




aperam
made for life

Nickel Iron and Cobalt Iron
Cold Rolled Strips



The range of our alloys, with specific physical and mechanical properties, covers most industrial needs in the sector of aerospace, automotive, cryogenics, petrochemicals, household appliances, electronics, clock and watch industries, shielding, electrical safety and renewable energies. However, for any specific request, we can research and create customized solutions.

The physical and mechanical properties of Aperam Alloys Imphy are closely associated with their suitability for processes such as stamping, cutting, machining, deep drawing, welding, drawing and forging.

These alloys are also available in various formats: bars, wires, and plates. For special request, contact us.

Magnetic alloys

Alloy	Typical chemical composition	Stds ⁽¹⁾	Principal properties	Typical applications
Soft Ni-Fe magnetic alloys with very high permeability and low coercivity				
MUMETAL	Ni 80 Fe Mo 5	A.D.I.J.M.	<ul style="list-style-type: none"> • High permeability 	<ul style="list-style-type: none"> • Magnetic shielding • Pole pieces
CRYOPHY	Ni 81 Fe Mo 5		<ul style="list-style-type: none"> • High permeability 	<ul style="list-style-type: none"> • Magnetic shielding at cryogenic temperature
PERMIMPHY PERMIMPHY SP	Ni 80 Fe Mo 5	A.D.I.J.M.	<ul style="list-style-type: none"> • High permeability, low loss • Enhanced stampability (SP) 	<ul style="list-style-type: none"> • Current sensing cores • Watch motor components • Rotor/stator laminations for synchro resolvers
PERMIMPHY R2	Ni 81 Fe Nb Mo 1	D.I.J.	<ul style="list-style-type: none"> • High wear resistance • Reduced magnetic deterioration due to coating stresses /enhanced saturation induction 	<ul style="list-style-type: none"> • Recording head cores
SATIMPHY	Fe Ni 56		<ul style="list-style-type: none"> • High permeability • Heat treatment under magnetic field required • High sensitivity at low current level 	<ul style="list-style-type: none"> • Current sensing cores
SUPERMIMPHY L	Ni 80 Fe Mo 5	A.D.I.J.M.	<ul style="list-style-type: none"> • Very high permeability 	<ul style="list-style-type: none"> • Profiled laminations for transformers • Flux concentrators for automotive torque sensors
SUPERMIMPHY LLS PERMIMPHY LLS	Ni 81 Fe Mo 6	D.I.J.	<ul style="list-style-type: none"> • High linear permeability, relatively unsusceptible to stress 	<ul style="list-style-type: none"> • Stacked laminations for earth leakage circuit breakers • Choke and transformer cores • Profiled laminations for modern transformers • Laminations and stacked laminations for repeater coils • Current sensing cores
SUPERMIMPHY T	Ni 80 Fe Mo 5	A.D.I.J.M.	<ul style="list-style-type: none"> • Very high permeability 	<ul style="list-style-type: none"> • Earth leakage circuit breaker cores • Current sensors
SUPERMIMPHY TLS	Ni 81 Fe Mo 6	D.I.J.	<ul style="list-style-type: none"> • Very high permeability, relatively unsusceptible to stress 	<ul style="list-style-type: none"> • Earth leakage circuit breaker cores • Current sensors
Soft Ni-Fe magnetic alloys with high permeability and high saturation induction				
