

Lightweight
Stainless Steel
for High-pressure
Applications



Balev[®]



Lightweight Stainless Steel for
High-pressure Applications.
Pressure is a privilege

Product Overview

Centravis Balev 304L® and Balev 316L® are next generation steel grades engineered for high-pressure applications, offering a reliable combination of strength, corrosion resistance, and formability demonstrating mechanical properties that may exceed those of Duplex stainless steel.

Developed through patented heat treatment technology, Balev 304L® and Balev 316L® provide enhanced performance in demanding environments from aerospace and automotive systems to complex industrial applications where reliability under stress is essential. The advanced properties of Balev 304L® and Balev 316L® allow thinner-walled tubing without compromising safety or efficiency, thereby offering lightweight cost-effective solutions for variety of technological challenges.

Application Areas

For industries, where materials must withstand extreme temperatures and corrosive environments:

- hydraulic systems and structural elements of aircraft and spacecraft;
- hydraulic connections, valves, and pumps in various industrial applications;
- chemical processing equipment;
- hydrogen production, storage, and transportation systems, high-pressure automotive fuel injection systems;
- high-pressure automotive fuel injection systems and exhaust systems where materials must withstand extreme temperatures and corrosive environments;
- oil and gas extraction and transportation under pressure.

Product standards

- ASTM A269, A213, A312
- EN 10216-5
- Individual customers' specifications

Forms of supply

- Seamless cold finished tubes and pipes
- Seamless cold finished U-tubes

Range of sizes*

OD 6,0–50 mm
WT 0,7–5,0 mm
Length up to 27 meters

*Upon the request, wider product range can be supplied.

Chemical composition of Balev 304L® and Balev 316L® is the same as for the grades TP304L or TP316L and their EN analogue:

Grade	C	Mn	P	S	Si	Cr	Ni	Mo	N	Cu	Pren
Balev 316L® same as TP316L/1.4404	0.035	2.00	0.045	0.030	1.00	16.0-18.00	10.0-14.0	2.0-3.0			26
Balev 304L® same as TP304L/1.4306	0.035	2.00	0.045	0.030	1.00	18.0-20.0	8.0-12.0				19
S31803	0.030	2.00	0.030	0.020	1.00	21.0-23.0	4.5-6.5	2.5-3.5	0.08-0.20		35
S32101	0.04	4.0-6.0	0.040	0.030	1.00	21.0-22.0	1.35-1.70	0.1-0.8	0.20-0.25	0.10-0.80	26
S32304	0.03	2.50	0.040	0.04	1.00	21.5-24.5	3.0-5.5	0.05-0.6	0.05-0.20	0.05-0.60	26

Chemistry maximum, unless a range or minimum is indicated.

PREN (Pitting Resistance Equivalent Number) = %Cr+3.3(%Mo+0.5%W) +16%N

PREN is a measure of the relative pitting corrosion resistance of stainless steel in a chloride-containing environment.

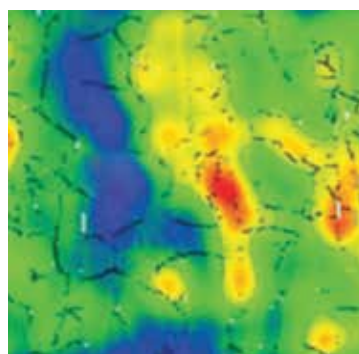
Balev304L; Balev316L: the internal designation of the material.

Microstructure

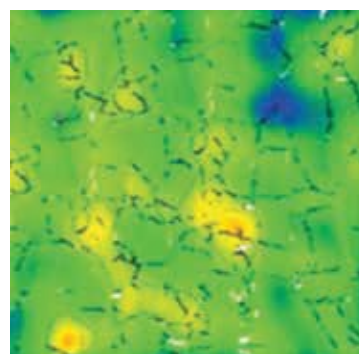
In addition to maintaining a stable austenitic microstructure across a broad temperature spectrum, including cryogenic conditions down to -196°C, the patented heat treatment technology fills Balev 304L® and Balev 316L® tubes and pipes with low-energy special grain boundaries. This feature significantly enhances the operational service life of the finished products.

Typical microstructure (stress fields):

TP304L/TP316L



Balev 304L® / Balev 316L®



A stable austenitic microstructure **with low-energy special** grain boundaries makes Balev 304L® or Balev 316L® an excellent choice for hydrogen applications, and chemical and petrochemical segments.

