YOUR ROPE IS
OUR PASSION

SPECIAL STEEL WIRE ROPES FOR CONTAINER AND HARBOUR APPLICATIONS

CASAR®
A WireCo® WorldGroup Brand

INTRODUCTION

CASAR Drahtseilwerk Saar was founded in 1948. Since its inception, CASAR has stood for innovative product developments, producing the first 8-strand ropes in 1949 when six-strand ropes were the standard. During the decades since, we continue to be the innovator in specialty wire ropes which is verified by our consistent growth over the decades.

We continually develop new and innovative technologies to improve our products and testing facilities. Our manufacturing operations have custom engineered monitoring systems which allow us to track the quality of production in real time. We have established and follow the industry's most comprehensive testing of products. Our quality assurance and certified manufacturing processes exceed all global standards, and our consultative approach for developing ropes ensures compliance and performance. CASAR has a network of international distribution partners in more than 40 countries all over the world. In 2007 CASAR became a part of WireCo WorldGroup, the world leader in wire and synthetic rope manufacturing.

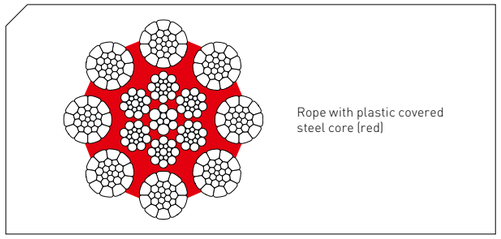
As part of the WireCo family, we have access to the world's largest and most advanced technical team in wire rope. We also now have the capability to utilize the extensive wire manufacturing capabilities of WireCo to allow for enhanced quality control and supply chain responsiveness. Beyond these factors, WireCo provides the market and financial strength to continue investing in research and equipment to assure CASAR remains the premier manufacturer of high performance crane ropes and underground mining hoist ropes.

ROPE TECHNOLOGY

ROPES WITH PLASTIC COVERED STEEL CORE (SINCE 1972)

In a CASAR PLAST rope, the proportion of plastic to the steel components is thoroughly harmonized in order to fulfill the aspired rope geometry. A plastic coating with a very constant thickness and quality is extruded around the steel core. A thermal after treatment just before the closing of the rope ensures that the outer strands are deeply implanted in the plastic jacket, thus forming plastic edges which separate the strands. First ropes of this kind went into harbours already in the 70's with great success. The benefit of an internal plastic layer is diversified:

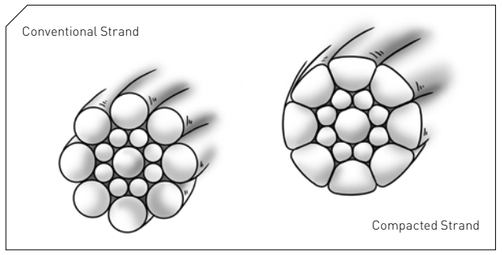
- Prevents internal wire breaks
- Prevents metal-to-metal contact
- Stabilizes the rope structure during installation and operation
- Seals in lubricant, reduces the maintenance effort
- Keeps out water and abrasive elements
- Absorbs dynamic energy
- Resistant to many chemical substances



ROPES WITH COMPACTED STRANDS (SINCE 1978)

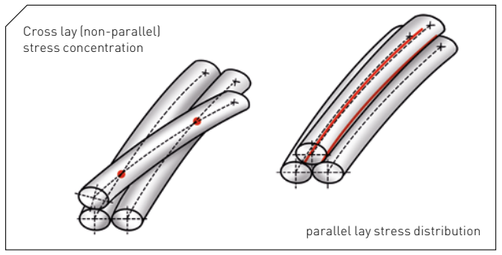
Ropes made of compacted strands have a higher breaking load, a greater flexibility and better rope to rope contact conditions than comparable ropes made out of conventional strands. Because of the thicker outer wires and the smaller exposed area they are more resistant to abrasion and corrosion.

The formation of negative impressions is significantly impaired. The rope life time on multiple layer drums is optimized. In order to produce a compacted strand, a conventional strand made of round wires is drawn through a compacting tool. During this procedure, the wires are plastically deformed, the strand diameter is reduced and the surface is made smooth. Resulting the contact conditions between the individual wires and the strand to-strand contacts are improved.



PARALLEL LAY ROPES

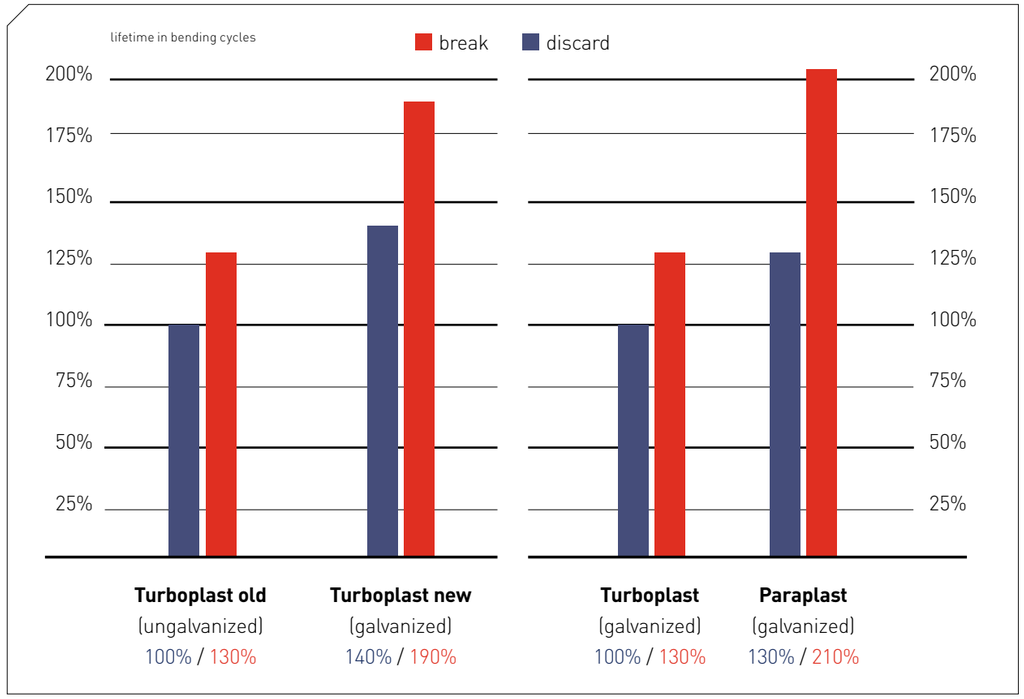
In a standard rope all wires and strands have different lay lengths. The high stress concentration at the cross-over point leads to an early internal failure. In a parallel lay rope all wires and strands have the same lay length. The linear contact leads to an optimal stress distribution. Furthermore the compacted parallel design leads to a higher fill factor and breaking strength. This combination of longer service life and higher breaking strength fulfills the growing demand of up-to-date container handling equipment.