SUPRA 36	Fe Ni 36	D.I.J.	<ul style="list-style-type: none"> • Good permeability, high resistivity 	<ul style="list-style-type: none"> • Laminations for repeater coils • Magnetic shielding • High frequency transformer cores
SUPRA 40	Fe Ni 40	J.	<ul style="list-style-type: none"> • Enhanced permeability and saturation induction • Excellent stampability 	<ul style="list-style-type: none"> • Alarm clock motor components • Automotive injectors
SUPRA 50 / SUPRA 50 SP	Fe Ni 48	A.D.I.J.	<ul style="list-style-type: none"> • High permeability and saturation induction • Low loss • Enhanced stampability (SP) 	<ul style="list-style-type: none"> • Automotive sensors and actuators, Torque sensors • Magnetic shielding • Watch motor components • Rotor/stator laminations for micro motors and synchro resolvers • Relay components for earth leakage circuit breakers.
SUPRA 50 G / SUPRA 50 GSP	Fe Ni 48	A.D.I.J.	<ul style="list-style-type: none"> • High permeability and saturation induction • Enhanced stampability (SP) 	<ul style="list-style-type: none"> • Watch motor components • Automotive actuators
SUPRA 50 T	Fe Ni 48	A.D.I.J.	<ul style="list-style-type: none"> • Very high permeability, high saturation induction • Giant-grained recrystallisation 	<ul style="list-style-type: none"> • Profiled laminations for bonded stacks for high-performance repeater coils • Earth leakage circuit breaker cores
SP 510	Ni 50 Fe Cr 9		<ul style="list-style-type: none"> • Saturation induction close to that of Fe-Ni80% alloys, low coercivity 	
SP 302	Ni 30 Fe Cu Cr 2		<ul style="list-style-type: none"> • Good corrosion resistance 	<ul style="list-style-type: none"> • Stepper motor stators for watch industry
Soft Co-Fe magnetic alloys with very high saturation induction				
AFK 1	Fe Co 27	ASTM A801 I	<ul style="list-style-type: none"> • Very high saturation induction • High ductility 	<ul style="list-style-type: none"> • High power-to-weight ratio motor and generator laminations • Pole pieces
AFK 502 R	Fe Co 49 V2	ASTM A801 I	<ul style="list-style-type: none"> • Very high saturation induction • High resistivity / high yield strength • High magnetostriction 	<ul style="list-style-type: none"> • High power-to-weight ratio motor and generator laminations • Pole pieces • Impact printer components • Magnetostrictive sensors • High power-to-weight ratio transformer laminations
AFK 502 FP ⁽²⁾	Fe Co 49 V2	ASTM A801	<ul style="list-style-type: none"> • Very high yield strength • Fully processed 	<ul style="list-style-type: none"> • Aerospace high velocity generators • High speed machines • High power density electrical machines • Active electromagnetic bearings
AFK 18	Fe Co 18	ASTM A801 I	<ul style="list-style-type: none"> • Very high saturation induction • High electrical resistivity • Magnetostriction $\lambda_s = 25$ ppm 	<ul style="list-style-type: none"> • High power-to-weight ratio motor and generator laminations • Pole pieces • Impact printer components • Laminations for actuators (automotive) • High power-to-weight ratio transformer laminations

