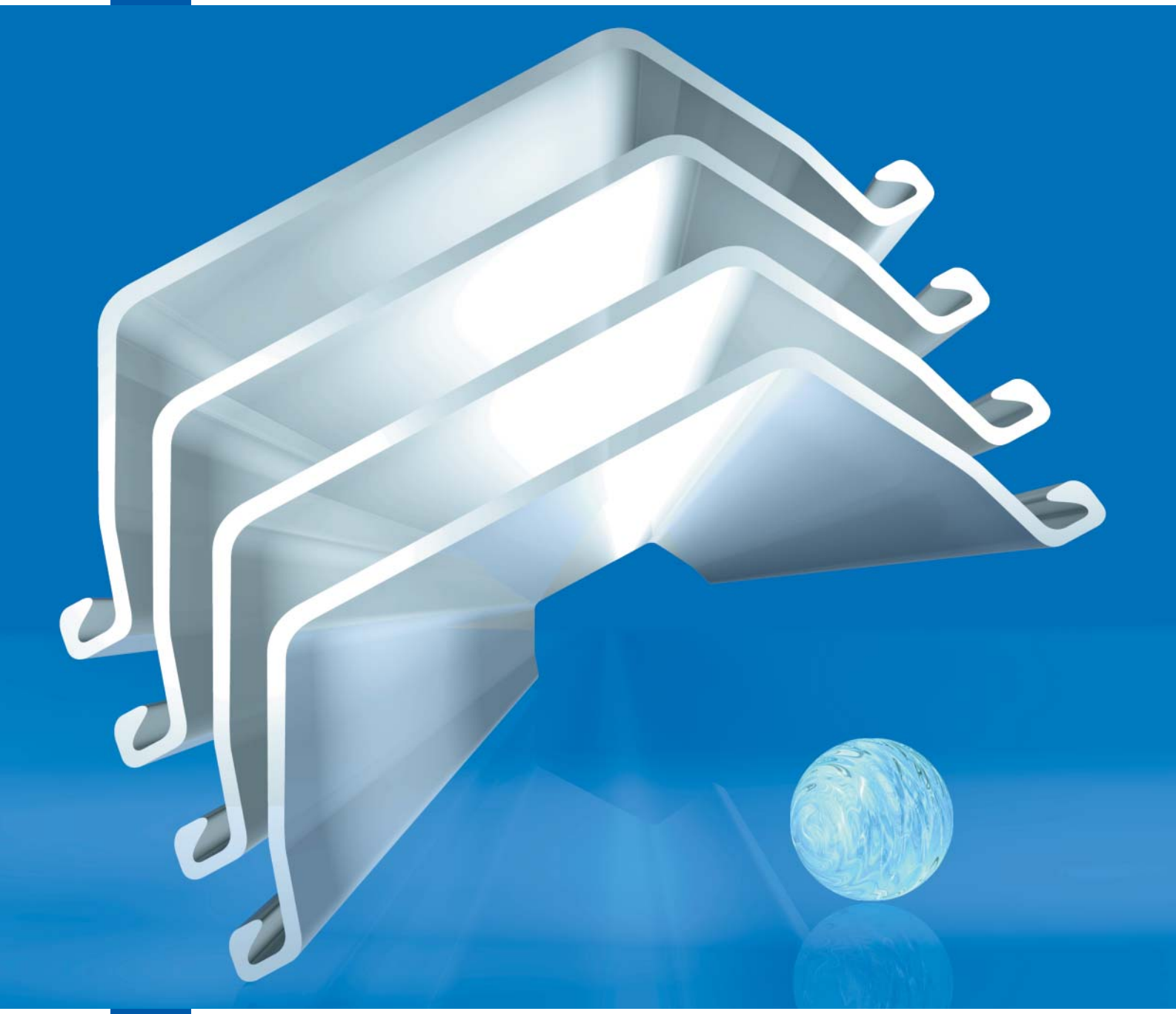
JFE

# JFESP

## JFE Steel Sheet Piles



JFE Steel Corporation

## INTRODUCTION

Steel sheet piles that are widely used in the construction of river embankments, quay walls of ports, retaining walls, cut-off walls, earthquake strengthening structures, and in many other types of construction work are becoming increasingly important.
JFE has been taking full advantage of the state-of-the-art rolling mills at West Japan Works to produce steel sheet piles (U-shaped and Combined) that conform to the new JIS standard (JIS A 5523) established in 2000 and to conventional JIS standards (JIS A 5528). We also pride ourselves on the construction of corner steel sheet piles made by integral roll forming and heavy-duty-coated steel sheet piles (JFE marine coat) for use in the marine environment.
We are confident that the wide range of steel sheet piles produced by JFE (JFESP) will fully satisfy the demanding needs of our customers.
You are kindly invited to find out for yourself the many advantages to be had in using our JFESP steel sheet piles, as well.

◀West Japan Works (Fukuyama)

▼West Japan Works (Kurashiki)

CONTENTS

## Features and Characteristics

### 1 A wide range of types and cost efficiencies to meet every need

Steel sheet piles (U-shaped and Combined) are available for economical design.

### 2 High reliability

Steel sheet piles are produced using the state-of-the-art facilities at our West Japan Works under rigorous quality control.

### 3 Excellent workability

The joints of steel sheet piles have a sufficient margin of flexibility when combined together to ensure excellent interchangeability and workability.