THE IMPORTANCE OF RE-LUBRICATION AND THE USE OF GALVANIZED ROPES

There are new findings in the performance differences between ungalvanized and galvanized ropes which are important to know. Most of the ropes can be ordered in both executions and in the past the strategy was mainly to recommend galvanized ropes if corrosion resistance is of importance. The fact that galvanized is more expensive and corrosion was not an important point in the application, mostly led to a use of blank ropes.

Based on recent tests at CASAR on the current performance difference between galvanized and ungalvanized ropes and also related to some feedback from the field use we have realized that the difference is in many cases quite significantly. An additional performance increase can be achieved with the CASAR PARAPLAST due to its specific parallel rope design.



Test results show a strong increase in bending fatigue cycles. Please note that the blue bar shows discard and the red bar shows rope break.

Feedback from the field showed some differences too. In this respect another important fact plays a critical role. In many cases a proper relubrication hasn't been done and the progressive corrosion reduced the life of the rope dramatically.

Corroded Ropes

NEW LUBRICATIONS FOR BETTER CORROSION PROTECTION

Here ongoing research led to improved grease additives which reduce the corrosion significantly. Many of our CASAR ropes have this additive as a standard component included.

The pictures to the left show corrosion after a 21 day test in a salt spray chamber. The new additive leads to an impressive improvement on corrosion resistance.

All those facts make us to propose to the sales organization that in many cases galvanized ropes could be the better choice, especially if those **requirements** exist:

- High number of bending cycles
- High humidity, risk of corrosion
- Relubrication doubtful, risk of dry rope (please note: Galvanized ropes need relubrication too!)

There are three **important restrictions** for the use of galvanized ropes.

- If the rope is used in an atmosphere containing hydrochlorid acid the zinc will be dissolved. This is the case if the rope runs for instance on a factory crane or hoist in a galvanization plant.
- Very high temperatures can weaken or even melt the zinc coating, this can happen in steel work cranes if the ropes are exposed to high heat radiation.
- Abrasive particles can destroy quite quickly the relatively soft zinc layer. This could be the case in a material handling crane processing ore or sand.

OLD PRODUCT

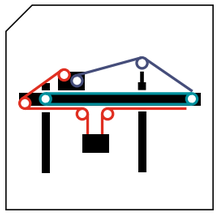
NEW PRODUCT

Based on all these findings we suggest to select galvanized ropes if the above mentioned requirements exist. This is typically the case in applications like container handling equipment (STS, straddle carrier, RTG, RMG), ship and offshore cranes and in some special high performance equipment like process cranes. There is a slightly higher price but the improved performance and corrosion resistance gives a strong argumentation in favour of galvanized ropes. For more information don't hesitate to contact the CASAR organization.

CASAR ROPES IN STS CRANES

The use of ropes in ship unloading cranes is certainly one of the most demanding tasks in a container terminal. The high time pressure in the discharge cycles requires a high speed of movement, both in picking the container as well as in the movement to the unloading point. High dynamic forces additionally burden the ropes. The most important aspect of this application is certainly the required high reliability and long life of the cables in use. Any unplanned downtime causes big problems and thus costs. Here, CASAR ropes have proven themselves in ports all over the world.

Our rope specialists analyze your system and can suggest the optimum rope for your system through their deep knowledge in order to improve your STS crane significantly.



ROPE RECOMMENDATIONS FOR STS CRANES

HOIST ROPE
CASAR TURBOPLAST
CASAR PARAPLAST
CASAR SUPERPLAST8
CASAR SUPERPLAST 10 MIX

BOOM HOIST
CASAR TURBOPLAST
CASAR PARAPLAST
CASAR SUPERPLAST8

TROLLEY
CASAR TURBOPLAST

BREAKING STRENGTH:

CASAR's double parallel rope constructions allow high breaking strength combined with an increased service life. The CASAR SUPERPLAST 10 MIX offers here the highest breaking strength.

WEAR RESISTANCE:

CASAR generally recommends compacted ropes for such heavy duty applications as the advantages of the smoother surface are significantly. Due to the increased contact surface between rope and drum/sheaves wear is reduced strongly.

BENDING CYCLES:

Due to the same length of double parallel ropes there is a perfect contact between the wires and the strands which avoids crossing points and hence improves the achievable bending cycles. Such ropes deliver a higher service life compared to standard rope designs.

