1. STEEL

ALLOYED STEEL - STAINLESS STEEL

AISI 304 / 1.4301

This is the most common Cr-Ni 18/8 quality and is used widely in the food processing and pharmaceutical industries for piping and storage units. AISI 304 is also used to manufacture all kinds of equipment for the brewing industry, margarine factories and abattoirs, as well as in the chemical industry to manufacture equipment for processes involved in the production of materials such as nitric acid, nitrates, nitrate fertilizers and explosives.

AISI 304L / 1.4306

Stainless steel 1.4306 is more highly-resistant to nitric acid at high concentrations and temperatures than 1.4301. This alloy is used primarily in the chemical, food processing, pharmaceutical and other industries for reactor vessels, storage tanks and other equipment. Stainless steel AISI 304L / 1.4306 is used chiefly in applications where the metal is deformed or subjected to thermal loads over extended periods. Use of this material is particularly recommended where temperatures of between 500°C / 932°F and 900°C/ 1652°F are likely to be encountered.

AISI 316 / 1.4401

Grade AISI 316 is the standard molybdenum-bearing grade, second only in importance to AISI 304 amongst the austenitic stainless steels. The molybdenum gives AISI 316 better overall corrosion-resistance properties than Grade AISI 304, and particularly higher resistance to pitting and crevice corrosion in chloride environments. It is readily brake-formed or roll-formed into a variety of components for industrial, construction and transport applications.

AISI 316 offers excellent corrosion resistance in a range of atmospheric environments and many corrosive media (generally more resistant than AISI 304). This material is subject to pitting and crevice corrosion in warm chloride environments, and to stress corrosion cracking above approximately 60°C/140°F. It can be considered as resistant to potable water containing a maximum chloride content of approximately 1000mg/L at ambient temperature, reducing to around 500mg/L at 60°C.

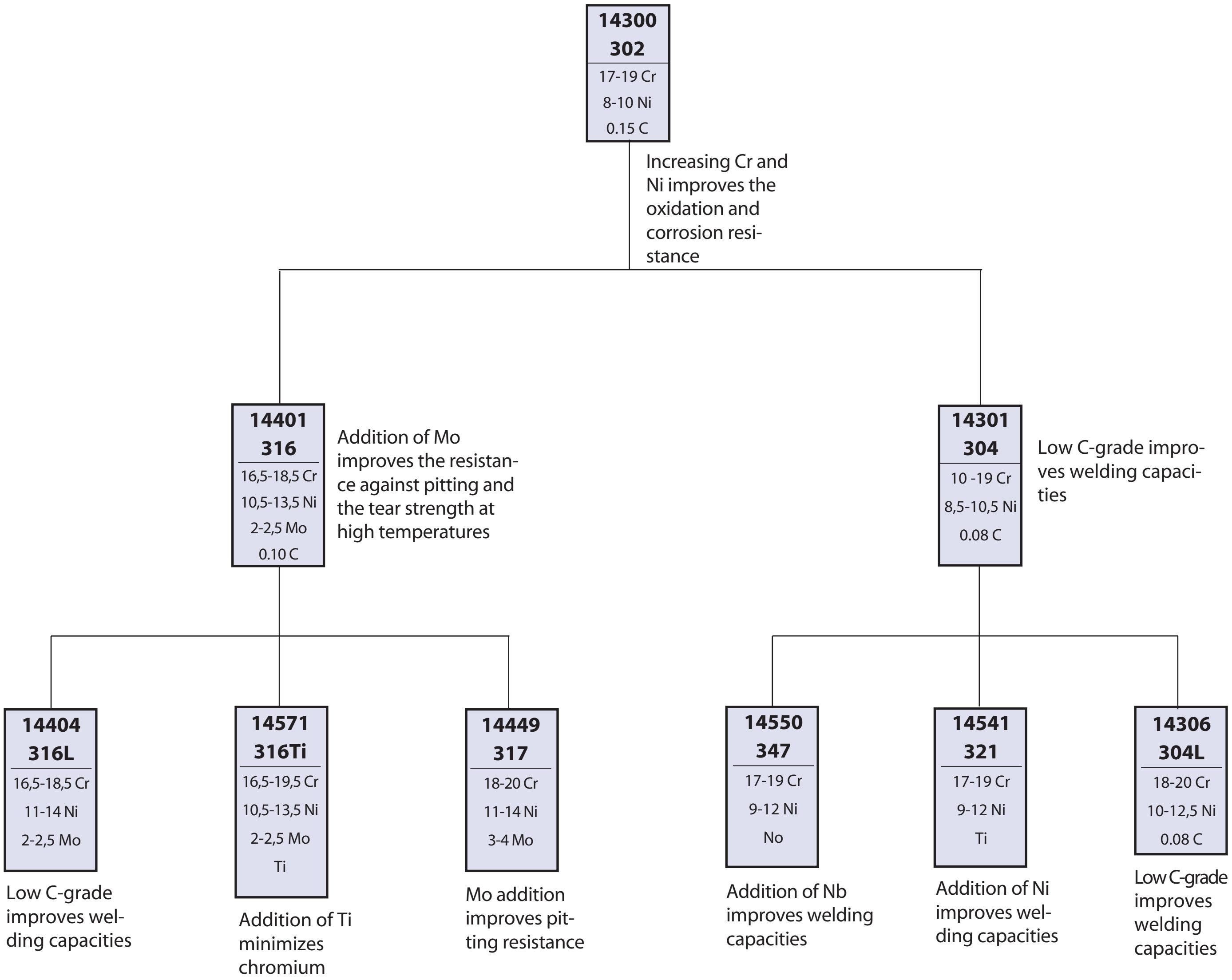
Grade AISI 316 is usually regarded as the standard “marine grade stainless steel”, but it is not resistant to warm sea water. In many marine environments, AISI 316 does exhibit surface corrosion, usually in the form of brown staining, particularly in association with crevices and rough surface finishes.