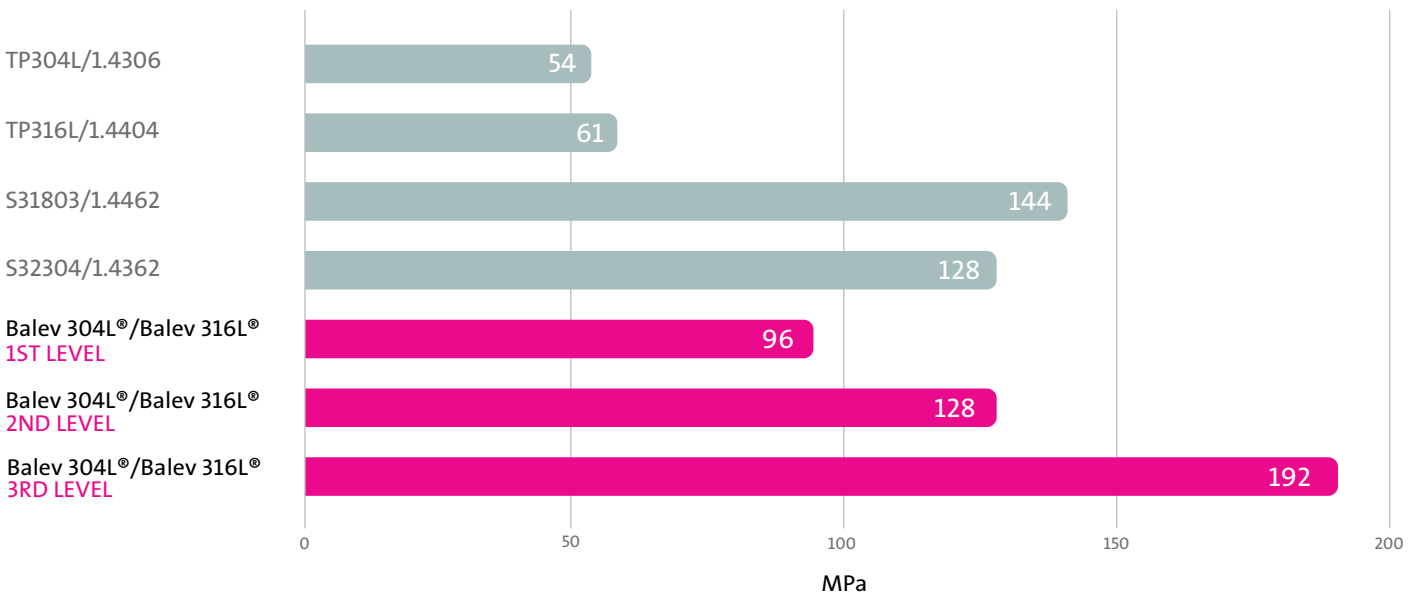
Mechanical and Physical Properties

Crafted from Balev 304L® and Balev 316L® grades, CentraVis tubes and pipes outperform those made from traditional Duplex stainless steel in terms of mechanical properties. Available in three distinct strength levels, Balev 304L® and Balev 316L® not only guarantee enhanced durability but also deliver superior value to end-users, ensuring a longer service life and optimal performance.

