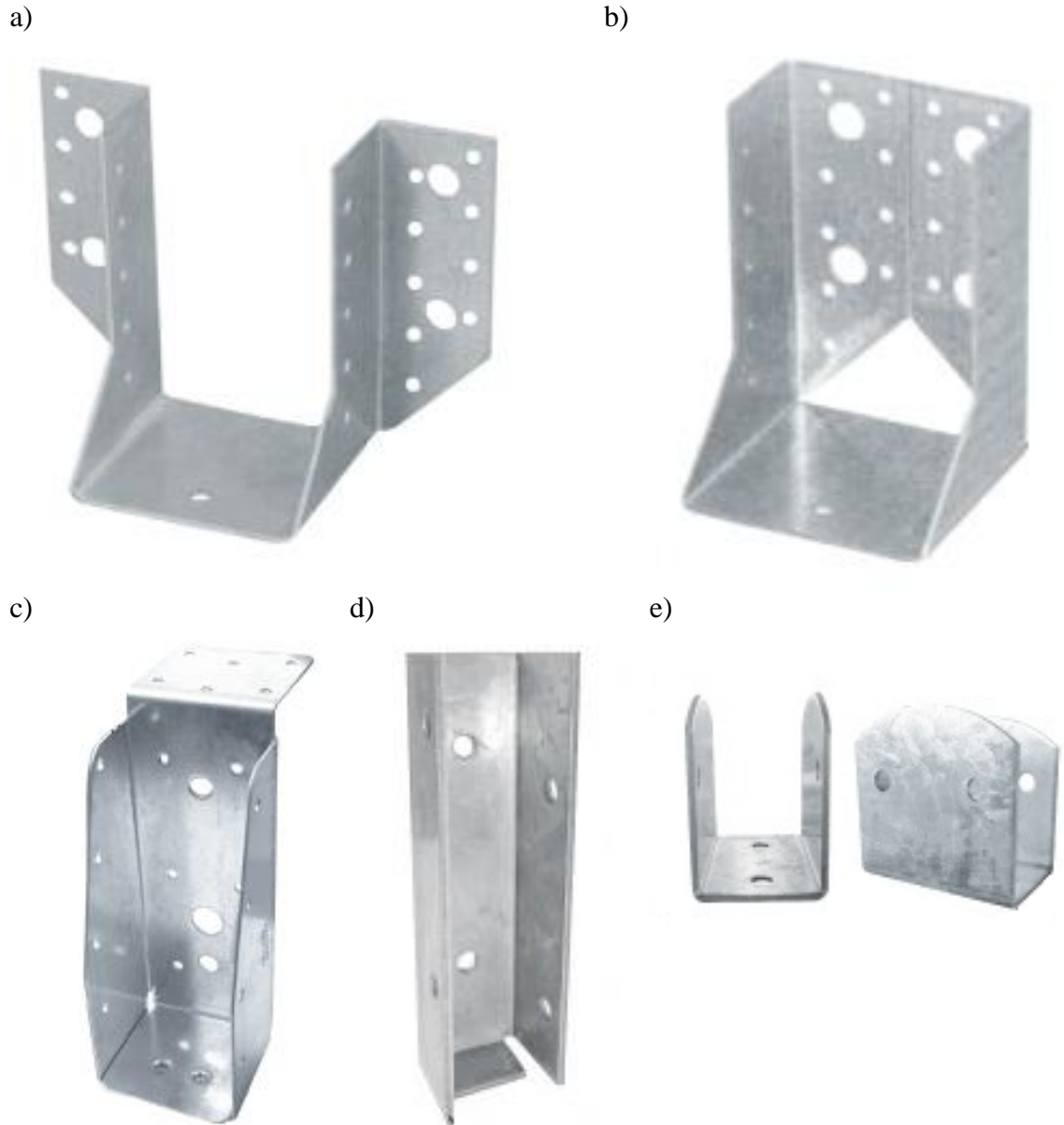


Figure 1. Different types of Taizhou Homer Joist Hangers: a) Out folded Joist Hanger, b) Inner folded Joist Hanger, c) Dutch Joist Hanger, d) Small Beam Shoe and e) U-Holder.

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.

Assessment

The manufacturer delivered technical specification of the product that corresponds to the scope of ETAG 015.

Conclusion

Requirements set in clause 1.1 of ETAG 015 are met.

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 ρ_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 $d = 4,5 \dots 5,0$ mm and the inner diameter of the threaded part $d_i \geq 3,0$ mm. The length of the threaded part of the screw shall be at least $6d$.



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.

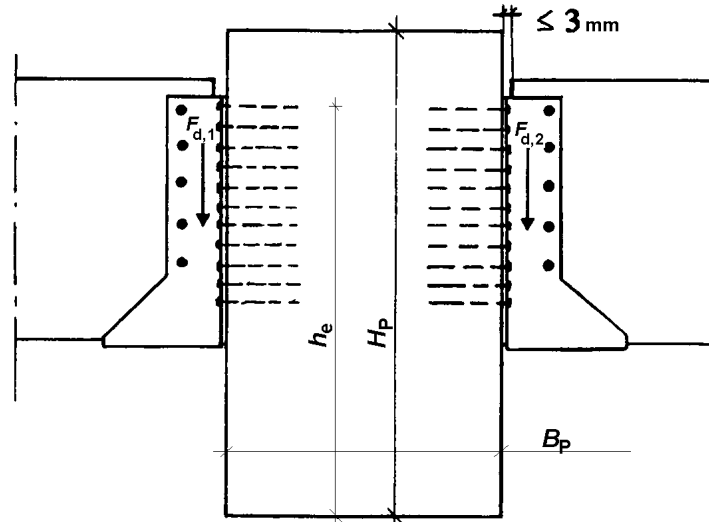


Figure 3. Typical use of Taizhou Homer Joist Hangers.

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 years¹.

2.3 Identification

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

Assessment

Information was given by the manufacturer regarding intended uses of the product.

Working life corresponds to clause 1.3 of ETAG 015.

Identification of the product is made as provided in ETAG 015, clause 5.

Conclusion

Requirements set in clauses 1.2, 1.3 and 5.1 of ETAG 015 are met.

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.

Assessment

Behaviour of the joints is ductile as defined in ETAG 015, 5.1.1.1; therefore, mechanical resistances are determined by calculation. Eurofins Expert Services Oy / Ari Kevärinmäki has developed design instructions for Taizhou Homer Joist Hangers as described in reports VTT-S-02287-13 and EUFI29-19006337-T2.

Method 2 has been used so that the ETA gives characteristic values for the nailing plates together with the equations for the calculation of design values.

No quantified performance is determined for ductility.

Conclusion

Calculations have been carried out according to the requirements in ETAG 015. Results of the assessment are given in the ETA.

Requirements set in clause 2.4.1 of ETAG 015 are met.

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.

Assessment

The product specification (including associated ancillary components) has been examined and an assessment or appropriate test and evaluation shall be carried out, to determine the thickness of corrosion protection or the material specification.

Conclusion

Assessment is based on the materials' specification.

Requirements set in clause 2.4.7 of ETAG 015 are met.

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.

Assessment

The three-dimensional nailing plates are considered to satisfy the requirements for performance class A1 of the characteristic reaction to fire, in accordance with the provisions of EC decision 96/603/EC (as amended) without the need for testing on the basis of the listing of their materials in that decision.

Conclusion

Requirements set in clause 2.4.2.1 of ETAG 015 are met.

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.

Assessment

The EOTA “model clauses on dangerous substances” apply.

The manufacturer has submitted the chemical constitution and composition of the materials and components of the product according to which there are no dangerous substances present in the product.

Conclusion

Requirements set in clause 2.4.3 of ETAG 015 are met.

Overall conclusion

Assessment has been conducted in accordance with ETAG 015 used as an EAD.

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 Commission², 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.

Documentation

Test reports presented by the manufacturer and other material used as basis for the assessment are presented in Annex 3.