## Usage and Applications

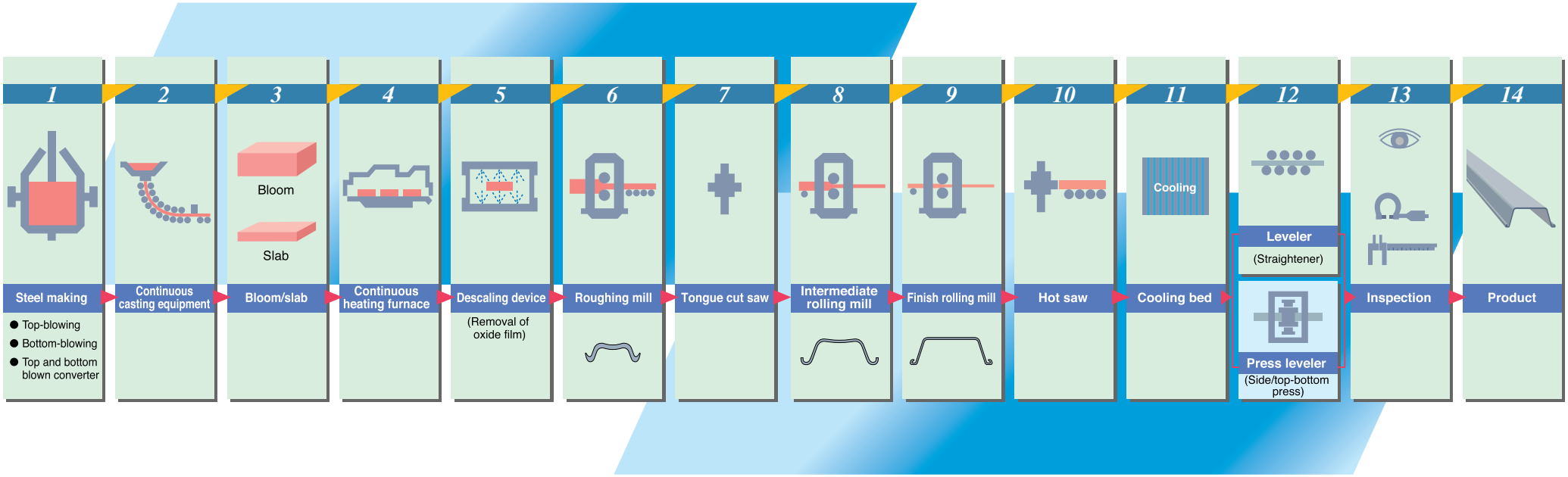
Steel sheet piles can be used for a very wide range of purposes including those listed below.

**1 For permanent structures** — Quay walls, embankments, breakwaters, retaining walls, scour protection walls, cut-off walls, dams, and training dikes, amongst others

**2 For temporary works** — Earth retaining, breasting, double cofferdams, and islet building, amongst others

**3 Special uses** — Oil retaining walls, protection of underground oil transport pipes, fill-up aseismic reinforcement walls, liquefaction prevention, and land subsidence prevention, amongst others

## Production Process of Steel Sheet Piles

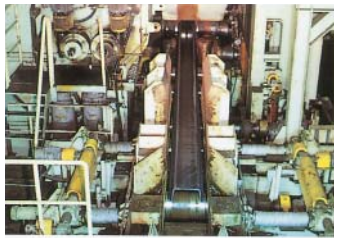


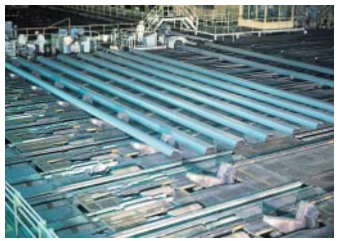


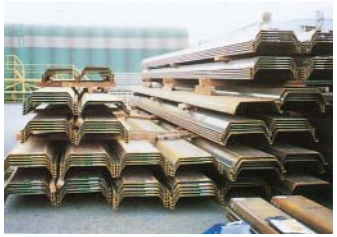
Intermediate rolling mill


Hot saw


Cooling bed


Leveler


Inspection of product


Shipment of product

# Standards

The standards most affecting the production of steel sheet piles are JIS A 5523 (hot-rolled steel sheet piles for welding) and JIS A 5528 (hot-rolled steel sheet piles).

## ■ Chemical composition

(Unit: %)

| Standard | Designation | Chemical composition (%) | | | | | | Carbon equivalent (%) |
|---|---|---|---|---|---|---|---|---|
| | | C | Si | Mn | P | S | Free nitrogen | Ceq |
| **JIS A 5523 (hot-rolled steel sheet piles for welding)** | **SYW295** | 0.18 max. | 0.55 max. | 1.50 max. | 0.040 max. | 0.040 max. | 0.0060 max. | 0.44 max. |
| | **SYW390 *** | 0.18 max. | 0.55 max. | 1.50 max. | 0.040 max. | 0.040 max. | 0.0060 max. | 0.45 max. |
| **JIS A 5528 (hot-rolled steel sheet piles)** | **SY295** | — | — | — | 0.040 max. | 0.040 max. | — | — |
| | **SY390** | — | — | — | 0.040 max. | 0.040 max. | — | — |

* SYW390 is not manufacutured usually, If you want this products, contact with us beforehand.

Notes: 1. The carbon equivalent is calculated using the following formula: Carbon equivalent (%) = C + Mn/6 + Si/24 + Ni/40 + Cr/5 + Mo/4 + V/14

2. The value of free nitrogen is represented by the total nitrogen in accordance with JIS A 5523, item #5. Chemical composition, Note 2.