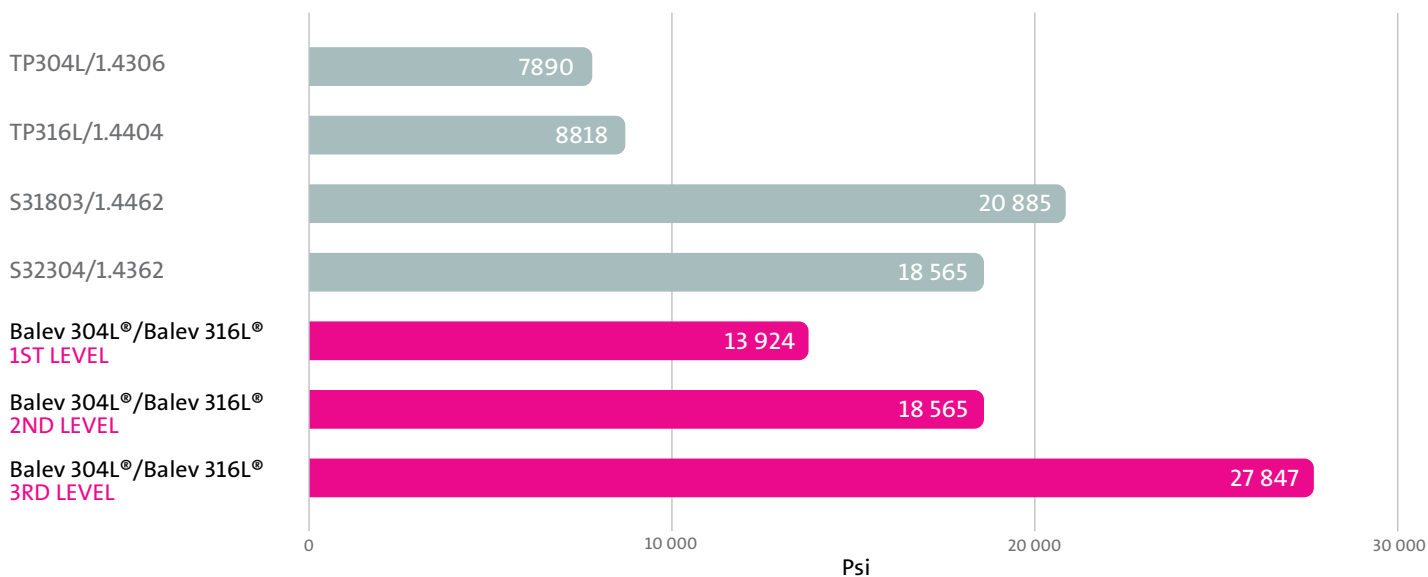
Grade	Steel grade Requirements of ASTM and EN standards			Maximum working pressure at ambient temperature*		
	Tensile Strength, MPa Min	Yield Strength, MPa Min	Elongation at break, % Min	MPa	Psi	Bar
TP304L/1.4306	485	170	35	54	7 890	544
TP316L/1.4404	490	190	35	61	8 818	608
S31803/1.4462	640	450	25	144	20 885	1 440
S32304/1.4362	690	400	25	128	18 565	1 280
1ST LEVEL						
Balev 304L® Balev 316L®	600	300	35	96	13 924	960
	2ND LEVEL					
	650	400	25	128	18 565	1 280