Documents available to the notified body responsible for the evaluation of constancy of performance (AVCP) include:

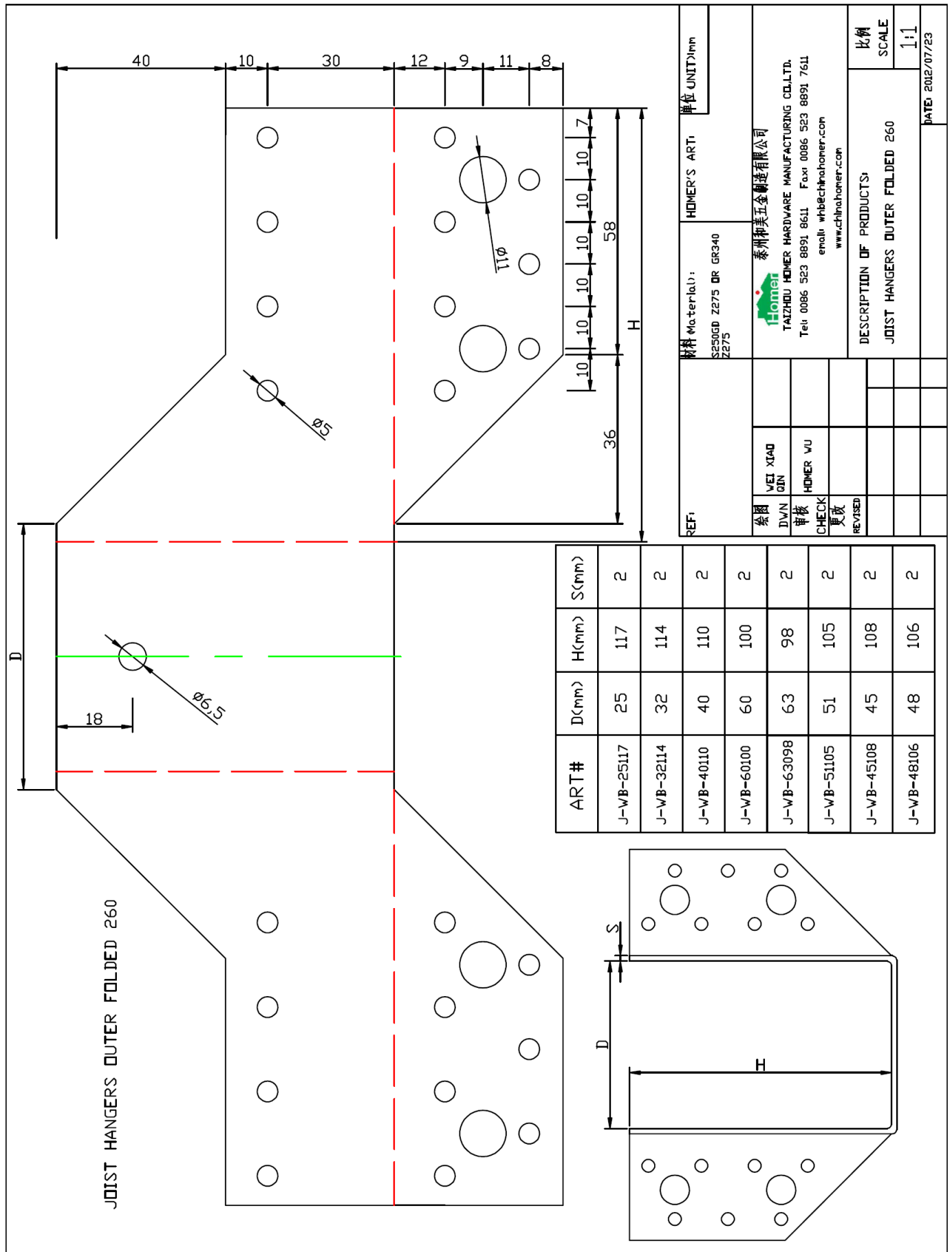
- The ETA
- Basic manufacturing process
- Product and materials specifications
- Control plan

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


Tiina Ala-Outinen
Business Development Manager

Ari Kevarinmäki
Leading Expert

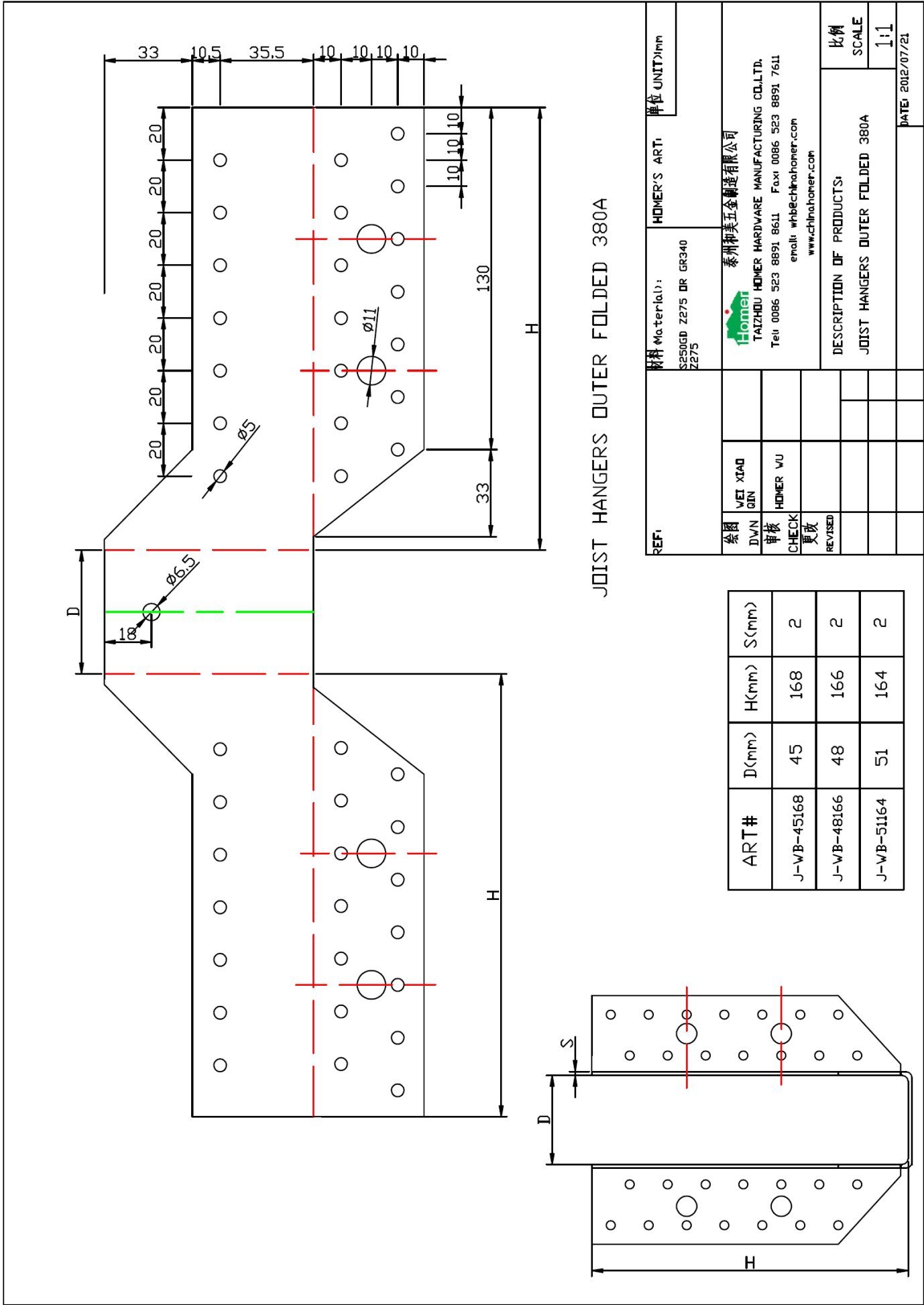
² Official Journal of the European Communities L 268 of 1/10/1997



The diagram illustrates a two-layer system. The top layer has a total width H and contains several particles (small circles) and two larger circles. The bottom layer has a total width D and contains several particles and two larger circles. A central channel of width S separates the two layers. The side regions of both layers are connected by a diagonal line, suggesting a fluid connection or a specific boundary condition.

REF:	材料 Material:		S250GD Z275 DR GR340 Z275		HOMER'S ART#:		单位 UNIT:mm	
绘图	VEI XTAD QIN		 泰州和美五金制造有限公司					
DWN	TAIZHOU HOMER HARDWARE MANUFACTURING CO.,LTD.							
审核	HOMER VU		Tel: 0086 523 8891 8611 Fax: 0086 523 8891 7611					
CHECK	email: whb@chinahomer.com							
更改	www.chinahomer.com							
REVISED			DESCRIPTION OF PRODUCTS:				比例	
			JOIST HANGERS OUTER FOLDED 320B				SCALE	
							1:1	
							DATE: 2012/07/20	