## ■ Mechanical properties

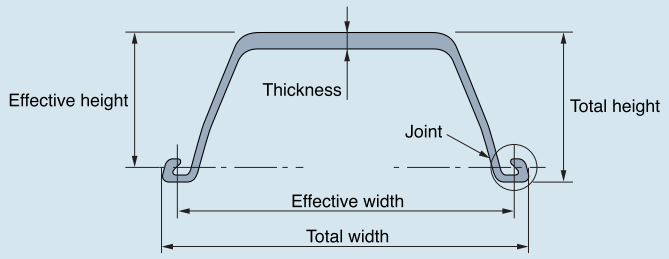
(Unit: %)

| Standard | Designation | Mechanical properties | | | | | |
|---|---|---|---|---|---|---|---|
| | | Yield point or yield strength ($N/mm^2$) | Tensile strength ($N/mm^2$) | Elongation (%) | Charpy absorbed energy (J) Height of sample x Width (mm) | | |
| | | | | | 10 x 10 | 10 x 7.5 | 10 x 5 |
| **JIS A 5523 (hot-rolled steel sheet piles for welding)** | **SYW295** | 295 min. | 450 min. | 18 min. | 43 min. | 32 min. | 22 min. |
| | **SYW390 *** | 390 min. | 490 min. | 16 min. | 43 min. | 32 min. | 22 min. |
| **JIS A 5528 (hot-rolled steel sheet piles)** | **SY295** | 295 min. | 450 min. | 18 min. | — | | |
| | **SY390** | 390 min. | 490 min. | 16 min. | — | | |

* SYW390 is not manufacutured usually, If you want this products, contact with us beforehand.

Notes: The Charpy absorbed energy is the value at the test temperature of 0°C.

## ■ Tolerances for shapes and dimensions

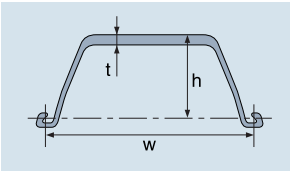
| | | U-shaped steel sheet pile | |
|---|---|---|---|
| | |  | |
| Standard | | JIS A 5523<br>(hot-rolled steel sheet piles for welding) | JIS A 5528<br>(hot-rolled steel sheet piles) |
| Total width | 400mm | ± 4mm | +10mm, -5mm |
| | 500mm | ± 5mm | |
| | 600mm | +6mm, -5mm | |
| Total height | | ± 4% | ± 4% |
| Thickness | Under 10mm | +1.0mm, -0.3mm | ± 1.0mm |
| | 10mm and over to 16mm excl. | +1.2mm, -0.3mm | ± 1.2mm |
| | 16mm or over | +1.5mm, -0.3mm | ± 1.5mm |
| Length | | + Not specified, 0 | + Not specified, 0 |
| Deflection | 10m or under in length | Total length x 0.1% max.<br>20mm max. | Total length x 0.12% max. |
| | Over 10m in length | | (Total length - 10m) x 0.10% + 12mm max. |
| Camber | 10m or under in length | Total length x 0.2% max.<br>20mm max. | Total length x 0.25% max. |
| | Over 10m in length | | (Total length - 10m) x 0.20% + 25mm max. |
| Difference in vertically cut section | | 4% of width max. | 4% of width max. |
| Difference in total width | | 4mm and under in difference between maximum and minimum total widths within 1m length from the edge | Not specified |
| Edge deflection* | | 1.5mm max. | Not specified |

* : Edge deflection shall be the value measured at the topside 1m from the edge or the 1/2 value measured at the tangent side.

# Shape and Cross-sectional Performance

## U-shaped steel sheet pile

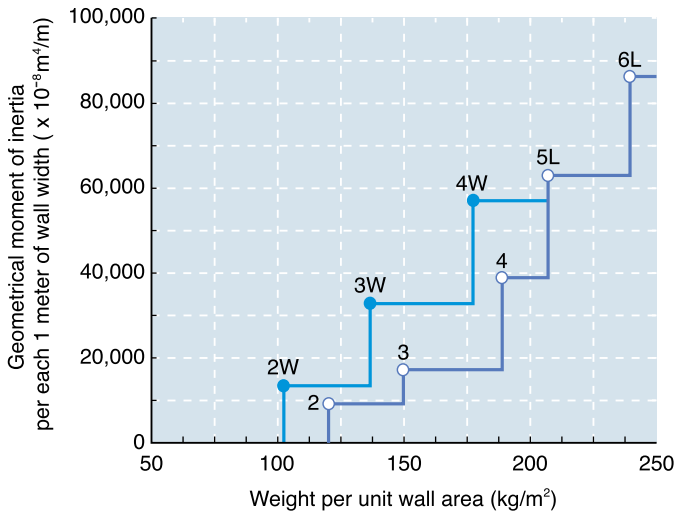
Select an appropriate type of U-shaped steel sheet pile based on the usage and load conditions.