	3RD LEVEL					
	800	600	Actual	192	27 847	1 920

* OD 10mm WT 1.8mm has been taken as an example for pressure resistance calculation acc. to ASTM A269/A269M
Balev 304L® and Balev 316L® tubes and pipes have superior technological (incl. flaring & flattening), plasticity, and saw cutting properties, as well as hot & cold bendability at a high level, typical of austenitic material.

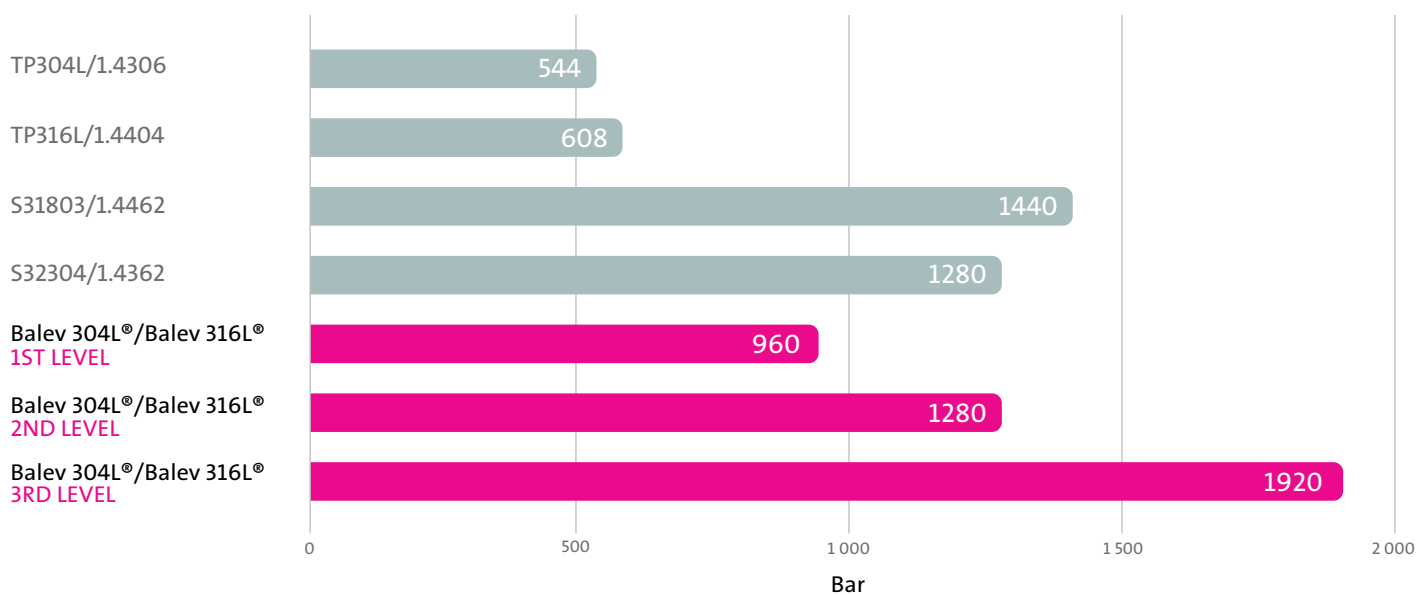
Comparison of maximum working pressure at ambient temperature, MPa