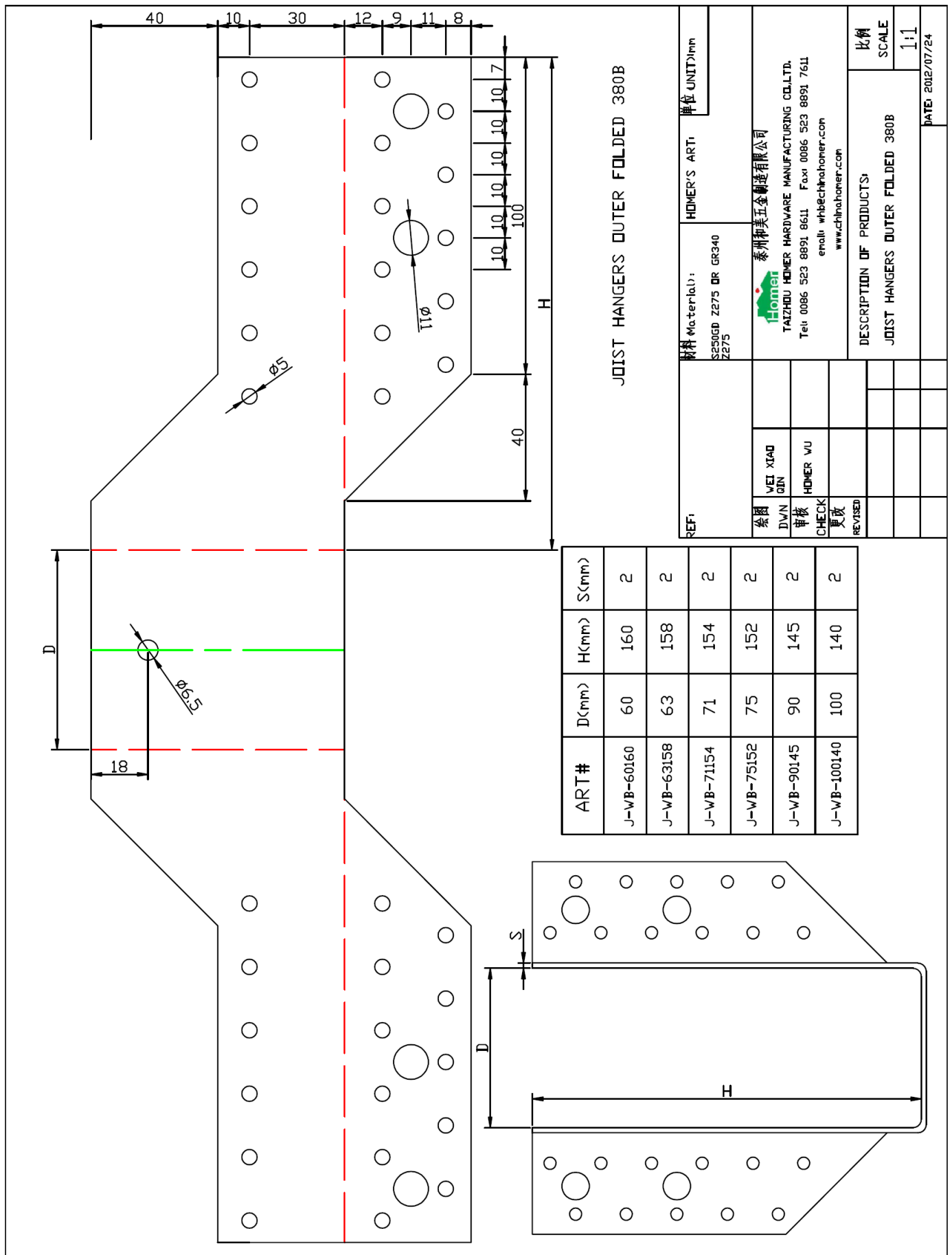
ART#	D(mm)	H(mm)	S(mm)
J-WB-45137	45	137	2
J-WB-48136	48	136	2
J-WB-51135	51	135	2

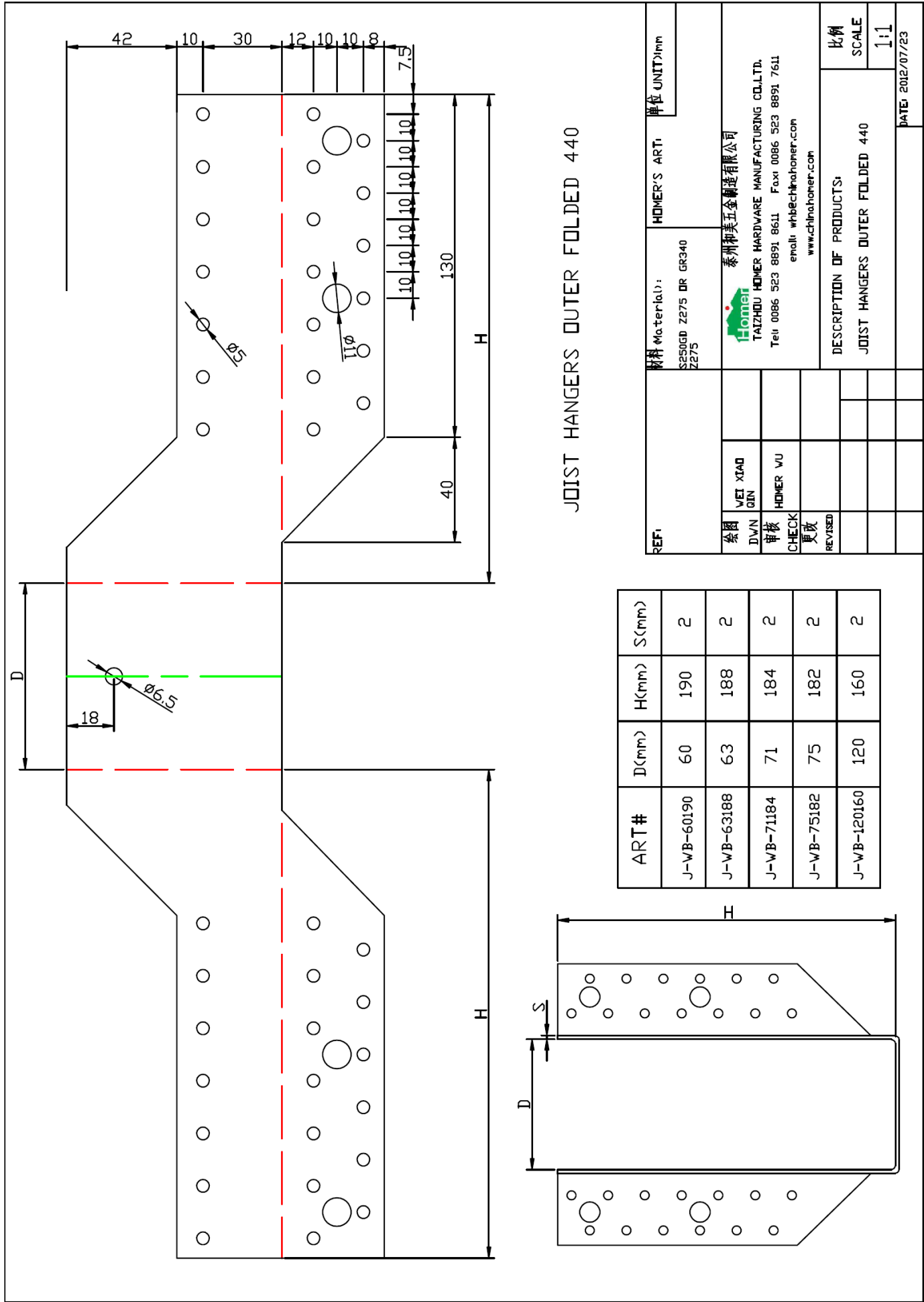


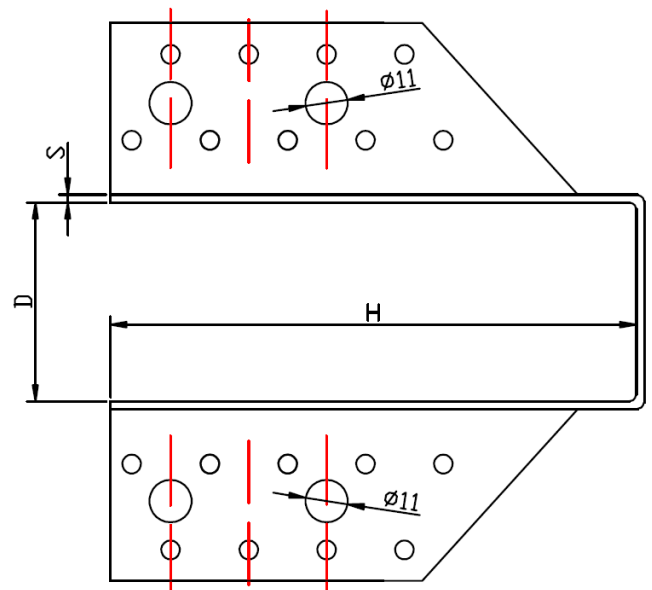
JOIST HANGERS OUTER FOLDED 380A

ART#	D(mm)	H(mm)	S(mm)
J-WB-45168	45	168	2
J-WB-48166	48	166	2
J-WB-51164	51	164	2

REF:	材料 Material:	HOMER'S ART:	单位 UNIT:mm
	S250GD Z275 DR GR340 Z275		
绘图 DWN 审核 CHECK 更改 REVISED	VEI XIAO GIN HOMER WU	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 1:1
			DATE: 2012/07/21

