



VIDP

Vacuum Induction Degassing and Pouring Furnaces

The Concept of Success in
Vacuum Induction Furnace Technology

VIDP – The Systems Concept

Equipment Advantages

Small Furnace Volume

- Reduced desorption surfaces
- Small vacuum pumping system
- Optimum control of the furnace atmosphere
- Low inert gas consumption

High Flexibility

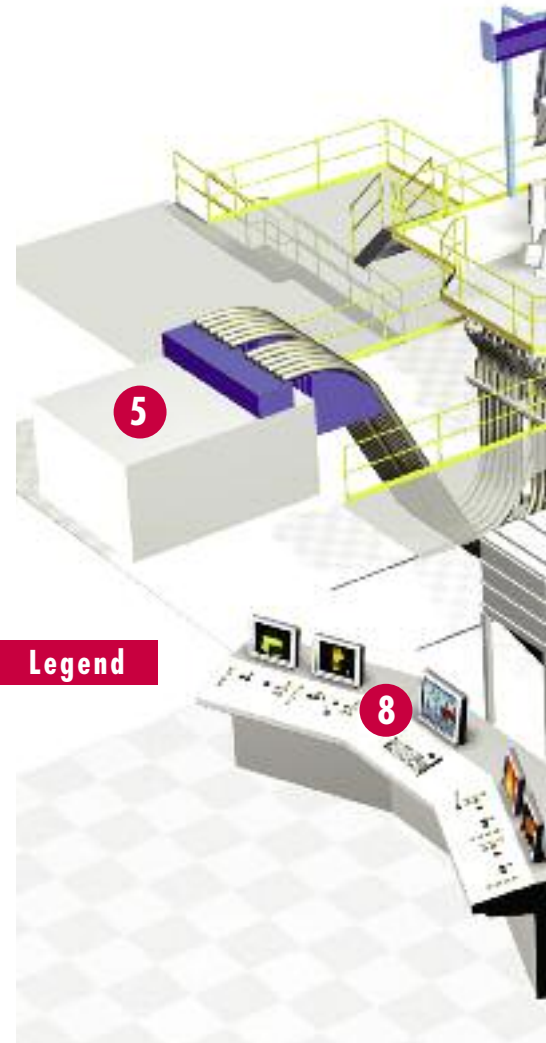
- Through a range of interchangeable lower furnace bodies
- Variable pouring technologies (Ingot Casting, Horizontal Continuous Casting, Powder Production)
- Unit can be modularly expanded
- Connection to multiple casting chambers

Easily Maintainable

- Power cables and hydraulic lines are outside the melting chamber – leaks do not affect the vacuum
- Simple maintenance of the vacuum pumps through effective filter system, smaller vacuum pumping system
- Tried and tested components, preventative fault diagnostics

Reliable crucible status monitoring

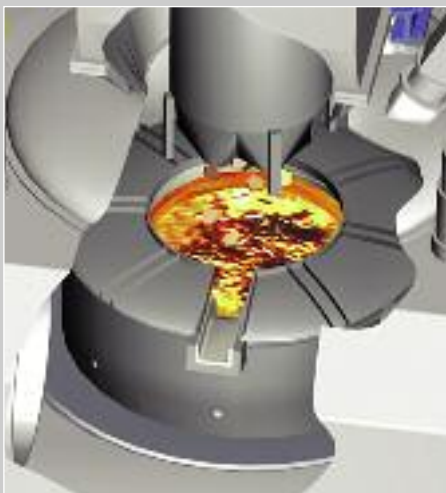
- Increased operational reliability
- Optimisation of the crucible life



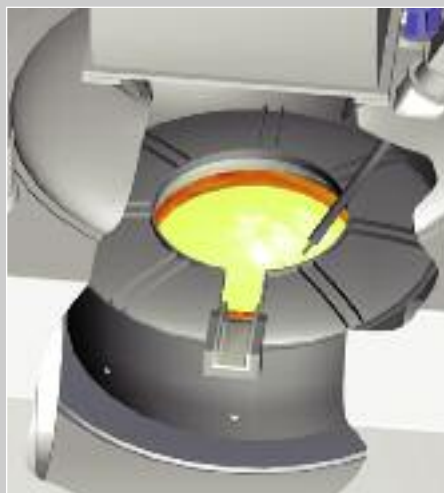
Legend

- ① VIDP melting chamber
- ② Mold chamber
- ③ Bulk charger
- ④ Launder lock
- ⑤ Melting power supply
- ⑥ Vacuum pumping system
- ⑦ Temperature measurement / sample taking
- ⑧ Central control desk