Magnetic alloys (continuation)

Alloy	Typical chemical composition	Stds ⁽¹⁾	Principal properties	Typical applications
Ni-Fe temperature compensating magnetic alloys				
			Curie point	
PHYTHERM 30	Fe Ni 30	I	30°C	<ul style="list-style-type: none"> • Electricity meters • Speedometers • High precision sensors • Measuring equipment
PHYTHERM 55	Fe Ni 30	I	50°C	
PHYTHERM 90	Fe Ni 30	I	90°C	
PHYTHERM 120	Ni 30 Fe Cu3 Cr2	I	120°C	
PHYTHERM 210 ⁽²⁾	Ni 50 Fe Cr 11	I	210°C	<ul style="list-style-type: none"> • Cooking pans • Induction cookware
PHYTHERM 230	Ni 50 Fe Cr 10	I	230°C	
PHYTHERM 260	Ni 50 Fe Cr 9	I	260°C	

⁽¹⁾ A= ASTM A 753; D= DIN 17405; I=IEC 404; J=JIS C 2531; M=MIL 14411

⁽²⁾ Please consult us

Special alloys

Alloy	Typical chemical composition	Standards	Principal properties	Typical applications
High yield strength alloys				
PHYNOX	Co 40 Cr 20 Ni 16 Fe 15 Mo 7 Mn	ASTM F1058 UNS R30003 UNS R30008	<ul style="list-style-type: none"> • Excellent mechanical properties up to 450°C • Excellent resistance to fatigue and stress relaxation • Excellent corrosion resistance (saltwater, acids...) • Inert in respect of human tissue • Non-magnetic • Hardening by cold working and ageing treatment 	<ul style="list-style-type: none"> • Mechanical watch movement mainspring • Springs for chemical, oil, aeronautics and space equipment • High reliability spring components for the automotive industry • Miscellaneous components for the defence industry • Prostheses and medical apparatus
DURIMPHY	Ni 18 Co 9 Mo 5 Ti	-	<ul style="list-style-type: none"> • Maraging steel with excellent mechanical properties up to 400°C • Good formability and weldability • Hardening by heat treatment without dimensional impact • Good fatigue resistance • Excellent response to nitriding 	<ul style="list-style-type: none"> • Form springs for watches • Belt for CVT transmission • Ball bearing cages • Rocket fins
PHYTIME	Ni 18 Co 17 Mo 5	-	<ul style="list-style-type: none"> • Excellent fatigue resistance 	<ul style="list-style-type: none"> • Springs • Belt for CVT transmission
DURPHYNOX	Fe Cr 12 Ni 9 Cu 2	AMS 5860 D	<ul style="list-style-type: none"> • Excellent mechanical properties up to 450°C • Hardening by heat treatment • Good corrosion resistance 	<ul style="list-style-type: none"> • Springs

Superalloys				
NICRIMPHY 600	Ni Cr Fe 9	2.4816 AMS 5540 ASTM B 168	<ul style="list-style-type: none"> • Good resistance to high-temperature oxidation • Good high-temperature mechanical properties • Good formability • Non-magnetic 	<ul style="list-style-type: none"> • Welded rolled tubes • Miscellaneous chemical industry equipment • Airbag gas generator membranes • Automotive engine and exhaust gaskets • Clamps • Sheets for furnace muffles
NICRIMPHY 601	Ni Cr 23 Fe Al	2.4851 ASTM B168	<ul style="list-style-type: none"> • Excellent resistance to high-temperature oxidation • Good high-temperature mechanical properties • Good formability • Non-magnetic 	<ul style="list-style-type: none"> • Engine gaskets • Automotive spark plugs • Sheets for furnace muffles
SUPERIMPHY 286	X 4 Ni Cr Ti 25-15	AISI 660 S 66286 1.4943 A 286	<ul style="list-style-type: none"> • Resistance to high-temperature oxidation and corrosion 	<ul style="list-style-type: none"> • Automotive exhaust gaskets • Clamps • Flanges, tubes, fasteners for chemical and petrochemical industries • Clamps for oil and off shore industry
SUPERIMPHY 625	Ni Cr 22 Mo 9 Nb	AISI 625 N26625 2.4856 ASTM B443	<ul style="list-style-type: none"> • Resistance to wet corrosion and high temperature oxidation 	<ul style="list-style-type: none"> • Airbag gas generator membranes • Automotive exhaust gaskets • Tubes, fasteners for chemical and petrochemical industries • Clamps for oil and off shore industry
SUPERIMPHY 718	Ni Cr 19 Fe Nb	UNS 07718 2.4668 ASTM B670	<ul style="list-style-type: none"> • Very good resistance to creep up to 700°C and to high-temperature oxidation in harsh environments 	<ul style="list-style-type: none"> • Turbo gaskets • Exhaust gaskets • Clamps

Special alloys (continuation)