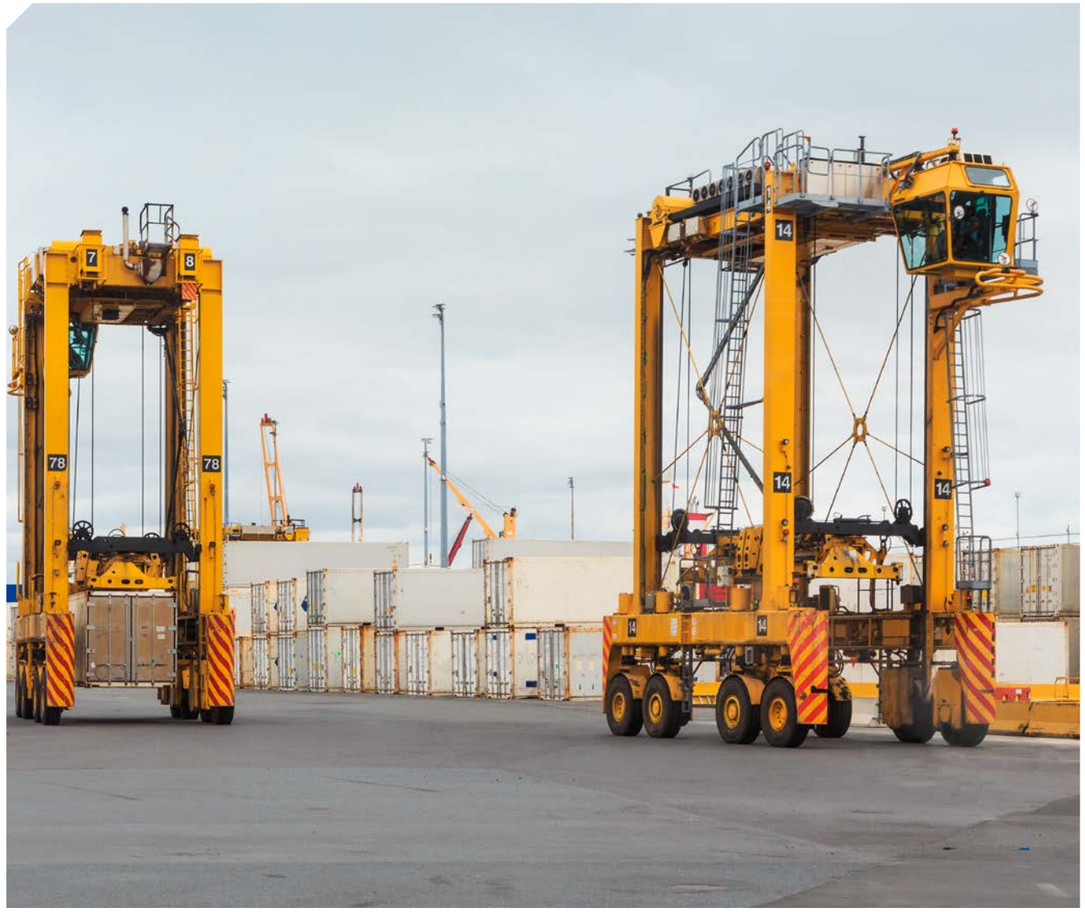
FLEXIBILITY:

A higher number of outer strands as well as a double parallel construction improve the rope's flexibility. The CASAR SUPERPLAST 10 MIX with its combination of both offers superior performance.

SHOCK LOADS:

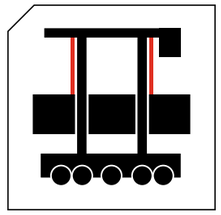
The very robust design of the CASAR TURBOPLAST delivers the highest resistance to shock loads.

	STS	TURBOPLAST	PARAPLAST	SUPERPLAST8	SUPERPLAST 10 MIX
Breaking Strength	●●	●	●●●	●●	●●●
Wear Resistance	●●	●●●	●●	●●	●●
Bending Cycles	●●●	●●	●●●	●●	●●●
Flexibility	●	●	●●	●●	●●●
Shock Loads	●●	●●●	●●	●●●	●●



CASAR ROPES IN STRADDLE CARRIERS

Even if doesn't look that way on a first glance, ropes in straddle carriers are heavily used lifting elements. Due to the very compact design of the straddle carrier a quite sophisticated system of a winch and sheaves is used to lift the container. This compactness often leads to high fleet angles especially in the upper lifting position. Here a robust and flexible rope is needed to cope with these requirements. Another challenge are the shock loads generated by the driving of the straddle carrier. The uneven ground of the harbour's driveways causes heavy vibrations in the whole system and the ropes have to act like shock absorbers. Here our CASAR TURBOPLAST offers a very good combination of a very robust rope construction along with a thick plastic layer around the core which helps dampening the shock loads. Similar to the robustness of the CASAR TURBOPLAST are the double parallel ropes CASAR PARAPLAST and CASAR SUPERPLAST 10 MIX, which are offering a higher number of bending cycles.



ROPE RECOMMENDATIONS FOR STRADDLE CARRIERS

HOIST ROPE
CASAR TURBOPLAST
CASAR PARAPLAST
CASAR SUPERPLAST 10 MIX

BREAKING STRENGTH:

CASAR's double parallel rope constructions allow high breaking strength combined with an increased service life. The CASAR SUPERPLAST 10 MIX offers here the highest breaking strength.

WEAR RESISTANCE:

CASAR generally recommends compacted ropes for such heavy duty applications as the advantages of the smoother surface are significantly. Due to the increased contact surface between rope and drum/sheaves wear is reduced strongly.

BENDING CYCLES:

Due to the same length of double parallel ropes there is a perfect contact between the wires and the strands which avoids crossing points and hence improves the achievable bending cycles. Such ropes deliver a higher service life compared to standard rope designs.

FLEXIBILITY:

A higher number of outer strands as well as a double parallel construction improve the rope's flexibility. The CASAR SUPERPLAST 10 MIX with its combination of both offers superior performance.

SHOCK LOADS:

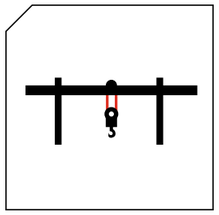
The very robust design of the CASAR TURBOPLAST delivers the highest resistance to shock loads.

	STRADDLE	TURBOPLAST	PARAPLAST	SUPERPLAST 10 MIX
Breaking Strength	●●	●	●●●	●●●
Wear Resistance	●●	●●●	●●	●●
Bending Cycles	●●	●●	●●●	●●●
Flexibility	●	●	●●	●●●
Shock Loads	●●●	●●●	●●	●●

CASAR ROPES IN PORTAL CRANES RTG AND RMG

Those portal cranes keep the ball rolling in a container terminal and are essential in the interface between the stored containers on one side and the means of transport. This can be trucks or freight trains which get the containers to their final destination inlands.

As on the STS cranes we talk here about a very frequent use with a lot of bending cycles under rough working conditions. A very proven solution comes with the CASAR TURBOPLAST which is the rope of choice in many terminals around the world. An interesting alternative which offers higher possible bending cycles is the CASAR PARAPLAST.



ROPE RECOMMENDATIONS FOR RTG / RMG

HOIST ROPE
CASAR TURBOPLAST
CASAR PARAPLAST
CASAR SUPERPLAST 10 MIX

BREAKING STRENGTH:

CASAR's double parallel rope constructions allow high breaking strength combined with an increased service life. The CASAR SUPERPLAST 10 MIX offers here the highest breaking strength.

WEAR RESISTANCE:

CASAR generally recommends compacted ropes for such heavy duty applications as the advantages of the smoother surface are significantly. Due to the increased contact surface between rope and drum/sheaves wear is reduced strongly.

BENDING CYCLES:

Due to the same length of double parallel ropes there is a perfect contact between the wires and the strands which avoids crossing points and hence improves the achievable bending cycles. Such ropes deliver a higher service life compared to standard rope designs. Double Parallel ropes as the CASAR PARAPLAST and SUPERPLAST 10 MIX are top players here.