AISI 316L / 1.4404

Grade AISI 316L is the low-carbon version of AISI 316 and is immune from sensitisation (grain boundary carbide precipitation). AISI 316L is used extensively in heavy gauge welded components (over about 6mm). Use of this material is particularly recommended where temperatures of between 500°C/932°F and 900°C/1652°F are likely to be encountered.

AISI 316Ti / 1.4571

Compared to AISI 304, AISI 316Ti is characterised by its properties in niric acid and in orgnic cooled acid solutions. Optimal processing properties are achieved by means of het treatment in the temperature range of +/- 1100°C followed by rapid cooling in air or water.



International material comparison - stainless steel

Germany	USA		SWEDEN	FRANCE	UK	ITALY	SPAIN	JAPAN	RUSSIA
W.-Nr.	AISI	UNS	SS	AFNOR	BS	UNI	UNE	JIS	GOST
1.4301	304	S 30400	2332	Z 6 CN 18.09	304 S 15	X 5 CrNi 18.10	F.3504-X 5 CrNi 18.10	SUS 304	08Ch18N10
1.4305	303	S 30300	2346	Z 10 CNF 18.09	303 S 21	-	-	-	-
1.4306	304L	S 30403	2352	Z 2 CN 18.10	304 S 12	X 3 CrNi18.11	F.3503-X 2 CrNi 18.10	SUS 304L	03Ch18N11
1.4301	301	S 30100	-	Z12Cn17-07	301 S 21	-	-	SUS 301	-
1.4401	316	S 31600	2347	Z 6 CND 17.11	316 S 16	X 5 CrNiMo 17.12	F,3534-X 5 CrNiMo 17.12.2	SUS 316	-
1.4404	316L	S 31603	2348	Z 2 CND 17.12	316 S 14	X 2 CrNiMo 17.12	F.3533-X 2 CrNiMo 17.13.2	SUS 316L	-
1.4541	321	S 32100	2337	Z 6 CNT 18.10	321 S 31	X 6 CrNiTi 18.11	F.3523-X 6 CrNiTi 18.10	SUS 321	06Ch18N10T
1.4571	316Ti	S 31635	2350	Z 6 CNDT 17.12	320 S 31	X 6 CrNiMoTi 17.12	F.3535-X 6 CrNiMoTi 17.122	SUS 316Ti	10Ch17N13M2T

UNALLOYED STEEL

STEEL

The wide range of grades available allows steel to be used in a wide range of applications, including the automotive, construction and packaging industries. The excellent shape retention and strength characteristics of steel have made it one of the most important products created by man. Steel has a huge range of properties, including:

1. Weldability
2. Fatigue resistance
3. Electrical conductivity / thermal conductivity
4. Corrosion resistance when galvanized
5. Mouldability
6. Reusability
7. Mechanical strenght

International material comparison - steel

EN 10025-2	Material number	EN 10025 (former)	Germany	France	UK
S235JR	1.0038	S235JR	St 37-2	E 24-2	-
S355J0	1.0553	S355J0	St 52-3 U	E 36-3	50 C
S355JR	1.0577	S355J2G3	St 52-3 N	-	50 D

GALVANIZED STEEL

For example, steel flange couplings are galvanized to improve their corrosion resistance. The galvanizing process involves the adding of a zinc layer to the coupling surface. Zinc coatings prevent oxidation of the protected metal by forming a barrier and acting as a sacrificial anode if this barrier becomes damaged. Galvanized steel can be welded, but this is not recommended. Galvanized steel is suitable for high-temperature applications of up to 200°C / 392°F. Use at temperatures above this level will result in the zinc layer peeling off at the intermetallic layer.

