



# FASTENERS WASHERS

Product Sheet

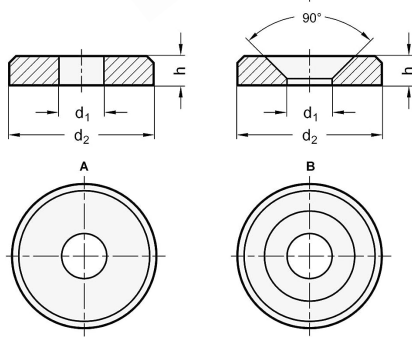


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# Stainless Steel Washers



**Description** - Our versatile range of Stainless Steel (SS) Washers offers superior mechanical strength and chemical resistance, catering to a myriad of industrial needs. Crafted from high-grade materials and employing advanced technology, these washers come in various grades, namely SS 304, SS 310, SS 316, SS 317, SS 321, SS 347, SS 410, and SS 904L. From machinery setups, food processing, construction, petrochemical plants, to marine applications, our washers find usage across diverse sectors. With customization options in shapes, sizes, and dimensions, we deliver products that align with our clients' unique requirements.



## Features

**Excellent Chemical Resistance:** SS 304 Washers, thanks to their chemical composition, provide superb resistance to various chemicals, rendering them suitable for diverse industry applications.

**High Weldability and Low Magnetic Permeability:** Our SS 310 Washers feature superior weldability and low magnetic permeability, making them an ideal choice for industries with specialized requirements.

**Superior Industrial Chemical Resistance:** Stainless Steel 316 Washers, prepared with higher quantities of molybdenum, provide impressive resistance against a wide range of industrial chemicals.

**Immunity to Intergranular Corrosion:** Stainless Steel 317 Washers are preferred in environments where welding is required, thanks to their outstanding immunity to intergranular corrosion.

## Stainless Steel Washer Specifications

Stainless Steel Grade	Washer Standards	Universal Washer Standards	Length	Washer Size
SS 304				
SS 309/310				
SS 316		DIN, ASTM,		M3 - M56,
SS 317	ASTM A193 / A194,	BS and all	3 mm to	3/6" to 2",
SS 321	ASME SA193 / SA194	International	200 mm	Custom
SS 347		Standards		Sizes
SS 410				
SS 904L				

**Oxidation Resistance and Low-Temperature Toughness:** SS 321 Washers offer remarkable oxidation resistance and low-temperature toughness, ideal for diverse temperature ranges.

**High Strength and Excellent Corrosion Resistance:** Our SS 347 Washers exhibit high strength, excellent corrosion resistance, and good mechanical properties at various temperatures.

**Exceptional Corrosion Resistance:** SS 410 Washers, formulated with chromium, provide exceptional corrosion resistance properties, making them suitable for applications involving mild corrosion, heat resistance, and high strength.

**Resistance to Stress:** Our SS 904L Washers are valued for their robust resistance to stress corrosion, cracking, and crevice corrosion, serving a wide array of industrial applications.

## Chemical Composition

Stainless Steel Grade	Cr (%)	Ni (%)	Mo (%)	Mn MAX (%)	Si MAX (%)	C MAX (%)	P MAX (%)	S MAX (%)	Fe (%)	Other
SS 304	18 - 20	8 - 10.5	-	2	0.75	0.08	0.045	0.03	Balance	0.1N
SS 309	18 - 20	8 - 10.5	-	2	0.75	0.08	0.045	0.03	Balance	-
SS 310	24 - 26	19 - 21	-	2	1.5	0.1	0.045	0.03	Balance	-
SS 316	16 - 18	11 - 14	2 - 3	2	1	0.08	0.045	0.03	67.8 min	-
SS 317	18 - 20	11 - 15	3 - 4	2	1	0.08	0.045	0.03	57.8 min	-
SS 321	17 - 19	9 - 12	-	2	1	0.08	0.045	0.03	Balance	0.7 Ti
SS 347	17 - 20	9 - 13	-	2	1	0.08	0.045	0.03	62.7 min	1 Nb + Ta
SS 410	11.5 - 13.5	0.75	-	1	1	0.15	0.04	0.03	Balance	-
SS 904L	19 - 23	23 - 28	4 - 5	2	1	0.02	0.04	0.03	Balance	1-2 Cu

