VDM® Alloy 59
Nicrofer 5923 hMo

Material Data Sheet No. 4130
August 2017

VDM® Alloy 59

Nicrofer 5923 hMo

VDM® Alloy 59 is a nickel-chrome-molybdenum alloy developed by VDM Metals, which has particularly low concentrations of carbon and silica and it is characterized by excellent corrosion resistance as well as high strength.

VDM® Alloy 59 is characterized by:

- excellent resistance against a multitude of corrosive media under oxidizing and reducing conditions,
- outstanding resistance against chloride-induced pitting and crevice corrosion, as well as resistance against stress corrosion cracking,
- excellent resistance in mineral acids such as nitric, phosphoric, sulfuric and salt acids, but especially against sulfur/salt acid mixtures,
- excellent resistance in contaminated mineral acids,
- very good processing characteristics and weldability with low propensity to form hot cracks,
- very resistant to sensitivation.

The material is on the list of materials acceptable for the transport of hazardous goods published by the BAM [German Federal Institute for Materials Research and Testing].

Designations

Standard	Material Designation
EN	2.4605 – NiCr23Mo16Al
ISO	15156/MR 0175
UNS	N06059

Standards

Product form	DIN	VdTÜV	ASTM	ASME	NACE	others
Sheet	17750 17744	505	B 575	SB 575	MR 0175/ISO 15156	
Strip	17744	505	B 575	SB 575	MR 0175/ISO 15156	API 5LD
Bar	17752 17744	505	B 574 B 564	SB 574 SB 564	MR 0175/ISO 15156	
Wire	17744					

Table 1 – Designations and standards

Chemical composition

	Fe	Cr	Ni	Mo	C	S	Mn	Si	Cu	P	Al	Co
Min.		22,0	Bal.	15,0							0,1	
Max.	1,5	24,0		16,5	0,01	0,01	0,5	0,1	0,5	0,015	0,4	0,3
Due to technical reasons the alloy may contain other elements then listed												

Table 3 – Chemical composition (%) according to VdTÜV data sheet 505

Physical properties

Density	Melting range	Relative magnetic permeability at 20 °C (68 °F)
8,6 g/cm³ bei 20 °C 537 lb/ft³ at 68 °F	1.310 bis 1.360 °C (710 – 738 °F)	1.001

Temperature		Specific heat capacity		Thermal conductivity		Electrical resistivity	Modulus of elasticity		Coefficient of thermal expansion	
°C	°F	$\frac{J}{Kg \cdot K}$	$\frac{Btu}{lb \cdot °F}$	$\frac{W}{m \cdot K}$	$\frac{Btu \cdot in}{sq.\,ft \cdot h \cdot °F}$	µΩ · cm	GPa	10^6 psi	$\frac{10^{-6}}{K}$	$\frac{10^{-6}}{°F}$
20	68	414	0.0989	10,4	6.01	126	210	30.5	-	-
100	212	425	0.102	12,1	6.99	127	207	30.0	11,9	6.61
200	392	434	0.104	13,7	7.92	129	200	29.0	12,2	6.78
300	572	443	0.106	15,4	8.90	131	196	28.4	12,5	6.94
400	752	451	0.108	17,0	9.82	133	190	27.6	12,7	7.06
500	932	459	0.11	18,6	10.7	134	185	26.8	12,9	7.17
600	1,112	464	0.111	20,4	11.8	133	178	25.8	13,1	7.28

Table 3 – Typical physical properties of VDM® Alloy 59 at elevated temperatures

Microstructural properties

VDM® Alloy 59 has a cubic, face-centered crystal structure.

Mechanical properties

The following properties apply to VDM® Alloy 59 in the solution-annealed condition and with the specified dimensions. The properties for larger dimensions must be agreed separately.