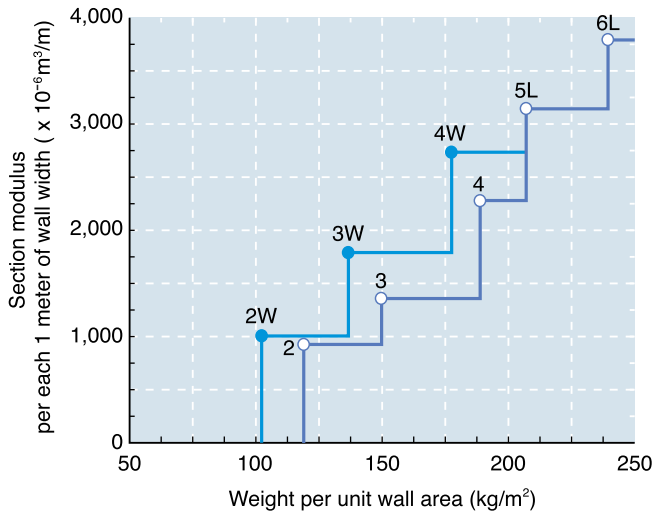



### ■ List of cross-sectional performance values

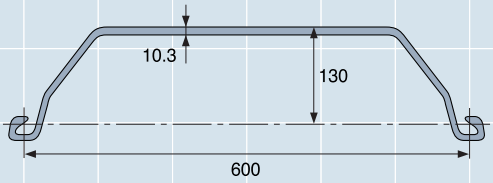
| Type | Dimensions | | | Per steel sheet pile | | | | Per each meter of wall width | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Effective width W (mm) | Effective height h (mm) | Thickness t (mm) | Cross section x $10^{-4}$ ($m^2$) | Geometrical moment of inertia x $10^{-8}$ ($m^4$) | Section modulus x $10^{-6}$ ($m^3$) | Unit weight (kg/m) | Cross section x $10^{-4}$ ($m^2$/m) | Geometrical moment of inertia x $10^{-8}$ ($m^4$/m) | Section modulus x $10^{-6}$ ($m^3$/m) | Unit weight (kg/$m^2$) |
| **JFESP−2W** | 600 | 130 | 10.3 | 78.70 | 2,110 | 203 | 61.8 | 131.2 | 13,000 | 1,000 | 103 |
| **JFESP−3W** | 600 | 180 | 13.4 | 103.9 | 5,220 | 376 | 81.6 | 173.2 | 32,400 | 1,800 | 136 |
| **JFESP−4W** | 600 | 210 | 18.0 | 135.3 | 8,630 | 539 | 106 | 225.5 | 56,700 | 2,700 | 177 |
| **JFESP−2** | 400 | 100 | 10.5 | 61.18 | 1,240 | 152 | 48.0 | 153.0 | 8,740 | 874 | 120 |
| **JFESP−3** | 400 | 125 | 13.0 | 76.42 | 2,220 | 223 | 60.0 | 191.0 | 16,800 | 1,340 | 150 |
| **JFESP−4** | 400 | 170 | 15.5 | 96.99 | 4,670 | 362 | 76.1 | 242.5 | 38,600 | 2,270 | 190 |
| **JFESP−5L** | 500 | 200 | 24.3 | 133.8 | 7,960 | 520 | 105 | 267.6 | 63,000 | 3,150 | 210 |
| **JFESP−6L** | 500 | 225 | 27.6 | 153.0 | 11,400 | 680 | 120 | 306.0 | 86,000 | 3,820 | 240 |

### ■ Geometrical moment of inertia and section modulus per weight

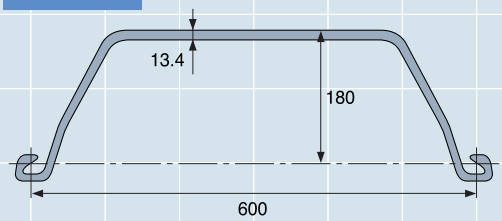


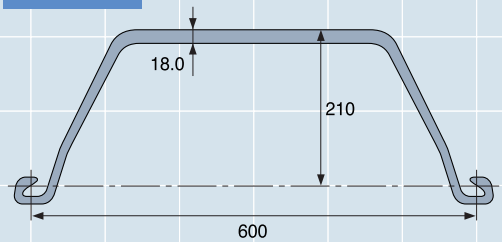
JFESP−2W



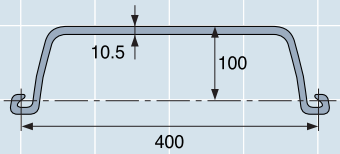

JFESP−3W



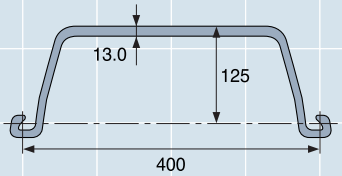

JFESP−4W



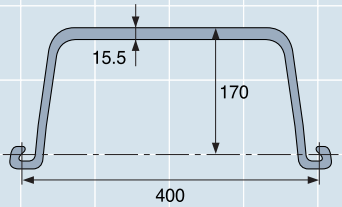

JFESP−2



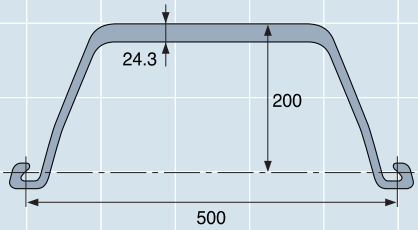

JFESP−3



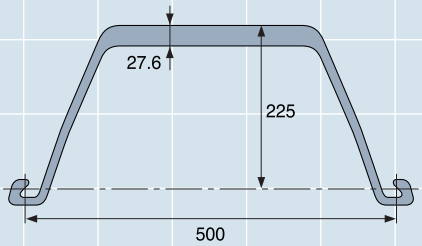

JFESP−4




JFESP−5L



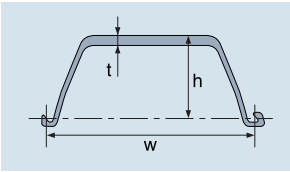

JFESP−6L



# Corner Steel Sheet Piles

## Hot-rolled corner steel sheet piles

Steel sheet piles made by hot rolling for 90° corners have less deformation than processed corner sheet piles. These piles have the added advantage that they can be piled up for easy transport and storage.
They can also be driven in the same way as general steel sheet piles.