Alloy	Typical chemical composition	Standards	Principal properties	Typical applications
Superalloys (continuation)				
NICRIMPHY 800	Ni 31 Cr 21 Fe	1.4876 UNS N08800 ASTM B409	<ul style="list-style-type: none"> • Good resistance to oxidation and carbonisation in high temperature atmosphere 	<ul style="list-style-type: none"> • Heating elements • Heat exchanger
NICRIMPHY 825	Ni 40 Cr 22 Fe Mo	ASTM B 423 ASTM B 425 UNS N08825 2.4858	<ul style="list-style-type: none"> • Excellent corrosion resistance 	<ul style="list-style-type: none"> • Tubes, fasteners for chemical and petrochemical industries • Heating elements • Heat exchanger
Electrical resistance alloys				
GILPHY 45	Fe Ni45 Cr23	-	<ul style="list-style-type: none"> • Excellent mechanical behaviour at high temperatures • Particularly suitable for reducing atmospheres (CO, CO₂, hydrocarbons) • Maximal operating temperature 1150 °C 	<ul style="list-style-type: none"> • Rail traction braking rheostats • Electrical resistors for thermal circuit breakers • Electrical furnace industry
GILPHY 80	Ni80 Cr20	ASTM B344 W 2.4869	<ul style="list-style-type: none"> • Increased oxidation resistance (rare-earth additions) • Excellent performances at high temperatures up to 1200°C 	<ul style="list-style-type: none"> • Electrical furnace industry • Heating elements • Household electrical appliances
GILPHY 70	Ni68 Cr30	-	<ul style="list-style-type: none"> • Very long operating life (30 % Cr) • Good performances in mixed atmospheric conditions (oxidizing - reducing or semi-reducing) • Maximal operating temperature 1250 °C 	<ul style="list-style-type: none"> • Electrical furnace industry
GILPHY 60	Ni60 Cr16 Fe bal	-	<ul style="list-style-type: none"> • Maximal operating temperature 1100 °C 	<ul style="list-style-type: none"> • Domestic electrical appliances • Electrical furnaces
GILPHY 30	Ni30 Cr20 Fe Bal	-	<ul style="list-style-type: none"> • Maximal operating temperature 1000 °C 	<ul style="list-style-type: none"> • Domestic electrical appliances
Welding alloys				
PHYWELD 625	Ni65 Cr22 Mo8,7 Nb3,6 Fe≤0,5	AWS A5.14 EQNiCrMo-3 UNS N06625 ASTM B443 2.4831	<ul style="list-style-type: none"> • Outstanding corrosion resistance in various media • Especial resistance to pitting and crevice corrosion 	<ul style="list-style-type: none"> • Overlay welding • Flux cored wire
PHYWELD 82	Ni73 Cr20 Nb2,7	AWS A5.14 EQNiCr-3	<ul style="list-style-type: none"> • High strength and creep rupture resistance at elevated temperature • Good corrosion resistance 	<ul style="list-style-type: none"> • Overlay welding • Flux-cored wire
PHYWELD 80	Ni80 Cr20	-	<ul style="list-style-type: none"> • Good formability 	<ul style="list-style-type: none"> • Flux-cored wire
PHYCOFE	Co Fe5	-	<ul style="list-style-type: none"> • High cobalt content • Good formability 	<ul style="list-style-type: none"> • Flux-cored wire

Controlled expansion alloys

Alloy	Typical chemical composition	Standards	Principal properties	Typical applications
Fe Ni				
INVAR	Fe Ni 36	DIN 1715 W 1.3912 A 54 - 301 SEW 385	<ul style="list-style-type: none"> • Very low expansion coefficient in the temperature range between 20°C and 100°C; $\alpha_m = 1,1 \cdot 10^{-6}/^\circ\text{C}$ 	<ul style="list-style-type: none"> • Moulds for composite components • Piezoelectric injectors • Shadow masks and frames for cathode ray tubes • Echoboxes and filters for mobile phone network relay stations
INOVAR	Fe Ni 36	DIN 1715 W 1.3912 A 54 - 301 SEW 385	<ul style="list-style-type: none"> • Expansion coefficient lower than that of Invar®, α_m between 20°C and 100°C = $0,8 \cdot 10^{-6}/^\circ\text{C}$ 	<ul style="list-style-type: none"> • Chemical analysis equipment • Mass spectroscopy, spectrometry and chromatography
INVAR M93	Fe Ni 36	A 54 - 301	<ul style="list-style-type: none"> • Low expansion coefficient between -185°C and 0°C. • Elevated mechanical properties at cryogenic temperatures 	<ul style="list-style-type: none"> • Gas carrier tank membranes • Liquefied natural gas loading and discharge pipes
N 42	Fe Ni 42	ASTM F30 DIN 17745 W 1.3917 A 54 - 301 SEW 385	<ul style="list-style-type: none"> • Expansion coefficient suited to silicon (integrated circuits), ceramics (aluminates) and hard glass 	<ul style="list-style-type: none"> • Integrated circuit lead frames • Electron gun components • Hermetic seals on glass and ceramics • Enamelled resistor ferrules • Moulds for composite parts