Temperature		Yield strength $R_{p\ 0.2}$		Yield strength $R_{p\ 1,0}$		Tensile strength R_m		Elongation A
°C	°F	MPa	ksi	MPa	ksi	MPa	ksi	%
20	68	340	49.3	380	55.1	690-900	100-131	40
100	212	290	42.1	330	47.9	650	94.3	40
200	392	250	36.3	290	42.1	615	89.2	40
300	572	220	31.9	260	37.7	580	84.1	40
400	752	190	27.6	230	33.4	545	79.0	40
450	842	175	25.4	215	31.2	525	76.1	40

Table 4 – Mechanical short-term properties at room temperature and elevated temperatures (min. values according VdTÜV material data sheet 505)

Product-form	Dimensions		Yield stress $R_{p\ 0,2}$		Yield stress $R_{p\ 1,0}$		Tensile strength R_m		Elongation at fracture A
	mm	in	MPa	ksi	MPa	ksi	MPa	ksi	%
Sheet/ Plate	0,5 – 6,4	0.0197-0.252	≥ 340	49.3	≥ 380	55.1	≥ 690	100	≥ 40
Sheet/ Plate	5 - 30	0.0197-118	≥ 340	49.3	≥ 380	55.1	≥ 690	100	≥ 40
Strip	0,5 bis 6,4	0.0197-0.252	≥ 340	49.3	≥ 380	55.1	≥ 690	100	≥ 40
Bar	≤100	≤ 3.94	≥ 340	49.3	≥ 380	55.1	≥ 690	100	≥ 40
Bar	≤100	≤ 3.94	≥ 320	46.4	≥ 360	52.1	≥ 650	94.3	≥ 40

Table 5 – Mechanical properties at room temperature (min. values according VdTÜV material datasheet 505)

ISO V impact value[1)]

ISO –V impact strength ak (mean value)	225 J/ cm^2 (minimum)	≥ 200J/cm^2 at -196 °C (-122 °F)
ISO – V notch impact enegery[1)] Kv	180 J (133 ft/lbf) (minimum)	≥160J at -196 °C (-122 °F)
2) Source: VdTÜV- material datasheet 505		

[1)] Cut axis perpendicular to the surface, sheet thickness <= 60 mm
Average value of 3 samples. Only one value can fall below the minimum average value at most by 30%.
The requirements refer to normal samples according to DIN EN ISO 148-1. For undersized samples, the values must be agreed separately with the manufacturer.
The values also apply for the heat-affected zone in welded joints.

Corrosion resistance

Due to the extremely low carbon and silica concentrations, VDM® Alloy 59 has no propensity for grain boundary dispersions in hot forming or welding. The alloy can therefore be used in many chemical processes with oxidizing and reducing media. Furthermore, VDM® Alloy 59 is more resilient against chloride ion attack due to its high nickel, chrome and molybdenum concentrations.
The corrosion tests described in the relevant standards usually refer to oxidizing conditions under which the VDM® Alloy 59 has proven to be clearly superior over all other Ni-Cr-Mo alloys. But VDM® Alloy 59 is also highly resistant under reducing conditions. Accordingly, its corrosion rate in boiling 10%-sulfuric acid is less than one-third of the attack measured on other introduced Ni-Cr-Mo alloys. With this excellent behavior, the alloy has also become successfully established in the chemical process industry in applications with reducing media.

Figures 1 and 2 show the excellent corrosion resistance of VDM® Alloy 59 in hydrochloric acid and sulfuric acid. Optimal corrosion resistance, however, can only be assured if the material is used in clean, metallic bright condition.

