Hydraulik
Technik

HTec PRO series

HTec PRO.V.1

HTec PRO.P.1

HTec PRO.K.1

HTec PRO.S.1

HTec PRO.L.1

HTec PRO.C.1

Hydraulic cylinders the HTec way

Why change an already good product?

Our customers are increasingly calling for longer wear intervals so as to increase the cost effectiveness of their machines and equipment.

Hydraulic cylinders are frequently exposed to extremely high mechanical and abrasive stresses.

This applies particularly to equipment operating in the potash and salt industry, in the surface and underground mining sector, in stone quarries, in iron and steel works, at power stations and in the offshore industry.

As manufacturers and maintenance engineers we have made it our mission to develop advanced hydraulic cylinders for applications of this kind.

In collaboration with leading developers in the field of materials technology we have succeeded in achieving something of a breakthrough in this area.

HTec hydraulic cylinders are manufactured using a combination of new materials and also have a special surface coating.

Because of their outstanding environmental performance the materials we use have a wide range of applications, for example in the foodstuffs industry.

The new HTec materials have been extensively examined and tested by RWTH (the Rhine-Westphalia Technical University) and found to exhibit a Vickers hardness of over 1700 (HV).

This corresponds to a Rockwell value of more than 80 HRC.

This conversion should be regarded as a comparative rating only, as the Rockwell value (HRC) is one of the most commonly used units for measuring the hardness of industrial materials at international level. The conversion table is in fact only used up to a value of 68 Rockwell (HRC), which is equivalent to 980 Vickers (HV).

All the coatings are extremely corrosion resistant and the resulting surface finish is not prone to flaking or peeling.

Other advantages include the materials' outstanding slip and emergency running characteristics, all of which effectively spells the end of pitting, sticking and seizing problems.

Our products are available in the following dimensions, according to the type of application and matching HTec version:

Piston diameter	:	Ø 20 to 1000 mm up to a length of 3000 mm
Piston rod diameter	:	Ø 10 to 1200 mm up to a length of 8000 mm

We would also be glad to follow up requests for other design dimensions.

Our products can be employed in an ambient temperature range of –50° C to +600° C.

HTec materials and coating combinations can be used in conjunction with all current hydraulic oils and fluids:

- mineral-based oils (H, HL, HLP, HVLP)
- fire-resistant fluids (HFA, HFB, HFC)
and - environment-friendly hydraulic fluids (HETG, HEPG, HEES, HEPR)

Water can also be used as the operating medium.

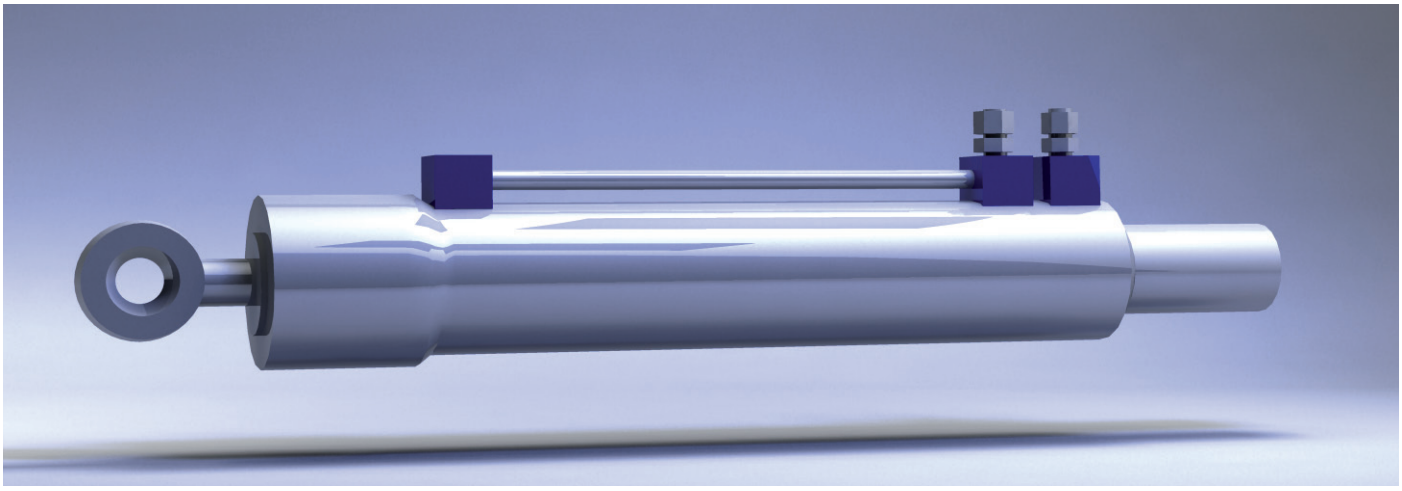
HTec components are suitable for operating pressures of up to 720 bar (72 MPa).