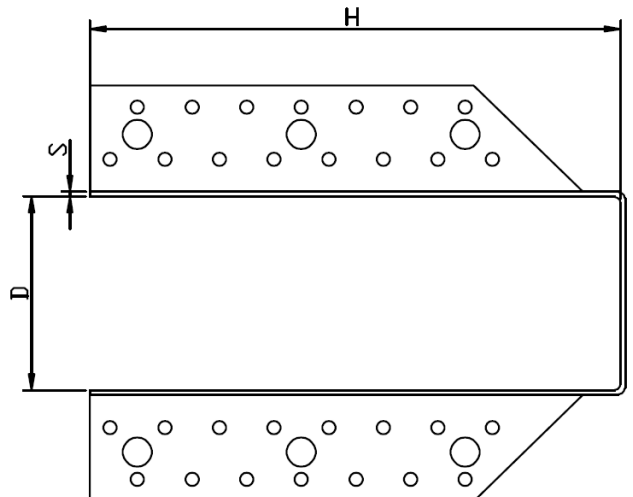







JOIST HANGERS OUTER FOLDED 320A

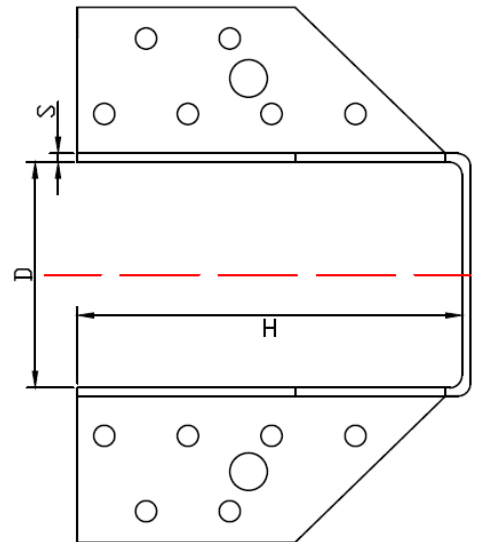
REF:	材料	Material:	HOMER'S ART:	单位 UNIT:mm
		S250GD Z275 DR GR340 Z275		
绘图	WEI XIAO QIN	泰州和美五金制造有限公司		比例
D/W/N		TAIZHOU HOMER HARDWARE MANUFACTURING CO.,LTD.		SCALE
审核	HOMER WU	Tel: 0086 523 8891 8611 Fax: 0086 523 8891 7611		1:1
CHECK		email: whb@chinahomer.com		
更改		www.chinahomer.com		
REVISED			DESCRIPTION OF PRODUCTS:	
			JUJIST HANGERS OUTER FOLDED 320A	
				DATE: 2012/07/23



JOIST HANGERS OUTER FOLDED 500

REF:	材料 Material(s): S250GD Z275 DR GR340 Z275		HOMER'S ART: 单位 UNIT: mm	
绘图 DWG	VEI XIAO QIN	 泰州和美五金制造有限公司 TAIZHOUI HOMER HARDWARE MANUFACTURING CO.,LTD. Tel: 0086 523 8891 8611 Fax: 0086 523 8891 7611 email: whb@chinahomer.com www.chinahomer.com		
审核	HOMER WU			
CHECK				
更改 REVISED				
			DESCRIPTION OF PRODUCTS: JOIST HANGERS OUTER FOLDED 500	
			比例 SCALE 1:1	
			DATE: 2012/07/23	

ART #	D(mm)	H(mm)	S(mm)
J-WB-75212	75	212	2
J-WB-100200	100	200	2

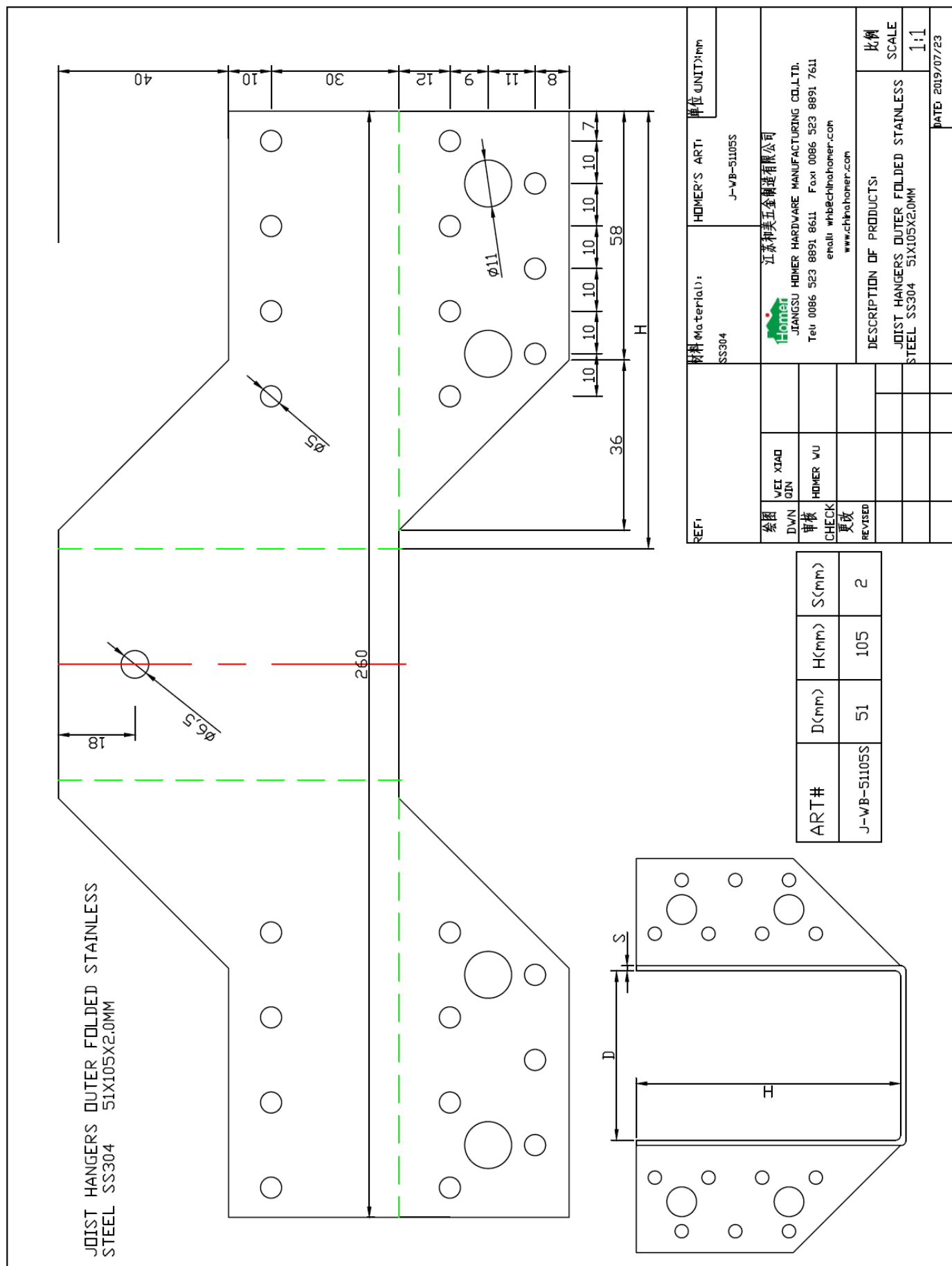
JOIST HANGERS OUTER FOLDED 238
STAINLESS STEEL SS304

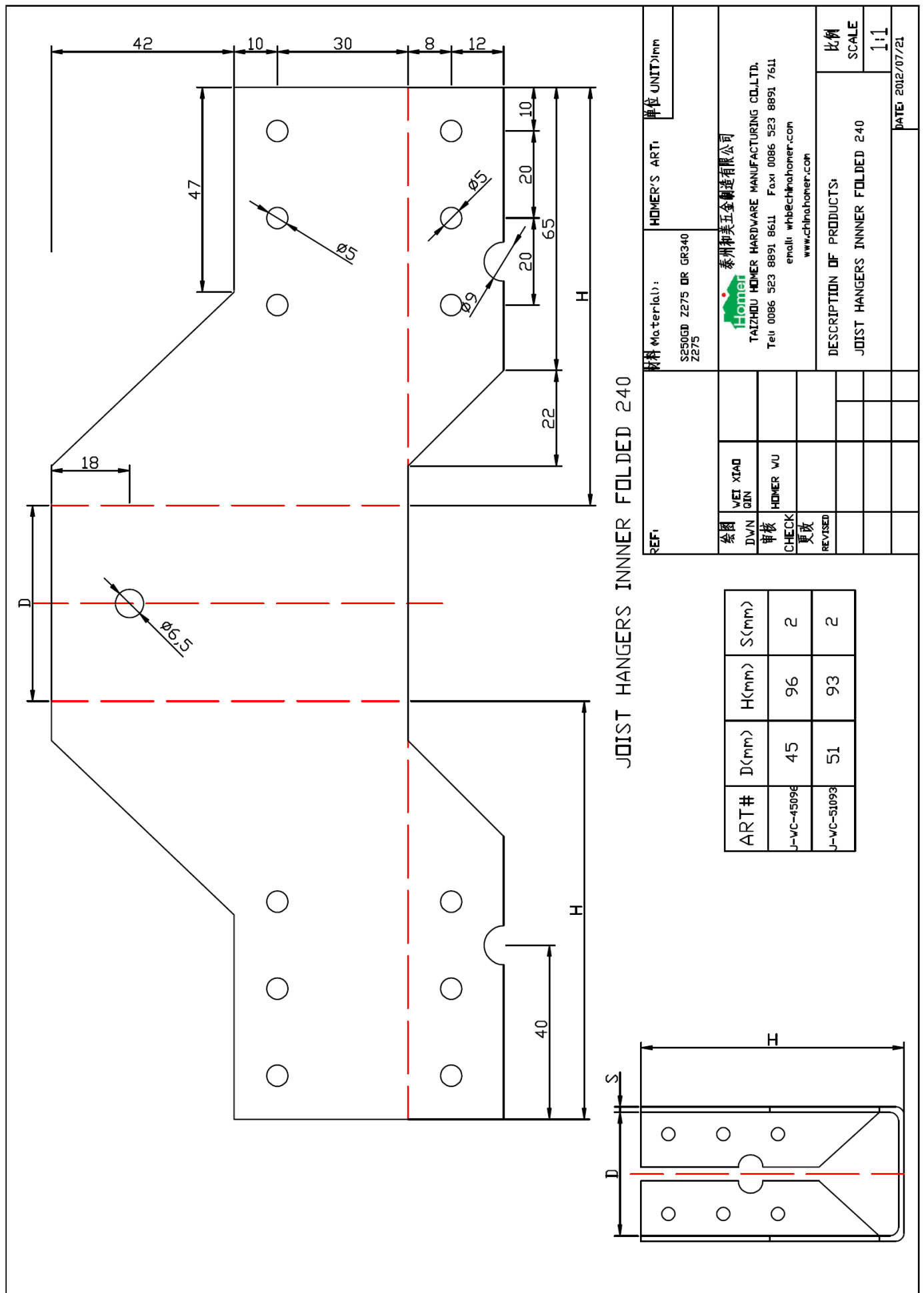
ART#	D(mm)	H(mm)	S(mm)
J-WB-48095S	48	95	2
J-WB-51093S	51	93	2