NON FERROUS ALLOYS

BRASS

Brass is an alloy of copper and zinc, which becomes mutually soluble when melted and therefore lose their individual identities. On cooling, the combination becomes brass. Small amounts of other elements can be added to brass to deliver specific effects and thereby add useful properties and desirable characteristics to the parent alloy.

1) Tin

Additions of around 1% are usual, giving a small increase in tensile strength and improved corrosion resistance under marine conditions.

2) Lead

Virtually insoluble in brass, it can be introduced to form discrete particles finely distributed throughout the alloy. These particles act as "chip breakers" in machining operations and enable higher-speed machining, finer swarf and reduced tool wear. The actual amount of lead added depend on end-user requirements, but normally range from 1.5% to 4.5%.

3) Iron

The addition of small amounts of iron (around 0.5%) increases tensile strength, but higher amounts can result in excessive tool wear and machining problems.

4) Aluminium

Use of this element increases hardness and tensile strength, but only at the expense of some reduction in ductility. 0.5% - 1.0% is normal, but some brass alloys may contain as much as 6% aluminium. These alloys offer high corrosion resistance in marine applications.

5) Manganese

The addition of 0.5 - 2.5%, usually in association with iron, increases tensile strength and hardness with only a slight reduction in ductility.

6) Nickel

Occasionally added in concentrations of 1 - 2%, nickel delivers some improvement in tensile strength with no reduction in ductility.

7) Arsenic

Arsenic in concentrations of 0.03 - 0.25% delivers high resistance to 'dezincification', a specific form of corrosion.

International material comparison - Brass

EN		US	Germany	France	UK	International
CuZN39Pb3	CW614N	B455 C 38500	MS 58	CuZn40Pb3	CZ 121	CuZN39Pb3
CuZn40Pb2	CW617N	B455 C 38000	MS 58	CuZn39Pb2	CZ 122	CuZn40Pb2

BRONZE

Bronze is a copper alloy made from natural ores alloyed with tin or other elements to create a metal which does not exist in nature. When such ore is refined, the metal looks like copper, but is harder and more useful for making tools, weapons and sculptures. Bronze is now widely used in tool and machinery manufacture, as well as in the minting of coins. The bronze solidification process is quite unique. When molten bronze is poured into a mould, it expands as it cools and fills every detail of the mould. As it cools further and solidifies, it shrinks slightly, so that the final result does not stick to the mould. Over time, bronze takes on a range of colours caused by surface oxidation. This effect is referred to as patina.

Traditionally, bronze was defined as a copper alloy containing tin (not exceeding 10%). Tin increases hardness, making bronze more wear-resistant than copper. Bronzes with a tin content of 10% or more are harder, stronger and more corrosion-resistant than brass.

Today's bronzes may vary quite significantly, and are typically copper alloys which may contain silicon (Si), manganese (Mn), aluminium (Al), zinc (Zn), lead (Pb), iron (Fe) and other elements, either with or without tin (Sn). The variations in bronze (both in proportion and elemental composition) can significantly affect its characteristics, whether by improving wear-resistance and/or machine-ability, or reducing corrosion in water, etc.

International material comparison - Bronze

EN		US	Germany	France	UK	International
CuSn5Zn5Pb5-C	CC491K	C83600	G-CuSn5ZnPb	CuSn5Pbn5Zn5	LG2	CuPb5SnZn5

ALUMINIUM

Aluminium is easily formed, machined and cast. Alloys containing small amounts of copper, magnesium, silicon, manganese, and other elements have very useful properties. One of the key properties of aluminium is its low density, being only one-third as heavy as steel. Aluminium and most of its alloys are highly resistant to most forms of corrosion. The metal's natural coating of aluminium oxide provides a highly-effective barrier to the ravages of air, temperature, moisture and chemical attack.

Aluminium is also a very good conductor of electricity, which, in combination with its other intrinsic qualities, has ensured its use as a replacement for copper in many applications. Aluminium is non-magnetic and non-combustible; properties invaluable in advanced industries like electronics and offshore engineering. Aluminium is non-toxic and impervious; qualities that quickly established it as a preferred material in the food and packaging industries. Other valuable properties include high reflectivity, heat barrier properties and heat conduction. The metal is malleable and easily worked using all the usual manufacturing and shaping processes.