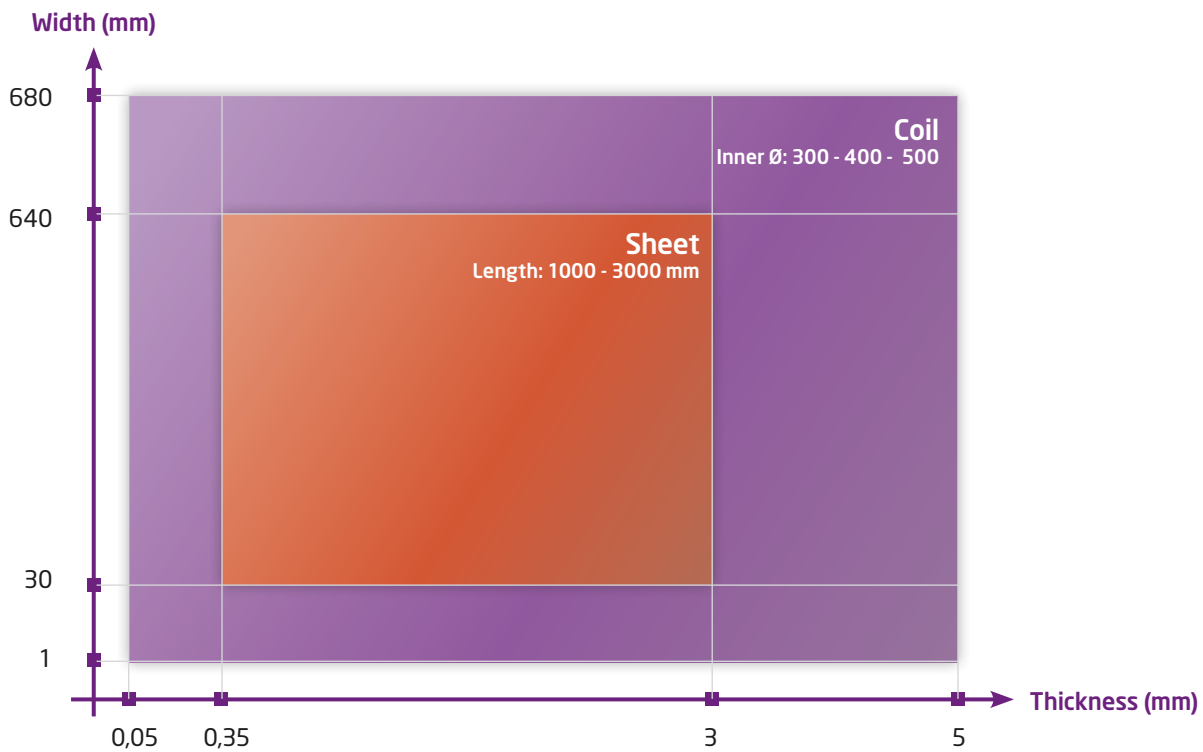
Controlled expansion alloys (continuation)

Alloy	Typical chemical composition	Standards	Principal properties	Typical applications
N 48	Fe Ni 48	ASTM F30 DIN 17745 W 1.3922 A 54 - 301	• Expansion coefficient suited to soft glass used for hermetic seals in electronics	• Hermetic feedthroughs • Electron gun components
N 52	Fe Ni 52	ASTM F30 W 2.4478 A 54 - 301	• Expansion coefficient suited to soft glass used for hermetic seals in electronics	• Hermetic feedthroughs • Reed relays • Miscellaneous glassmetal seals • Electronic components
Fe Ni Cr				
N 475	Fe Ni 47 Cr 5	A 54 - 301	• Expansion coefficient suited to soft glass	• Lighting • Vacuum fluorescent display
N 485	Fe Ni 48 Cr 5	DIN 17745 W 2.4486		
N 426	Fe Ni 42 Cr 6	ASTM F31 W 1.3946 A 54-301		
Fe Ni Co				
DILVER P1	Fe Ni 29 Co 17	ASTM F15 DIN 17745 W 1.3981 A 54 - 301 SEW 385	• Expansion coefficient suited to borosilicate glass and ceramics employed in electronics	• Hybrid circuit casings • Transistor and optoelectronic component cases and bases • Electronic tubes (power, X-ray...) • Hermetic feedthroughs • SAW filters • Oscillator housings • CRT electron gun components • Concentrated solar power