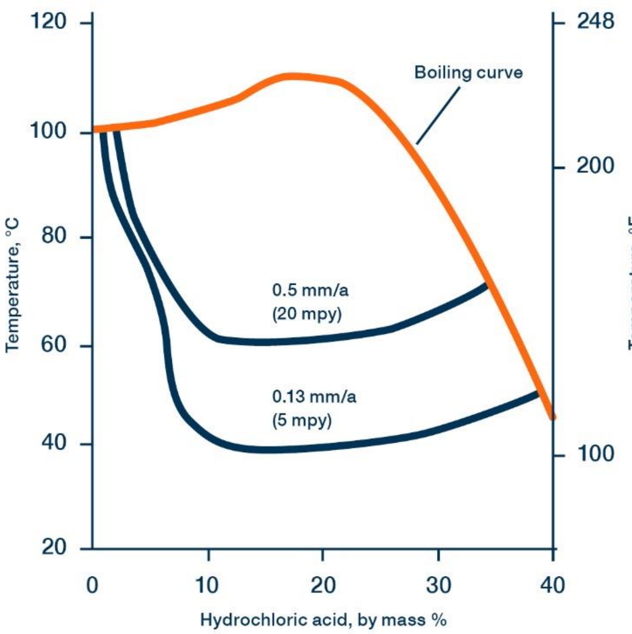

Fig. 1: ISO corrosion diagram of VDM® Alloy 59 in hydrochloric acid, as determined by static immersion tests

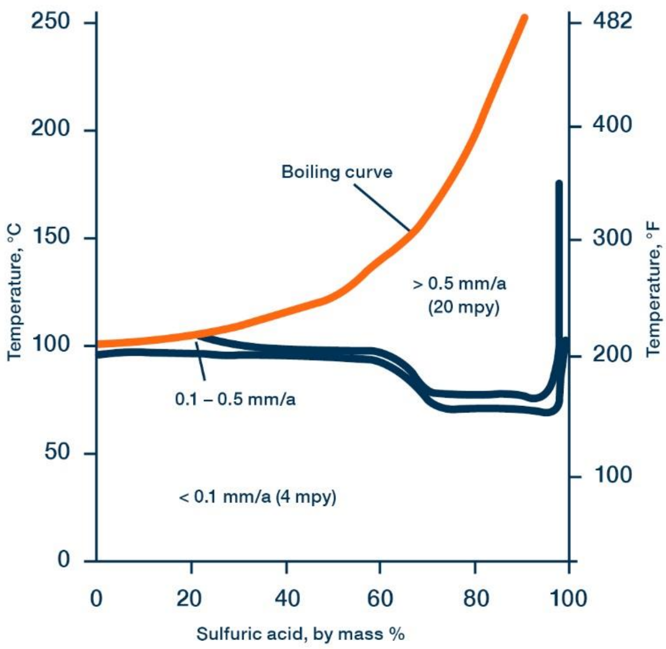

Fig. 2: ISO corrosion diagram of VDM® Alloy 59 in sulfuric acid, as calculated based on static immersion tests over at least 120h

Applications

VDM® Alloy 59 is suitable for a wide spectrum of applications in chemistry, petro chemistry, energy and environmental engineering. Typical applications are:

- Plant components for organic chemistry processes with media containing chloride, especially where catalytic systems on chloride basis are used.
- Multi-purpose plants in the chemicals industry
- Plant parts in active substance preparation and the pharmaceuticals industry
- Scrubber, heat exchangers, flaps, ventilators and agitators for flue gas desulfurization (FGD) in fossil fuel power plants and waste combustion plants
- SO_2-washers for ship diesel engines
- Components for seawater and concentrated brines
- Equipment and components for geothermal energy and acid gas applications
- Reactors for acetic acids and acetic anhydrides
- Reactors for hydrofluoric acid
- Sulfuric acid coolers

Fabrication and heat treatment

VDM® Alloy 59 is ideally suited for processing by means of common industrial processing techniques.

Heating

It is important that the workpieces are clean and free of any contaminants before and during heat treatment. Sulfur, phosphorus, lead and other low-melting point metals can result in material damage during the heat treatment. This type of contamination is also contained in marking and temperature-indicating paints or pens, and also in lubricating grease, oils, fuels and similar materials. The sulfur content of fuels must be as low as possible. Natural gas should contain less than wt.-0.1% sulfur. Heating oil with a maximum sulfur content of wt.-0.5% is also suitable. Electric furnaces are to be preferred due to precise temperature control and lack of contaminants due to fuel. The furnace temperature should be set between neutral and slightly oxidizing and should not change between oxidizing and reducing. The workpieces must not come in direct contact with flames.