International material comparison - Aluminium

Europe	Germany	USA	FRANCE	UK	ITALY
EN	W.-Nr.	AISI	AFNOR	BS	UNI
EN AW-6082	AlMg Si 1	6082	6082	6082	3571
EN AC-42100	G-AlSi 7CMG	A375.0	A-S7G03	2L99	-

THERMOPLASTICS

POLYPROPYLENE

Polypropylene is an economical material that offers a combination of outstanding physical, chemical, mechanical, thermal and electrical properties not found in any other thermoplastic. Compared with low- and high-density polyethylene, it has lower impact strength, but superior working temperature and tensile strength.

Polypropylene offers excellent resistance to organic solvents, degreasing agents and electrolytic attack. It is light in weight, stain-resistant and has a low moisture absorption rate. Polypropylene is a tough, heat-resistant, semi-rigid material, ideal for the transfer of hot liquids or gases. It is recommended for vacuum systems and wherever high temperatures and pressures are likely to be encountered. It offers excellent resistance to acids and alkalies, but performs poorly with aromatic, aliphatic and chlorinated solvents.

HIGH DENSITY POLYETHYLENE (HDPE)

A linear polymer, High Density Polyethylene (HDPE) is prepared from ethylene by a catalytic process. The absence of branching results in a more closely packed structure with a higher density and somewhat higher chemical resistance than LDPE. HDPE is also somewhat harder and more opaque and it can withstand rather higher temperatures 120°C / 248°F for short periods and 110° C / 230°F continuously.

High density polyethylene lends itself particularly well to blow molding, e.g. for bottles, cutting boards, dipping baskets, dippers, trays and containers. Dynalab Corp's plastic fabrication shop fabricates thousands of catalog and custom acrylic products.

HDPE is excellent resistance (no attack) to dilute and concentrated acids, alcohols and bases. It shows good resistance (minor attack) to aldehydes, esters, aliphatic and aromatic hydrocarbons, ketones and mineral and vegetable oils.

NYLON (POLYAMIDE)

Nylon (Polyamide), is considered to be the first engineering thermoplastic. It is one of many heterochain thermoplastics which has atoms other than C in the chain. Nylon is created when a condensation reaction occurs between amino acids, dibasic acids and diamines. Commercially Nylon is commonly used in the production of tire cords, rope, belts, filter cloths, sports equipment and bristles. It is particularly useful when machined into bearings, gears, rollers and thread guides.

Polyamide is excellent resistance (no attack) to oils and bases. It has a good resistance (no attack) to solvents, formaldehyde and alcohols. It’s resistance is limited (moderate attack and suitable for short term use only) to dilute acids. Polyamide has poor resistance (not recommended for use with) to phenols