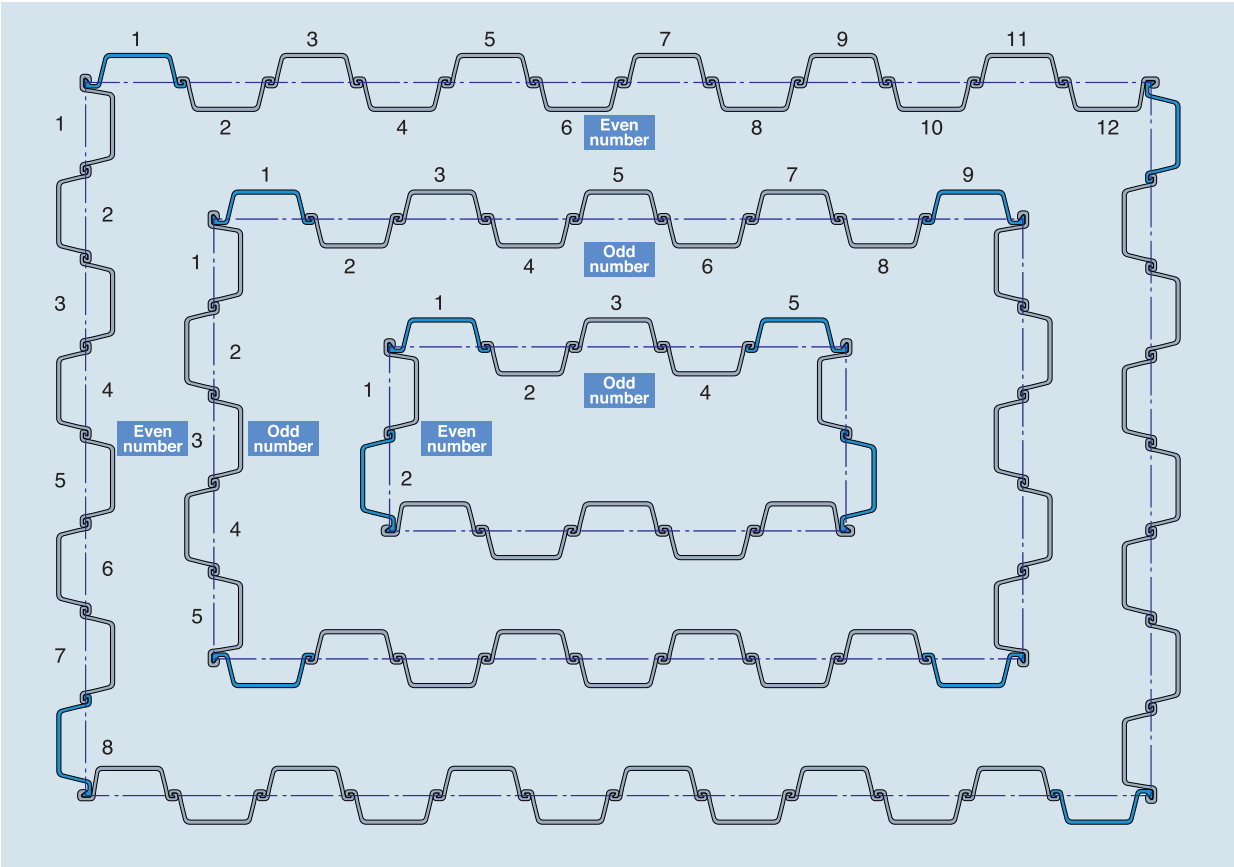

### ■ Cross-sectional performance

| Type | Dimensions | | | Cross section | Weight | | Geometrical moment of inertia | | Section modulus | |
|---|---|---|---|---|---|---|---|---|---|---|
| | W (mm) | h (mm) | t (mm) | Per each pile x $10^{-4}$ ($m^2$) | Per each pile (kg/m) | Per each meter of wall (kg/$m^2$) | Per each pile x $10^{-8}$ ($m^4$) | Per each meter of wall x $10^{-8}$ ($m^4$/m) | Per each pile x $10^{-6}$ ($m^3$) | Per each meter of wall x $10^{-6}$ ($m^3$/m) |
| **JFESP−C3** | 400 | 125 | 13.0 | 76.42 | 60.0 | 150 | 2,220 | 16,800 | 223 | 1,340 |
| **JFESP−C4** | 400 | 170 | 15.5 | 96.99 | 76.1 | 190 | 4,670 | 38,600 | 362 | 2,270 |

The material used in the production of hot-rolled corner steel sheet piles is the same as that used in general steel sheet piles.