Comparison of maximum working pressure at ambient temperature Psi



Comparison of maximum working pressure at ambient temperature, Bar



Physical properties

Grade	Mean coefficient of thermal expansion from 20C (68F) to 200C (392F) $\times 10^{-6}$	Density, g/cm ³
Balev304L® same as TP304L/1.4306	16,4	7,98
Balev316L® same as TP316L/1.4404	16,9	8,0
TP316LU G	16,9	8,0
S31803/32205	13,5	7,8
S32101	13,5	7,8
S32304	13,5	7,75
310Mo LN 925Cr-22Ni-2Mo	15,5	7,9

Estimated working pressure

OD		WT		TP304L, TP316L		Balev304L/Balev316L 1ST LEVEL		Balev304L/Balev316L 2ND LEVEL		Balev304L/Balev316L 3RD LEVEL	
inch	mm	inch	mm	psi	bar	psi	bar	psi	bar	psi	bar
0,236	6	0,039	1	7 929	547	11 603	800	15 471	1 067	23 206	1 600
0,236	6	0,059	1,5	12 884	888	18 855	1 300	25 140	1 733	37 710	2 600
0,25	6,35	0,028	0,71	4 776	329	6 989	482	9 319	643	13 978	964
0,25	6,35	0,035	0,89	6 462	446	9 456	652	12 608	869	18 912	1 304
0,25	6,35	0,036	0,91	6 649	458	9 730	671	12 973	894	19 460	1 342
0,25	6,35	0,048	1,22	9 552	659	13 978	964	18 638	1 285	27 957	1 928
0,25	6,35	0,049	1,24	9 739	671	14 253	983	19 003	1 310	28 505	1 965
0,25	6,35	0,059	1,5	12 174	839	17 816	1 228	23 754	1 638	35 631	2 457
0,25	6,35	0,063	1,6	13 111	904	19 186	1 323	25 582	1 764	38 372	2 646
0,25	6,35	0,064	1,63	13 391	923	19 597	1 351	26 130	1 802	39 195	2 702
0,25	6,35	0,065	1,65	13 579	936	19 871	1 370	26 495	1 827	39 743	2 740
0,313	7,94	0,035	0,89	5 168	356	7 562	521	10 083	695	15 125	1 043
0,313	7,94	0,036	0,91	5 317	367	7 782	537	10 376	715	15 563	1 073
0,315	8	0,039	1	5 947	410	8 702	600	11 603	800	17 405	1200
0,315	8	0,059	1,5	9 663	666	14 141	975	18 855	1 300	28 282	1 950
0,315	8	0,079	2	13 380	923	19 580	1 350	26 107	1 800	39 160	2 700
0,375	9,53	0,035	0,89	4 305	297	6 301	434	8 401	579	12 601	869
0,375	9,53	0,036	0,91	4 430	305	6483	447	8 644	596	12 967	894
0,375	9,53	0,048	1,22	6 365	439	9 314	642	12 419	856	18 628	1 284
0,375	9,53	0,049	1,24	6 489	447	9 497	655	12 662	873	18 993	1 310
0,375	9,53	0,064	1,63	8 923	615	13 058	900	17 411	1 200	26 116	1 801
0,375	9,53	0,065	1,65	9 048	624	13 241	913	17 654	1 217	26 481	1 826
0,375	9,53	0,08	2,03	11 400	786	16 683	1 150	22 244	1 534	33 366	2 301
0,375	9,53	0,083	2,11	11 849	817	17 341	1 196	23 121	1 594	34 681	2 391
0,394	10	0,039	1	4 757	328	6 962	480	9 282	640	13 924	960
0,394	10	0,059	1,5	7 731	533	11 313	780	15 084	1 040	22 626	1 560
0,394	10	0,063	1,6	8 325	574	12 183	840	16 244	1 120	24 366	1 680
0,394	10	0,079	2	10 704	738	15 664	1 080	20 885	1 440	31 328	2 160
0,473	12	0,039	1	3 964	273	5 802	400	7 735	533	11 603	800
0,473	12	0,059	1,5	6 442	444	9 427	650	12 570	867	18 855	1 300
0,473	12	0,079	2	8 920	615	13 053	900	17 405	1200	26 107	1 800
0,5	12,7	0,035	0,89	3 231	223	4 728	326	6 304	435	9 456	652
0,5	12,7	0,036	0,91	3 324	229	4 865	335	6 487	447	9 730	671
0,5	12,7	0,048	1,22	4 776	329	6 989	482	9 319	643	13 978	964
0,5	12,7	0,049	1,24	4 870	336	7 126	491	9 502	655	14 253	983
0,5	12,7	0,064	1,63	6 696	462	9 799	676	13 065	901	19 597	1 351
0,5	12,7	0,065	1,65	6 789	468	9 936	685	13 248	913	19 871	1 370
0,5	12,7	0,08	2,03	8 555	590	12 519	863	16 692	1 151	25 038	1 726
0,5	12,7	0,083	2,11	8 892	613	13 012	897	17 350	1 196	26 025	1 794
0,552	14	0,039	1	3 398	234	4 973	343	6 630	457	9 945	686
0,552	14	0,059	1,5	5 522	381	8 081	557	10 774	743	16 161	1 114
0,552	14	0,079	2	7 646	527	11 189	771	14 918	1 029	22 377	1 543
0,586	14,88	0,125	3,18	11 438	789	16 738	1 154	22 317	1 539	33 476	2 308
0,591	15	0,039	1	3 171	219	4 641	320	6 188	427	9 282	640
0,591	15	0,059	1,5	5 154	355	7 542	520	10 056	693	15 084	1 040
0,591	15	0,079	2	7 136	492	10 443	720	13 924	960	20 885	1 440
0,626	15,88	0,048	1,22	3 820	263	5 590	385	7 453	514	11 179	771
0,626	15,88	0,048	1,22	3 820	263	5 590	385	7 453	514	11 179	771
0,626	15,88	0,049	1,24	3 894	269	5 699	393	7 599	524	11 398	786
0,626	15,88	0,064	1,63	5 355	369	7 836	540	10 449	720	15 673	1 081
0,626	15,88	0,065	1,65	5 430	374	7 946	548	10 595	730	15 892	1 096

