

# AEROVAL GL3



## APPLICATIONS

Aerospace component (aircraft-engine and airframe components, gas turbine engine ducting, combustion liners, ...), chemical-processing equipment handling mixed acids both oxidizing and reducing, power generation equipment (superheater-tube shield, soot-blower tubes, boiler-tube separator and hangers), sea water application (ship and submarine parts, offshore industry), pollution control equipment for environmental protection, nuclear water reactors (reactor-core and control-core components), heat shields, furnace hardware, plant equipment, MIG/TIG electrodes.

Grade 1 is recommended for application where combination of tensile and rupture properties is requested (above 1038°C). In this condition ductility and toughness at cryogenic temperature are very good.

Grade 2 is recommended for application where the resistance to creep is important (above 815°C) and where cold drawing or cold rolling operation are further requested. It shows good resistance to many corrosion atmospheres. It is not used for application below at 816°C.

Above 650°C both grade could be used.

When this alloy is requested for application below 649°C it is recommended another heat treatment (900°C + air quench).

## DESIGNATIONS

UNS	AECMA	AFNOR	EN
N06625	Ni-P97HT/Ni-PH3601	NC22DNb	2.4856/NiCr22Mo9Nb

## CHEMICAL COMPOSITION (chemistry shall conform to the following percentages by weight)

Element	C	Mn	Si	P	S	Cr	Ta	Cb+Ta	Co	Mo	Fe	Al	Ti	Ni
Min[%]	-	-	-	-	-	20.00	-	3.15	-	8.00	-	-	-	58.00
Max[%]	0.10	0.50	0.50	0.015	0.015	23.00	0.05	4.15	4.00	10.00	5.00	0.40	0.40	-

## HEAT TREATMENTS

Condition		Temperatures	Soaking times	Cooling
Grade 1	Annealed	870°C min	depend on volume and section thickness. Generally 0.5 - 1hrs	Water quenching or rapid air cooling
Grade 2	Sol Annealed	1090°C min (*)	depend on volume and section thickness. Generally 0.5 - 1hrs	

(\*)with or without subsequent stabilization anneal at 982°C min to increase resistance to sensitization



**ACCIAIERIE VALBRUNA**

## MATERIAL DESCRIPTION

GL3 is a solid solution nickel-base alloy. This alloys shows high mechanical properties at temperatures up to 450°C and above 600°C, good corrosion resistance in different environment (mineral and organic acids), to crevice corrosion, pitting, erosion, intergranular attack, stress corrosion cracking resistance.

This performances are achieved by the combination of Nickel, Chromium, Molybdenum and Columbium.

This grade can be subjected to two different heat treatments to achieve appropriate mechanical properties for different application: annealing (grade 1) and solution annealing (grade 2).

## CORROSION AND OXIDATION RESISTANCE

This alloy exhibits high resistance to corrosive attack in a wide variety of environment. The combination of Nickel and Chromium provides to oxidizing media, while the combination of Nickel and Molybdenum provides resistance to reducing conditions, however the Columbium content prevents intergranular corrosion and the Molybdenum content enhances the resistance to pitting and crevice corrosion. At high temperatures this grade maintains good resistance to scaling and oxidation.

## COLD WORKING

This grade can be cold-formed by standard processes. Generally after cold working with more than 15% deformation a solution annealed heat treatment (grade 2) is requested.

# AEROVAL GL3

## PHYSICAL PROPERTIES

Density (gr/cm <sup>3</sup> at 20°C)	8.44		
Modulus of elasticity (GPa)	annealed: 208		sol annealed: 201
Mean Coefficient of Thermal Expansion (10 <sup>-6</sup> /°C)	20° → 200°C : 13.10	20° → 400°C : 13.90	20° → 500°C : 14.40
Thermal Conductivity (W/mK at 20°C)	9.8		
Electrical resistivity (μΩ×m at 20°C)	1.26		
Magnetic Permeability (20°C, 200 oersted)	1.006		

## MECHANICAL PROPERTIES

Condition	Dimension (mm)	Ultimate Tensile Strength (N/mm <sup>2</sup> ), min	0.2% Yield Strength (N/mm <sup>2</sup> ), min	Elongation [50mm or 4D] (%), min	Reduction of Area (%), min	Hardness Brinell (HB)
Grade 1	φ < 100	820	410	30	40	240 max
	101 < φ < 254	740	340	25		
Grade 2	all	670	270	30	50	

## HOT WORKING

Process	Heating temperatures	Cooling
Forging	900° - 1150°C (**)	Water quenching or rapid air

(\*\*) At temperature below of 1010°C this grade becomes very difficult to be hot formed, for this reason different steps of hot working with intermediate heat treatment are necessary. An reduction of 15/20% is recommended for finishing steps.

To achieve properties and corrosion resistance annealing or solution annealing treatments are requested on the final product.

## WELDABILITY

It is designed for use with gas-tungsten-arc or a consumable electrode. After the welding final heat treatment is not requested because material maintains same behavior of base metal. Nevertheless standard practices should be followed.

## SPECIFICATIONS

ASTM	DIN	EN	BS	AMS
B446, B564	17744, 17752	10095	3076-NA21	5666



**ACCIAIERIE VALBRUNA**

**ACCIAIERIE VALBRUNA**

VIALE DELLA SCIENZA, 25 36100 VICENZA ITALY

Tel. +39 (0)444 968211 Fax +39 (0)444 963836

www.acciaierie-valbruna.com

e-mail: info@valbruna.it

e-mail: special.products@valbruna.it