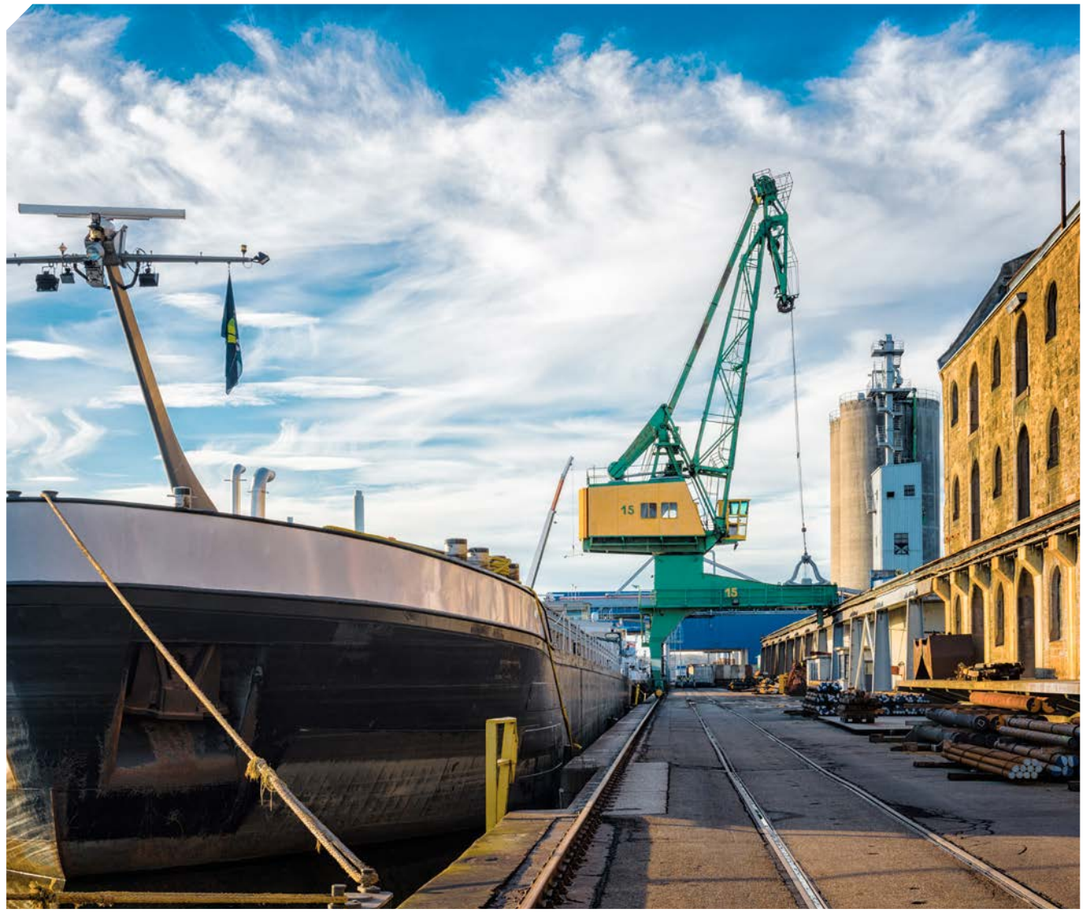
FLEXIBILITY:

A higher number of outer strands as well as a double parallel construction improve the rope's flexibility. The CASAR PARAPLAST with its combination of both offers superior performance.

SHOCK LOADS:

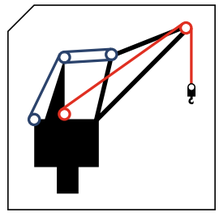
The very robust design of the CASAR TURBOPLAST delivers the highest resistance to shock loads.

	RTG/RMG	TURBOPLAST	PARAPLAST	SUPERPLAST 10 MIX
Breaking Strength	●	●	● ● ●	● ● ●
Wear Resistance	● ●	● ● ●	● ●	● ●
Bending Cycles	● ● ●	● ●	● ● ●	● ● ●
Flexibility	●	●	● ●	● ● ●
Shock Loads	● ●	● ● ●	● ●	● ●



CASAR ROPES IN HARBOUR MOBILE CRANES

Harbour mobile cranes are a very flexible lifting equipment in a harbour environment. Often they have to fullfil multiple tasks as to move containers, general cargo, bulk or assembly work in a ship yard. There are lifting ropes for the hoist work but the ropes used to offset the boom are a challenging application too. Many cranes are equipped with both CASAR TURBOPLAST for both operational areas thus providing excellent performance day by day.



ROPE RECOMMENDATIONS FOR HARBOUR MOBILE CRANES

HOIST ROPE
CASAR TURBOPLAST

BOOM HOIST
CASAR TURBOPLAST
CASAR PARAPLAST

BREAKING STRENGTH:

CASAR's double parallel rope constructions allow high breaking strength combined with an increased service life. The CASAR PARAPLAST offers here the highest breaking strength.

WEAR RESISTANCE:

CASAR generally recommends compacted ropes for such heavy duty applications as the advantages of the smoother surface are significantly. Due to the increased contact surface between rope and drum/sheaves wear is reduced strongly.

BENDING CYCLES:

Due to the same length of double parallel ropes there is a perfect contact between the wires and the strands which avoids crossing points and hence improves the achievable bending cycles. Such ropes deliver a higher service life compared to standard rope designs.

FLEXIBILITY:

A higher number of outer strands as well as a double parallel construction improve the rope's flexibility. The CASAR PARAPLAST with its combination of both offers superior performance.

SHOCK LOADS:

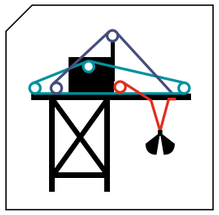
The very robust design of the CASAR TURBOPLAST delivers the highest resistance to shock loads.

	HMC	TURBOPLAST	PARAPLAST
Breaking Strength	●●	●	●●●
Wear Resistance	●●	●●●	●●
Bending Cycles	●●	●●	●●●
Flexibility	●	●	●●
Shock Loads	●●	●●●	●●

CASAR ROPES IN GRAB CRANES

Ropes in such bulk unloading applications are those with the most critical performance needs. Frequent shock loads and the permanent duty cycles demand a great deal of the ropes in use. The greatest challenge is with the hoisting ropes as they have to deal with the shock loads when the grab is falling into the ore or coal and is then activated by the hoist ropes. For this the CASAR ropes with their special plastic covered core guarantee an excellent structural stability and keeps dirt and humidity out of the rope.