## Mechanical Properties

Stainless Steel Grade	Tensile Strength (MPa)	Yield Strength 0.2% Proof (MPa)	Elongation (% in 50mm)	Hardness Rockwell B (HR B)	Hardness Brinell (HB)
SS 304	515	205	40	92	201
SS 309	515	205	40	92	201
SS 310	515	205	40	95	217
SS 316	515	205	35	95	217
SS 317	515	205	35	95	217
SS 321	515	205	35	95	217
SS 347	515	205	35	95	201
SS 410	480	275	16	95	201
SS 904L	485	275	20	70-90	150-166

## Physical Properties

Stainless Steel Grade	Density (G/Cm <sup>3</sup> )	Melting Point (°C)	Thermal Expansion (Mm/M°C)	Thermal Conductivity (W/M·K)	Electrical Resistivity (No·M)	Specific Heat (J/Kg·K)
SS 304	8.0	1400 - 1455	17.2	16.2	720	500
SS 309/310	7.9	1400 - 1455	14.2	14.2	720	500
SS 316	8.0	1390 - 1450	15.9	16.3	740	500
SS 317	7.9	1390 - 1450	15.9	14.6	740	500
SS 321	8.0	1450	16.6	16.1	720	500
SS 347	7.96	1450	16.0	16.3	720	500
SS 410	7.74	1400 - 1450	9.9	24.9	570	460
SS 904L	7.98	1300 - 1390	15.0	11.5	950	450

## Washer Shapes



Crinkle Washer



Flat Washer



Nord Lock Washer



Shnorr Washer



Serrated Washer



Spring Washer



Square Plate Washer



Spherical Washer



Tapper Washer



Two Tongue Washer

## Comparasion of Grades

### Available Washer Types

- Plain Washer
- Spring Washer
- Tooth Washer
- Tapper Washer
- Tab Washer
- Star Washer
- Square Washer
- Spherical Washer
- USS Flat Washer
- Wave Washer

- SAE Flat Washer
- Bonded Sealing Washer
- Lock Washer External Tooth
- Lock Washer Internal Tooth
- Structural Washer
- Fender Washer
- Spring Lock Washer
- Finishing Washer
- Dock Washer
- Belleville Washer

Stainless Steel Grade	Advantages	Disadvantages	Typical Applications
SS 304	Excellent corrosion resistance, good formability, good weldability	Lower strength at high temperatures, not suitable for extremely corrosive environments	Kitchen equipment, architecture, medical equipment
SS 310	High temperature resistance, excellent toughness at cryogenic temperatures	More expensive, less readily available	Heat treatment industry, furnace parts
SS 316	Excellent corrosion resistance, especially against chlorides and other industrial solvents	More expensive than SS 304	Marine applications, chemical processing
SS 317	More resistant to corrosion and pitting than 316, especially in chloride environments	High cost, less readily available	Chemical and petrochemical processing
SS 321	Improved intergranular corrosion resistance due to added titanium	Not as readily available as 304, more expensive	Aerospace, high temperature applications
SS 347	Enhanced high-temperature service due to the addition of columbium and tantalum	High cost, less readily available	Aerospace, high temperature applications
SS 410	Excellent hardness after heat treatment, good corrosion resistance for a martensitic stainless steel	Poor corrosion resistance compared to austenitic grades, must be hardened for maximum effectiveness	Cutlery, dental and surgical instruments
SS 904L	Super austenitic, hence improved resistance to strong reducing acids, particularly sulfuric acid	More expensive, less readily available	Chemical processing, pollution control equipment



# Material Options

## High Nickel Washers

**Description** - Our High Nickel Washers are engineered with superior craftsmanship, providing unrivalled mechanical strength, resistance to high temperatures, and exceptional corrosion resistance. Incorporating grades such as Inconel 600, 601, 625, and 718; Incoloy 800, 800H, 825, and 925; Monel 400, K-500; and Hastelloy C276, C22, C-2000; as well as Titanium Grade 2 and 5, these washers are designed to thrive in harsh environments, making them perfect for applications in the marine, power generation, chemical, aerospace, and construction industries.

### Features

**Superior Resistance to Crevice and Pitting Corrosion:** Our Inconel 600 and 601, Incoloy 800H and 925, and Hastelloy C276 and C22 washers are renowned for their outstanding resilience against crevice and pitting corrosion, ensuring their longevity even in the most hostile environments.