Hot forming

VDM® Alloy 59 should be hot-worked in a temperature range between 1,180 and 950 °C (2,156-1,742 °F) with subsequent rapid cooling down in water or air. For heating up, workpieces should be placed in a furnace which has been heated up to the maximum hot forming temperature. Heat treatment after hot forming is recommended for achieving optimal corrosion behavior.

Cold forming

The workpieces should be in the annealed condition for cold forming. VDM® Alloy 59 has a significantly better work hardening rate than the widely used austenitic stainless steels. This must be taken into account during the design and selection of forming tools and equipment and during the planning of forming processes. Intermediate annealing is necessary for major cold forming work. For cold forming of > 15%, a final solution annealing must be conducted.

Heat treatment

The solution annealing should take place at temperatures between 1,100 and 1,180 °C (2,012-2,156 °F), preferably at 1,120°C (2,049 °F). The retention time during annealing depends on the semi-finished product thickness and it is calculated as follows:

- For thicknesses $d \leq 10mm$, the retention time is $t = d \cdot 3min/mm$
- For thicknesses $d = 10$ to 20 mm, the retention time $t = 30 \text{ min} + (d – 10 \text{ mm}) \cdot 2 \text{ min/mm}$
- For thicknesses $d > 20$ mm, the retention time $t = 50 \text{ min} + (d – 20 \text{ mm}) \cdot 1 \text{ min/mm}$

The retention time commences with material temperature equalization; longer times are generally considerably less critical than retention times that are too short.

Cooling down should be accelerated with water or air in order to achieve optimum properties. The material must be placed in a furnace that has been heated up to the maximum annealing temperature before any heat treatment. For the product forming belt, the heat treatment can be performed in a continuous furnace at a speed that is adapted to the strip thickness and a temperature that differs from the specified temperatures and times. The cleanliness requirements listed under "Heating" must be observed.

Descaling and pickling

Oxides of VDM® Alloy 59 and heat tint in the area around welds adhere more strongly than in stainless steels. Grinding using extremely fine abrasive belts or grinding discs is recommended. It is imperative that grinding burns be avoided. Before pickling in saltpeter-hydrofluoric acid mixtures, the oxide layers should be destroyed by abrasive blasting or fine grinding, or pre-treated in salt baths. The pickling baths used should be carefully monitored with regard to concentration and temperature.

Machining

Machining of VDM® Alloy 59 should take place in an annealed condition. Because of the considerably elevated tendency toward work hardening in comparison with low-alloy austenitic stainless steels, a low cutting speed and a feed level that is not too high should be selected and the cutting tool should be engaged at all times. An adequate chip depth is important in order to cut below the previously formed strain-hardened zone. Optimum heat dissipation through the use of large quantities of suitable, preferably aqueous, lubricants has considerable influence on a stable machining process.

Welding information

When welding nickel alloys and special stainless steels, the following information should be taken into account:

Safety

The generally applicable safety recommendations, especially for avoiding dust and smoke exposure must be observed.

Workplace

A separately located workplace, which is specifically separated from areas in which C steel is being processed, must be provided. Maximum cleanliness is required, and drafts should be avoided during gas-shielded welding.

Auxiliary equipment and clothing

Clean fine leather gloves and clean working clothes must be used.

Tools and machines

Tools that have been used for other materials may not be used for nickel alloys and stainless steels. Only stainless steel brushes may be used. Machines such as shears, punches or rollers must be fitted (e.g. with felt, cardboard, films) so that the workpiece surfaces cannot be damaged by such equipment due to pressed-in iron particles as this can lead to corrosion.

Edge preparation

Edge preparation should preferably be carried out using mechanical methods such as lathing, milling or planing. Abrasive waterjet cutting or plasma cutting is also possible. In the latter case, however, the cut edge (seam flank) must be cleanly reworked. Careful grinding without overheating is also permissible.