Estimated working pressure

OD		WT		TP304L, TP316L		Balev304L/Balev316L 1ST LEVEL		Balev304L/Balev316L 2ND LEVEL		Balev304L/Balev316L 3RD LEVEL	
inch	mm	inch	mm	psi	bar	psi	bar	psi	bar	psi	bar
0,63	16	0,039	1	2 973	205	4 351	300	5 802	400	8 702	600
0,63	16	0,059	1,5	4 832	333	7 071	488	9 427	650	14 141	975
0,63	16	0,079	2	6690	461	9 790	675	13 053	900	19 580	1 350
0,63	16	0,099	2,5	8 362	577	12 238	844	16 317	1 125	24 475	1 688
0,63	16	0,118	3	10 035	692	14 685	1 013	19 580	1 350	29 370	2 025
0,709	18	0,039	1	2 643	182	3 868	267	5 157	356	7 735	533
0,709	18	0,059	1,5	4 295	296	6 285	433	8 380	578	12 570	867
0,709	18	0,079	2	5 947	410	8 702	600	11 603	800	17 405	1 200
0,709	18	0,099	2,5	7 433	513	10 878	750	14 504	1 000	21 756	1 500
0,709	18	0,118	3	8 920	615	13 053	900	17 405	1 200	26 107	1 800
0,751	19,05	0,048	1,22	3 184	220	4 659	321	6 213	428	9 319	643
0,751	19,05	0,049	1,24	3 246	224	4 751	328	6 334	437	9 502	655
0,751	19,05	0,064	1,63	4 464	308	6 532	450	8 710	601	13 065	901
0,751	19,05	0,065	1,65	4 526	312	6 624	457	8 832	609	13 248	913
0,751	19,05	0,083	2,11	5 928	409	8 675	598	11 566	797	17 350	1 196
0,751	19,05	0,095	2,4	6 743	465	9 867	680	13 156	907	19 734	1 361
0,751	19,05	0,109	2,77	7 782	537	11 388	785	15 184	1 047	22 777	1 570
0,751	19,05	0,14	3,56	10 001	690	14 636	1 009	19 515	1346	29 273	2 018
0,788	20	0,059	1,5	3 865	267	5 656	390	7 542	520	11 313	780
0,788	20	0,079	2	5 352	369	7 832	540	10 443	720	15 664	1 080
0,788	20	0,099	2,5	6 690	461	9 790	675	13 053	900	19 580	1 350
0,788	20	0,118	3	8 028	554	11 748	810	15 664	1 080	23 496	1 620
0,788	20	0,158	4	10 704	738	15 664	1 080	20 885	1 440	31 328	2 160
0,867	22	0,059	1,5	3 514	242	5 142	355	6 856	473	10 285	709
0,867	22	0,079	2	4 865	335	7 120	491	9 493	655	14 240	982
0,985	25	0,059	1,5	3 092	213	4 525	312	6 034	416	9 050	624
0,985	25	0,079	2	4 282	295	6 266	432	8 354	576	12 531	864
0,985	25	0,099	2,5	5 352	369	7 832	540	10 443	720	15 664	1 080
0,985	25	0,118	3	6 422	443	9 398	648	12 531	864	18 797	1 296
1,001	25,4	0,048	1,22	2 388	165	3 495	241	4 659	321	6 989	482
1,001	25,4	0,049	1,24	2 435	168	3 563	246	4 751	328	7 126	491
1,001	25,4	0,065	1,65	3 395	234	4 968	343	6 624	457	9 936	685
1,001	25,4	0,083	2,11	4 446	307	6 506	449	8 675	598	13 012	897
1,001	25,4	0,095	2,4	5 057	349	7 400	510	9 867	680	14 801	1 020
1,001	25,4	0,126	3,2	6 743	465	9 867	680	13 156	907	19 734	1 361
1,182	30	0,063	1,6	2 775	191	4 061	280	5 415	373	8 122	560
1,182	30	0,099	2,5	4 460	308	6 527	450	8 702	600	13 053	900
1,182	30	0,118	3	5 352	369	7 832	540	10 443	720	15 664	1080
1,182	30	0,158	4	7 136	492	10 443	720	13 924	960	20 885	1 440
1,251	31,75	0,126	3,2	5 394	372	7 894	544	10 525	726	15 787	1 089
1,379	35	0,079	2	3 058	211	4 475	309	5 967	411	8 951	617
1,379	35	0,099	2,5	3 823	264	5 594	386	7 459	514	11 189	771
1,379	35	0,118	3	4 587	316	6 713	463	8 951	617	13 426	926
1,497	38	0,079	2	2 817	194	4 122	284	5 496	379	8 244	568
1,497	38	0,118	3	4 225	291	6 183	426	8 244	568	12 366	853
1,497	38	0,158	4	5 634	388	8 244	568	10 992	758	16 489	1 137
1,497	38	0,197	5	7 042	486	10 305	711	13 740	947	20 611	1 421
1,655	42	0,079	2	2 549	176	3 730	257	4 973	343	7 459	514
1,655	42	0,118	3	3 823	264	5 594	386	7 459	514	11 189	771
1,97	50	0,158	4	4 282	295	6 266	432	8 354	576	12 531	864
1,97	50	0,197	5	5 352	369	7 832	540	10 443	720	15 664	1 080

Formability

Compared to duplex steel grades S31803 and S32304, high-strength Centraviv materials, Balev 304L® and Balev 316L®, provide superior formability and bendability. This makes them the preferred choice for applications requiring complex shaping and tight bending, delivering exceptional performance and versatility.