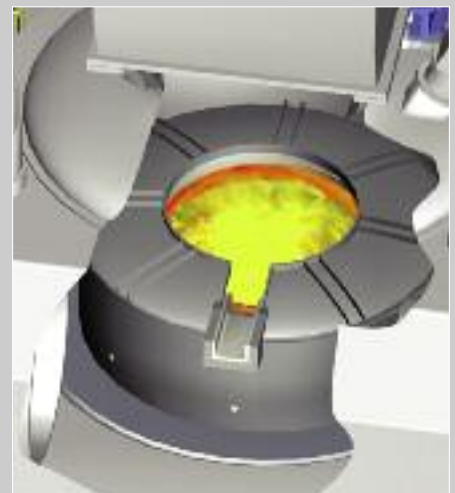
Vacuum charging

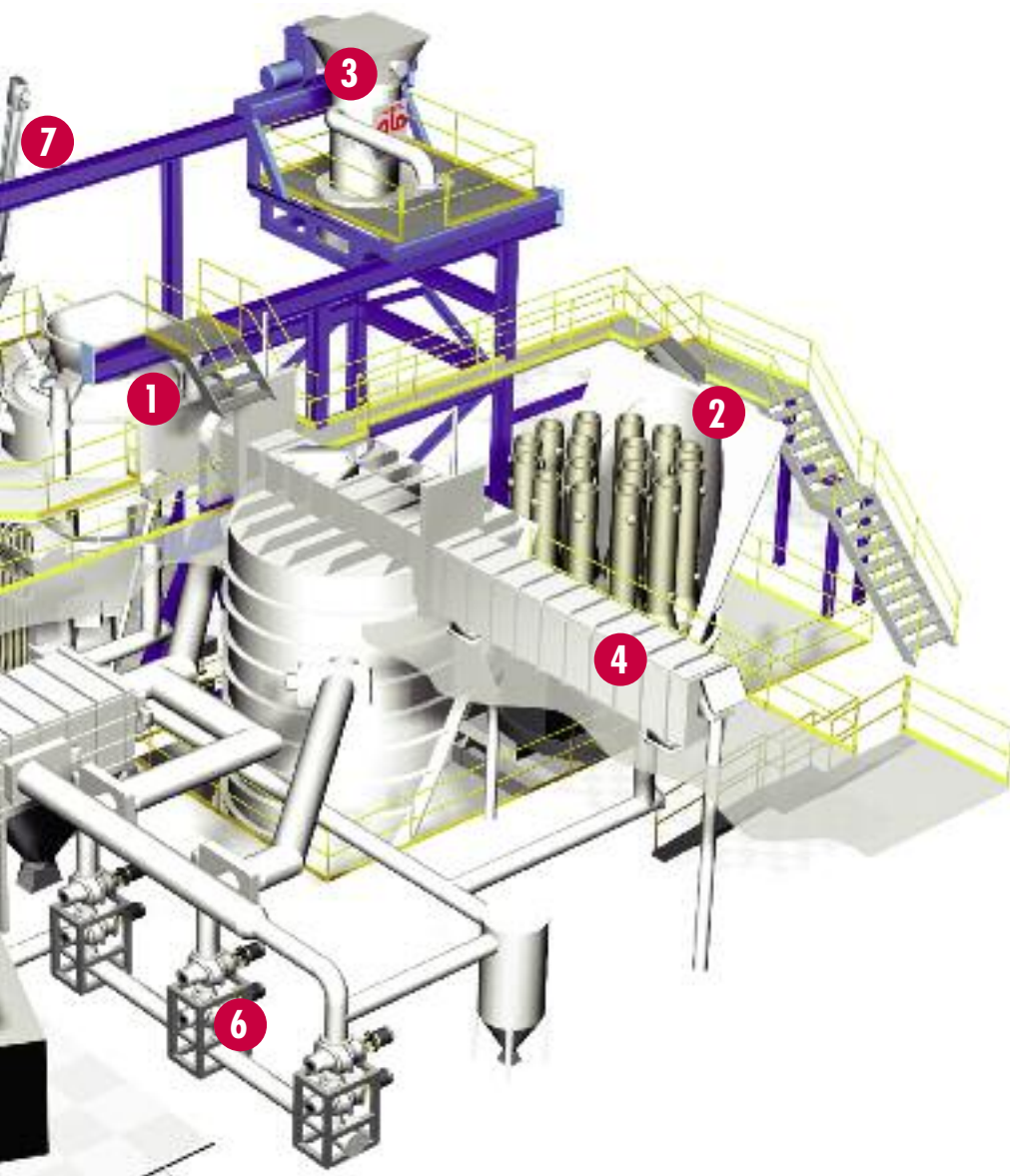


Temperature measurement – Sample taking



Degassing – Homogenizing

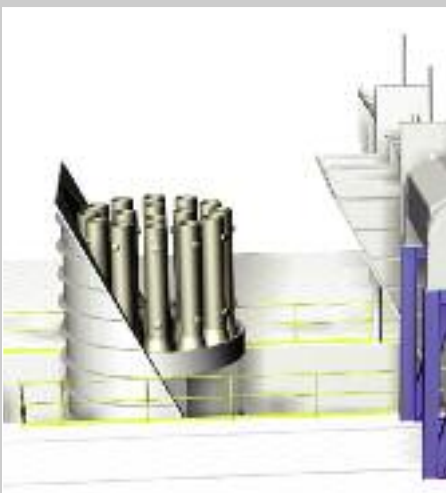




Fast Furnace Change

- < 1 hour with hot crucible
- High operating availability
- Increased productivity by up to 25 %
- Rapid alloy change
- Separate crucible break out and relining stations

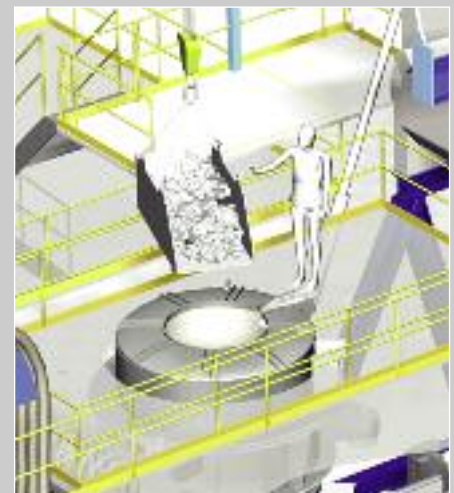
Mold loading



Tapping



Open charging / Crucible cleaning



VIDP: Higher Quality, Flexibility and P

Applications

- Charging, melting, degassing, distilling, alloying, homogenizing and pouring of specialty alloys under vacuum or protective gas for applications in
