

# ARMCO® Pure Iron and Specialty Stainless Steels



Representing ARMCO®  
products since 1924



# PH

## Precipitation Hardening

Precipitation Hardening Stainless Steels like 17-4 PH<sup>®</sup>, 15-5 PH<sup>®</sup>, PH 13-8 Mo, 17-7 PH<sup>®</sup> and PH 15-7 Mo<sup>®</sup> are offering varied and unique combinations of high strength and hardness, excellent corrosion resistance, good fabricating characteristics, and ease of hardening by heat treatment.



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# PH

## **17-4 PH®**

Unique combination of high strength / high hardness / excellent corrosion resistance / easy heat treatment; widely used in the aerospace, chemical, petrochemical, food processing, paper, and general metal-working industries. Applications include: pump shafts, valve stems, balls, gates, bushings and trims; mixing screws, fasteners, couplings, wear rings, hydraulic actuators, and screws.

## **15-5 PH®**

Ferrite-free version of 17-4 PH to improve transverse mechanical properties; widely used in: the aerospace, chemical, petrochemical, food processing, paper, and general metalworking industries.

## **PH 13-8 Mo**

Designed for high performance applications requiring high strength coupled with excellent resistance to corrosion and stress corrosion. Applications include: forgings, cold-headed and machined fasteners, aircraft-parts, nuclear reactor components, landing gear parts, pins and lock washers, high-performance shafting, and petrochemical application requiring stress corrosion resistance combined with high strength.

## **17-7 PH®**

Provides valuable property combinations particularly well suited for aerospace applications. This special alloy also provides benefits for other applications requiring formability, high strength and good corrosion resistance, as well as excellent properties for flat springs, bellville washers, eyelets, and strain gauges at temperatures up to 316° C.

## **PH 15-7 Mo®**

Particularly beneficial for a wide range of applications that include: retaining rings, springs, aircraft bulkheads, welded and brazed honeycomb panelling, and other aircraft components requiring high strength at elevated temperatures.

## Chemical Analysis, wt %

Grade	C (max)	Cr	Ni	Si (max)	Mn (max)	Cu	Mo	Al
17-4 PH	0,07	15,0 - 17,0	3,0 - 5,0	1,0	1,0	3,0 - 5,0	-	-
15-5 PH	0,07	14,0 - 15,5	3,5 - 5,5	1,0	1,0	2,5 - 4,5	-	-
PH 13-8 Mo	0,05	12,0 - 13,3	7,5 - 8,5	0,1	0,1	-	2,0 - 2,5	0,90 - 1,35
17-7 PH	0,09	16,0 - 18,0	6,5 - 7,8	1,0	1,0	-	-	0,75 - 1,50
PH 15-7 Mo	0,09	14,0 - 16,0	6,5 - 7,8	1,0	1,0	-	2,0 - 3,0	0,75 - 1,50

## Typical Mechanical Properties

Grade	Condition	UTS, MPa (N/mm <sup>2</sup> )	0,2% YS, MPa (N/mm <sup>2</sup> )	Elongation, % in 2"	Reduction of Area, %	Hardness	Impact Charpy V-Notch, J
17-4 PH	H 900	1379	1276	14	50	420 HB	20
	H 1025	1172	1138	15	56	352 HB	47
	H 1075	1138	1034	16	58	341 HB	54
	H 1150D	965	758	20	60	302 HB	100
	H 1150M	862	586	22	68	311 HB	135
15-5 PH VAC	H 900	1379	1276	14	50	420 HB	20
	H 1150M	862	586	22	68	277 HB	136
PH 13-8 Mo	RH 950	1620	1482	12	45	48 HRC	27
	H 1150M	896	586	22	70	32 HRC	162
17-7 PH Strip	RH 950	1620	1517	6	-	49 HRC	-
	TH 1050	1379	1276	9	-	43 HRC	-
PH 15-7 Mo Strip	CH 900	1828	1793	2	-	50 HRC	-
	A 1750	1034	372	12	-	85 HRB	-

Note: Other conditions (H925, H1000, H1025, H1150, etc.) are also available.

# NITRONIC®

**Nitro** = Nitrogen, **Nic** = Nickel

NITRONIC Stainless Steels are austenitic iron-base alloys of chromium, nickel, and manganese that are nitrogen strengthened. High strength levels, excellent corrosion resistance and extremely low-magnetic permeability in most of the grades even after severe cold work characterize these special stainless steels. In addition, they exhibit excellent cryogenic properties.