Corrosion resistance

Balev 304L® has a good resistance to atmospheric corrosion, as the high chromium content of the material provides resistance to oxidizing solutions such as nitric acid up to 55% weight and up to 176°F (80°C). Balev 304L® can also operate successfully in caustic solutions free of chlorides.

Balev 316L® performs well in sulfur containing service, in both high concentrations and temperatures (depending on the actual service condition). Due to the well-balanced chemical composition, the material ensures superior pitting resistance in applications involving chloride solutions, particularly in an oxidizing environment.

Weldability

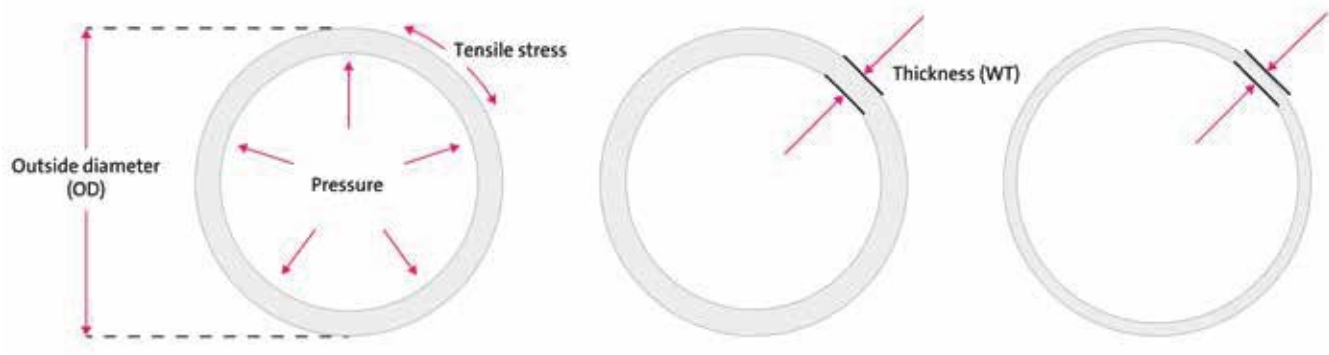
Balev 304L® and Balev 316L® are non-magnetic in all conditions and have excellent weldability, meaning that a postweld heat treatment is not necessary.

Heat treatment

Balev 304L® and Balev 316L® tubes and pipes are manufactured using patented heat treatment technology, ensuring a consistently stable and fully austenitic microstructure.

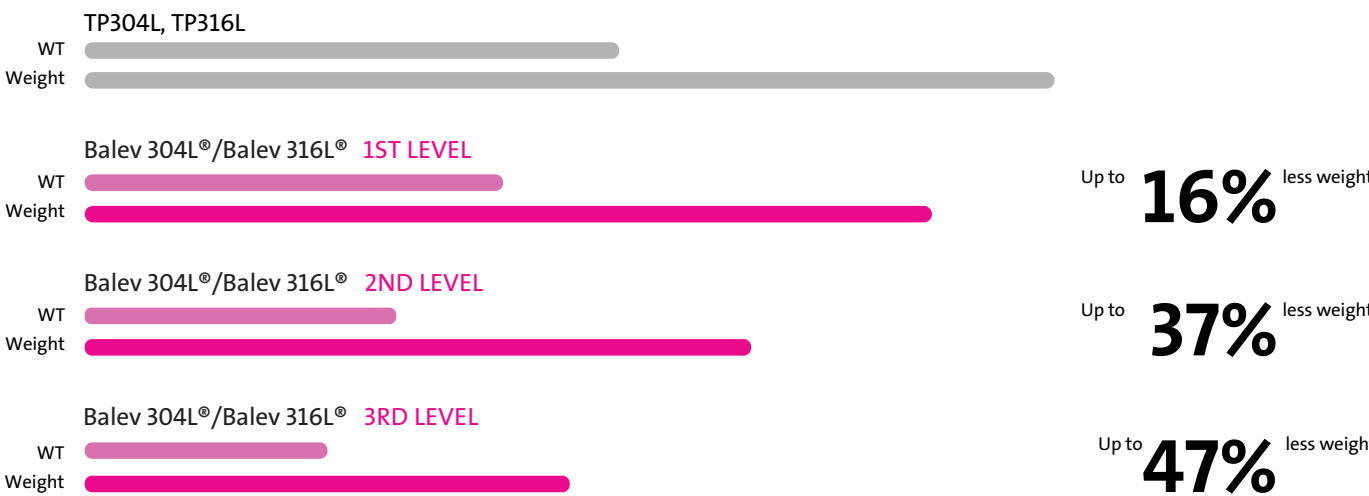
Cost efficiency

Balev 304L® and Balev 316L® tubes and pipes provide an advantage in cost efficiency, allowing the use of thinner-walled tubes without sacrificing structural integrity. This material ensures a reduction in weight and material use, offering a more economical option compared to traditional TP304L and TP316L, and Duplex grades S31803 and S32304. Higher material strength **makes it possible to apply a minimum of 40% thinner-walled tubes.**