ATTENTION:
Ropes used in loading terminals for iron ore have to be selected very carefully. Here CASAR offers special rope designs to cope with those specific requirements. For more info, please contact CASAR directly.



ROPE RECOMMENDATIONS FOR GRAB CRANES

HOIST ROPE
CASAR TURBOPLAST
CASAR PARAPLAST
CASAR SUPERPLAST 10 MIX

BOOM HOIST
CASAR TURBOPLAST

TROLLEY
CASAR TURBOPLAST

BREAKING STRENGTH:

CASAR's double parallel rope constructions allow high breaking strength combined with an increased service life. The CASAR SUPERPLAST 10 MIX offers here the highest breaking strength.

WEAR RESISTANCE:

CASAR generally recommends compacted ropes for such heavy duty applications as the advantages of the smoother surface are significantly. Due to the increased contact surface between rope and drum/sheaves wear is reduced strongly.

BENDING CYCLES:

Due to the same length of double parallel ropes there is a perfect contact between the wires and the strands which avoids crossing points and hence improves the achievable bending cycles. Such ropes deliver a higher service life compared to standard rope designs.

FLEXIBILITY:

A higher number of outer strands as well as a double parallel construction improve the rope's flexibility. The CASAR SUPERPLAST 10 MIX with its combination of both offers superior performance.

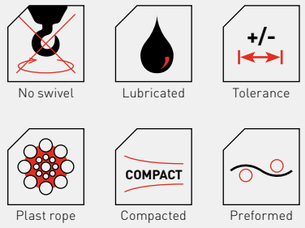
SHOCK LOADS:

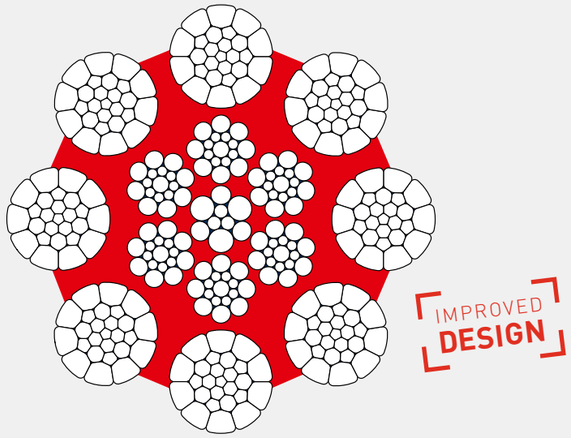
The very robust design of the CASAR TURBOPLAST delivers the highest resistance to shock loads.

	GRAB	TURBOPLAST	PARAPLAST	SUPERPLAST 10 MIX
Breaking Strength	●	●	● ●	● ● ●
Wear Resistance	● ● ●	● ● ●	● ●	● ●
Bending Cycles	● ● ●	● ●	● ● ●	● ● ●
Flexibility	●	●	● ●	● ● ●
Shock Loads	● ● ●	● ● ●	● ●	● ●

CASAR **TURBOPLAST**

PROPERTIES





Nominal Diameter		Weight		Minimum Breaking Force 1770 N/mm²				1960 N/mm²				2160 N/mm²			
mm	inch	kg/m	lb/ft	kN	t [metric]	lbs	t [2000 lbs]	kN	t [metric]	lbs	t [2000 lbs]	kN	t [metric]	lbs	t [2000 lbs]
12		0,67	0,45	117,0	11,93	26.303	13,15	130,0	13,26	29.225	14,61	144,0	14,68	32.372	16,19
	1/2	0,75	0,51	131,0	13,36	29.450	14,72	146,0	14,89	32.822	16,41	161,8	16,50	36.374	18,19
13		0,76	0,51	135,0	13,77	30.349	15,17	147,0	14,99	33.047	16,52	161,7	16,49	36.352	18,18
14		0,91	0,61	161,0	16,42	36.194	18,10	177,0	18,05	39.791	19,90	196,0	19,99	44.063	22,03
15		1,06	0,71	187,0	19,07	42.039	21,02	205,0	20,90	46.086	23,04	226,0	23,05	50.807	25,40
16	5/8	1,21	0,81	212,0	21,62	47.659	23,83	232,0	23,66	52.156	26,08	252,0	25,70	56.652	28,33
17		1,34	0,90	236,0	24,07	53.055	26,53	259,0	26,41	58.226	29,11	283,0	28,86	63.621	31,81
18		1,51	1,02	266,0	27,12	59.799	29,90	292,0	29,78	65.644	32,82	314,0	32,02	70.590	35,29
19	3/4	1,67	1,12	299,0	30,49	67.218	33,61	327,0	33,35	73.513	36,76	351,0	35,79	78.908	39,45
20		1,87	1,26	329,0	33,55	73.962	36,98	361,0	36,81	81.156	40,58	391,0	39,87	87.900	43,95
21		2,04	1,37	359,0	36,61	80.706	40,35	394,0	40,18	88.575	44,29	421,0	42,93	94.645	47,32
22		2,23	1,50	401,0	40,89	90.148	45,07	439,0	44,77	98.691	49,35	468,0	47,72	105.211	52,61
	7/8	2,25	1,51	410,0	41,81	92.172	46,09	449,0	45,79	100.939	50,47	478,0	48,74	107.459	53,73
23		2,44	1,64	436,0	44,46	98.017	49,01	478,0	48,74	107.459	53,73	511,0	52,11	114.877	57,44
24		2,66	1,78	464,5	47,37	104.424	52,21	514,3	52,44	115.619	57,81	556,0	56,70	124.994	62,50
25		2,84	1,91	516,0	52,62	116.001	58,00	566,0	57,72	127.242	63,62	602,0	61,39	135.335	67,67
	1	2,92	1,96	533,4	54,39	119.913	59,96	584,6	59,61	131.423	65,71	621,6	63,39	139.741	69,87
26		3,13	2,11	562,0	57,31	126.343	63,17	616,0	62,82	138.482	69,24	655,0	66,79	147.250	73,62
27		3,38	2,27	599,0	61,08	134.661	67,33	657,0	67,00	147.699	73,85	702,0	71,58	157.816	78,91
28		3,60	2,42	645,0	65,77	145.002	72,50	707,0	72,09	158.940	79,47	748,0	76,28	168.157	84,08
	1 1/8	3,79	2,55	671,9	68,52	151.049	75,52	736,5	75,10	165.572	82,79	779,2	79,46	175.171	87,59
29		3,87	2,60	695,0	70,87	156.242	78,12	760,0	77,50	170.855	85,43	807,0	82,29	181.421	90,71
30		4,15	2,79	745,0	75,97	167.483	83,74	813,0	82,90	182.770	91,38	871,0	88,82	195.809	97,90
31		4,44	2,98	796,0	81,17	178.948	89,47	869,0	88,61	195.359	97,68	930,0	94,83	209.072	104,54
32	1 1/4	4,75	3,19	848,0	86,47	190.638	95,32	938,0	95,65	210.871	105,44	988,0	100,75	222.111	111,06
33		5,06	3,40	897,0	91,47	201.654	100,83	979,0	99,83	220.088	110,04	1.059,0	107,99	238.073	119,04
34		5,36	3,60	959,0	97,79	215.592	107,80	1.055,0	107,58	237.173	118,59	1.114,0	113,60	250.437	125,22
35	1 3/8	5,66	3,81	1.012,3	103,23	227.574	113,79	1.113,9	113,59	250.415	125,21	1.175,7	119,89	264.308	132,15
36		5,95	4,00	1.066,0	108,70	239.646	119,82	1.164,0	118,70	261.678	130,84	1.242,0	126,65	279.213	139,61
38	1 1/2	6,68	4,49	1.192,0	121,55	267.972	133,99	1.301,0	132,67	292.476	146,24	1.395,0	142,25	313.608	156,80
40		7,40	4,97	1.317,0	134,30	296.073	148,04	1.438,0	146,64	323.275	161,64	1.552,0	158,26	348.903	174,45
	1 5/8	7,88	5,29	1.402,3	143,00	315.249	157,62	1.531,1	156,13	344.212	172,11	1.652,5	168,51	371.500	185,75
42		8,11	5,45	1.457,0	148,57	327.547	163,77	1.591,0	162,24	357.671	178,84	1.694,0	172,74	380.826	190,41
44		8,96	6,02	1.593,0	162,44	358.121	179,06	1.739,0	177,33	390.943	195,47	1.873,0	190,99	421.067	210,53
	1 3/4	9,08	6,10	1.626,5	165,86	365.652	182,83	1.775,5	181,05	399.148	199,57	1.911,0	194,87	429.610	214,80
46		9,78	6,57	1.755,0	178,96	394.540	197,27	1.916,0	195,38	430.734	215,37	2.042,0	208,23	459.060	229,53
48	1 7/8	10,65	7,16	1.905,0	194,26	428.261	214,13	2.079,0	212,00	467.378	233,69	2.225,0	226,89	500.200	250,10
50		11,57	7,77	2.036,0	207,62	457.711	228,86	2.265,0	230,97	509.192	254,60	2.423,0	247,08	544.712	272,36