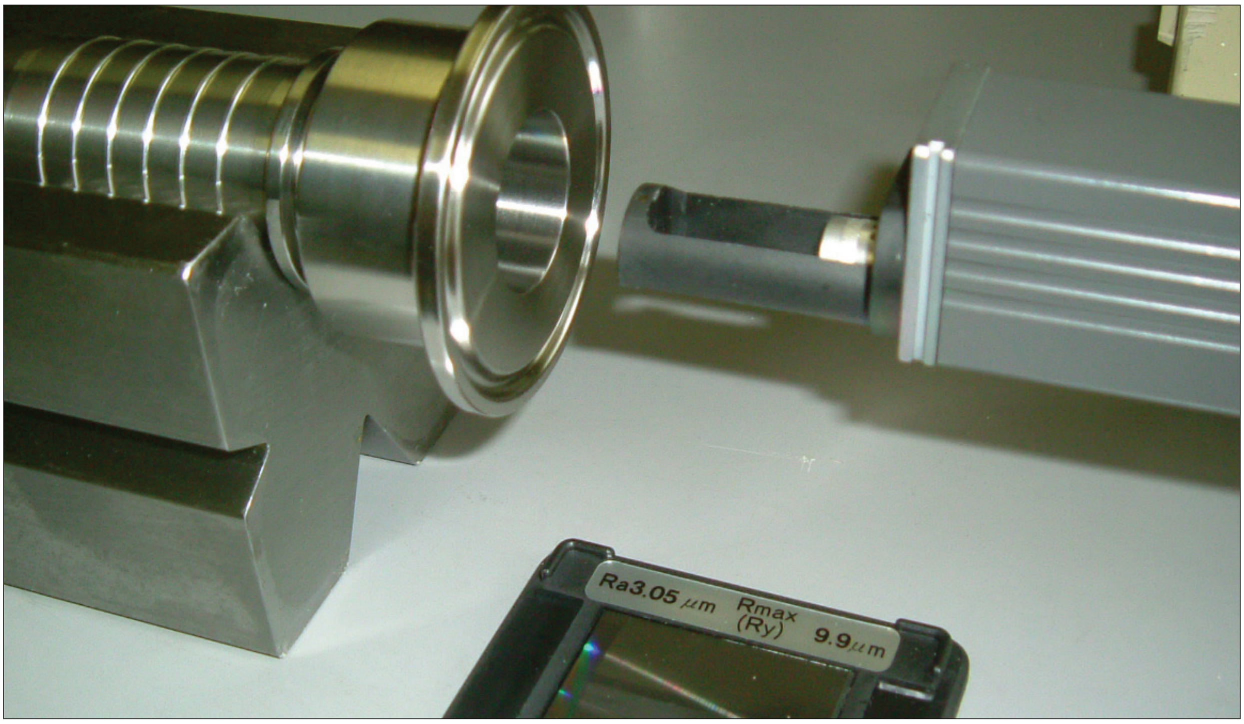
2. Surface treatments

Stainless steel surface cleanliness and smoothness

Microbiological cleanliness and particle control is of greatest importance and necessity in industrial applications like semiconductor manufacturing, pharmacy and biotechnology. The demand for process cleanliness in respect of analysis of process gases, water, chemicals and products in the pharmacy and biotechnology industries also plays a major role.
Stainless steel is a common and obvious choice of material where sanitary and cleanliness is required. It looks clean and is easily handled, welded, bent and formed. Under normal conditions it does not rust.
Stainless steel is available in cold-rolled or hot-rolled sheets, seamless tubes, welded tubes, bars and many other forms.
Surface roughness requirements have become increasingly common in the food and beverage industries in order to avoid contamination, particle build-up or the growth of impurities in gases and liquids. There is also a need to avoid fouling and surface contamination in pipelines and vessels.
These demanding and highly-specified requirements for stainless steel surfaces have resulted in the development of electro-polishing, which is now accepted as a standard industrial method of meeting the highest demands of surface roughness and surface cleanliness for stainless steel products and components.

Ra value

Stainless steel surfaces vary depending on the manufacturing method used (cold-rolled, hot-rolled, extruded, drawn or welded). Mechanical treatments like grinding will also affect the surface of stainless steel.
Surface roughness measurement (Ra, R max) is the most common way of evaluating surface quality.
However, this method reveals nothing about metallurgical cleanliness, characteristics or the material's ability to resist surface contamination, since all it shows is an average vertical deviation from a straight line. So surface roughness figures are just a small part of evaluating surface quality. Microscopic examination of the surface provides valuable information about its microstructure and character.



The following methods are used in order to obtain surfaces with a fine and low Ra values:

1. Grinding/mechanical polishing
2. Blasting
3. Electro-polishing

1. Grinding/mechanical polishing is a very useful way of removing scratches or other mechanical defects. The surface acquires a uniform appearance, and very low Ra values can be achieved by repeated polishing. However, the outer surface layer and grain boundaries are contaminated with oxides, material from the grinding belt and lubricants (where used). The austenitic structure is also damaged, and the surface loses the properties of the underlying material. This defective surface layer is well-defined and is known as the "Beilby" layer. Its negative effects are poor corrosion resistance and risk of contamination between surface and medium.

2. Blasting has similar negative effects to grinding. Blasting should not be used as a preparation for electro-polishing. Blasting gives an even appearance and is used primarily for surfaces not intended to come into contact with media.

3. Electro-polishing is an electrochemical method which removes a surface layer approximately 20μm thick, most of which comes from the peaks of the micro-profile. The austenitic structure appears very clean, the surface has a bright, shiny appearance, and even the outer surface has the same properties as the underlying material. The technical advantages of electro-polishing are:
    * Metallurgical cleanliness
    * Reduced friction
    * Improved corrosion resistance
    * Reduced surface area
    * Easy cleaning

The electro-polishing process may improve a surface finish by up to 50%, and removes material at the same time as reducing surface roughness. Since material is removed, process runtimes are often limited to maintain dimensional tolerances, thus delivering actual surface roughness improvements of between 10% and 35%. Electro-polishing improves surfaces at the microscopic level, so if the material has a surface texture or scratching, electro-polishing will only produce a shiny texture or shiny scratch. Mechanical polishing should be used to remove macroscopic texture or blemishes.

The life span of electro-polished surfaces
Electro-polishing is a surface treatment, not a surface coating, so polished surfaces can be physically damaged or degraded in the same way as the underlying material. An electro-polished AISI 316 stainless steel surface has the same strength and hardness as those published for AISI 316 material. It should however be noted that electro-polishing can produce such a shiny finish that even the finest surface scratch may be visible. Electro-polished surfaces are more resistant to corrosion, and are therefore more resilient in many corrosive environments.

The difference between electro-polishing and mechanical polishing
Electro-polishing is an electrochemical process, whereas mechanical polishing is a mechanical process. Electro-polishing is a surface treatment that can improve surface finish, since it dissolves material from the surface. Mechanical polishing, like machining, alters a surface by cutting material from it. Electro-polishing improves surface finish at the microscopic level, whilst mechanical polishing improves it at the macroscopic level.

