



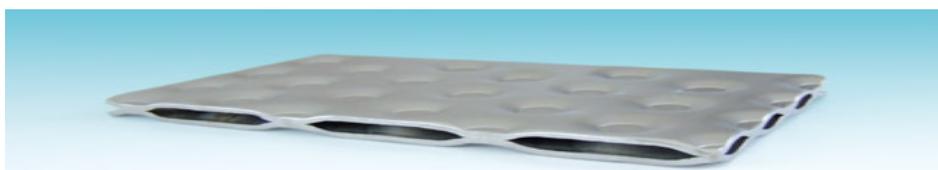
### Heat exchanger plates at a glance

The wavy “pillow like” surface has renamed it as pillow plate heat exchanger (PPHE).

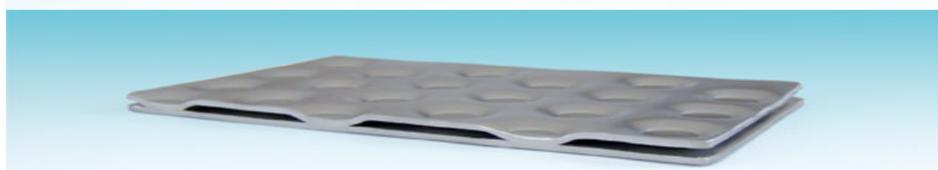
Heat exchanger plates represent a good alternative to conventional heat exchanger: both the welding spots and the waviness of the channel enhance lateral mixing and thus turbulence, which results in a good thermo-hydraulic performance of PPHE. Pillow plates also offer several design advantages, such as a fully welded and hermetically sealed construction, a high structural stability, compactness and light weight. The manufacturing is simple as the insulation also.

### Plate models

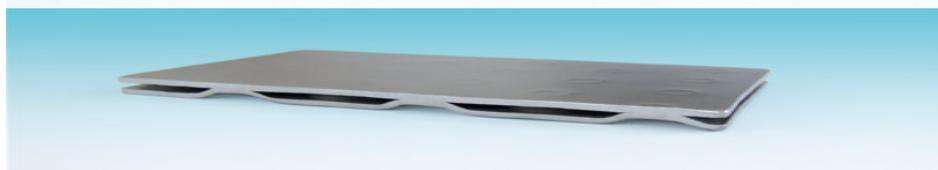
PRESSURE PLATE  
(PP)



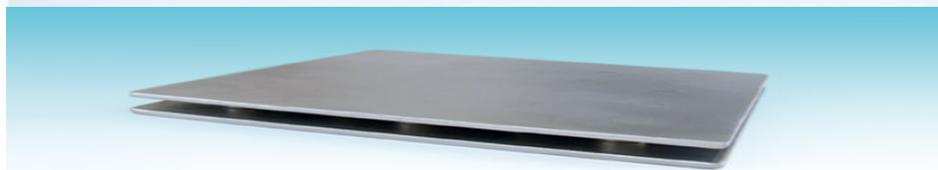
FLATE PRESSURE  
PLATE  
(FPP)



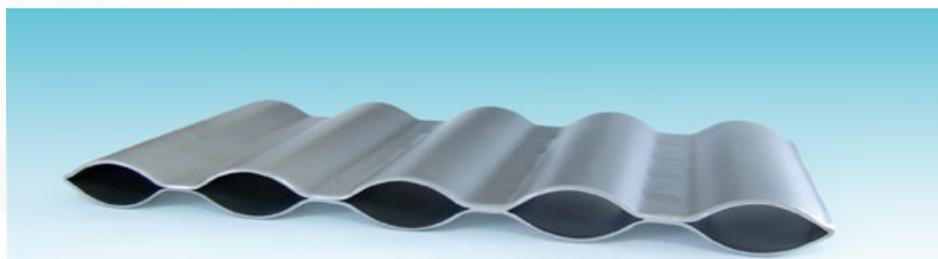
FLATE PRESSURE  
PLATE  
(FPP)



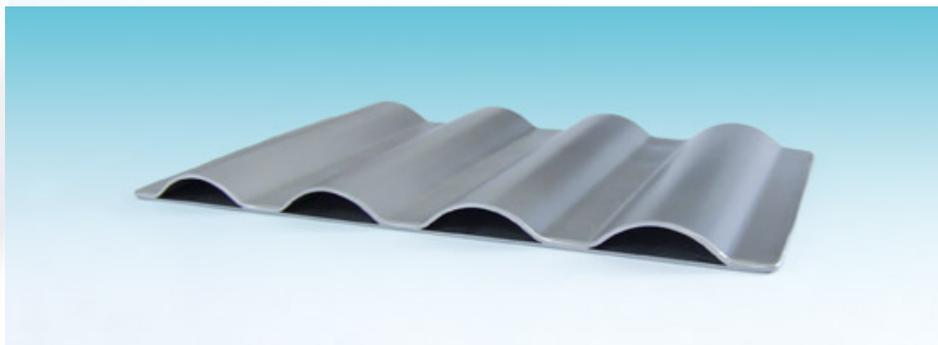
FLAT PRESS PLATE  
(FPP)