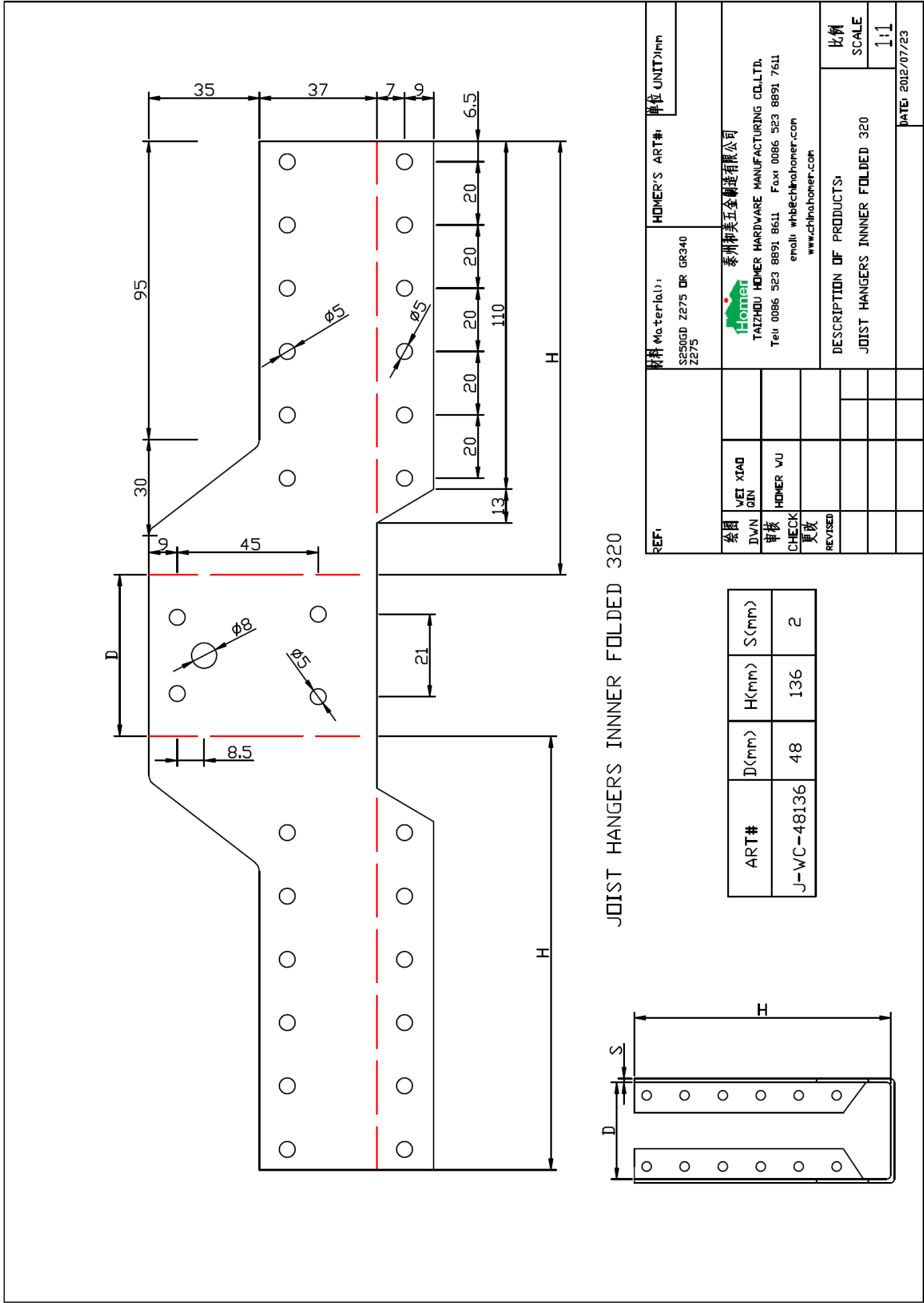
REF:	材料		Material(s):		HOMER'S ARTI: J-WB-4809SS J-WB-51093S		单位 (UNIT):mm	
			SS304					
绘图	WEI XIAO GIN	江苏和美五金制造有限公司						
DWN	HOMER HARDWARE MANUFACTURING CO.,LTD.							
审核	HOMER WU	Tel: 0086 523 8891 8611 Fax: 0086 523 8891 7611						
CHECK	email: whb@chinahomer.com							
更改	www.chinahomer.com							
REVISED	DESCRIPTION OF PRODUCTS:				比例		SCALE	
					JOIST HANGERS OUTER FOLDED 238			
					STAINLESS STEEL SS304			
					DATE: 2019/09/25			