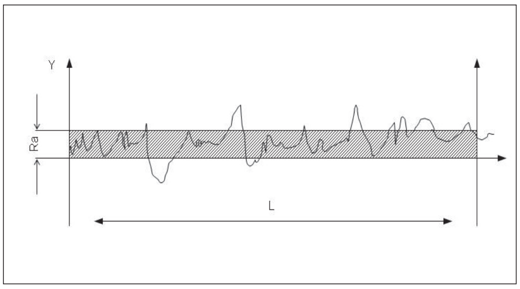
Roughness certificate

When considering roughness measurements, measuring instruments work within a specific spatial bandwidth, which means that some features are too wide (or far apart) to be detected, whilst some are too narrow (or close together). These limits are commonly expressed in terms of spatial frequency (i.e., the inverse of maximum or minimum widths). The degree of roughness measured (RMS or Ra) does not include features outside this range.
For comparisons between measurements (or instruments) to be valid, the spatial bandwidths must be identical. There are also limits of operation for measuring the amplitude of surface features. When expressing roughness, it is important to specify not only bandwidth, but also to state the specific range of surface amplitudes covered by the instrument used.

LMC-Couplings triclamp couplings can be supplied with roughness certificates on request. This certificate demonstrates that the requested roughness average is achieved. The roughness certificate contains several reference measurements:

1. Ra
2. Ry
3. Rz
4. Rq

Ra – Arithmetical Roughness average



Ra is the arithmetic average of the absolute values of profile height deviations from the mean line, recorded within the evaluation length. Simply put, Ra is the average of a set of individual measurements of the peaks and valleys of a surface within the scanning path. Ra is the preferred method for evaluating gradual surface changes. The calculation formula used means that the numerical value measured for Ra is always smaller than that for Rz for the same roughness profile.

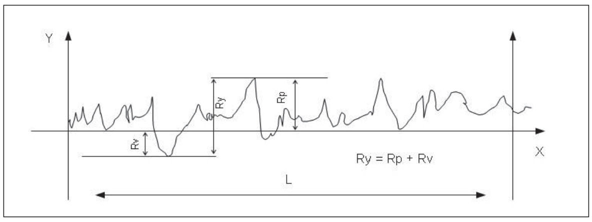
$$Ra = (1/L)\int_0^L |Z(x)|dx$$

L = evaluation length
Z(x) = the profile height function
The digital approximation is:

$$Ra = (|Z_1| + |Z_2| + \ldots + |Z_N|)/N$$

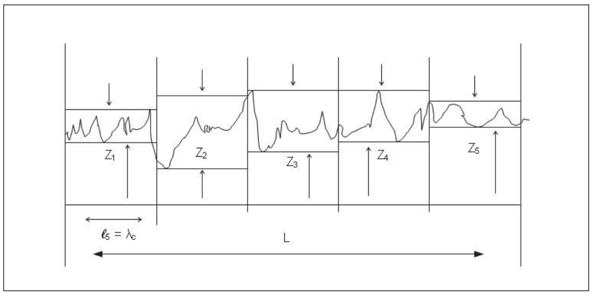
Ry – Maximum height

A portion stretching over a reference length in the direction in which the average line extends is cut out from the roughness curve. The gap between the peak line and the trough line is measured in microns (µm) in the direction of the magnitude axis.



Rz – Determined roughness

The determined roughness depth Rz is the mathematical average of the largest individual roughness depths Zn from a number of individual measurement paths l5 = λc. Averaging the largest roughness depths of measurement paths directly adjacent to each other reduces the influence exerted by individual peaks and ridges. The complete path L is the sum of the individual measurement paths.



$$Rz = \frac{Z1 + Z2 + Z3 + Z4 + Z5}{5}$$

RMS (Rq) – Root mean square average

RMS is the root mean square average of the profile height deviations from the mean line, recorded within the evaluation length.

L= evaluation length
Z(x) = the profile height function

The digital approximation is:

$$Rq = \left[\left(Z_1^2 + Z_2^2 + \ldots + Z_N^2\right) / N\right]^{1/2}$$

Difference between Ra and RMS

Ra and RMS both represent surface roughness, but are calculated differently. Ra is the Roughness Average of the measured microscopic peaks and valleys of a surface. RMS is the Root Mean Square of the measured microscopic peaks and valleys of a surface. Each value uses the same individual height measurements of surface peaks and valleys, but in different formula. The formulas are shown above. It can be seen that a single large peak or flaw within the microscopic surface texture will affect (raise) the RMS value more than the Ra value.