Striking

Striking may only take place in the seam area, such as on the seam flanks or on an outlet piece, and not on the component surface. Scaling areas are places that may be more susceptible to corrosion.

Included angle

Compared to C-steels, nickel alloys and special stainless steels exhibit lower thermal conductivity and greater heat expansion. Larger root gaps and root openings (1 to 3 mm) are required to live up to these properties. Due to the viscosity of the welding material (compared to standard austenitic steels) and the tendency to shrink, included angles of 60 to 70° – as shown in figure 3 – have to be provided for butt welds.

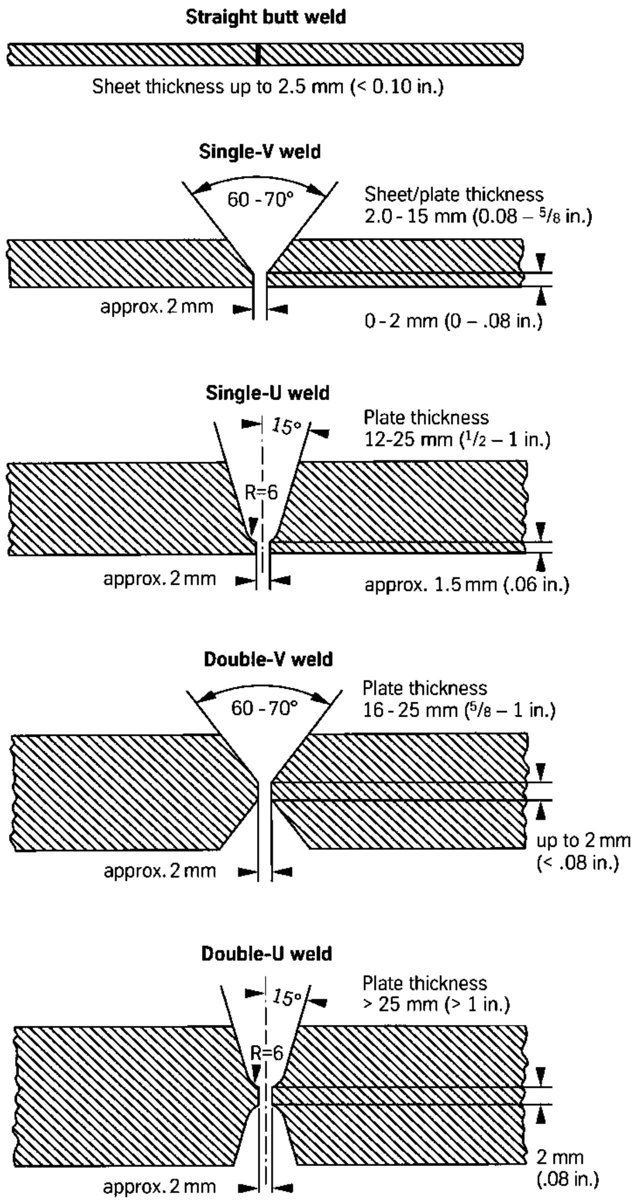

Figure 3 – Seam preparation for welding nickel alloys and special stainless steels

Cleaning

Cleaning of the base material in the seam area (both sides) and the welding filler (e.g. welding rod) should be carried out using acetone.

Welding technique

VDM® Alloy 59 can be welded using conventional processes with metals of the same type as well as many other metals. This includes TIG, GMAW (MIG/MAG), plasma, electron beam welding and handheld electrical welding. The use of a pulse technique is preferable during shielding gas welding processes. The use of a multi-component shielding gas (Ar + He + H2 + CO2) with low CO2 concentrations (< 0.12%) is recommended for the MAG process. For welding, VDM® Alloy 59 should be in a solution-annealed condition and free of scale, grease and markings. When welding the root, care should be taken to achieve best quality root protection using pure argon (argon 4.6) so that the welding edge is free of oxides after welding the root. Root protection is also recommended for the first and, in certain cases depending on the welded construction, also for the second intermediate layer weld after root welding. Any heat tint in the intermediate layers must be removed while the welding edge is still hot, preferably by means of a stainless steel brush.