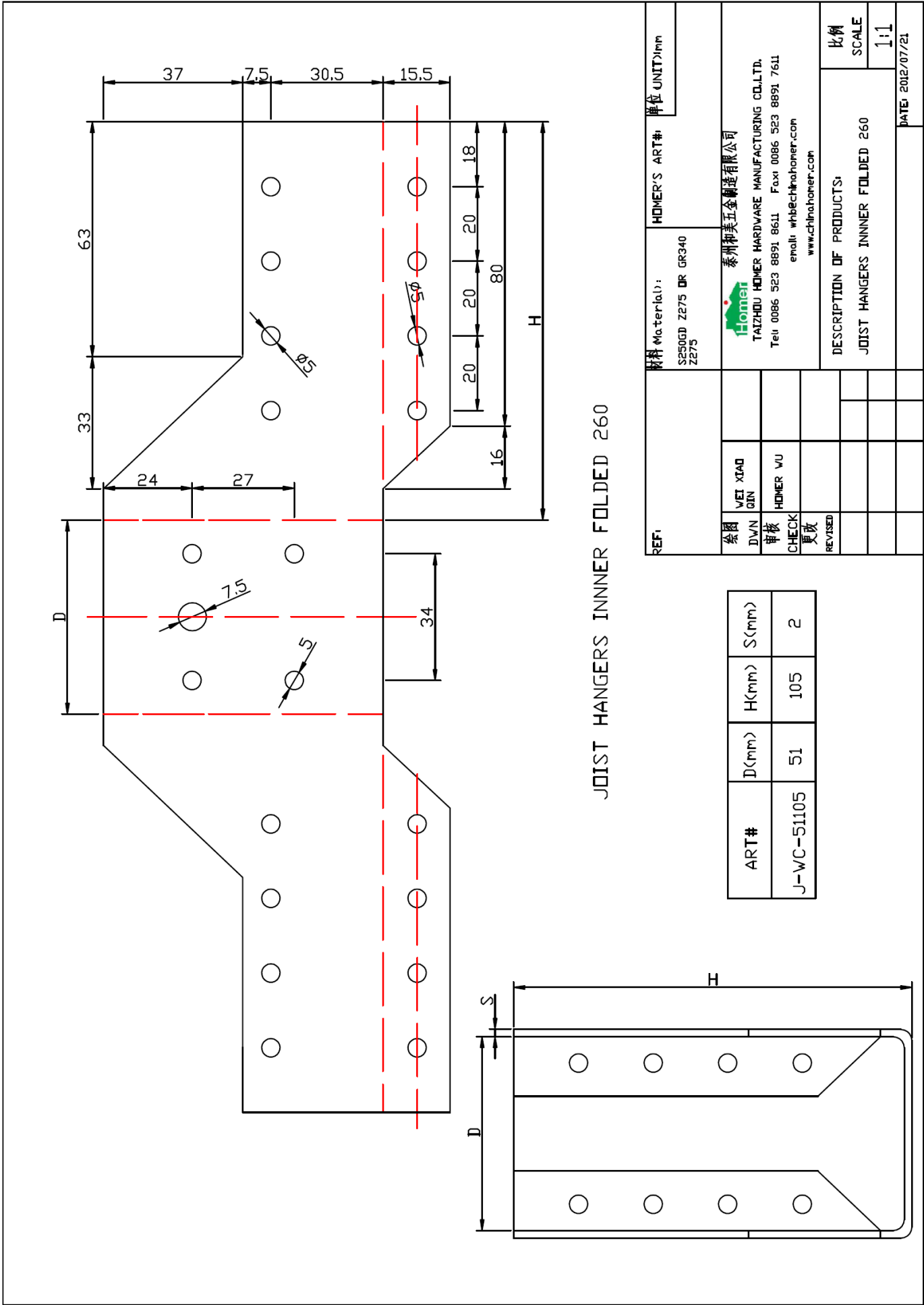


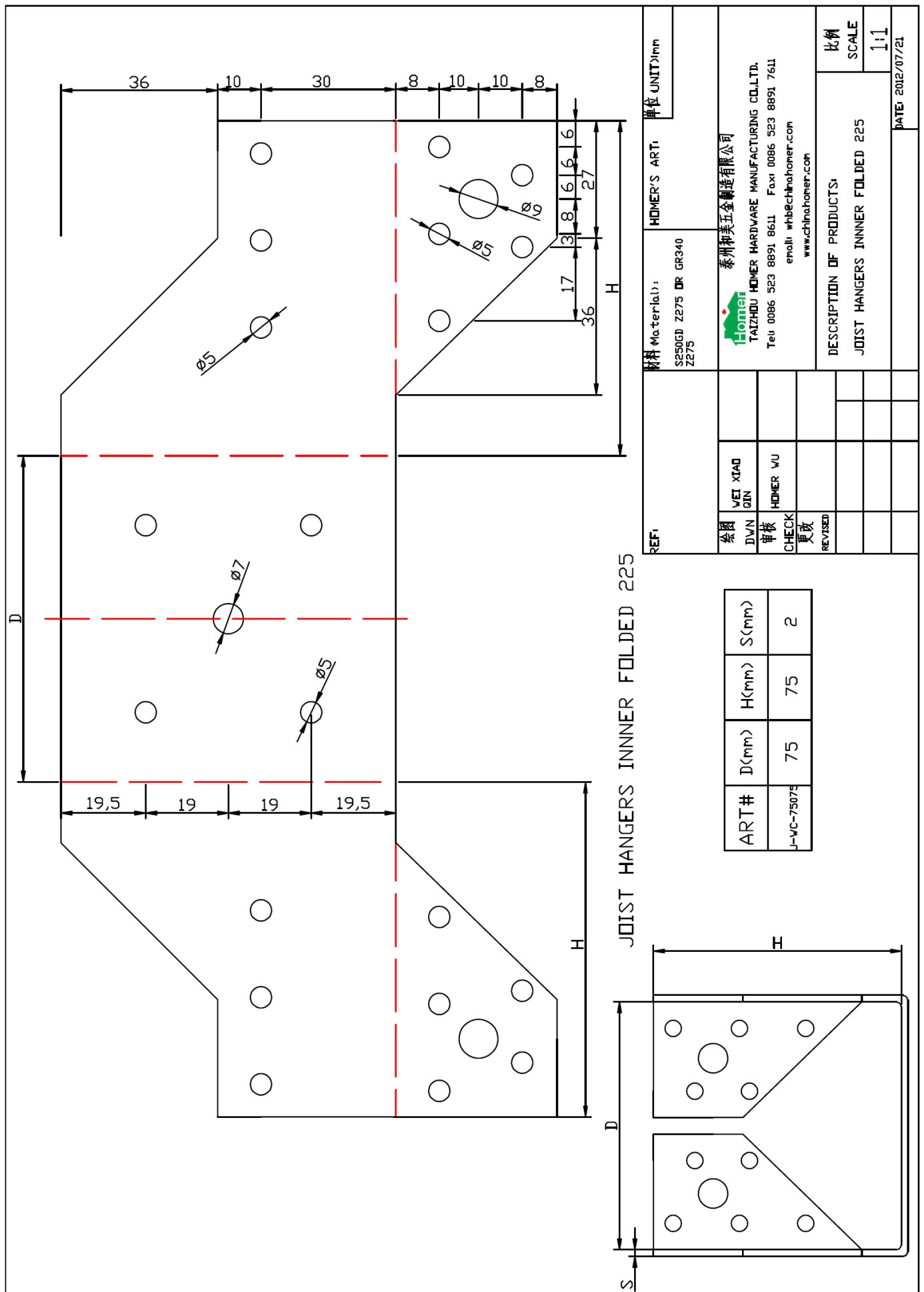
ANNEX 1: Product details and definitions

