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Materials Testing

Product Information

Xforce P, Xforce HP and Xforce K load cells

Xforce Family (5 N up to 250 kN)

Xforce HP, Fmax 10 kN

Patented Xforce load cells - exclusive at Zwick Roell
Xforce load cells are only available from Zwick Roell. These high accuracy load cells are used for all Zwick load frames.

Applicational range
Xforce load cells are ideal for tensile, compression and flexural / bending testing as well as through-zero cyclic testing.

Parasitic forces
All Xforce load cells are highly insensitivie to parasitic forces (transverse forces, bending moments, torque moments, temperature).

Construction type and configuration of the load cells

- All Xforce load cells are based on the rotation-symmetric or axis-symmetric principle and are therefore highly insensitive to transverse forces.
- The low overall height allows shorter test arrangements to be achieved with, for example, reduced bending issues.
- The construction type provides a high operating force, very small measurement distances and high stiffness.

Self identifying sensor plugs
The smart load cells have a unique electronic identification system stored on internal EEPROM:

- *testXpert*® II testing software automatically identifies sensor type and properties
- force and travel limits automatically imported
- sensor overloads plus date stored in EEPROM

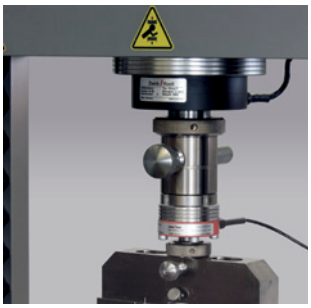
Faster load cell changeover by option connection via mounting stud
If several load cells are used or if there is to be a frequent changing of load cells, we recommend the option connection via mounting stud.

- This offers flexibility and significant time savings.
- The load cell cables will not be strained by screwing or unscrewing when changing load cells.
- Reference positions for various test set-ups are automatically achieved (with the threaded mounting the reference position changes depending on the amount of threads used).

Simple mechanical pin system
All load cells have an accurately fitted play-free connection pin so that grips and test fixtures can be quickly and firmly aligned on the machine test axis.

Second connection bolt for two test areas
Xforce K load cells are the only load cells which can be used for two test areas because of double sided connection studs.

Xforce K with a second connection



Xforce quick-change system

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Materials Testing

Product Information

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System calibration

- Before delivery every load cell is calibrated with the testing machine, drive and measurement and control electronics as a complete system. This is documented in the accompanying factory calibration certificate.

Calibration and accuracy according to ISO 7500-1

- The Xforce load cells far exceed the requirements of the Standards.
- Xforce load cells fulfill all five criteria of the accuracy classes according to ISO 7500-1, over a very wide measurement range. (see fig. 1)
- In connection with *testControl* the Xforce HP and Xforce K load cells (from 200 N) typically offer a better linearity (relative accuracy) than is required by ISO 7500. The linearity error (relative accuracy) is less than 1% of the measured value even at 0.1% of the load cell capacity, it is less than 0.25% from 0.4% of load cell´s capacity. (see fig. 2)
- This very wide measurement range often avoids the need for a second load cell, thereby saving the cost of a second load cell and subsequent annual calibration costs.
- Nearly the entire measurement range is available even with large preloads caused by heavy test fixtures or specimen grips. The load cell can be used to the full capacity even when fixtures or grips represent 45 % of the load cell capacity.

Over load security, force limits

- The load cells are extremely robust, and have a high operating force (up to 150% of their maximum capacity), so the need for overload protection can often be avoided (e.g. preloaded spring packages, mechanical bearings or guides for transverse force absorption).
- Xforce load cells are very robust and can withstand loads up to 300 % of their capacity without mechanical damage and up to 150% without zero shift.
- Xforce HP load cells in the 5 - 100 N range have integrated overload protection and are therefore protected against greater overloads (tensile forces, compressive forces, bending moments etc.).
- The unique use of both soft and hard limit switches within the testing machine control system allows the load cells and test fixtures to be easily protected against crosshead overtravel (only integrated in Zwick Roell machines and software).
- Load limits can be configured in *testXpert*® II to automatically switch off the test system at predefined levels, thereby protecting the load cell.