Welding filler

The use of the following fillers is recommended for gas-shielded welding methods:

Welding rods and wire electrodes:
VDM® FM 59 (material no. 2.4607)
UNS N06059 AWS A5.14: ERNiCrMo-13
DIN EN ISO 18274: S Ni 6059 (NiCr23Mo16)

Welding parameters and influences

It must be ensured that work is carried out using targeted heat application and low heat input as listed in Table 6 as an example. The stringer bead technique is recommended. The interpass temperature should not exceed 120°C. In principle, checking of welding parameters is necessary.

Heat input Q can be calculated as follows:

$$Q = \frac{U \cdot I \cdot 60}{v \cdot 1{,}000} \left(\frac{kJ}{cm}\right)$$

U = arc voltage, volts
I = welding current strength, amperes
v = welding speed, cm/min

Thick-ness	**Welding pro-cess**	**Filler material**		**Root pass**[1)]		**Internediate and final passes**		**Welding speed**	**Shielding gas**	
mm (in)		**Diameter mm (in)**	**Speed (m/min.)**	**I in (A)**	**U in (V)**	**I in (A)**	**U in (V)**	**(cm/min.)**	**Type**	**Rate (l/min.)**
3 (0.118)	m-TIG	2 (0.0787)	-	90	10	110-120	11	15	I1, R1 with max 3% H_2	8-10
6 (0.236)	m-TIG	2-2,4 (0.0787-0.0945)	-	100-110	10	120-140	12	14-16	I1, R1 with max 3% H_2	8-10
8 (0.315)	m-TIG	2.4 (0.0945)	-	100-110	11	130-140	12	14-16	I1, R1 with max 3% H_2	8-10
10 (0.394)	m-TIG	2.4 (0.0945)		100-110	11	130-140	12	14-16	I1, R1 with max 3% H_2	8-10
3 (0.118)	Autom.-TIG [2)]	1.2 (0.0472)	1.2	-	-	150	11	25	I1, R1 with max 3% H_2	12-14
5 (0.197)	Autom. -TIG[2)]	1.2 (0.0472)	1.4			180	12	25	I1, R1 with max 3% H_2	12-14
2 (0.0787)	Autom. TIG (HD)	1 (0.0394)				180	11	80	I1, R1 with max 3% H_2	12-14
10 (0.394)	Autom. TIG (HD)	1.2 (0.0472)				220	12	40	I1, R1 with max 3% H_2	12-14
4 (0.157)	Plasma[3)]	1,2 (0.0472)	1	180	25			30	I1, R1 with max 3% H_2	30
6 (0.236)	Plasma[3)]	1,2 (0.0472)	1	200-220	25			26	I1, R1 with max 3% H_2	30
8 (0.315)	GMAW[4)] (MIG/Mag)	1.0 (0.0394)	6-7	-	-	130-140	23-27	24-30	I1, I3-ArHe30, Z-ArHeHC 30/2/0.12	18
10 (0.394)	GMAW[4)] (MIG/MAG)	1.2 (0.0472)	6-7	-	-	130-150	23-27	25-30	I1, I3-ArHe30, Z-ArHeHC 30/2/0.12	18

Information

[1)] Root pass: it must be ensured that there is sufficient root protection, for example using Ar 4.6, for all inert gas welding processes.

[2)] Autom. TIG: the root pass should be welded manually (see manual TIG parameters)

[3)] Plasma: recommended plasma gas Ar 4.6 / plasma quantity 3.0-3.5 l/min

[4)] GMAW (MIG/MAG): the use of multi-component shielding gases is recommended for MAG welding.

Section energy kJ/cm: autom. TIG-HD max. 6; TIG, GMAW (MIG/MAG) manual, mechanized max. 8; plasma max. 10

The values are intended as guidance to simplify the setting of welding machines.