HS

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NITRONIC 50 HS  
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H. 425604  
AV MR

# NITRONIC®

## **NITRONIC 30**

Developed for applications requiring good level of aqueous corrosion resistance combined with good resistance to abrasive and metal-to-metal wear like: automotive hose clamps, flat ware, springs, mixing tanks, mining equipment, conveyor belt pins, bushings, well screens, coal screens, chute liners, and wear plates.

## **NITRONIC 40**

One of the most versatile austenitic stainless steels combining high yield strength with good corrosion resistance. Because of its high strength and fabricability extensively used in a wide variety of aircraft applications, providing substantial weight savings for parts such as: ducting or bellow springs, tailpipes and exhaust systems, clamps, flanges, and hydraulic tubing.

## **NITRONIC 50**

Effective alloy for components using the combination of excellent corrosion resistance and high strength, such as: pumps, valves, fittings, fasteners, cables, chains, screens and wire cloth, marine hardware, boat shafting, heat exchanger parts, and springs. This alloy is included in the NACE MR0175 / ISO 15156 "Petroleum and natural gas industries - Materials for use in H<sub>2</sub>S-containing Environments in oil and gas production".

## **NITRONIC 60**

Economical galling and wear resistant austenitic stainless steel at both ambient and elevated temperatures for applications like: valve stems, seats and trim, fastening systems including nuts and bolts; screening, chain-drive systems; pin, bushings, and roller bearings.



## Chemical Analysis, wt %

Grade	C (max)	Cr	Ni	Mn	Mo	N	Si
NITRONIC 30	0,03	15,0 - 17,0	1,5 - 3,0	7,0 - 9,0	-	0,15 - 0,30	max. 1,0
NITRONIC 40	0,08	19,0 - 21,5	5,5 - 7,5	8,0 - 10,0	-	0,15 - 0,40	max. 1,0
NITRONIC 50	0,06	20,5 - 23,5	11,5 - 13,5	4,0 - 6,0	1,5 - 3,0	0,20 - 0,40	max. 1,0
NITRONIC 60	0,10	16,0 - 18,0	8,0 - 9,0	7,0 - 9,0	-	0,08 - 0,18	3,5 - 4,5

## Typical Mechanical Properties

Grade	Condition	UTS, MPa (N/mm <sup>2</sup> )	0,2% YS, MPa (N/mm <sup>2</sup> )	Elongation, % in 2" (50,8 mm)	Reduction of Area, %	Permeability, H = 500
NITRONIC 30	Strip 3,15 mm	811	372	52	-	1,0014
NITRONIC 40	Bar – annealed	683	448	48	70	1,0020
NITRONIC 50	Bar – annealed	827	414	50	70	1,0040
	Bar – HS	937	731	33	66	1,0040
	Bar – Super HS	1009	830	27	63	1,0040
NITRONIC 60	Bar – annealed	696	414	60	76	1,0030

Bar material in as supplied condition at room temperature. The usual condition supplied is solution annealed. The mechanical values are depending on diameter and grade of transformation.

# ARMCO® Pure Iron

High Purity Iron

ARMCO Pure Iron is a steelworks product unique in its purity, with a minimum iron content of 99.85%. All natural impurities have been largely removed.

Developed in 1909 in the U.S.A., ARMCO Pure Iron was first produced in Germany in 1927. Even after a century of technical progress, ARMCO Pure Iron, now more highly refined, is still an important product because of its flexible application possibilities.

# ARMCO® Telar 57

Soft Magnetic Iron

ARMCO Telar 57 is a material variant of ARMCO Pure Iron and was developed to meet the special requirements of the electrical industry.

ARMCO Telar 57 is particularly popular in electromagnetic components which have to show high induction levels during magnetization.