Equivalent Ra values for surface finish grade numbers

Roughness values Ra micrometres	Roughness values Ra micro inches	Roughness Grade Numbers
50	2000	N12
25	1000	N11
12.5	500	N10
8.3	250	N9
3.2	125	N8
1.6	63	N7
0.8	32	N6
0.4	16	N5
0.2	8	N4
0.1	4	N3
0.05	2	N2
0.025	1	N1

MATERIALS

	MATERIAL DESCRIPTION					MECHANICAL PROPERTIES					
	W.-nr	GERMANY - DIN	USA - AISI/SAE	FRANCE - AFNOR	UK - BS	$R_p0.2$ N/mm^2	Rm N/mm^2	A_5	Z %	Av %	HRC
Stainless steel	1.4301	X 5 CrNi 18 10	304	Z6CN18.09	304S15	195	500~700	45	60	85	130~180
	1.4305	X 10 CrNiS 18 9	303	Z10CNF18.09	303S21	195	500~700	35	60	-	130~180
	1.4306	X 2 CrNi 19 11	304L	Z2CN18.10	304S12	180	460~680	45	60	85	120~180
	1.4401	X 5 CrNiMo 17 12 2	316	Z6CND17.11	316S16	205	510~710	40	60	85	130~180
	1.4435	X 2 CrNiMo 18 14 3	316L	Z2CND17.13	316S12	190	490~690	35	60	85	120~180
	1.4541	X 6 CrNiTi 18 10	321	Z6CN18.10	321S12	200	500~730	40	50	85	130~190
	1.4571	X 6 CrNiMoTi 17 12 2	316Ti	Z6CNDT17.12	320S17	210	500~730	35	50	85	130~190
	2,4602	-	Hastelloy® C-22™		-	372	786	62	-	-	-
	2.4360	-	Monel® Alloy 400™		-	276~690	552~758	30~60	-	-	75~100
Steel	1.0116	Fe 360 D 1 (St37-3)	A573-81 65	E 24-U	4360 40 C	235	340~510	26	24	27	-
	1.0570	Fe 510 D 1 (St52-3)	SAE 1518	E 36-3	4360 50 B	355	490~680	22	-	23	-
	1.0727	45S20	SAE 1151	45 MF 4	212 M 44	375	640~830	7	-	-	-
	1.0737	9SMnPb36k	12L14	S300Pb	-	390	490~740	8	-	-	-
	1.1181	Ck35	SAE 1035	XC38	080 A 32	370	600~750	19	45	40	48~58
	1.1191	Ck45	SAE 1045	XC42	080 M 46	430	650~800	16	40	30	55~62
	1,5217	20MnV6	-	-	-	400	520~720	17	-	-	-
Aluminium	3.0615	AlMgSiPb	6012	A SgPb	-	200	275	8	-	-	80
	3.1645	AlCuMgPb	2007	A-U4PB	-	220~250	340~370	7	-	-	90~100
	3.3215	AlMgSi 1	6082	A-SGM 0,7	H30	200~260	275~310	12~10	-	-	80~95
	3.3206	AlMgSi 0,5	6060	A-GS	H9	160	215	12	-	-	70
	3.3503	AlMg 3	5754	A-G3M	-	80	180	14	-	-	45
Brass	2.0401	CuZn 39 Pb3 (Ms58)	ASTM 360	UZ39PB2	CZ121Pb3	250	430	15	-	-	125
	2.0321	CuZn 37 (Ms63)	ASTM 272	UZ36	CZ108	370	440~540	8	-	-	135
Bronze						120	270	12	-	-	70