Fulfillment of all 5 criteria according to ISO 7500-1

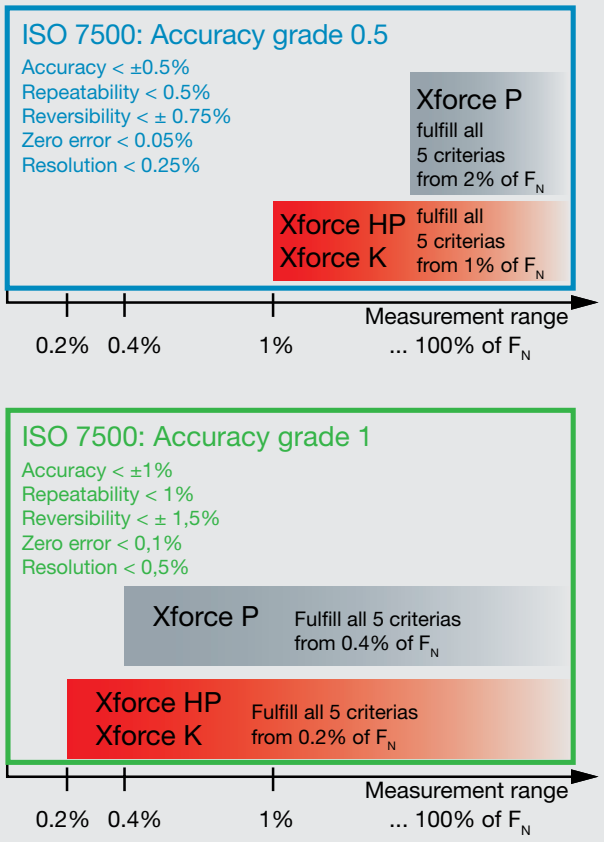

Fig. 1
Accuracy grade 1: Xforce HP and Xforce K load cells fulfill the requirements of all five criteria from 0.2% of the capacity, Xforce P load cells from 0.4% of the capacity.
Accuracy grade 0.5: Xforce load cells fulfill the requirements of all five criteria from 1% rsp. 2% of the capacity.

Linearity according to ISO 7500-1
Xforce HP and Xforce K (from 200 N)

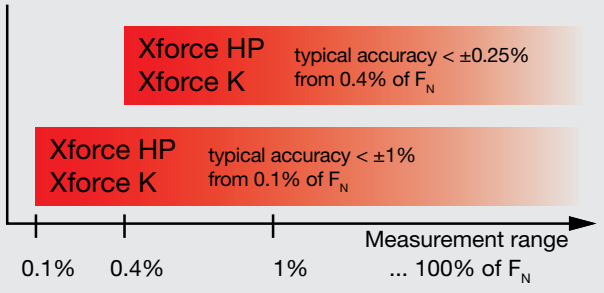

Fig. 2
The linearity error (relative accuracy) is typically < ± 0.25% in the range from 0.4 ... 100% of the capacity.
The measurement range which achieves a relative accuracy < ±1%, typically starts at 0.1% of the rated capacity.

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Materials Testing

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Xforce P, Xforce HP and Xforce K load cells

Technical data: Xforce P, Xforce HP and Xforce K

Design	Xforce P (5 up to 100N)	Xforce HP [1] (5 up to 100N)	Xforce P (200N - 250kN)	Xforce HP [1] (200N - 10kN)	Xforce K [1] (10 - 250kN)
	Parallel double bending-beam		Multiple bending beam		Bending ring
Force limits/ranges					
Operating force	150% of F_N	150% of F_N	150% of F_N	150% of F_N	150% of F_N
Limit force	150% of F_N	150% of F_N	150% of F_N	150% of F_N	150% of F_N
Force at break	300% of F_N	1.000 N [2]	300% of F_N	300% of F_N	300% of F_N
Limiting transverse load at mounting stud	100% of F_N	200 N [2]	100% of F_N	100% of F_N	100% of F_N
Parasitic influences					
Infl. of bending moment of F_{act} /mm	±0.25%	±0.07%	±0.25%	±0.07%	±0.015%
Influence of torque of F_N / mm	±0.2%	±0.1%	±0.2%	±0.2%	±0.005%
Temperature range	+10... +60 °C	+10... + 60 °C	+10... +60 °C	+10... +60 °C	+10... +60 °C
Storage temperature	-30... +60 °C	-30... + 60 °C	-30... +60 °C	-30... +60 °C	-30... +60 °C
Temperature influence on the zero-signal TK0					
(... of F_N per K)	±0.01%	±0.005%	±0.01%	±0.0025%	±0.001%
Temperature influence on the characteristic value TKC					
(... of F_N per K)	±0.01%	±0.005%	±0.01%	±0.004%	±0.004%
Further characteristics					
Nominal characteristic	2mV/V	2mV/V	2mV/V	2mV/V	
Protection class	IP 42	IP 42	IP 54	IP 54	
Cable length	3.5 m	3.5 m	3.5 m	3.5 m	