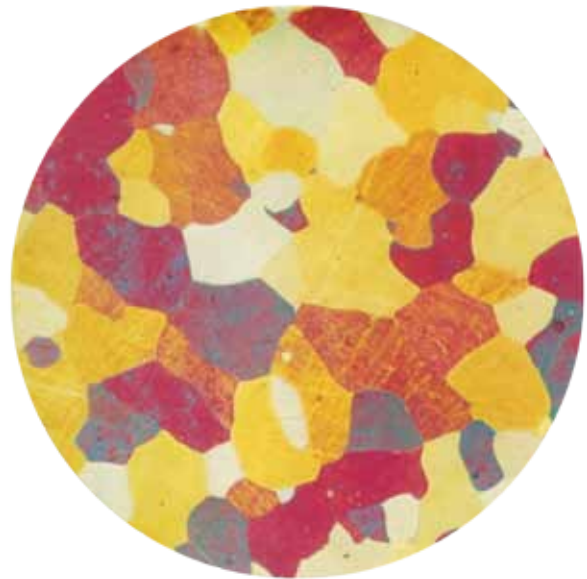


# ARMCO® Pure Iron

ARMCO Pure Iron is produced to meet the highest quality requirements. ARMCO Pure Iron undergoes purification during melting using special steelmaking and refining techniques. Following solidification, it therefore has a homogenous composition with regard to the distribution of the accompanying elements, a very low oxygen content and very good slag purity. Due to the low carbon content, the microstructure consists of 100% ferrite.

ARMCO Pure Iron is used in several industrial processes and products. Uses for ARMCO Pure Iron include melt feedstock material to produce a variety of ferrous-bearing products such as: low-carbon steels, stainless steels, acid-resistant steels, heat resistant steel, high nickel-iron alloys, magnetic alloys, and casting alloys for stainless and heat resistant steels.

ARMCO Pure Iron is also used directly in applications for transportation (aerospace and automotive), energy (chemical/petrochemical equipment, conventional power stations and various nuclear applications), highly corrosive environments (anodes, galvanizing tanks and like uses), magnetic devices (core, pole, yoke and armature magnets and magnetic shielding), and welding (rods and fuse wire).





## Grade 2

Composition	Max. Analysis, wt %
Carbon (C)	0,010
Manganese (Mn)	0,100
Phosphorus (P)	0,010
Sulfur (S)	0,008
Nitrogen (N)	0,006
Copper (Cu)	0,030
Cobalt (Co)	0,005
Tin (Sn)	0,010

## Grade 4

Composition	Max. Analysis, wt %
Carbon (C)	0,010
Manganese (Mn)	0,060
Phosphorus (P)	0,005
Sulfur (S)	0,003
Nitrogen (N)	0,005
Copper (Cu)	0,030
Cobalt (Co)	0,005
Tin (Sn)	0,005

The high purity of ARMCO Pure Iron is the primary reason for the following special properties:

- + Excellent magnetic properties
- + Improved resistance against corrosion and oxidation in comparison to normal steels
- + Good cold forming capability
- + Ideally suitable for welding

### Forms of delivery:

- + Slabs
- + Billets and Blooms
- + Roundbars
- + Flat- and Squarebars
- + Wire in Coils
- + Sheets and Plates
- + Coils, flat rolled
- + Forgings

# ARMCO® Telar 57

ARMCO Telar 57 is a soft magnetic material of the High Purity Iron type, particularly favored in D.C. relay applications.

It is used in several industrial processes and products, in applications for: transportation (aerospace and automotive), magnetic devices (core, pole, yoke and armature magnets), automation, and power distribution (circuit breakers).

ARMCO Telar 57 is characterized by the following important features:

- + low coercive force
- + high magnetic induction
- + excellent aging stability

It achieves the values required in accordance with DIN 17405 for RFe grades with advanced soft magnetic properties.

## ARMCO® Telar 57

Composition	Analysis, wt %
Carbon (C)	Max. 0,020
Manganese (Mn)	0,35 - 0,50
Phosphorus (P)	Max. 0,020
Sulfur (S)	0,015 - 0,030
Nitrogen (N)	0,005
Copper (Cu)	0,070
Aluminium (Al)	0,050 - 0,100
Silicon (Si)	Traces

## Stability against magnetic aging (DIN 17405)

Telar 57 Condition	Coercive Force
Sample after anneal	69,2 A/m
After anneal and aging	70,1 A/m
Aging	+ 1,3 %

As a variant of ARMCO Pure Iron, ARMCO Telar 57 contains well-defined additions of following elements:

- + Manganese – for increased efficiency during decarburization
- + Aluminum – for excellent stability against magnetic aging
- + Sulfur – for easing machinability in comparison to ARMCO Pure Iron

### Forms of delivery:

- + Roundbars, hot rolled and cold drawn
- + Flatbars, cold rolled
- + Wire in coils

# About us

AK Steel International and its offices in Europe

AK Steel International is a subsidiary of the AK Steel Corporation which is headquartered in West Chester, Ohio, U.S.A.