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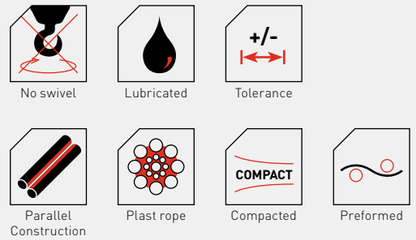
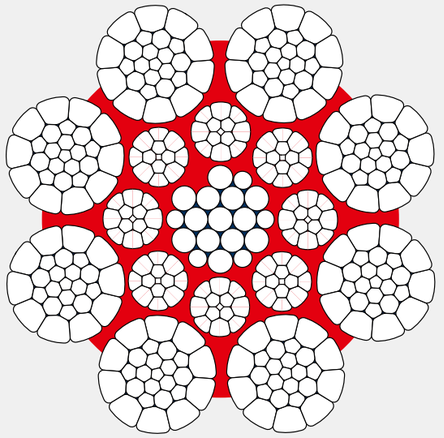
PROPERTIES





Very High Breaking Force

Nominal Diameter		Weight		Minimum Breaking Force 1960 N/mm²				2160 N/mm²			
mm	inch	kg/m	lb/ft	kN	t [metric]	lbs	t [2000 lbs]	kN	t [metric]	lbs	t [2000 lbs]
12		0,72	0,48	137,2	13,99	30.844	15,42	147,8	15,07	33.227	16,61
	1/2	0,80	0,54	152,4	15,54	34.261	17,13	164,1	16,73	36.891	18,45
13		0,83	0,56	159,7	16,29	35.902	17,95	172,0	17,54	38.667	19,33
14		0,96	0,65	184,8	18,84	41.545	20,77	199,0	20,29	44.737	22,37
15		1,12	0,75	212,3	21,65	47.727	23,86	228,6	23,31	51.391	25,70
16	5/8	1,27	0,86	240,4	24,51	54.044	27,02	258,9	26,40	58.203	29,10
17		1,42	0,96	273,3	27,87	61.440	30,72	294,4	30,02	66.184	33,09
18		1,61	1,08	304,3	31,03	68.409	34,20	327,7	33,42	73.670	36,83
19	3/4	1,78	1,20	342,0	34,87	76.885	38,44	368,4	37,57	82.820	41,41
20		2,01	1,35	379,7	38,72	85.360	42,68	408,9	41,70	91.924	45,96
21		2,20	1,48	414,7	42,29	93.228	46,61	446,6	45,54	100.400	50,20
22		2,40	1,61	456,8	46,58	102.693	51,35	491,9	50,16	110.583	55,29
	7/8	2,44	1,64	466,1	47,53	104.783	52,39	502,0	51,19	112.854	56,43
23		2,64	1,77	517,1	52,73	116.249	58,12	556,9	56,79	125.196	62,60
24		2,87	1,93	561,8	57,29	126.298	63,15	605,0	61,69	136.009	68,00
25		3,11	2,09	609,0	62,10	136.909	68,45	655,9	66,88	147.452	73,73
	1	3,18	2,13	628,7	64,11	141.337	70,67	677,1	69,05	152.218	76,11
26		3,38	2,27	662,2	67,53	148.868	74,43	713,1	72,72	160.311	80,16
27		3,63	2,44	711,0	72,50	159.839	79,92	765,8	78,09	172.159	86,08
28		3,89	2,61	760,6	77,56	170.990	85,49	819,1	83,53	184.141	92,07
	1 1/8	4,08	2,74	792,2	80,78	178.094	89,05	853,1	86,99	191.784	95,89
29		4,18	2,81	820,3	83,65	184.411	92,21	883,5	90,09	198.619	99,31
30		4,49	3,02	884,0	90,14	198.731	99,37	952,0	97,08	214.018	107,01
31		4,78	3,21	821,4	83,76	184.658	92,33	1.003,6	102,34	225.618	112,81
32	1 1/4	5,11	3,43	978,3	99,76	219.931	109,97	1.065,6	108,66	239.556	119,78
33		5,45	3,66	1.042,5	106,31	234.363	117,18	1.135,6	115,80	255.293	127,65
34		5,75	3,86	1.097,0	111,86	246.615	123,31	1.194,9	121,85	268.624	134,31
35	1 3/8	6,11	4,11	1.163,9	118,69	261.655	130,83	1.267,7	129,27	284.990	142,50
36		6,42	4,32	1.233,8	125,81	277.369	138,68	1.343,9	137,04	302.121	151,06
38	1 1/2	7,20	4,84	1.377,2	140,44	309.607	154,80	1.500,1	152,97	337.236	168,62
40		7,98	5,36	1.533,5	156,38	344.744	172,37	1.670,3	170,32	375.498	187,75
	1 5/8	8,38	5,63	1.632,8	166,50	367.068	183,53	1.778,5	181,36	399.823	199,91
42		8,78	5,90	1.680,1	171,32	377.701	188,85	1.830,1	186,62	411.423	205,71
44		9,64	6,48	1.851,4	188,79	416.211	208,11	2.016,6	205,64	453.350	226,67
	1 3/4	9,77	6,56	1.889,5	192,68	424.776	212,39	2.058,1	209,87	462.679	231,34
46		10,54	7,08	2.022,8	206,27	454.743	227,37	2.203,3	224,68	495.321	247,66
48	1 7/8	11,46	7,70	2.202,0	224,54	495.029	247,51	2.398,5	244,58	539.204	269,60
50		12,52	8,41	2.365,3	241,20	531.740	265,87	2.576,4	262,72	579.198	289,60