As well as being used in the manufacture of hydraulic cylinders HTec materials can also be employed on many other components that are subject to increased levels of mechanical and corrosive stress, such as bushings, pins and rollers.

No matter what the application, there will always be the right material combination to be found among the HTec range of products.

HTec products can be used in various applications:

Aluminium works	Rock engineering	Mobile technology
Plant engineering	Iron and steel industry	Offshore applications
Underground mining	Power stations	Papermaking
Cement works and quarries	Foodstuffs industry	Hydraulic presses
Chemicals	Mecanical engineering	Opencast mining



We have carried out a number of tests in-house in order to demonstrate the performance and resilience of HTec materials.

One of the tests in this series was carried out on a hydraulic cylinder with the special HTec PRO.V.1 surface coating combined with the core materials HTec N58V, HTec S48V and HTec F20W.

In this case the following cylinder components were replaced with HTec parts:

- Piston rod

one-piece; forged, manufactured in HTec N58V material,
combined with special coating HTec PRO.V.1

Advantage:

The HTec PRO.V.1 coating gives the piston rod a surface hardness of >1700 Vickers (HV).

The use of HTec N58V material greatly improves the overall performance of the piston rod, see Material Review table.

The area around the piston-rod eye is also much less prone to deformation (which is usually caused by the eye becoming worn out).

- Cylinder barrel

Manufactured from HTec F20W material,
internally coated with HTec PRO.V.1

Advantage:

Using HTec PRO.V.1 for the surface coating gives the inner surface of the cylinder barrel a hard ness rating of >1700 Vickers (HV).

- Cylinder base

Manufactured from HTec S48V material

Advantage:

Using HTec S48V material increases the strength of the cylinder base and makes it much less prone to deformation (caused by wear to the bottom eye).

- piston, piston halves,
- piston and piston-rod guides,
- guide bushings and bearing bushes

manufactured from HTec F20W material combined with a special HTec PRO.V.1 coating

Advantage:

Using HTec F20W material in combination the HTec PRO.V.1 coating gives the parts a hardness rating of >1700 Vickers (HV)

The investigations were carried out on our test bench under normal operating conditions:

- test pressure 300 bar
- oil temperature max. 80° C
- operating medium hydraulic oil type HLP 46, filtered at 20 µm

The test phase lasted 90 days, in the course of which the hydraulic cylinder completed more than 1 million strokes.

The cylinder and associated components were stripped down after approximately 500,000 strokes in order to examine the state of wear.

Findings:

There were no signs of wear and tear, score marks or any other form of damage.

The seals were also no more affected by the test than usual.

After the inspection had been completed the cylinder was re-assembled and connected back up to the bench.

Test run record
Hydraulic cylinder

Day	Stroke/ min	Stroke/ h.	Stroke/ day	Hours	Day	Stroke/ min	Stroke/ h.	Stroke/ day	Hours	Day	stroke/ min	stroke/ h.	Stroke/ day	Hours
1	8	480	9600	20	**Übertrag**			343.680	716	**Übertrag**			685.440	1.428
2	8	480	11520	24	31	8	480	11520	24	61	8	480	11520	24
3	8	480	11520	24	32	8	480	11520	24	62	8	480	11520	24
4	8	480	11520	24	33	8	480	11520	24	63	8	480	11520	24
5	8	480	11520	24	34	8	480	11520	24	64	8	480	11520	24
6	8	480	11520	24	35	8	480	11520	24	65	8	480	11520	24
7	8	480	11520	24	36	8	480	11520	24	66	8	480	11520	24
8	8	480	11520	24	37	8	480	11520	24	67	8	480	11520	24
9	8	480	11520	24	38	8	480	11520	24	68	8	480	11520	24
10	8	480	11520	24	39	8	480	11520	24	69	8	480	11520	24
11	8	480	11520	24	40	8	480	11520	24	70	8	480	11520	24
12	8	480	11520	24	41	8	480	11520	24	71	8	480	11520	24
13	8	480	11520	24	42	8	480	11520	24	72	8	480	11520	24
14	8	480	11520	24	43	8	480	11520	24	73	8	480	11520	24
15	8	480	11520	24	44*	8	480	7680	16	74	8	480	11520	24
16	8	480	11520	24	45	8	480	11520	24	75	8	480	11520	24
17	8	480	11520	24	46	8	480	11520	24	76	8	480	11520	24
18	8	480	11520	24	47	8	480	11520	24	77	8	480	11520	24
19	8	480	11520	24	48	8	480	11520	24	78	8	480	11520	24
20	8	480	11520	24	49	8	480	11520	24	79	8	480	11520	24
21	8	480	11520	24	50	8	480	11520	24	80	8	480	11520	24
22	8	480	11520	24	51	8	480	11520	24	81	8	480	11520	24
23	8	480	11520	24	52	8	480	11520	24	82	8	480	11520	24
24	8	480	11520	24	53	8	480	11520	24	83	8	480	11520	24
25	8	480	11520	24	54	8	480	11520	24	84	8	480	11520	24
26	8	480	11520	24	55	8	480	11520	24	85	8	480	11520	24
27	8	480	11520	24	56	8	480	11520	24	86	8	480	11520	24
28	8	480	11520	24	57	8	480	11520	24	87	8	480	11520	24
29	8	480	11520	24	58	8	480	11520	24	88	8	480	11520	24
30	8	480	11520	24	59	8	480	11520	24	89	8	480	11520	24
					60	8	480	11520	24	90	8	480	11520	24
			343.680	**716**				**685.440**	**1.428**				**1.031.040**	**2.148**