WAVE PLATE  
(WP)



SINGLE WAVE PLATE  
(SWP)





### Fabrication

Nuova Isma manufactures heat exchanger plates in form of:

- Pressure plate
- Wave plate

Instead the common “inflation process”, PPHE are manufactured with sheet embossing prior the spot welding, due to the higher pressure required for the higher thicknesses.

The higher thickness is an historic trademark that combines with the construction of high pressure reactors and hydrogenators (up to 65 bar for vessel with internal PPHE) made by Nuova Isma and a simple manufacturing.

Plates are sealed by ERW process (for spot welding) and TIG or MIG/MAG process (for perimeter).

### Shapes

The possible shapes are different:

- Simple “flat shape” for exchanger battery
- Jacket of tank and vessels
- Integral body shell by plate calendering



Steam/Air exchanger battery (PP)  
(H=1550mm, W=485mm)



Fumes/Water Cyclone integral body shell: double FP  
(H=1500mm, Øe=900 mm)



## Thicknesses

Here below some common thickness for PP,FPP:

TYPE	Thk mat.A(mm)	Thk mat. divisory(mm)	Thk mat.B(mm)
PP	1.5		2.5
PP	2.0	(4.0)	2.0
PP	3.0	(6.0)	3.0
FPP	4.0 <sup>1</sup>		2.0
PP	4.0 <sup>2</sup>	(8.0)	4.0
FPP	6.0		2.0
FPP	6.0		3.0
FPP	12.0		3.0

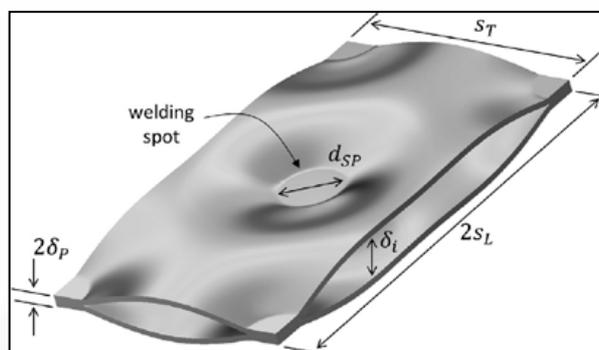
where the number in brackets indicates the potential partition metal for the desired flow pattern.

- PP) Embossed sheet up to 5 mm maximum.  
 FPP) Flat foil sheet up to 15 mm maximum.  
 WP-SWP) Waved foil sheet up to 3 mm maximum.

## PPHE Pattern

Nuova Isma common pattern is 40/80 (in order  $S_T$ ,  $2S_L$ ) staggered spot welding, meaning a triangular pitch:  $\arctan(2S_L/S_T)=75^\circ$

Other pattern upon request.



## Materials

PPHE and Wave plate are manufactured with warhorse materials against the corrosion such as:

- austenitic stainless steels AISI 304L, 310S, 316L, 316Ti, 321, 904L
- duplex stainless steels AISI 329L
- Nickel alloy C-4, C-22, C-276, 59, 800, 825

Other materials upon request.

<sup>1</sup> Bursting pressure up to 130 bar for FPP 4+2

<sup>2</sup> Bursting pressure up to 320 bar for PP 4+4



### Surface finishing

- Sandblasted
- Microspheres-blasted
- Brushed
- Mirror polished

### Operating conditions and Fluids

The uses of PPHE are several and cover any industrial area of process industry where liquid/liquid or gas/liquid heat exchange is required; for example:

- heat recovering from steam or exhaust fumes (up to 1000°C)
- cooling and heating of vessels
- condensers

Steam and water are the common fluids inside the plates for heating and cooling, but any fluid can be adopted if the proper choice of the construction material and operating condition are made.

Since Nuova Isma do not adopt series production, discharging section and velocities have to be analyzed case by case with plate geometry and allowable pressure drop.

Here below some data regarding water pressure drop.

<b>H2O Flow rate (lt/min/m plate width)</b>	<b>Pressure drop (bar/m plate length)</b>
0	0.00
50	0.08
70	0.15
80	0.20
90	0.25
100	0.31
120	0.44