[1] HP/K versions recommended for applications in which bending moments or overloads in the tensile/compression direction may occur.
[2] Via integrated mechanical support frame.

Please note the tips for test set-up in order to minimise parasitic influences (see chapter 3.1.7)

	Maximum capacity F_N [N]	5	10	20	50	100
	Maximum capacity F_N [lbf]	1.12	2.25	4.50	11.24	22.48
Xforce P	**Item number**	**057091**	**060253**	**060256**	**060257**	**060258**
(bis 100 N)	***Item number for ProLine [2]***	***063919***	***063920***	***063921***	***063922***	***063923***
	Accuracy grade 1 from (0.4% of F_N)	0.02 N [5]	0.04 N	0.08 N	0.2 N	0.4 N
	Connection	M28x1.5	M28x1.5	M28x1.5	M28x1.5	M28x1.5
	Limiting bending moment [Nm] [3]	0.7	1.0	1.30	2.0	3.0
Xforce HP [1]	**Item number**	**063924**	**063925**	**063926**	**060259**	**060260**
(bis 100 N)	***Item number for ProLine [2]***	***063927***	***063929***	***063930***	***063932***	***063933***
	Accuracy grade 1 from (0.2% of F_N)	0.02 N [5]	0.02 N [5]	0.04 N	0.1 N	0.2 N
	Connection	M28x1.5	M28x1.5	M28x1.5	M28x1.5	M28x1.5
	Bending stop moment [Nm] [4]	0.6	0.9	1.2	1.5	2.4
	Limiting bending moment [Nm] [3]	6	6	6	6	6
Xforce P/HP (bis 100 N)						
	Dia. of mounting stud [mm]	8	8	8	8	8
	Limiting torque [Nm]	10	10	10	10	10

[1] HP version recommended for applications in which bending moments or overloads in the tensile/compression direction may occur.
[2] Only in combination with a ProLine load frame, please note the remark for this topic.
[3] Max. bending moments Mb with load cell unloaded in measurement direction. The values should be halved if nominal load is applied to the load cell at the same time.
[4] A bending moment off this magnitude causes a force shunt on the limit switch stop during the test.
[5] In order to be able to calibrate and use the extended range of Xforce 5N und 10N, the appropriate environmental and operating conditions must be present. Basically this means a shock and vibration-free installation site. Detailed information can be found in the operating manual and the Environmental Conditions.

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Materials Testing

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Xforce P (200 N - 10 kN)

Maximum capacity F_N [kN]	**0.2**	**0.5**	**0.5**	**1**	**2.5**	**5**	**10**	**10**
Maximum capacity F_N [lbf]	45	112	112	225	562	1124	2248	2248
Item number	**011563**	**011562**	**057993**	**011560**	**011558**	**011556**	**017955**	**011554**
Item number for ProLine [2]	***018542***	***018540***	***058423***	***018539***	***018538***	***018537***	***-***	***018536***
Accuracy grade 1 from (0.4% of F_N)	0.8 N	2 N	2 N	4 N	10 N	20 N	40 N	40 N
Connection via	M28x1.5	M28x1.5	M28x1.5	M28x1.5	M28x1.5	M28x1.5	flange 1	M28x1.5
Dia. of mounting stud [mm]	8	8	20	20 [1]	20	20	20	20
Limiting bending moment [Nm] [3] [4]	3 (2)	7 (5)	7 (5)	17 (15)	34 (30)	58 (50)	115 (80)	115 (80)
Limiting torque [Nm] [4]	5 (14)	7 (35)	7 (35)	17 (50)	17 (80)	17 (130)	17 (200)	17 (200)