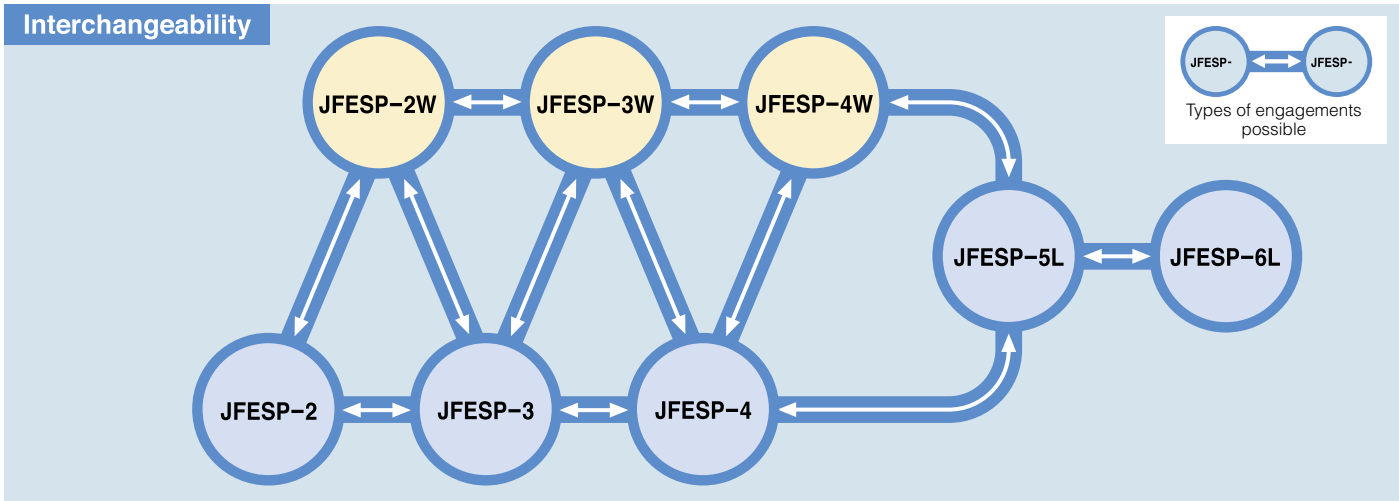
## Driving procedure

Wall closing is easy when the central dimension of the steel sheet pile wall is a multiple of the effective width of the steel sheet piles.

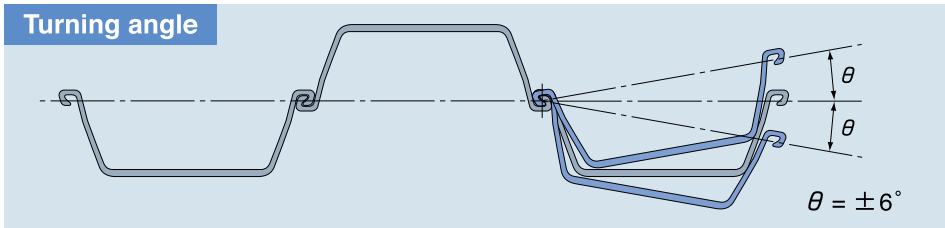


# Interchangeability and Turning Angle of Steel Sheet Piles

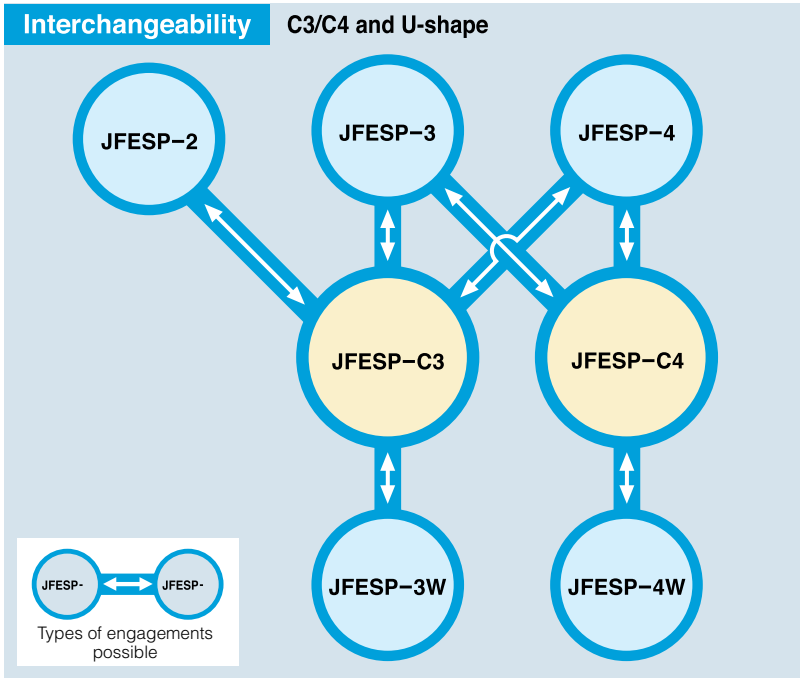
## U-shaped steel sheet piles

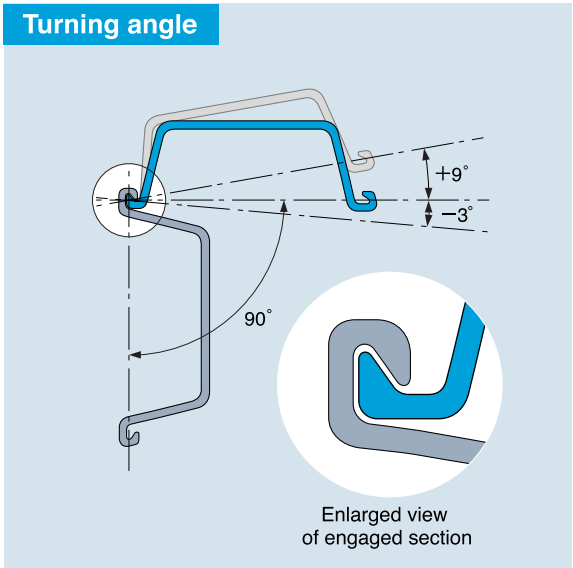



● The standard engagement range is shown here, which may vary according to the working conditions.




## Corner Steel Sheet Piles




The standard turning angles when type C3 and type 3 are engaged, as well as when type C4 and type 4 are engaged, are shown below.