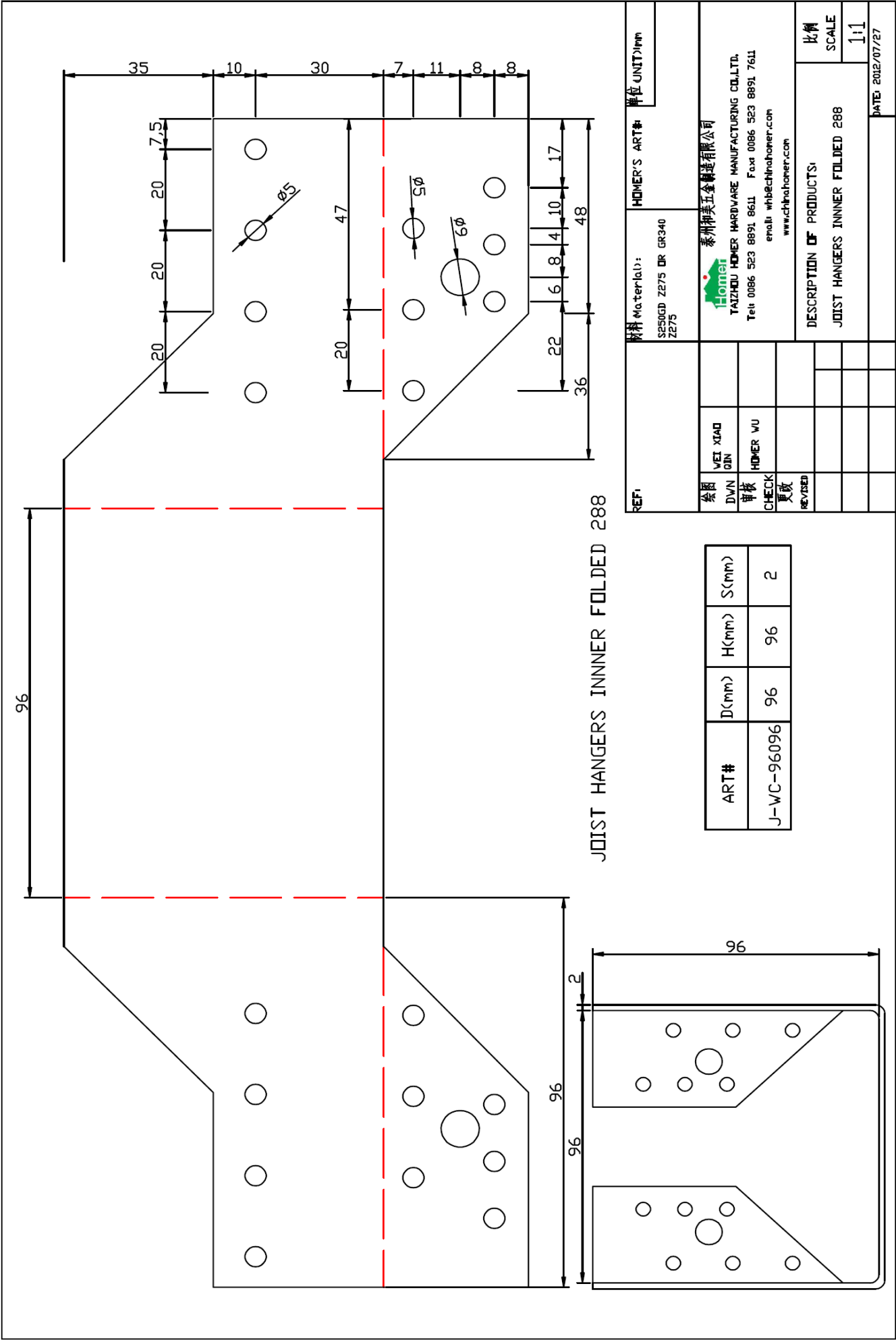


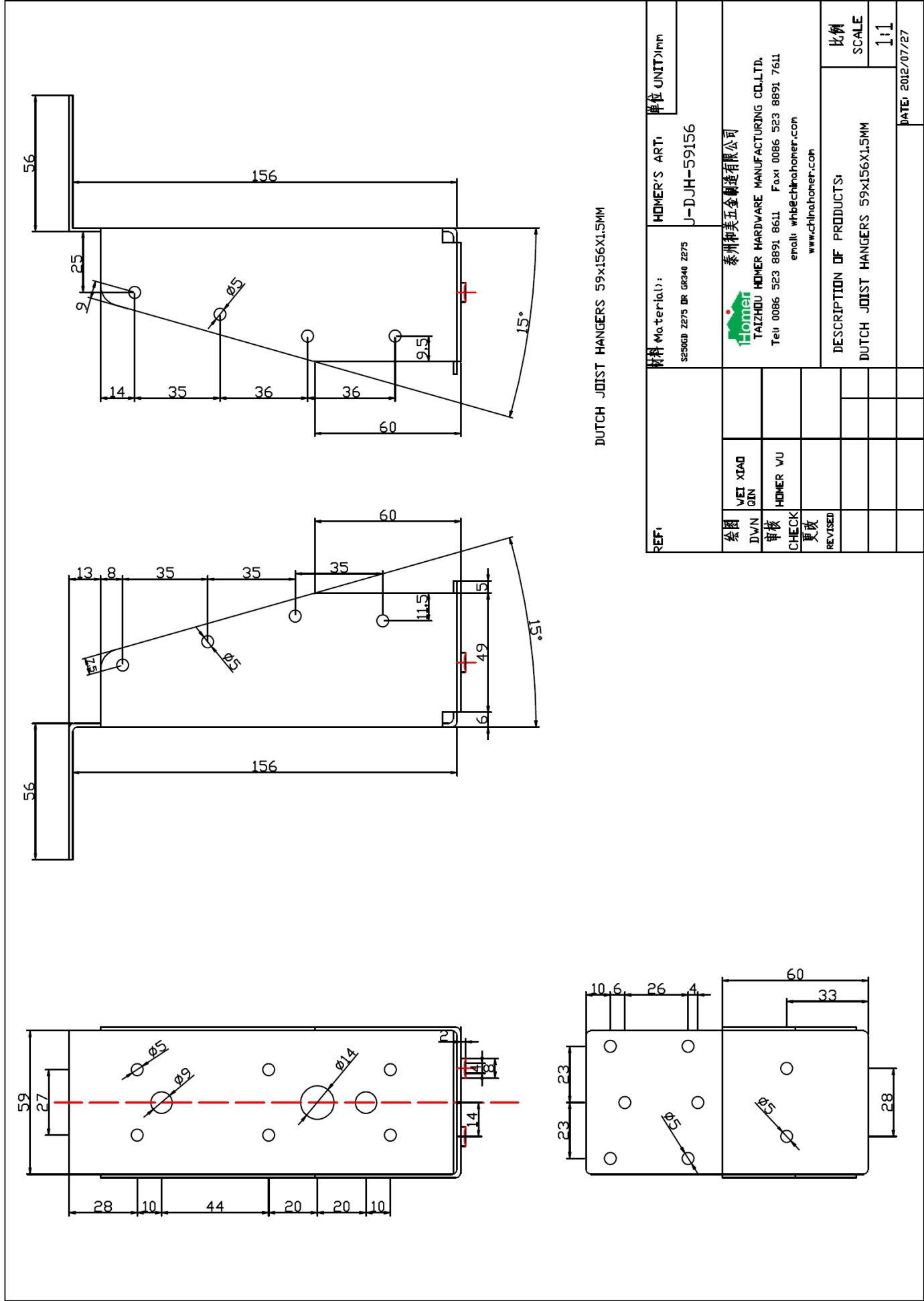


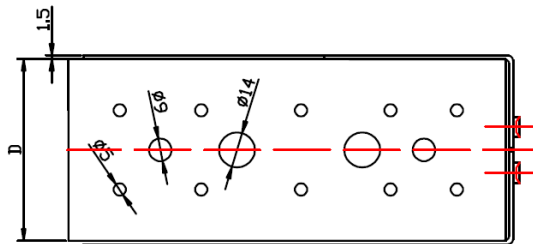




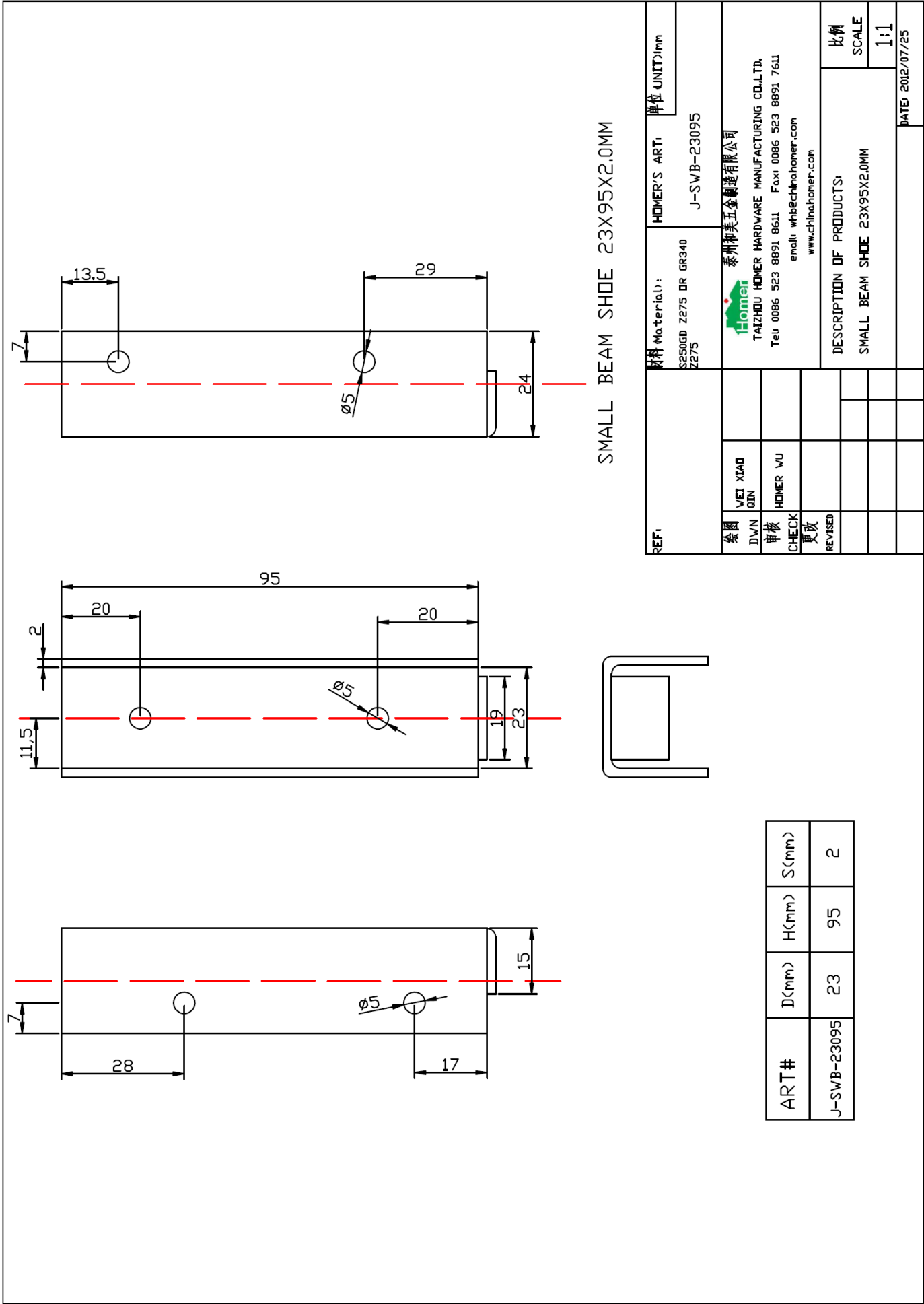


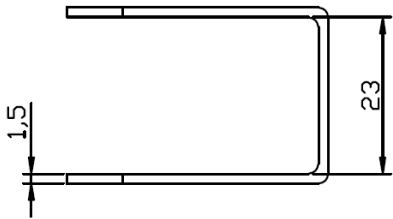




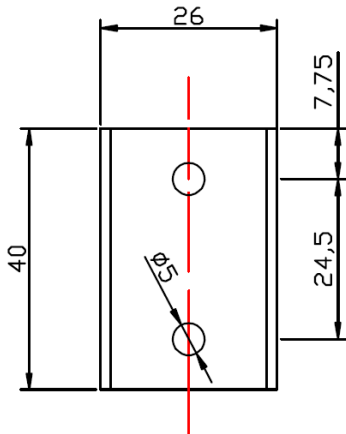
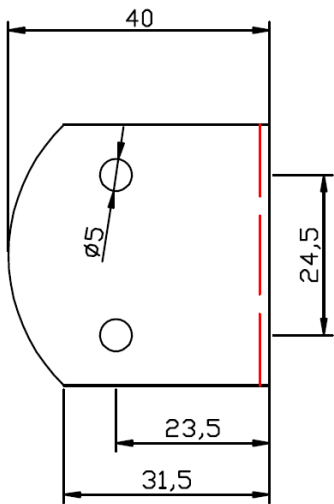



ART NRS.	Dimensions DXH (MM)	Holes in back plate			Holes in lip		slide plate
		ø9MM	ø14MM	ø5MM	ø9MM	ø5MM	
J-DJH-71X171	71X171	2	2	10	1	5	4
J-DJH-71X196	71X196	2	2	10	1	5	4





U HOLDER 23X40X40X1.5MM



REF:	材料 Material:	HOMER'S ART:	单位 UNIT: mm
	S250GD Z275 DR GR340 Z275	J-UH-2340	
绘图 DWN	WEI XIAO QIN	 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	
审核 CHECK	HOMER WU		
更改 REVISED			
DESCRIPTION OF PRODUCTS:			比例 SCALE
U HOLDER 23X40X40X1.5MM			1:1
			DATE: 2012/07/25

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

$$F_{y,v,d} \leq \frac{R_{T,d}}{2} \quad (1)$$

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

$$F_{v,d} \leq \frac{R_{P,d}}{2} \quad (2)$$

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

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

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

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

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_{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,
- γ_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 :

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

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

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 $1/2$ with screws from the load-carrying capacity $F_{v,Rk}$ and the characteristic value of the embedding strength

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

The characteristic withdrawal resistance of the nail

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

and for the screw

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

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 ρ_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 ρ_k is the characteristic density of timber in the actual connection. If the penetration depth for an anchor nail is less than $t_{pen} \leq 8d = 32$ mm, the resistance according to Eq. (8a) is reduced by $(t_{pen}/8\text{mm} - 3)$.