Table 6 – Welding parameters

Availability

VDM® Alloy 59 is available in the following standard semi-finished forms:

Sheet/Plate

Delivery condition: Hot or cold rolled, heat treated, descaled or pickled

Condition	Thickness mm (in)	Width mm (in)	Length mm (in)	Piece Weight
Cold rolled	1-7 (0.039-0.275)	≤ 2,500 (98.42)	≤ 12,500 (492)	
Hot rolled*	3-55 (0.11-2.165)	≤ 2,500 (98.42)	≤ 12,500 (492)	≤ 2.100 kg (4,630 lb)

Strip

Delivery condition: Cold rolled, heat treated, pickled or bright annealed

Thickness mm (in)	Width mm (in)	Coil-inside diameter mm (in)			
0,025-0,15 (0.000984-0.00591)	4-230 (0.157-9.06)	300 (11.8)	400 (15.7)	500 (19.7)	–
0,15-0.25 (0.00591-0.00984)	4-720 (0.157-28.3)	300 (11.8)	400 (15.7)	500 (19.7)	–
0,25-0,6 (0.00984-0.0236)	6-750 (0.236-29.5)	–	400 (15.7)	500 (19.7)	600 (23.6)
0,6-1 (0.0236 -0.0394)	8-750 (0.315-29.5)	–	400 (15.7)	500 (19.7)	600 (23.6)
1-2 (0.0394-0.0787)	15-750 (0.591-29.5)	–	400 (15.7)	500 (19.7)	600 (23.6)
2-3 (0.0787-0.118)	25-750 (0.984-29.5)	–	400 (15.7)	500 (19.7)	600 (23.6)

Rolled sheet – separated from the coil – are available in lengths from 250-4,000 mm (9.84 to 157.48 in).

Rod

Delivery condition: Forged, rolled, drawn, heat treated, oxidized, descaled or pickled, turned, peeled, ground or polished

Dimensions	Outside diameter mm (in)	Length mm (in)
General	6-800 (0.236-31.5)	1,500-12,000 (59.1 – 472)
Material specific dimensions	8-450 (0.315-17.7	1,500-12.000 (59.1 - 472)

Further shapes and dimensions on request

Wire

Delivery condition: Drawn bright, ¼ hard to hard, bright annealed in rings, containers, on spools and headstocks

Drawn mm (in)	Hot rolled mm (in)
0.16-10 (0.006-0.04)	5.5-19 (0.22-0.75)

Other shapes and dimensions such as discs, rings, seamless or longitudinally welded pipes and forgings can be re-quested.

Publications

The following technical literature has been published about the material VDM® Alloy 59:

M. Jasner, W. Herda, M. Rockel: Crevice corrosion behaviour of high-alloyed austenitic steels and nickel-base alloys in seawater, determined under various test conditions; Applications of Stainless Steel 92, Lohf. Proc., Stockholm, 446 – 457 (1992).

M. Rockel, G. K. Grossmann: Metallische Werkstoffkonzepte für Rauchgasentschwefelungsanlagen [Metal Materials Concepts for Flue Gas Desulfurization Systems]; Stahl '92, issue 4/92. R. Kirchheiner, F. Stenner: Metallische Verbund-werkstoffe garantieren Korrosionsschutz auf Lebenszeit [Metal Compound Materials Guarantee Corrosion Protection for a Lifetime]; VDI Reports No. 1027, 1992.

R. Kirchheiner, M. Köhler, U. Heubner: Nicrofer 5923 hMo, ein neuer hochkorrosionsbeständiger Werkstoff für die Chemische Industrie, die Umwelttechnik und verwandte Anwendungen; [A New Highly Corrosion Resistant Material for the Chemicals Industry, Environmental Engineering and Related Applications]; Werkstoffe und Korrosion 43, 388–395 (1992).

U. Heubner, M. Köhler: Das Zeit-Temperatur-Ausscheidungs- und das Zeit-Temperatur- Sensibilisierungs-Verhalten von hochkorrosionsbeständigen Nickel-Chrom-Molybdänlegierungen [The Time-Temperature Precipitation and Time-Temperature Sensitization Behavior of Highly Corrosion-Resistant Nickel-Chrome-Molybdenum Alloys]; Werkstoffe und Korrosion 43, 181–190 (1992).