# Table of Weights

(Unit: kg)

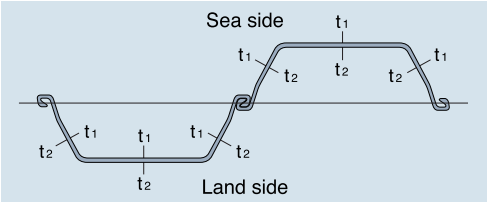
| Type / Length m | U-shaped steel sheet pile | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 2W | 3W | 4W | 2 | 3 | 4 | 5L | 6L |
| **1.0** | 61.8 | 81.6 | 106 | 48.0 | 60.0 | 76.1 | 105 | 120 |
| **5.0** | 309 | 408 | 530 | 240 | 300 | 380 | 525 | 600 |
| **5.5** | 340 | 449 | 583 | 264 | 330 | 419 | 578 | 660 |
| **6.0** | 371 | 490 | 636 | 288 | 360 | 457 | 630 | 720 |
| **6.5** | 402 | 530 | 689 | 312 | 390 | 495 | 682 | 780 |
| **7.0** | 433 | 571 | 742 | 336 | 420 | 533 | 735 | 840 |
| **7.5** | 464 | 612 | 795 | 360 | 450 | 571 | 788 | 900 |
| **8.0** | 494 | 653 | 848 | 384 | 480 | 609 | 840 | 960 |
| **8.5** | 525 | 694 | 901 | 408 | 510 | 647 | 892 | 1,020 |
| **9.0** | 556 | 734 | 954 | 432 | 540 | 685 | 945 | 1,080 |
| **9.5** | 587 | 775 | 1,007 | 456 | 570 | 723 | 998 | 1,140 |
| **10.0** | 618 | 816 | 1,060 | 480 | 600 | 761 | 1,050 | 1,200 |
| **10.5** | 649 | 857 | 1,113 | 504 | 630 | 799 | 1,102 | 1,260 |
| **11.0** | 680 | 898 | 1,166 | 528 | 660 | 837 | 1,155 | 1,320 |
| **11.5** | 711 | 938 | 1,219 | 552 | 690 | 875 | 1,208 | 1,380 |
| **12.0** | 742 | 979 | 1,272 | 576 | 720 | 913 | 1,260 | 1,440 |
| **12.5** | 772 | 1,020 | 1,325 | 600 | 750 | 951 | 1,312 | 1,500 |
| **13.0** | 803 | 1,061 | 1,378 | 624 | 780 | 989 | 1,365 | 1,560 |
| **13.5** | 834 | 1,102 | 1,431 | 648 | 810 | 1,027 | 1,418 | 1,620 |
| **14.0** | 865 | 1,142 | 1,484 | 672 | 840 | 1,065 | 1,470 | 1,680 |
| **14.5** | 896 | 1,183 | 1,537 | 696 | 870 | 1,103 | 1,522 | 1,740 |
| **15.0** | 927 | 1,224 | 1,590 | 720 | 900 | 1,142 | 1,575 | 1,800 |

Note: The type and length are determined by taking the design and workability into consideration.

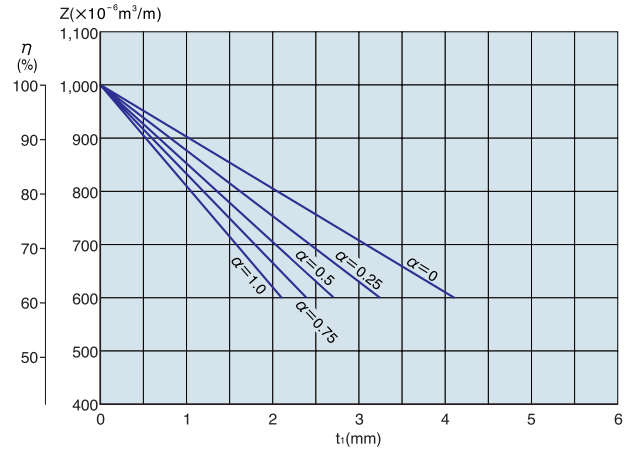
# Section Modulus of Steel Sheet Piles after Corrosion

Calculations of the section modulus of steel sheet piles after corrosion are shown below.

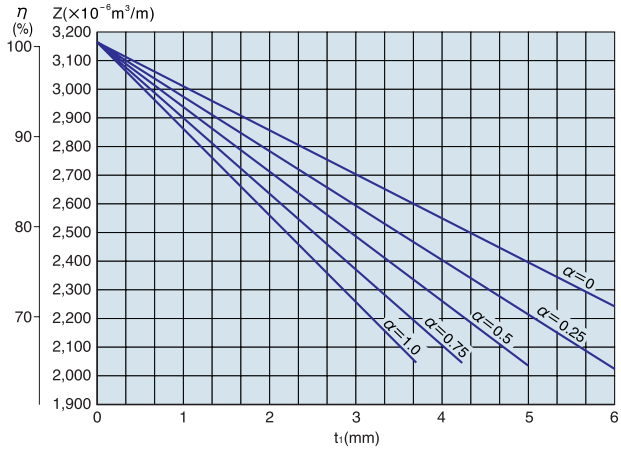
| | |
|---|---|
| Z | Section modulus of steel sheet pile after corrosion (x $10^{-6}m^3/m$) |
| $Z_0$ | Section modulus of steel sheet pile without corrosion (x $10^{-6}m^3/m$) |
| $\eta$ | Ratio of section modulus of steel sheet pile after corrosion to Zo: $\eta = Z/Zo$ (%) |
| $t_1$, $t_2$ | Thickness of corrosion on respective sides of steel sheet pile (mm) |
| $\alpha$ | Ratio of t2 to t1: $\alpha = t2/t1$ |