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

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

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

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

when the force component

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

where

plus sign (+) 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) $B \times H \times t$	fasteners			
		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

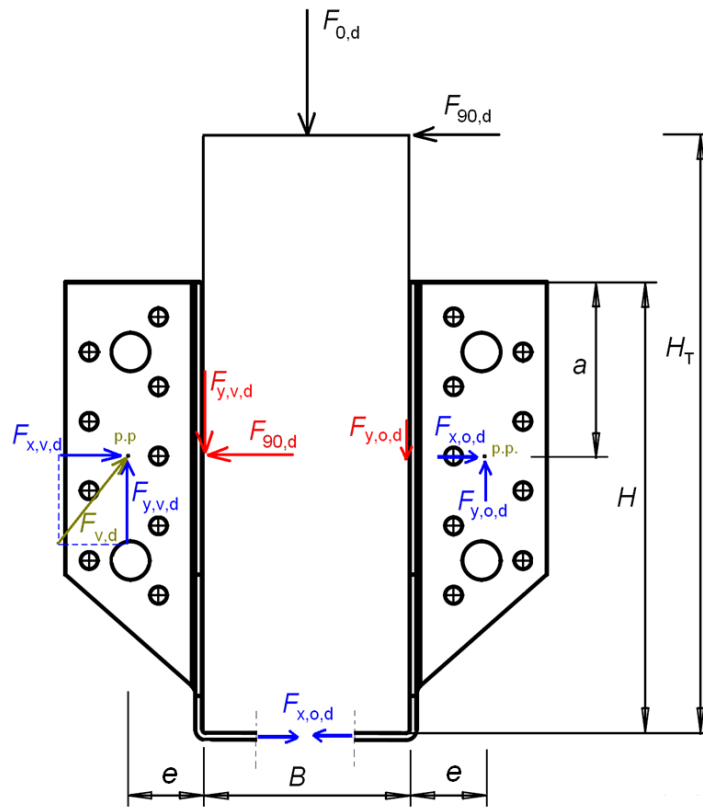


Figure A2.1 Definition of symbols used and the model for forces acting in Outer folded joist hanger. pp indicates centroid for the group of fasteners.

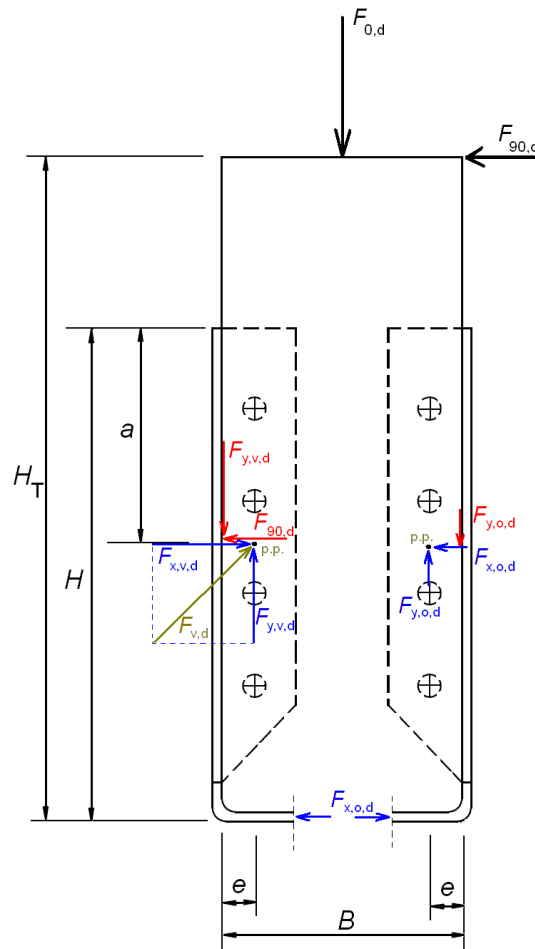


Figure A2.2 Definition of symbols used and the model for forces acting in Inner folded Joist Hanger. pp indicates centroid for the group of fasteners.

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) $B \times H \times t$	fasteners			
		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 $1,0..1,5H$, 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

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

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

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

where

- k_{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,
- γ_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 $1,5H$ and
- H is the depth of the joist hanger as given in Table A2.1.

The following equation shall be satisfied:

$$\frac{F_{0,d}}{R_{0,d}} + \frac{F_{90,d}}{R_{90,d}} \leq 1 \quad (14)$$

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

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

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

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

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

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

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_{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,

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

and factor

$$k_m = \min(k_1, k_2, \dots, k_{np}) \quad (18)$$

where factor k_i for fastener i

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

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.

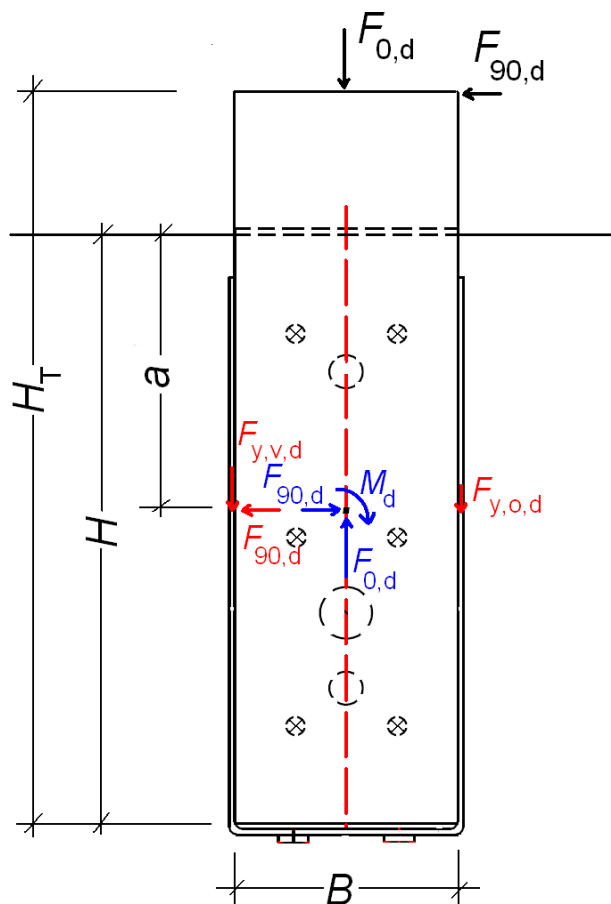


Figure A2.3 Definition of symbols used and the model for forces acting in Dutch Joist Hangers and Small Beam Shoe.

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) $B \times H \times t$	n_T	n_P	a (mm)	k_m	
					$H_T = H$	$H_T = 1,5H$
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:

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

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).

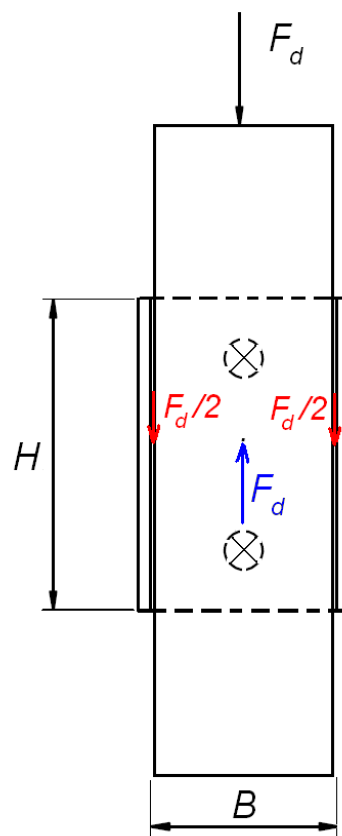


Figure A2.4 Forces acting in the U-Holder.

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

$$F_{d,1} + F_{d,2} \leq \frac{k_{\text{mod}} \cdot 14 \cdot B_P}{\gamma_M} \cdot \sqrt{\frac{h_e}{\left(1 - \frac{h_e}{H_P}\right)}} \quad (21)$$

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;
- γ_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 joist 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

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

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

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

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 .

ANNEX 3

MATERIAL USED AS BASIS FOR THE ASSESSMENT

Ref. No.	Author or institution	Report No.	Date	Title / Issue
1	VTT Expert Services Ltd	VTT-S-02287-13	2013	Initial testing of Joist Hangers
2	VTT Expert Services Ltd	VTT-S-04575-13	2013	Report regarding initial factory inspection at Taizhou Homer Hardware Manufacturing in Taizhou City, China
3	Eurofins Expert Services Oy	EUFI29-19006337-T2	2020	Initial testing of Stainless Steel Joist Hangers