**Excellent High-Temperature Strength:** Crafted from grades such as Inconel 600 and 718, Incoloy 800 and 925, and Titanium Grade 5, these washers maintain their integrity in high-temperature environments, showcasing impressive tensile strength, creep rupture, and creep resistance.

**High Weldability and Formability:** The Inconel 601 and 625, as well as Incoloy 800 and 825, and Titanium Grade 2 washers boast excellent weldability and formability, making them adaptable to a variety of applications that require complex shaping and joining techniques.

**Outstanding Resistance to Oxidizing and Reducing Environments:** Featuring an exceptional composition of alloys, our Incoloy 800, 825, and Hastelloy C276, C22, C-2000 washers can withstand both oxidizing and reducing environments, providing reliability and durability under diverse conditions.

**Increased Tensile Strength and Hardness:** The Monel 400 and K-500, Incoloy 925, and Titanium Grade 5 washers strike an ideal balance between increased tensile strength and hardness, making them perfect for heavy-duty industrial applications.

**Superior Corrosion Resistance:** Our Inconel 625, Incoloy 800H and 825, Hastelloy C276 and C-2000, and Titanium Grade 2 washers are engineered with superior corrosion resistance, ensuring their longevity in various corrosive environments.

### High Nickel Washer Specifications

High Nickel Group	Washer Standards	Universal Washer Standards	Length	Washer Size
Monel 400	ASTM B164 / ASME SB164	DIN, ASTM, BS and all International Standards	3 mm to 200 mm	M3 - M56, 3/6" to 2", Custom Sizes
Monel K500				
Inconel 600/601/625	ASTM B 166, ASME SB 166			
Inconel 718	ASTM B637, ASME SB637			
Incoloy 800/800H/ 800HT	ASTM B 408, ASME SB 408			
Incoloy 825	ASTM B 425 / ASME SB 425			
Incoloy 925	ASTM B 637 / ASME SB 637			
Hastelloy C276	ASTM B 574 / ASME SB 574			
Hastelloy C2000	ASTM B 574/575, ASME SB 574/575			
Hastelloy C22	ASTM B 574 / ASME SB 574			
Titanium 2	ASTM B 348 / ASME SB 348			
Titanium 5				



# Mild Steel & Carbon Steel Washers

**Description** - Mild Steel Washers, praised for their corrosion resistance and high tensile strength, are preferred for their ductility and malleability in the piping and petrochemical industries. They offer excellent finish, durability, and strength, ensuring high quality.

In contrast, Carbon Steel Washers, crafted from steel with up to 2.1% carbon content, gain enhanced strength and toughness after heat treatment. They offer robustness at the cost of reduced weldability and slightly lower melting points, providing a variety of applications due to multiple available grades.



## Features

**Corrosion Resistance:** Mild Steel Washers demonstrate excellent resistance to corrosion, pitting, and crevice corrosion, guaranteeing longevity in different conditions.

**Tensile Strength and Thermal Resilience:** Both types of Washers exhibit high tensile strength, with Mild Steel Bolts being particularly resistant to high temperatures.

**Ductility and Malleability:** Mild Steel Washers are known for their ductility and malleability, making them versatile for various industrial uses.

**Heat Treatment Enhancement:** Carbon Steel Washers, when subjected to heat treatment, display significantly improved toughness and strength due to the higher carbon content.

**Quality and Durability:** Both Mild Steel and Carbon Steel Washers are manufactured to the highest quality standards, offering great finishing, durability, and strength.

**Variety of Grades:** Carbon Steel Washers are available in multiple grades, providing flexibility for diverse applications.

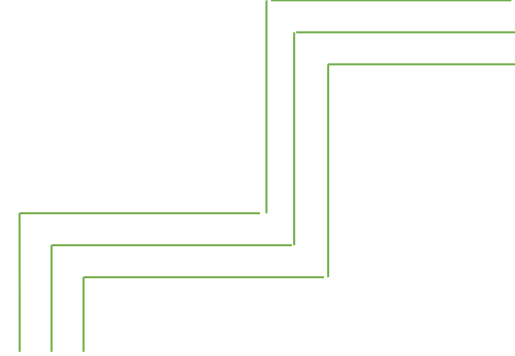
**Enhanced Strength:** The higher carbon content in Carbon Steel Washers results in enhanced strength, despite a slight reduction in weldability and the melting point.