* After 501.120 strokes of the cylinder was removed - nothing found

In a second test we then investigated how a standard set-up performed in relation to the HTec version under identical conditions.

The test arrangement comprised a cylinder barrel 300 mm in length, in half-shell form, and a piston of 60 mm width, in the following combinations:

half-shell: St52, piston: St52
half-shell: St52, piston: bronze
and half-shell: HTec, piston: HTec.

The piston was moved to and fro in the barrels by means of a cam mechanism and at a speed of 80 strokes/min.

In order to accelerate the ageing process each run was carried out as a fatigue test, without the use of lubricants and at normal room temperature. The test was only terminated after the failure or destruction of the test combination.

Results of the individual test runs:

Standard product – half-shell: St52, piston: St52

The test with this combination had to be interrupted after about 12,000 strokes because of severe scoring in the cylinder barrel and on the piston.

Standard product – half-shell: St52, piston: bronze

The test with this combination had to be terminated after about 36,000 strokes because of severe scoring in the cylinder barrel and on the piston.

HTec test set-up:

After nearly 14 days and more than 1.5 million strokes, which corresponds to about 300 hours of operation, there were no discernible or measurable signs of wear and tear.

In order to expose the HTec set-up to even higher stress levels a mixture of quartz sand and oil with a particle size of between 0.5 and 0.8 mm was introduced between the cylinder barrel and the piston after the 14th day of the test.

Some of the quartz sand and oil mixture was pushed back and forwards by the piston, but most of it remained beneath the piston and was pulverised to a very fine size.

A fresh mixture was inserted every day in order to maintain the grinding properties of the quartz sand.

This had the effect of permanently simulating a very high level of contamination.

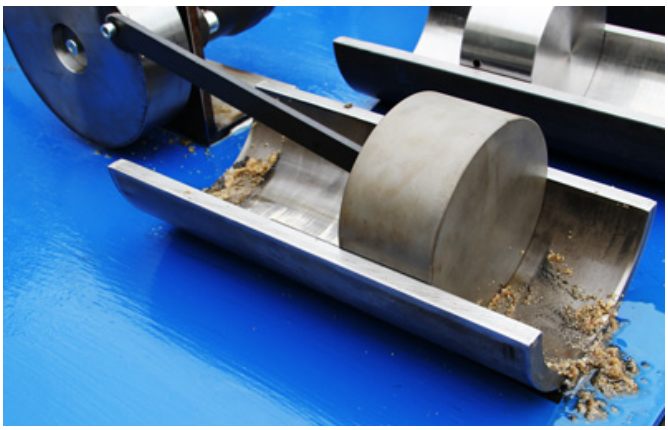
This particular test phase lasted 31 days, which made the entire test duration 45 days in total.

The HTec combination was in action for a total operating period of more than 6.6 million strokes.

To date this set-up has displayed no discernible or measurable signs of wear.

There were no signs of scoring or any other form of damage to the cylinder barrel and piston.