Several subsidiaries of AK Steel International operate on the European continent. Offices are located in The Netherlands, Germany, France, United Kingdom, Spain and Italy.

In the fall of 1999, the parent company of these subsidiaries, ARMCO Inc. merged with AK Steel, Middletown, Ohio one of the leading U.S. producers of steel mill products for the automotive, household appliances, and construction industries.

It was through this merger that the name ARMCO was changed to AK Steel in April 2000.

AK Steel is a leading producer of flat-rolled carbon, stainless and electrical steel products, primarily for the automotive, infrastructure and manufacturing, electrical power generation and distribution markets.

## **AK Steel International B.V.**

Breda, Netherlands (Founded 1970)

## **AK Steel Ltd.**

Stevenage, Great Britain (Founded 1924)

## **AK Steel International B. V. Germany Branch**

Cologne, Germany (Founded 1927)

## **AK Steel SARL**

Suresnes, France (Founded 1934)

## **AK Steel s.r.l.**

Genoa, Italy (Founded 1935)

## **AK Steel Merchandising S.A.**

Barcelona, Spain (Founded 1962)





AK STEEL RESEARCH AND INNOVATION CENTER

# Our Product Offerings

At a glance



## Ferritic Chrome Steels

409 ULTRA FORM<sup>®</sup>, 18 Cr-Cb<sup>™</sup>, 439 ULTRA FORM and 18 SR<sup>®</sup> are typically used for applications requiring high resistance against hot corrosion along with economical cost-performance. Applications include e.g. automotive exhaust-systems, heat exchangers as well as gas burners.

## Electrical Steels

AK Steel mainly exports Grain Oriented Electrical Steels; both regular grain oriented (M-2, M-3, M-4, M-5 and M-6) and high-permeability (TRAN-COR<sup>®</sup> H GOES and TRAN-COR X GOES) for production of power and distribution transformers.

## Aluminized Steels

AK Steel aluminized steels offer formability plus corrosion and heat protection for high-temperature applications. In addition, they offer excellent atmospheric corrosion protection. AK Steel produces two kinds of aluminized products: **Type 1**, used for automotive exhaust systems, furnace heat exchangers and other heat-resistant applications; **Type 1 Stainless 409 and 439**, used for automotive extra long-life exhaust systems.

### **ARMCO® Pure Iron**

One of the purest grades of iron ever produced and widely used for re-melting applications as well as for the production of high-quality galvanizing tanks; also used in electromagnetic applications requiring e.g. excellent electrical conductivity and/or low coercive force. Moreover, used as high purity soft iron for soft metallic gaskets or joint rings, and for sacrificial anodes in cathodic protection systems.



### **ARMCO® Telar 57**

Soft magnetic material variant of ARMCO Pure Iron, which was developed to meet the special requirements of the electrical industry. ARMCO Telar 57 is particularly popular in electromagnetic components which have to show high induction levels during magnetisation outstanding resistance against aging, e.g. relays, electromagnets, pole pieces, magnet frames.

### **Precipitation Hardening Stainless Steels (PH)**

17-4 PH®, 15-5 PH®, PH 13-8 Mo, 17-7 PH®, and PH 15-7 Mo® are offering varied and unique combinations of high strength and hardness, excellent corrosion resistance, good fabricating characteristics and ease of hardening by heat treatment.

### **NITRONIC® Stainless Steels**

NITRONIC 30, 40, 50 and 60 are austenitic iron-base alloys of chromium, nickel and manganese that are nitrogen strengthened. High strength levels, excellent corrosion resistance and extremely low-magnetic permeability in most of the grades even after severe cold work characterize these specialty stainless steels. In addition, they exhibit excellent cryogenic properties.

For additional information please contact  
your local AK Steel International sales office

at

[www.aksteel.eu](http://www.aksteel.eu)

The information and data in this document have been drawn up to the best of our knowledge and belief, and are solely intended as general information. The information merely represents an aid for the reader so that he may reach his own assessment and decision, and does not contain any guarantees relating to suitability for material applications.

The data referring to mechanical properties and chemical analyses are the result of random samples from certain areas and comply with the mandatory procedures. All guarantees relating to these values are restricted to the experimental plants and procedures used. No guarantee is given for material values obtained in other experimental plants.

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