Mild Steel & Carbon Steel	Washer Standards	Universal Washer Standards	Length	Washer Size
Mild Steel	ASTM A193 / A194, ASME SA193 / SA194	DIN, ASTM, BS and all International Standards	3 mm to 200 mm	M3 - M56, 3/6" to 2", Custom Sizes
Carbon Steel	ASTM A307, ASME SA307 / ASTM F844 ASME SF844			

## Mild & Carbon Steel Specifications

# Duplex & Super Duplex Steel Washers

**Description** - Unleashing the power of Duplex and Super Duplex Steel, our high-quality washers exemplify robustness, supreme corrosion resistance, and adaptability. Ideally employed in demanding sectors like marine, power generation, chemical, and food processing, these washers deliver unparalleled strength and durability.



## Duplex and Super Duplex Steel Specifications

### Features

**Superior Corrosion Resistance:** Utilizing Duplex Steel 31803, Duplex 32205, Super Duplex S32750, and Super Duplex 32760, our washers offer unmatched resistance against localized corrosion, including intergranular, pitting, and crevice types.

**Unmatched Strength and Durability:** Duplex Steel 31803 and Super Duplex 32760 washers boast strength twice that of standard washers, ensuring phenomenal durability and longevity.

**Excellent Workability and Weldability:** The Duplex F51 and Super Duplex F53 washers, characterized by their low carbon content, demonstrate superior workability, machinability, and weldability, making them versatile for a plethora of applications.

**Incredible Resistance to Corrosion Fatigue and Stress Cracking:** Super Duplex 32760, also known as Zeron 100, offers exceptional resistance to corrosion fatigue and stress corrosion cracking, perfect for rigorous usage in industries like mining, oil and gas, desalination, and pulp and paper.

**Outstanding Thermal Stability and Heat Resistance:** Super Duplex S32750 washers are renowned for their impressive thermal stability and high-temperature resistance, ensuring reliable performance under challenging thermal conditions.

D and Super D Steel Washer	Washer Standards	Universal Washer Standards	Length	Washer Size
D S31803 (F51)				M3 - M56,
D S32205 (F60)	ASTM A 479 /	DIN, ASTM, BS and all International Standards	3 mm to 200 mm	3/6" to 2",
SD S32750 (F53)	ASME SA 479			Custom Sizes
SD S32760 (F55)				



# F436, SMO 254 and EN 8/9 Washers

**Description** - Showcasing an extensive assortment of industrially robust EN 8/9, 254 SMO, and F436 washers, our product portfolio is designed to deliver high-performance solutions optimized for durability and versatility. Each grade of our washers demonstrates exceptional characteristics that cater to a wide spectrum of industrial needs, embodying superior strength and resilience to thrive in demanding environmental conditions. Additionally, our washers are readily available in diverse specifications to suit unique industrial demands, underlining our commitment to providing tailored solutions. From offering enhanced holding power to demonstrating supreme corrosion resistance, these washers encapsulate the pinnacle of quality engineering and manufacturing excellence.



## Features

**Exceptional Load-bearing Capacity:** Renowned for their robust design, EN 8/9 Washers deliver high load-bearing capacity and low deflection range, making them an ideal choice for various industrial applications.

**Superior Resistance and Workability:** Designed to withstand extreme conditions, the 254 SMO Washers offer excellent workability, high strength, and resistance to scaling, pitting, crevice corrosion, and chloride stress corrosion cracking.

**Ultimate Resilience and Flexibility:** The F436 Washers, manufactured from carbon and weathering steel, meet specified chemical composition values and dimensions, promising excellent workability and fulfilling a range of industrial requirements.

**Varied Application:** With a wide variety of dimensions and specifications available, these washers find applications in sectors like construction, marine, petrochemicals, power generation, and paper & pulp industries.