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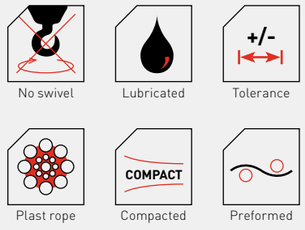
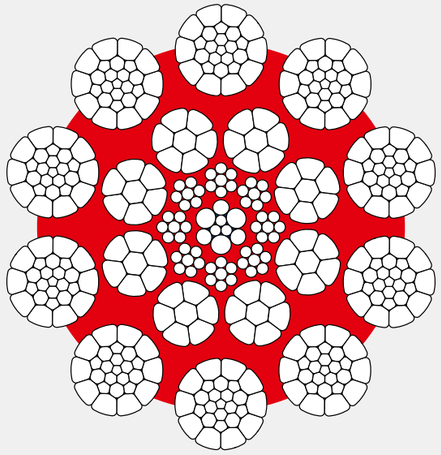
CASAR **SUPERPLAST8**

PROPERTIES





Nominal Diameter		Weight		Minimum Breaking Force 1960 N/mm²				Minimum Breaking Force 2160 N/mm²			
mm	inch	kg/m	lb/ft	kN	t [metric]	lbs	t [2000 lbs]	kN	t [metric]	lbs	t [2000 lbs]
12		0,69	0,46	127,0	12,95	28.551	14,28	139,0	14,17	31.248	15,62
	1/2	0,77	0,52	142,2	14,51	31.979	15,99	155,7	15,88	35.000	17,50
13		0,81	0,54	152,0	15,50	34.171	17,09	166,0	16,93	37.318	18,66
14		0,93	0,62	174,0	17,74	39.117	19,56	190,0	19,37	42.714	21,36
15		1,07	0,72	200,0	20,39	44.962	22,48	219,0	22,33	49.233	24,62
16	5/8	1,22	0,82	227,0	23,15	51.032	25,52	248,0	25,29	55.753	27,88
17		1,39	0,93	260,0	26,51	58.450	29,23	285,0	29,06	64.071	32,04
18		1,56	1,05	293,0	29,88	65.869	32,93	321,0	32,73	72.164	36,08
19	3/4	1,74	1,17	320,0	32,63	71.939	35,97	351,0	35,79	78.908	39,45
20		1,93	1,30	358,0	36,51	80.482	40,24	395,0	40,28	88.800	44,40
21		2,12	1,43	395,0	40,28	88.800	44,40	436,0	44,46	98.017	49,01
22		2,33	1,56	432,0	44,05	97.117	48,56	474,0	48,34	106.559	53,28
	7/8	2,37	1,59	440,9	44,96	99.114	49,56	483,7	49,33	108.750	54,38
23		2,54	1,71	473,0	48,23	106.335	53,17	518,2	52,84	116.496	58,25
24		2,78	1,86	517,4	52,76	116.316	58,16	566,9	57,81	127.444	63,72
25		3,00	2,02	559,6	57,06	125.803	62,90	613,4	62,55	137.898	68,95
	1	3,10	2,08	577,7	58,90	129.861	64,93	633,2	64,57	142.346	71,17
26		3,24	2,18	604,9	61,68	135.987	67,99	662,7	67,58	148.981	74,49
27		3,48	2,34	646,8	65,96	145.406	72,70	708,6	72,26	159.300	79,65
28		3,74	2,51	698,9	71,27	157.119	78,56	762,0	77,70	171.304	85,65
	1 1/8	3,89	2,62	727,9	74,23	163.638	81,82	793,6	80,93	178.412	89,21
29		3,99	2,68	737,8	75,24	165.864	82,93	808,3	82,42	181.713	90,86
30		4,28	2,88	796,8	81,25	179.128	89,56	872,9	89,01	196.236	98,12
31		4,53	3,04	846,7	86,34	190.346	95,17	927,5	94,58	208.510	104,26
32	1 1/4	4,86	3,27	925,9	94,42	208.151	104,08	1.014,3	103,43	228.024	114,01
33		5,19	3,49	968,4	98,75	217.705	108,85	1.060,9	108,18	238.500	119,25
34		5,58	3,75	1.046,0	106,66	235.150	117,58	1.145,9	116,85	257.609	128,80
35	1 3/8	5,89	3,96	1.103,7	112,55	248.122	124,06	1.209,1	123,30	271.816	135,91
36		6,26	4,21	1.172,5	119,56	263.588	131,79	1.284,5	130,98	288.767	144,38
38	1 1/2	6,87	4,62	1.282,5	130,78	288.317	144,16	1.405,0	143,27	315.857	157,93
40		7,67	5,15	1.429,3	145,75	321.319	160,66	1.565,8	159,67	352.006	176,00
	1 5/8	8,17	5,49	1.521,9	155,19	342.130	171,06	1.667,2	170,01	374.804	187,40
42		8,45	5,68	1.581,5	161,27	355.535	177,77	1.732,6	176,68	389.504	194,75
44		9,24	6,21	1.725,8	175,98	387.975	193,99	1.890,7	192,80	425.046	212,52
	1 3/4	9,43	6,33	1.761,3	179,60	395.952	197,98	1.929,6	196,76	433.785	216,89
46		10,25	6,89	1.899,3	193,68	426.980	213,49	2.080,7	212,17	467.760	233,88
48	1 7/8	11,08	7,44	2.068,9	210,97	465.107	232,55	2.266,6	231,13	509.552	254,78
50		11,95	8,03	2.232,3	227,63	501.841	250,92	2.445,5	249,37	549.770	274,89