 - Aerospace
 - Medical equipment
 - Tool making
 - Chemical engineering
 - Power generation equipment
 - Electronics
- Primary melter for ESR, VAR, precision casting and powder metallurgy feedstock
- Production of rolling and forging ingots, remelting electrodes, barsticks and molten metal for continuous casting and precision casting

Materials

- Superalloys
- Nickel-base alloys
- Cobalt-base alloys
- Tool steels
- Stainless steels
- Amorphous alloys
- Magnetic materials
- High purity or reactive Copper and Aluminum alloys



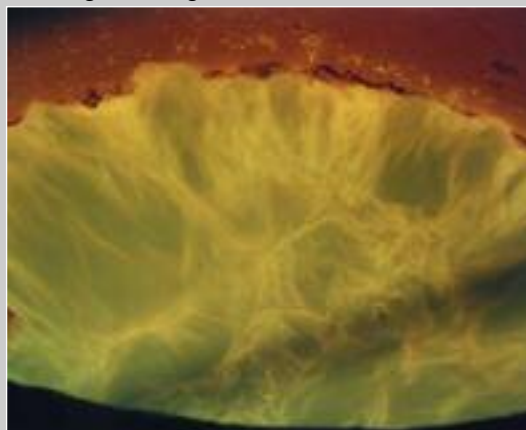
Exact meeting of alloy specs • Highest material