	CHEMICAL PROPERTIES									
	W.-nr	C %	Si %	Mn %	P %	S %	Cr %	Mo %	Ni %	Others %
Stainless steel	1.4301	0,070	1,000	2,000	0,045	0,030	17,000~19,000	-	8,500~10,500	-
	1.4305	12,000	1,000	2,000	0,060	0,150~0,350	17,000~19,000	-	8,000~10,000	-
	1.4306	0,030	1,000	2,000	0,045	0,030	18,000~20,000	-	10,000~12,500	-
	1.4401	0,070	1,000	2,000	0,045	0,030	16,500~18,500	2,000~2,500	10,500~13,500	-
	1.4435	0,030	1,000	2,000	0,045	0,025	17,000~18,500	2,500~3,000	12,500~15,000	-
	1.4541	0,080	1,000	2,000	0,045	0,030	17,000~19,000	-	9,000~12,000	Ti ≥(5x%C)≤ 0,800
	1.4571	0,080	1,000	2,000	0,045	0,030	16,500~18,500	2,000~2,500	10,500~13,500	Ti ≥(5x%C)≤ 0,800
	2,4602	0,010	0,080	0,500	-	-	22,000	13,000	55,560	Co2.5/W3/Fe3/$V_{0.35}$
	2.4360		0,500	2,000	-	0,024	-	-	66,500	Fe 2.5 / Cu 31
Steel	1.0116	0,170	-	1,400	0,045	0,045	-	-	-	-
	1.0570	0,200	0,550	1,600	0,045	0,045	-	-	-	-
	1.0727	0,42~0,50	-	0,700~1,100	0,060	0,180~0,250	-	-	-	-
	1.0737	0,150	0,050	1,100~1,500	0,100	0,340~0,400	-	-	-	Pb: 0,150~0,350
	1.1181	0,320~0,39	0,400	-	0,035	0,030	0,400	0,100	0,400	-
	1.1191	-	0,400	0,500~0,800	0,035	0,030	0,400	0,100	0,400	-
	1,5217	0,220	0,500	1.200~1,700	0,040	0,040	-	-	-	V: 0.15
Aluminium	3.0615	0,60~1,40	0,50	0,10	0,40~1,00	0,60~1,20	0,30	0,30	0,20	-
	3.1645	0,80	0,80	3,30~4,60	0,50~1,00	0,40~1,80	0,10	0,80	0,20	-
	3.3215	0,70~1,30	0,50	0,10	0,40~1,00	0,60~1,20	0,25	0,20	0,10	-
	3.3206	0,30~0,60	0,10~0,30	0,10	0,10	0,35~0,60	0,05	0,15	0,10	-
	3.3503	0,40	0,40	0,10	0,50	2,60~3,60	0,30	0,20	0,15	-
Brass	2.0401	57,0~59,0	2,5~3,5	35,5~38,5	0,10	0,50	0,50	0,30	0,40	-
	2.0321	62,0~64,0	0,10	35,2~37,2	0,03	0,10	0,30	0,05	0,10	-
Bronze	2.1090	0,05	4,0~6,0	4,0~6,0	-	0,30	2,50	-	4,00~6,00	Cu 81~85 / Sb 0.3

TECHNICAL INFORMATION: PROPERTIES OF ELASTOMERS

ASTM 1418	NR	SBR	NBR	EPDM	IIR	CR	AU	CSM	VMQ	FVMQ	FKM
ISO code 1629	NR	SBR	NBR	EPDM	IIR	CR	AU	CSM	MVQ	MFQ	FPM
Shoreness (Shore A)	30-90	40-90	40-95	40-80	20-80	20-90	50-90	40-90	10-90	40-80	60-90
Pull strength (p.s.i.)	3000	3000	2500	2500	2000	3000	5000	2500	1400	900	2000
Tear strenght	E	V	G	G	V	V	E	F	N	N	G
Wear strength	E	E	G	G	G	G	V	V	N	N	G
Inflammable hydr. liquids	N	N	N	V	V	F	N	N	G	V	F to E
Lubricants	N	N	G	N	N	F	V	F	F	E	E
Fuel oils	N	N	G	N	N	F	V	F	R	E	E
Hydraulic oils	N	N	U	N	N	G	V	U	G	E	E
Vegetable oils	N	F	U	F	U	G	V	G	G	E	E
Animal fats	N	F	U	F	U	G	V	G	G	E	E
Trade gasoline	N	N	V	N	N	F	V	F	F	E	E
Gasoline high octane	N	N	G	N	N	N	V	N	N	E	E
Kerosene	N	N	V	N	N	F	V	F	F	E	E
Aromatic hydrocarbons	N	N	F	N	N	N	G	R	N	E	E
Alifatic hydrocarbons	N	N	V	N	N	G	V	G	F	E	E
Water (< 80°C - 176°F)	G	V	V	E	E	F	F to N	E	E	E	E
Water (> 80°C - 176°F)	N	F	F	E	G	N	N	E	E	E	G
Alcohols	G	G	V	E	E	E	F	V	E	E	E
Ketones	N	N	N	G	V	N	N	F	G	N	N
Concentrated acids	N	N	N	F	F	N	N	V	F	F	V
Diluted acids	F	F	F	G	E	G	N	E	G	V	E
Alkalis?	G	G	F	V	E	G	N	E	G	F	G
Chlorated solvents	N	N	F	N	N	N	F	N	N	E	E
Ozone / obselence light	F	F	F	U	U	E	E	U	U	U	U
Max. C°/F° continue	70°C/155°F	110°C/230°F	120°C/248°F	145°C/293°F	120°C/248°F	105°C/220°F	70°C/155°F	140°C/284°F	230°C/446°F	205°C/400°F	200°C/392°F
Electr. properties	U	E	N	U	U	E	G	G	U	U	U
Flame extinguishing	No	No	No	No	No	Yes	No	Yes	No	No	Yes

E= Excellent V= Very good G= Good F= Fair N= Not recomended