Xforce P (20 - 250 kN)

Maximum capacity F_N [kN]	**20**	**30**	**50**	**100**	**150**	**250**
Maximum capacity F_N [lbf]	4496	6744	11240	22481	33721	56202
Item number	**017907**	**017908**	**017909**	**017910**	**017911**	**017912**
Item number for ProLine [2]	***019242***	***019246***	***019248***	***019254***	***-***	***-***
Accuracy grade 1 from (0.4% of F_N)	80 N	120 N	200 N	400 N	600 N	1000 N
Connection via	flange 1	flange 1	flange 1	flange 2	flange 2	flange 2
Dia. of mounting stud [mm]	36	36	36	60	60	60
Limiting bending moment [Nm] [3] [4]	460 (250)	500 (250)	650 (250)	4500 (3500)	5000 (4000)	6000 (5000)
Limiting torque [Nm] [4]	250 (1500)	250 (1800)	250 (3000)	6500 (10000)	5800 (12500)	11000 (15000)

Xforce HP [6] (200 N - 10 kN)

Maximum capacity F_N [kN]	**0.2**	**0.5**	**0.5**	**1**	**2.5**	**5**	**10**	**10**
Maximum capacity F_N [lbf]	45	112	112	225	562	1124	2248	2248
Item number	**011571**	**011570**	**057991**	**011569**	**011568**	**011566**	**017953**	**011565**
Item number for ProLine [2]	***018548***	***018547***	***058424***	***018546***	***018545***	***018544***	***018554***	***018543***
Accuracy grade 1 from (0.2% of F_N)	0.4 N	1 N	1 N	2 N	5 N	10 N	20 N	20 N
Connection via	M28x1.5	M28x1.5	M28x1.5	M28x1.5	M28x1.5	M28x1.5	flange 1	M28x1.5
Dia. of mounting stud [mm]	8	8	20	20 [1]	20	20	20	20
Limiting bending moment [Nm] [3] [4]	3 (2)	7 (5)	7 (5)	17 (15)	34 (30)	58 (50)	115 (80)	115 (80)
Limiting torque [Nm] [4]	5 (14)	7 (35)	7 (35)	17 (50)	17 (80)	17 (130)	17 (200)	17 (200)

Xforce K [6] (10 - 250 kN)

Maximum capacity F_N [kN]	**10**	**20**	**30**	**50**	**100**	**150**	**250**
Maximum capacity F_N [lbf]	2248	4496	6744	11240	22481	33721	56202
Item number	**325944** [5]	**318936**	**325642**	**318934**	**318932**	**320304**	**318930**
	-	**-**	**-**	**-**	**068922** [7] [8]	**-**	**068918** [7]
Item number for ProLine [2]	***-***	***325222***	***325644***	***325223***	***325328***	***-***	***-***
Accuracy grade 1 from (0.2% of F_N)	20 N	40 N	60 N	100 N	200 N	300 N	500 N
Connection via	flange 1	flange 1	flange 1	flange 1	flange 2	flange 2	flange 2
Dia. of mounting stud [mm]	20	36	36	36	60	60	60
Limiting bending moment [Nm] [3]	500	600	700	1100	4800	8000	30000
Limiting torque [Nm]	500	500	500	1800	10000	20000	55000

[1] Note: with Xforce load cells the mounting stud diameter has been changed from 8 to 20 mm for the 1kN load cell!
[2] Only in combination with a ProLine load frame; please see note regarding this.
[3] Max. bending moments Mb for load cells not loaded in the measurement direction. The values should be halved if nominal load is applied to the load cell at the same time.
[4] The values relating to the limit moments for the connecting system are in brackets. If these are exceeded, re-calibration will be necessary.
[5] Already included: Option 2. Mounting studs for use of the load cell in two test areas.
[6] HP/K – version recommended for applications in which bending moments or overloads in the tensile/compression direction may occur.
[7] Flange interface with centering in place of mounting studs (pitch circle 115/220/264 mm, centering spigot D30/70 mm).
[8] Design and technical datas as the item number 068918, calibrated up to 100kN (Class1 from 200N).

All data at ambient temperature.