Other Types	Washer Standards	Universal Washer Standards	Length	Washer Size
F 436	ASTM F436, ASME SF436	DIN, ASTM, BS and all International Standards	3 mm to 200 mm	M3 - M56, 3/6" to 2", Custom Sizes
SMO 254	ASTM A193 / A194, ASME SA193 / SA194			
EN 8/9	-			

## F436, SMO 254 & EN 8/9 Specifications



# Copper Nickel Washers

**Description** - Our Copper Nickel Washers are renowned across various industrial sectors for their unwavering strength, thermal stability, and remarkable oxidation resistance. Available in two versatile grades, 90/10 and 70/30, these washers offer customized sizes and shapes to fit your exact requirements. The 90/10 grade is known for its affordability, biofouling resistance, and good fabricability, while the 70/30 grade excels in corrosion resistance, even in challenging environments, and is optimal for more demanding applications.

## Features

**Versatility across Grades:** Whether you opt for Copper Nickel 90/10 for its cost-effectiveness and biofouling resistance or choose the more corrosion-resistant 70/30 grade for demanding applications, you're assured of quality and versatility across the range.

**Diverse Sizes and Shapes:** Catering to a wide variety of industrial needs, our Copper Nickel Washers are offered in diverse shapes and sizes, tailored to specific applications.

**Thermal Stability and Strength:** Exhibiting impressive thermal stability and moderate strength, these washers ensure longevity and resilience in high-temperature environments.

**Superior Oxidation Resistance:** Our Copper Nickel Washers boast high oxidation resistance, performing exceptionally well even in moist air and steam conditions.

**Corrosion Resistance:** With the addition of manganese, niobium, chromium, and iron in Copper Nickel 90/10 and the enhanced corrosion resistance of Copper Nickel 70/30 in high-velocity waters and polluted seawater, our washers stand resilient against corrosive environments.

**Excellent Fabricability:** Copper Nickel 90/10 Washers show good fabricability and high inherent resistance to biofouling, while the 70/30 grade can be easily fabricated, cold-worked, and welded without material considerations, demonstrating their versatility.

## Copper Nickel Washer Specifications

Copper Nickel Washer	Washer Standards	Universal Washer Standards	Length	Washer Size
CN 90/10	ASTM B151 / B152, ASME SB151 / SB152	DIN, ASTM, BS and all International Standards	3 mm to 200 mm	M3 - M56, 3/6" to 2", Custom Sizes
CN 70/30				



## Coating Solutions

We provide a wide range of coating solutions designed to enhance the performance and longevity of various industrial components. Our offerings include a variety of metallic coatings and PTFE coatings, each tailored to meet specific operational requirements and environmental conditions.

### Metallic Coatings

Metallic coatings, including Nickel, Zinc, Chromium, Gold, and Silver, offer corrosion resistance and other beneficial properties. They are widely used across various industries.

**Hot-Dip Galvanized Coatings:** These coatings provide dual corrosion protection for steel: barrier and galvanic. They act as a semi-impermeable barrier against corrosion-causing environmental elements.

**Mechanical Galvanizing:** This process, similar to hot-dip galvanizing, applies a zinc coating on bare steel, offering protective benefits.

**Silver-Plating:** Ideal for applications where lubricants can't be used or galling is a risk. Silver plating acts as a solid lubricant, reducing friction when used dry.

#### Types of Metallic Coatings

- Electro Zinc Plating (UNI 4721 - ASTM B633 - BS 1706)
- Hot-Dip Galvanizing (ASTM A153 - ISO 1461- UNI 3740- BS 729)
- Aluminizing (ISO 2063)
- Nickel Plating (ASTM B689)
- Silver Plating (ASTM B254 - B700)
- Chromium / Zinc Coating (Dacromet 320 / 500 - ASTM F1136)
- Electro Cadmium Plating (ASTM B766)
- Electroless Nickel Plating (ASTM B733)
- Zinc Phosphate Coating / Manganese Phosphate Coating (ASTM F1137)
- Electro Zinc/Nickel Plating (ASTM B841)
- Mechanical Zinc Coating (ASTM B695)

### PTFE Coatings

PTFE (Polytetrafluoroethylene) coatings, including Xylan, Teflon, and Fluorocarbon, are known for their corrosive chemical and heat resistance, and their low friction surface. PTFE coated bolts offer:

- Low Coefficient of Friction
- Nonwetting properties
- Heat Resistance up to 260°C/ 500 °F
- Cryogenic Stability down to -270°C/ -454 °F
- Chemical Resistance, except against molten alkali metals and highly reactive fluorinating agents.