Cylinder barrel as half-shell St 52 on St 52				
Tag	**Hub/min**	**Hub/Std**	**Hub/Tag**	**Stunden**
1	80	4.800	12.000	2,5
			12.000	2,5



Cylinder barrel as half-shell St52 on bronze				
Tag	**Hub/min**	**Hub/Std**	**Hub/Tag**	**Stunden**
1	80	4.800	36.000	7,5
			36.000	7,5

Cylinder barrel as half-shell HTec format				
Tag	**Hub/min**	**Hub/Std**	**Hub/Tag**	**Stunden**
1	80	4.800	48.000	10
2	80	4.800	115.200	24
3	80	4.800	115.200	24
4	80	4.800	115.200	24
5	80	4.800	115.200	24
6	80	4.800	115.200	24
7	80	4.800	115.200	24
8	80	4.800	115.200	24
9	80	4.800	115.200	24
10	80	4.800	115.200	24
11	80	4.800	115.200	24
12	80	4.800	115.200	24
13	80	4.800	115.200	24
14*	80	4.800	115.200	24
15	80	4.800	33600	7
16	80	4.800	115.200	24
17	80	4.800	115.200	24
18	80	4.800	115.200	24
19	80	4.800	115.200	24
20	80	4.800	115.200	24
21	80	4.800	115.200	24
22	80	4.800	115.200	24
23	80	4.800	115.200	24
24	80	4.800	115.200	24
25	80	4.800	115.200	24
26	80	4.800	115.200	24
27	80	4.800	115.200	24
28	80	4.800	115.200	24
29	80	4.800	115.200	24
30	80	4.800	115.200	24
31	80	4.800	115.200	24
32	80	4.800	115.200	24
33	80	4.800	115.200	24
34	80	4.800	115.200	24
35	80	4.800	115.200	24
36	80	4.800	115.200	24
37	80	4.800	115.200	24
38	80	4.800	115.200	24
39	80	4.800	115.200	24
40	80	4.800	115.200	24
41	80	4.800	115.200	24
42	80	4.800	115.200	24
43	80	4.800	115.200	24
44	80	4.800	115.200	24
45	80	4.800	115.200	24
			6.648.000	1.385

After the 14th day the trial was under Introduction of quartz sand continued.

For every application the right solution - We combine these to your needs

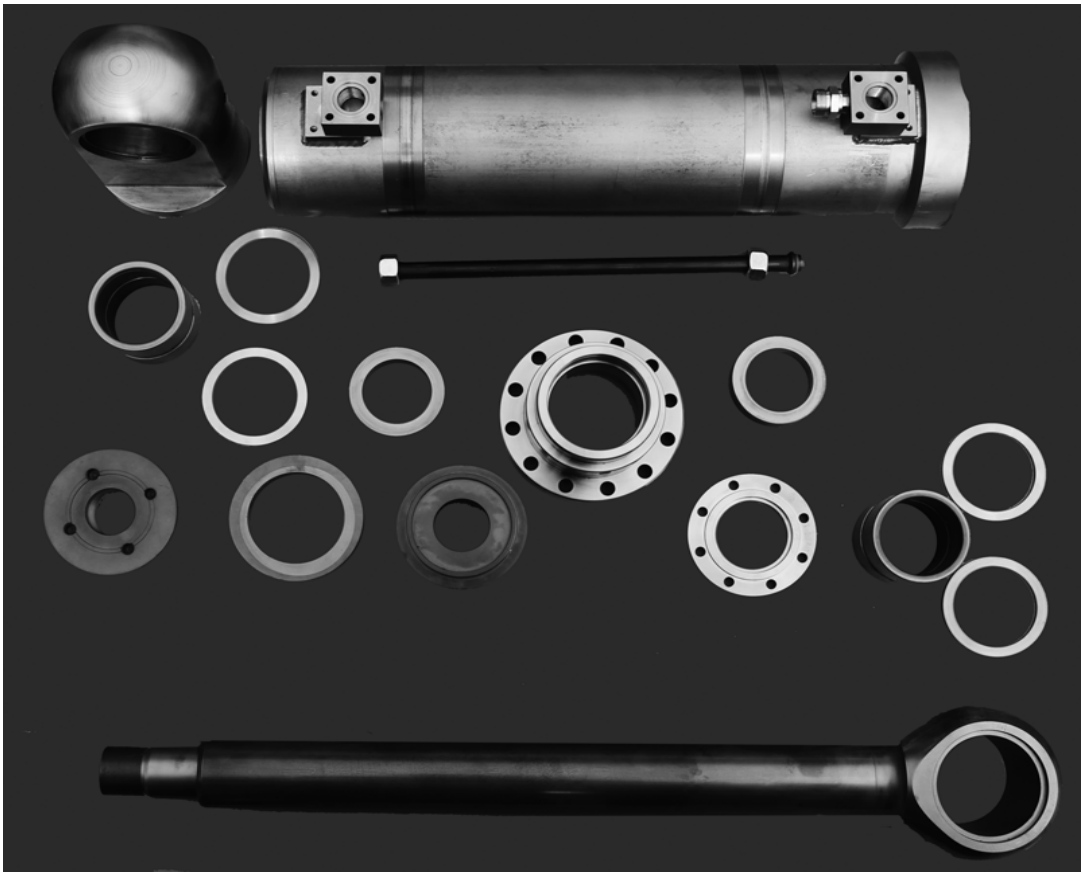
Assembly	Material	Coating					
		PRO.V.1	PRO.P.1	PRO.K.1	PRO.L.1	PRO.S.1	PRO.C.1
Cylinder tube	D81V				x	x	
	E38B		x	x			
	E78F		x	x			
	F20W	x					
Piston rod	D81V				x		
	E38B		x	x			x
	E78F		x	x			x
	F20W	x				x	x
	N58V	x				x	x
	P67V	x	x			x	x
	S48V	x				x	x
	T77V		x	x			
Guide element	D81V				x	x	
	F20W	x					
	N58V	x					
	S48V	x					
	T77V		x	x			
Piston	D81V				x	x	
	E38B		x	x			
	E78F		x	x			
	F20W	x				x	
	N58V	x				x	
	P67V	x				x	
	S48V	x				x	
	T77V		x	x			
Bushing	D81V				x	x	
	E38B		x	x			
	E78F		x	x			
	F20W	x				x	
	N58V	x				x	
	P67V	x	x			x	
	S48V	x				x	
	T77V		x	x			
Pin	D81V				x	x	
	E38B		x	x			
	E78F		x	x			
	F20W	x				x	
	N58V	x				x	
	P67V	x	x			x	
	S48V	x				x	
	T77V		x	x			
Base/con-rod head	D81V				x	x	
	E38B		x	x			
	E78F		x	x			
	F20W	x				x	
	N58V	x				x	
	P67V	x	x			x	
	S48V	x				x	
	T77V		x	x			