Charging, alloying, temperature measurement and sample taking



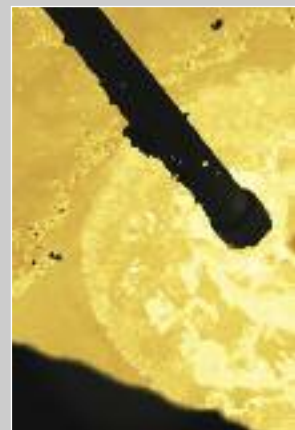
The VIDP furnace can be charged liquid in open air or under vacuum through a mobile bulk charger lock

Degassing and Refining/Homogenizing



3 phase electro-magnetic stirring for controlled bath movement with low power input during refining phase, gas purging with porous plug in crucible bottom

Temperature measurement and sample taking



Temperature measurement and sample taking either a small vacuum lock lance

productivity



16 ton VIDP system
Böhler Edelstahl
Kapfenberg, Austria

Vacuum crucible preheat station



Metallurgy

- Attainment of precision analyses
- Removal of gasses (such as O, H, N), metallic impurities and harmful trace elements
- Fine decarburization down to ELC qualities
- Distilling off unwanted elements
- Prevention of oxidation losses and avoidance of Oxide and Nitride formation
- Decanting of slag inclusions
- Homogenization of the melt
- Treatment of the melt with reactive gasses

cleanliness • Versatile pouring possibilities • Rapid product change

Sampling



Sample taking are possible through the furnace or through the bulk charger

Casting



Controlled tilting of the entire furnace housing for tapping the melt into the transfer launder

Maintenance



Quick changing of the furnace body and quick crucible cleaning for an alloy change as well as effective loading/packing of the crucible

The VIDP-Process Advantages

Vacuum- (pressure $< 10^{-3}$ mbar) or protective gas operation possible

- The entire melt chamber can be permanently left under a controlled atmosphere during a melting campaign lasting several days

All important secondary metallurgical treatment steps take place in a vessel equipped with appropriate vacuum locks

- All necessary process steps such as charging, deslagging, temperature measurement, sample taking and alloying are possible without interrupting the vacuum

Small furnace volume (1:10 compared to chamber type furnaces) and small internal furnace surfaces

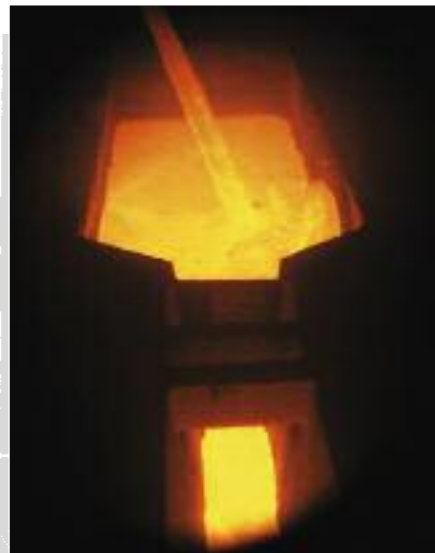
- Lowest desorption surfaces and low gas emission
- Only a small vacuum pumping system required
- Easy cleaning
- Large melt surface and better relationship for boundary dependant reactions and thus high degassing rates
- High crucible freeboard
- Safety with foaming melts or delay in boiling

Electromagnetic stirring

- Optimum degassing of the melt without energy input and overheating
- Good homogenization and rapid mixing in of reactive alloying elements
- Exact setting of melt temperature
- Decanting of inclusions