Bimetals

Alloy	Typical chemical composition	Standards	Principal properties	Typical applications
Thermostatic bimetals				
AS	B6M / INVAR	DIN 1715	• Standard DIN grade K = 28.5 10 ⁻⁶ / °C	Temperature indicating equipment • Thermometers
R80	NC4 / INVAR	ASTM B 388	• Standard ASTM grade K = 26.5 10 ⁻⁶ / °C	Temperature control • Thermostats for domestic electrical appliances • Room thermostats • Mixer taps
108 SP	B72M / INVAR	DIN 1715	• High deflection K = 39 10 ⁻⁶ / °C	
AS Series	B6M / Ni or Cu / INVAR	DIN 1715	• Resistivity values from 0.78 μohm.m to 0.06 μohm.m	Timers and temperature control • Cigar lighters, toasters
R 80 Series	NC4 / Ni or Cu / INVAR	ASTM B 388	• Resistivity values from 0.79 μohm.m to 0.04 μohm.m	Safety • Thermal circuit breakers • Thermal relays • Miniature temperature/current overload protectors
SP Series	B72M / Ni or Cu / INVAR	-	• Resistivity values from 1.40 μohm.m to 0.05 μohm.m	
BS	B6M / N42	DIN 1715	• High linearity limit up to 380°C K = 22 10 ⁻⁶ / °C	Temperature compensation • Bimetallic temperature compensators for CRTs
BS9	B6M / Cu / N42	DIN 1715	• As BS with high thermal conductivity	
IN 540	NC19 / NC38		• Resistant to corrosion	Timer and temperature control • Kettle
Bimetal components				
B72M	Mn Cu 18 Ni 10	ASTM B 753 T-10	• Very high expansion coefficient	• Thermostatic bimetals
B6M	Fe Ni 20 Mn 6	ASTM B 753 T-20	• High expansion coefficient	
NC4	Fe Ni 22 Cr 3	ASTM B 753 T-22	• High expansion coefficient	
INVAR CBH	Fe Ni 36	ASTM B 753 T-36	• Low expansion coefficient	
N42 CB	Fe Ni 42	ASTM B 753 T-42	• Low expansion coefficient	

Available coil sizes



Specific sizes are available upon request.

Packing types



Cardboard box



wooden box
(for export)