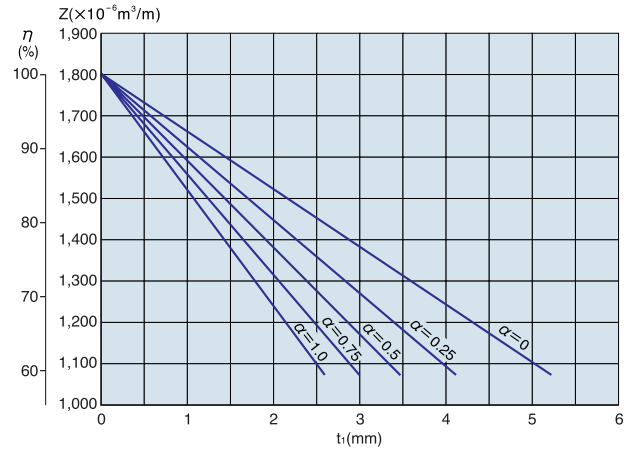

## JFESP−2W



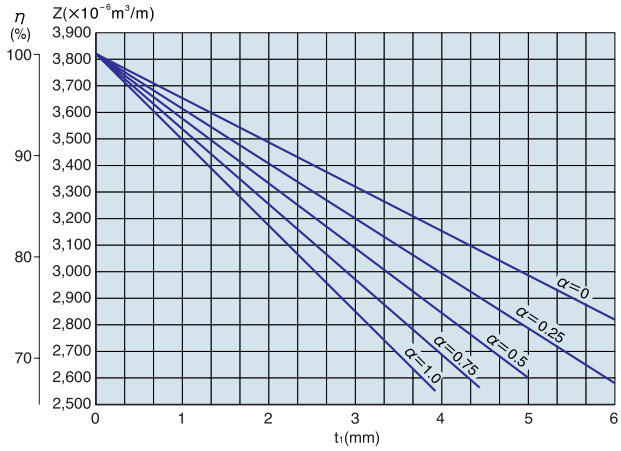

## JFESP−5L



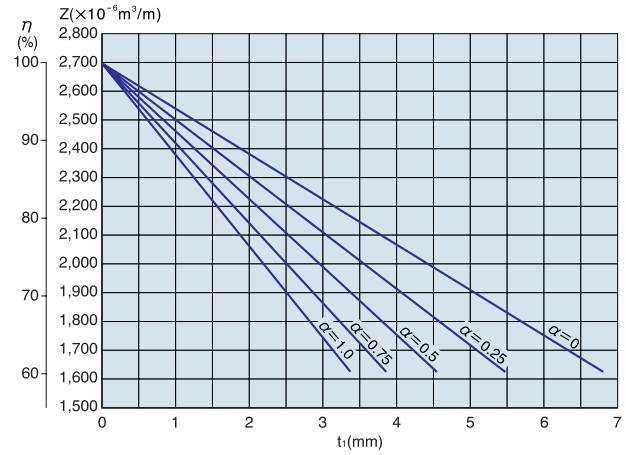

## JFESP−3W




## JFESP−6L



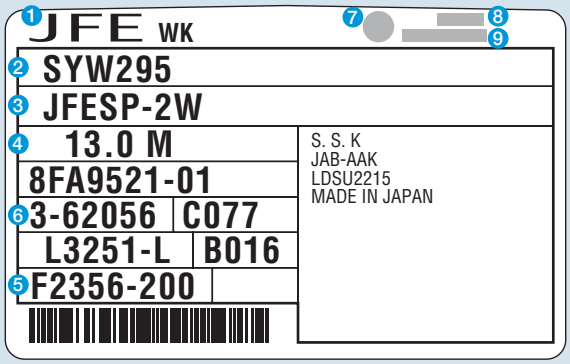

## JFESP−4W

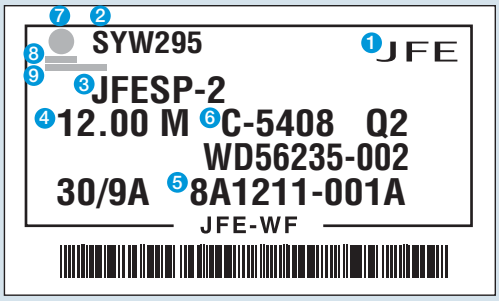



● For details, refer to "Steel Sheet Piles - From Design to Installation" issued by the Japanese Association for Steel Pipe Piles.

# Forms and Methods of Packing

## ■ Examples of labeling



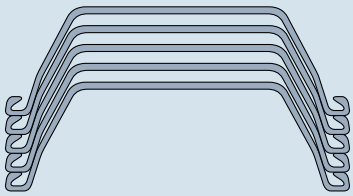

1. Company mark
2. Standard code
3. Type of sheet pile
4. Length
5. Product No.
6. Steel No.
7. JIS mark
8. Abbreviation of accredited certification body
9. Certification No.

The standard methods of packing steel sheet piles are shown below.

| Kind | Type | Method of packing | Number of stacked sheet piles |
|---|---|---|---|
| U-shape | JFESP-2W | Stack 1 | 5 sheets |
| | JFESP-3W | Stack 1 | 5 sheets |
| | JFESP-4W | Stack 1 | 5 sheets |
| | JFESP-2 | Stack 1 | 5 sheets |
| | JFESP-3 | Stack 1 | 5 sheets |
| | JFESP-4 | Stack 1 | 5 sheets |
| | JFESP-5L | Stack 1 | 5 sheets |
| | JFESP-6L | Stack 1 | 3 sheets |

[Note] Contact us regarding other forms and methods of packing.

**Stack 1 (Example of five stacked U-shaped steel sheet piles)**



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