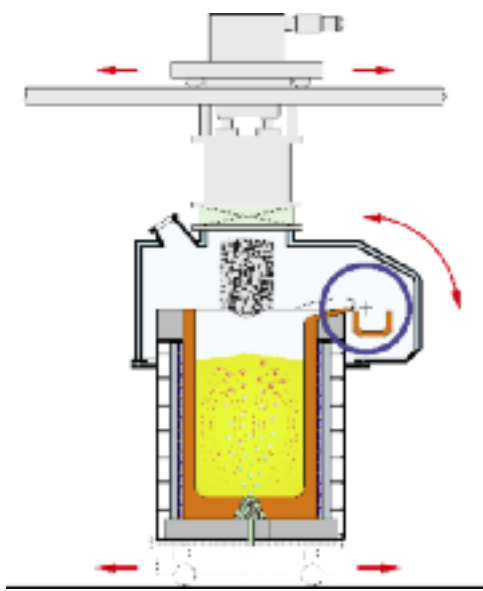
Effective degassing/Distillation



Pouring into the transfer launder



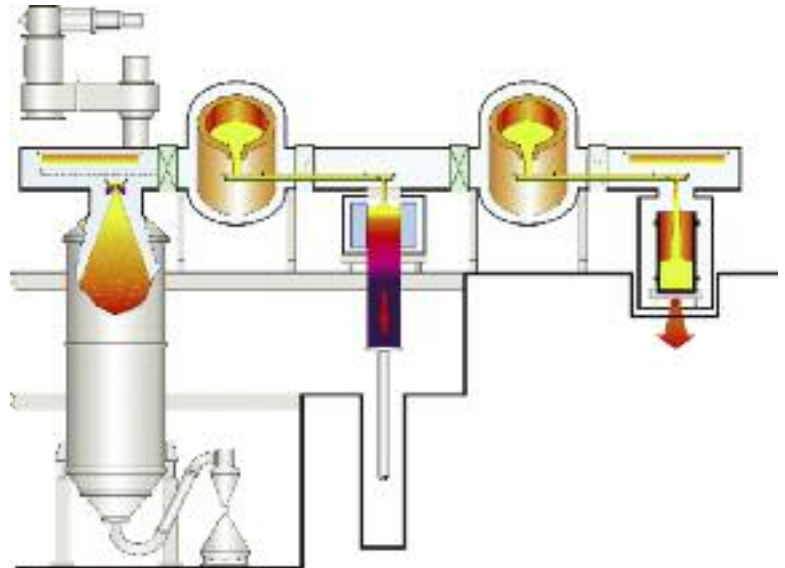
Tundish box with slag weir



The VIDP-Casting Options

Maximum flexibility with the choice of process and pouring options such as

- Removable casting chamber for small or medium sizes
- Fixed casting chamber for large forging ingots and remelt electrodes
- Tundish chamber with horizontal and vertical continuous casting
- Atomization system for production of powders and/or spray casting



The VIDP-Process Control

- Process data collection and documentation with link to a host computer facilitates reproducible quality settings
- Safe, simple operation thanks to automated sequencing procedure
- Automatic crucible monitoring for increased process safety
- Automatic suction capacity measurement and leak rate detection



VIDP 400 (1-3 tons)



Key technical data

- Charge capacity 2 tons
- Production of Fe/Ni/Rare Earth based Hydrogen storage alloys
- Pouring of ingots and plates
- Melting power 810 kW
- Operating pressure 10^{-2} mbar

VIDP 400, Treibacher Auermet, Ravne, Slovenia

View with open casting chamber



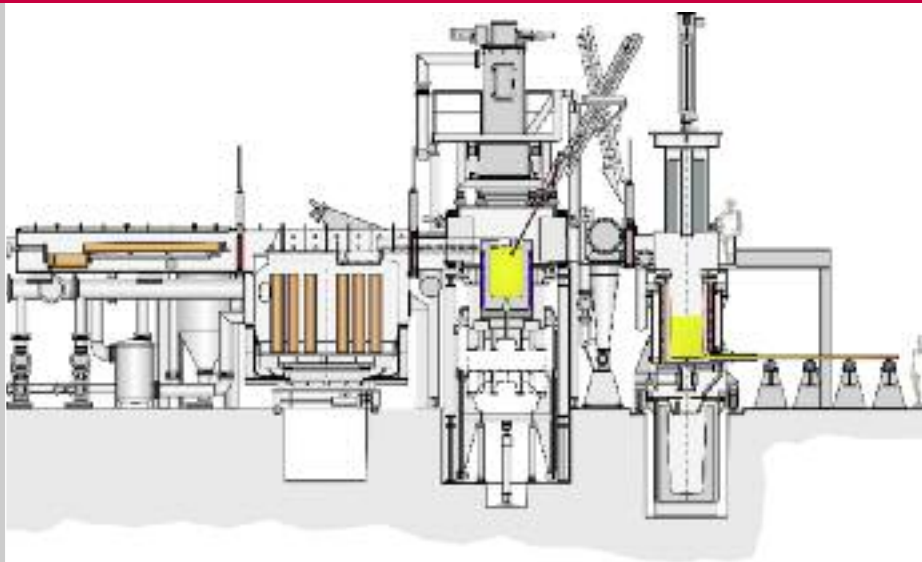
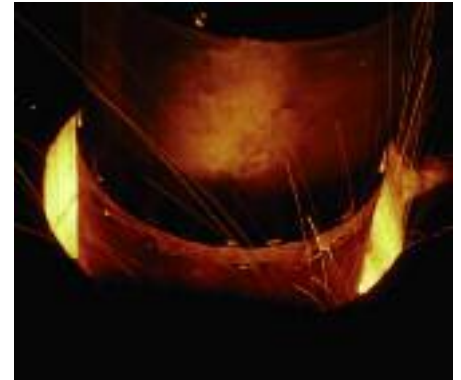
VIDP 1000 (4-8 tons)