sheets box

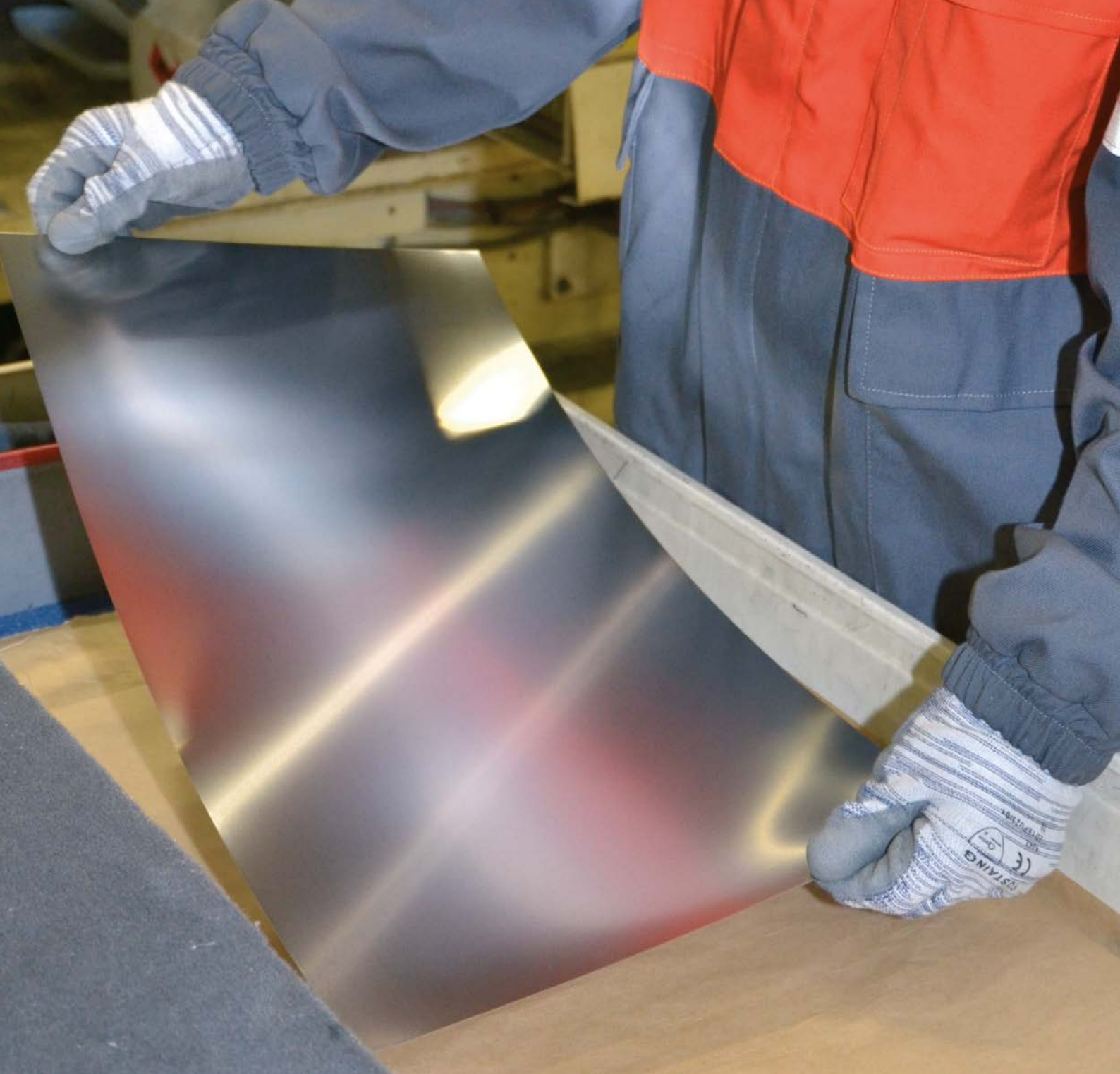


Pallet horizontal axis



Pallet eye to the sky



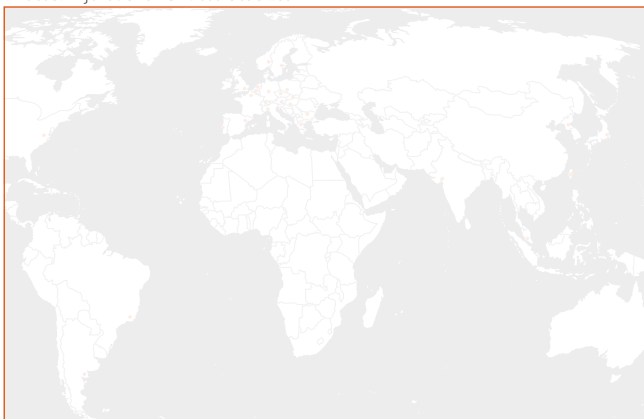


© January 2013 - Aperam Alloys Imphy.

While every care has been taken to ensure the information contained in this publication is as accurate as possible, Aperam Alloys Imphy cannot guarantee its completeness nor that it is free from error.

AFK®, Cryophy®, Dilver®, Durimphy®, Invar®, Nicrimphy®, Phynox®, Phytyme®, Phytherm®, Superimphy®, Supermimphy®, Satimphy® are registered trademarks of Aperam Alloys Imphy.

Photos: © Jordache - Shutterstock.com



Contact us:

www.aperam.com/alloys-imphy

nickel.alloys@aperam.com

T: +33 (0)3 86 21 38 97

F: +33 (0)3 86 21 39 59

Aperam Alloys Imphy

BP1

58160 Imphy

FRANCE