Material Overview

HTec system

Material	D81V	E38B	E78F	F20W	N58V	P67V	S48V	T77V
Layer thickness	> 60 µm	> 60 µm	> 60 µm	> 60 µm	> 60 µm	> 60 µm	> 60 µm	> 60 µm
Tolerance	ISO 7-8	ISO 7-8	ISO 7-8	ISO 7-8	ISO 7-8	ISO 7-8	ISO 7-8	ISO 7-8
Surface roughness [Ra]	max 0,25 µm	max 0,25 µm	max 0,25 µm	max 0,25 µm	max 0,25 µm	max 0,25 µm	max 0,25 µm	max 0,25 µm
Roundness	1/2 Toleranz	1/2 Toleranz	1/2 Toleranz	1/2 Toleranz	1/2 Toleranz	1/2 Toleranz	1/2 Toleranz	1/2 Toleranz
Bearing surface	Mr ≥ 50%	Mr ≥ 50%	Mr ≥ 50%	Mr ≥ 50%	Mr ≥ 50%	Mr ≥ 50%	Mr ≥ 50%	Mr ≥ 50%
Micro cracks	300 - 600	300 - 600	300 - 600	300 - 600	300 - 600	300 - 600	300 - 600	300 - 600
Hardness [Vickers (HV)]	>800	>1200	>1200	>1400	>1700	>1700	>450	> 1400
Straightness	≤ 0,1 / 1000	≤ 0,1 / 1000	≤ 0,1 / 1000	≤ 0,1 / 1000	≤ 0,1 / 1000	≤ 0,1 / 1000	≤ 0,1 / 1000	≤ 0,1 / 1000
Temperature resistance	> 600 °C	450 °C	450 °C	> 600 °C	> 600 °C	> 600 °C	450 °C	450 °C
Tensile strength Rm [N/mm²]	600 - 700	530 - 680	540 - 690	550 - 600	1100 - 1350	950 - 1050	900 - 1200	900 - 1200
Yield strength Re [N/mm²]	480 - 560	380 - 450	380 - 450	370 - 490	770 - 945	800 - 890	500 - 900	760 - 1000

The use of HTec components as a basis for the ongoing development of hydraulic cylinders and various other parts will make a major contribution to cost efficiency.



Hydraulic cylinder components based on the HTec system

As well as significantly extending the service life of machines and equipment the HTec system can reduce the cost of machine stoppages and production downtime and the expenses associated with spare parts maintenance and personnel deployment.

This also makes for significant reductions in the follow-up costs for incidental repair and maintenance work.

The only maintenance required involves replacing the seals and gaskets and some minor work on the HTec components using HT's own SDF process.

Of course all the components will still have to be replaced if the hydraulic system suffers a catastrophic failure.

If you wish to know more about our products or test programme please contact us at any time.

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