VIDP 1000, Ross & Catherall, Sheffield, U. K.

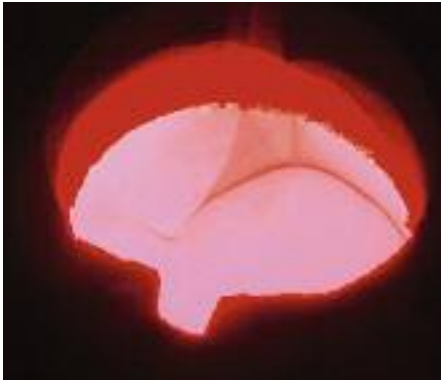
Key technical data

- Charge capacity 8 tons
- Production of Ni/Co base alloys
- Pouring of small ingots (Barsticks) and provision of molten metal for horizontal continuous casting system
- Melting power 2,000 kW
- Operating pressure 10^{-3} mbar



VIDP systems with Ingot casting and horizontal continuous casting

VIDP 2000 (9-18 tons)



Key technical data

- Charge capacity 16 tons
- Production of Special Steels and Ni/Co base alloys
- Pouring of large forging ingots and remelt electrodes
- Melting power 3,500 kW
- Operating pressure 10^{-2} mbar



VIDP 2000, Böhler Edelstahl, Kapfenberg, Austria



Melting chamber in pouring position

VIDP 3000 (19-30 tons)



Key technical data

- Charge capacity 22 tons
- Production of Special Steels and Ni/Co base alloys
- Pouring of large forging ingots and remelt electrodes
- Melting power 5,000 kW
- Operating pressure 10^{-2} mbar

VIDP 3000, Carpenter Technology, Reading, PA, USA



Control center (tilted position for tapping in the background)

Technical Data

Characteristic	Units	VIDP 400	VIDP 1000	VIDP 2000	VIDP 3000
Crucible size Capacity (based on Ni)	(metric tons)	1 - 3	4 - 8	9 - 18	19 - 30
Typical cycle times					
Ni-Co base alloy	(h)	6 - 8	6 - 8	6 - 8	6 - 8
Fe base alloys/ Special steels	(h)	3 - 6	3 - 6	3 - 6	3 - 6
Furnace changeover times	(h)	< 1	< 1	< 1	< 1
Operating pressure					
With mechanical pump set	(mbar)	10 ⁻¹ - 10 ⁻²	10 ⁻¹ - 10 ⁻²	10 ⁻¹ - 10 ⁻²	10 ⁻¹ - 10 ⁻²
With oil booster pump set	(mbar)	10 ⁻² - 10 ⁻³	10 ⁻² - 10 ⁻³	10 ⁻² - 10 ⁻³	10 ⁻² - 10 ⁻³
Electrical layout					
Output melting power supply	(kW)	600 - 1,500	1,500 - 2,500	2,500 - 3,500	3,500 - 5,000
Connected power vacuum pump set and auxiliary equipment (depends on scope of supply)	(kVA)	ca. 150	ca. 250	ca. 300	ca. 350
Cooling water					
Total consumption ($\Delta t=10\text{ }^{\circ}\text{C}$)	(m ³ x h ⁻¹)	ca. 100	ca.150	ca. 200	ca. 250
Floor area Length (L) x Width (W)	L x B (m)	10 x 10	12 x 10	14 x 14	25 x 16
Height	(m)	8.5	9.5	10	12
Recommended					
Crane capacity	(metric tons)	20	30	50	70

The Solution



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