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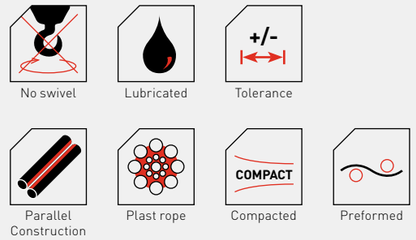
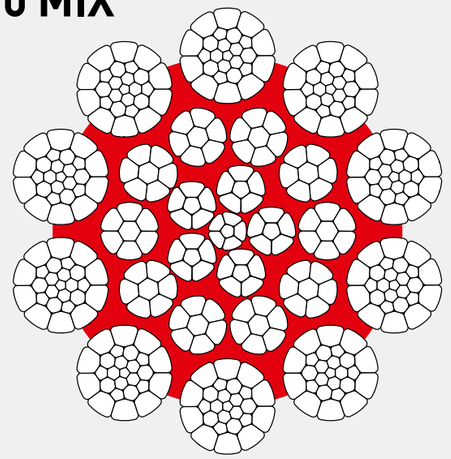
CASAR **SUPERPLAST10 MIX**

PROPERTIES





High Breaking Force

Nominal Diameter		Weight		Minimum Breaking Force 1960 N/mm²				Minimum Breaking Force 2160 N/mm²			
mm	inch	kg/m	lb/ft	kN	t [metric]	lbs	t [2000 lbs]	kN	t [metric]	lbs	t [2000 lbs]
16	5/8	1,24	0,83	237,0	24,17	53.280	26,64	259,0	26,41	58.226	29,11
17		1,42	0,95	270,0	27,53	60.698	30,35	291,0	29,67	65.419	32,71
18		1,53	1,03	301,0	30,69	67.667	33,83	328,0	33,45	73.737	36,87
19	3/4	1,87	1,25	344,0	35,08	77.334	38,67	375,0	38,24	84.303	42,15
20		2,03	1,36	377,0	38,44	84.753	42,38	406,0	41,40	91.272	45,64
21		2,16	1,45	412,0	42,01	92.621	46,31	449,0	45,79	100.939	50,47
22		2,43	1,63	465,0	47,42	104.536	52,27	507,0	51,70	113.978	56,99
	7/8	2,51	1,69	474,6	48,40	106.694	53,35	519,7	53,00	116.833	58,42
23		2,65	1,78	507,0	51,70	113.978	56,99	546,0	55,68	122.746	61,37
24		2,89	1,94	553,0	56,39	124.319	568,70	602,0	61,39	135.335	67,67
25		3,11	2,09	594,0	60,57	133.536	66,77	647,0	65,98	145.451	72,73
	1	3,29	2,21	613,2	62,53	137.853	68,93	670,8	68,40	150.802	75,40
26		3,37	2,27	645,0	65,77	145.002	72,50	695,0	70,87	156.242	78,12
27		3,63	2,44	692,0	70,57	155.568	77,78	754,0	76,89	169.506	84,75
28		3,96	2,66	757,0	77,19	170.180	778,40	825,0	84,13	185.467	92,73
	11/8	4,16	2,79	788,4	80,40	177.239	88,62	863,2	88,02	194.055	97,03
29		4,23	2,84	808,0	82,39	181.646	90,82	871,0	88,82	195.809	97,90
30		4,44	2,99	847,0	86,37	190.413	95,21	923,0	94,12	207.499	103,75
31		4,77	3,20	913,0	93,10	205.251	102,63	994,0	101,36	223.460	111,73
32	1 1/4	5,13	3,45	982,0	100,14	220.762	110,38	1.057,0	107,79	237.623	118,81
33		5,41	3,64	1.036,0	105,64	232.902	116,45	1.129,0	115,13	253.809	126,90
34		5,65	3,79	1.106,0	112,78	248.639	124,32	1.205,0	122,88	270.895	135,45
35	1 3/8	6,12	4,11	1.167,0	119,00	262.352	131,18	1.277,4	130,26	287.171	143,59
36		6,45	4,34	1.235,0	125,94	277.639	138,82	1.330,0	135,62	298.996	149,50
38	1 1/2	7,16	4,81	1.369,0	139,60	307.763	153,88	1.492,0	152,14	335.415	167,71
40		7,91	5,31	1.496,0	152,55	336.314	168,16	1.621,0	165,30	364.415	182,21
	1 5/8	8,68	5,83	1.592,9	162,43	358.098	179,05	1.733,3	176,75	389.661	194,83
42		8,75	5,88	1.654,0	168,66	371.834	185,92	1.792,0	182,74	402.858	201,43
44		9,62	6,47	1.820,0	185,59	409.152	204,58	1.972,0	201,09	443.323	221,66
	1 3/4	10,10	6,78	1.857,4	189,40	417.560	208,78	2.020,9	206,08	454.316	227,16
46		10,53	7,08	1.985,0	202,42	446.246	223,12	2.150,0	219,24	483.339	241,67
48	1 7/8	11,51	7,74	2.176,0	221,89	489.184	244,59	2.356,0	240,25	529.650	264,82
50		12,43	8,35	2.350,0	239,64	528.301	264,15	2.546,0	259,62	572.363	286,18

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