D. C. Agarwal, W. R. Herda, J. Klöwer: Case Histories on Solving Severe Corrosion Problems in the CPI and other Industries by an advanced Ni-Cr-Mo Alloy 59 (UNS N06059); CORROSION 2000, Paper No. 00501, NACE International, Houston, 2000.

D. C. Agarwal, J. Klöwer: Nickel Base Alloys: Corrosion Challenges in the New Millenium; CORROSION 2001, Paper No. 01325, NACE International, Houston, 2001.

D. C. Agarwal, G. K. Grossmann: Case Histories on the use of Nickel Alloys in Municipal & Hazardous Waste Fueled Facilities; CORROSION 2001, Paper No. 01177, NACE International, Houston, 2001.

D. C. Agarwal, U. Brill, R. A, Corbett: Results of Various Tests on Welded and Unwelded alloy 59 for Rad-Waste Containers; CORROSION 2001, Paper No. 01120, NACE International, Houston, 2001.

Application case histories of Ni-Cr-Mo and 6Mo alloys in the petrochemical and chemical process industries; Stainless Steel World, May 2002.

D. C. Agarwal, U. Brill, R. Behrens; Alloy 59: UNS N06059, provides answers to many critical problems of the marine industry: Crevice Corrosion, Weld repair, SCC of Fasteners; CORROSION 2004, Paper No. 04281, NACE International, Houston, 2004.

D. C. Agarwal, R. Behrens: Results of various corrosion and mechanical tests on cold reduced bars of alloy 59, UNS N06059, for fastener applications; CORROSION 2005, Paper No. 05231, NACE International, Houston, 2005.

D. C. Agarwal: Neue Anwendung der Superlegierung Alloy 59 in der Rauchgaswäsche [New Application of the Alloy 59 Super Alloy in Flue Gas Cleaning]; ThyssenKrupp techforum, July 2005.

Volker Wahl, Helena Alves, Rolf Streib Boxberg III: More Than 20 Years of Positive Experience With Metallic FGD Scrubber, VGB Workshop Flue Gas Cleaning Coppenhagen 2016.

Dr. Helena Alves, Helmut Werner, D.C. Agarwal: Corrosion performance and applications of Alloy 31 and Alloy 59 in sulfuric acid media. Corrosion 2006, Paper 06222, NACE International.

D.C. Agarwal, Helena Alves: Applications of Alloy 59 (UNS N06059) and ALLOY 31 (UNS N08031) in mitigating corrosion problems in CPI and petrochemical. Corrosion 2007, Paper 07186, NACE International.

Helena Alves, Martin Schmitz-Niederau: Successful applications of nickel-alloys and high alloyed stainless steels in seawater service.

Helena Alves, Ralph Baessler: New results on the selection of nickel alloys and a 6% Mo special stainless steel for high-temperature acid service. Corrosion 2009, Paper 09369, NACE International.

Imprint

14 August 2017

Publisher
VDM Metals International GmbH
Plettenberger Straße 2
58791 Werdohl
Germany

Disclaimer
All information contained in this data sheet is based on the results of research and development work carried out by VDM Metals International GmbH and the data contained in the specifications and standards listed available at the time of printing. The information does not represent a guarantee of specific properties. VDM Metals reserves the right to change information without notice. All information contained in this data sheet is compiled to the best of our knowledge and is provided without liability. Deliveries and services are subject exclusively to the relevant contractual conditions and the General Terms and Conditions issued by VDM Metals. Use of the most up-to-date version of this data sheet is the responsibility of the customer.

VDM Metals International GmbH
Plettenberger Straße 2
58791 Werdohl
Germany

Phone +49 (0)2392 55 0
Fax +49 (0)2392 55 22 17

vdm@vdm-metals.com
www.vdm-metals.com