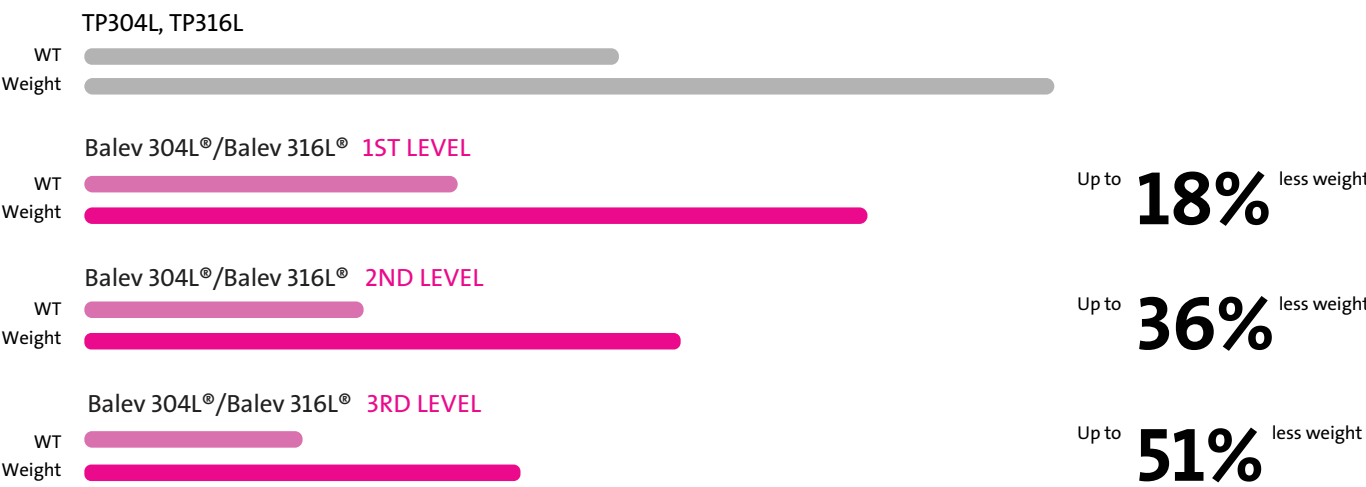
Use Cases

Case 1	Size		Pressure	Weight		Decrease in weight
	OD	WT		per 1m, kg	per 100m, kg	
TP304L, TP316L	6,35	1,65	936	0,19	19	
Balev 304L®/Balev 316L® 1ST LEVEL	6,35	1,22	964	0,16	16	16%
Balev 304L®/Balev 316L® 2ND LEVEL	6,35	0,91	947	0,12	12	37%
Balev 304L®/Balev 316L® 3RD LEVEL	6,35	0,71	964	0,10	10	47%
TP304L, TP316L	6,35	0,71	329			



Use Cases

Case 2	Size		Pressure	Weight		Decrease in weight
	OD	WT	bar	per 1m, kg	per 100m, kg	
TP304L, TP316L	9,53	2,11	817	0,39	39	
Balev 304L®/Balev 316L® 1ST LEVEL	9,53	1,63	900	0,32	32	18%
Balev 304L®/Balev 316L® 2ND LEVEL	9,53	1,22	856	0,25	25	36%
Balev 304L®/Balev 316L® 3RD LEVEL	9,53	0,89	869	0,19	19	51%
TP304L, TP316L	9,53	0,89	297			



As the engineering world pledges to enhance environmental stewardship, the role of advanced, lightweight materials becomes pivotal—not just in sectors like aerospace and automotive but across the entire industry. Balev steel stands at the forefront of this transformative era, driving success and sustainability. Choose Balev steel: where innovation meets responsibility, driving us towards a safer, greener planet.



Empowering a Greener Future with Balev Steel – The Core of Engineering Excellence

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