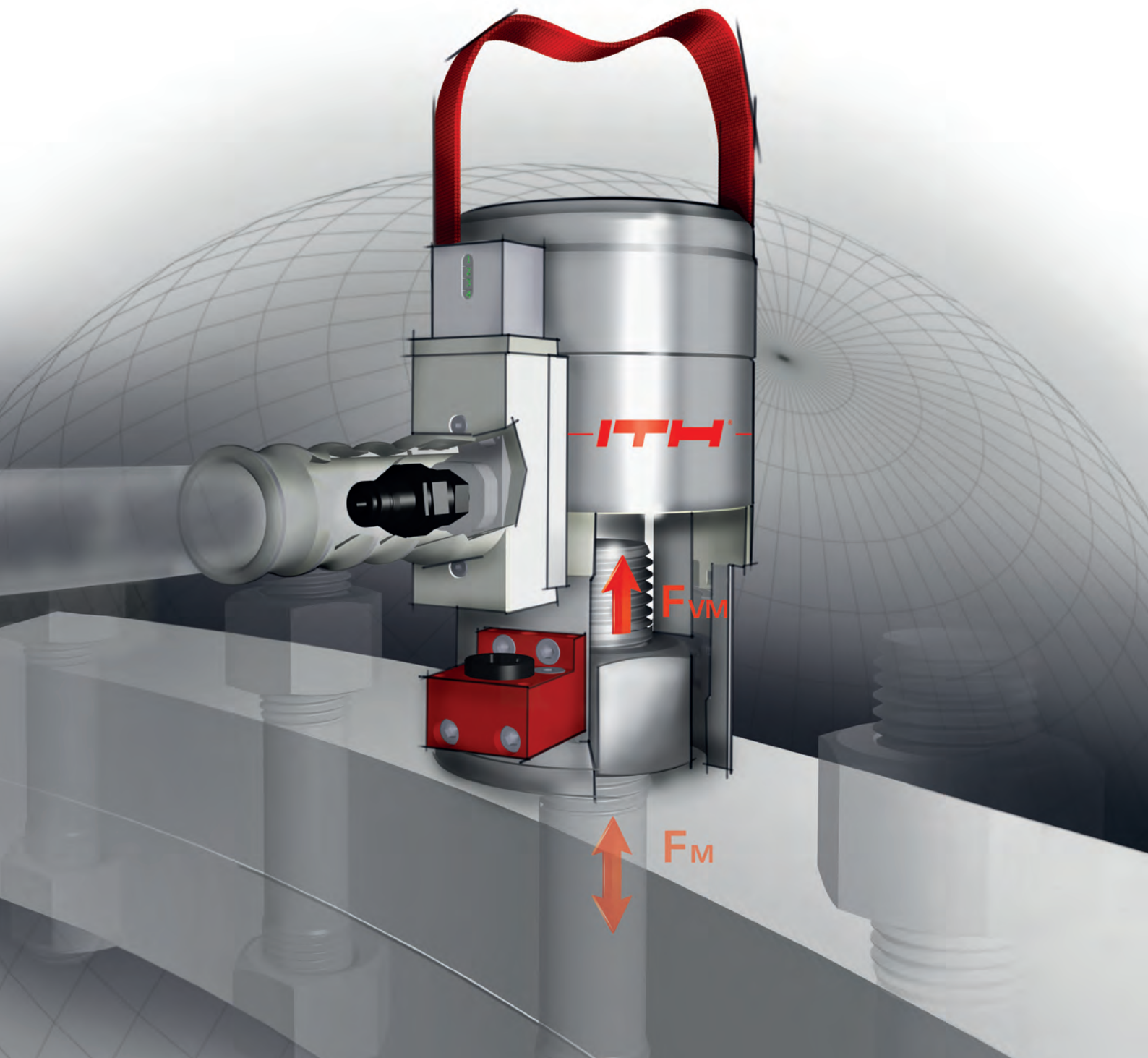


# ITH<sup>®</sup>

## Bolting Technology



**Bolt Tensioning  
Cylinders**



[www.ITH.com](http://www.ITH.com)

English

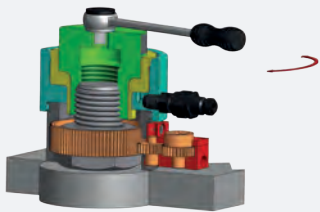
# Technical Requirements for the use of Bolt Tensioning Cylinders

## Technical introduction

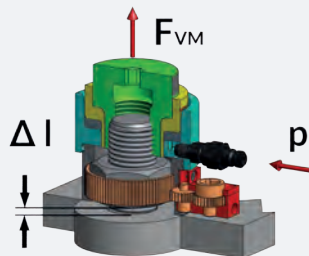
Industrial bolting tools can be divided by their fundamental bolting method: there is the rotation method (torqueing) and tensioning method. Rotation methods (torqueing) work according to the torque or the rotation angle principle. When torqueing the accuracy of the preload force is influenced negatively by friction and by torsion and bending loads which

affect the bolt itself. When using the ITH Stretch Method there are no effects of friction, bending or torsion ("Hydraulic, friction-free and torsion-free tightening") affecting the bolting procedure. The initial assembly preload  $F_{VM}$  are applied with a very high precision of +/- 2.0% and with a high repeatability.

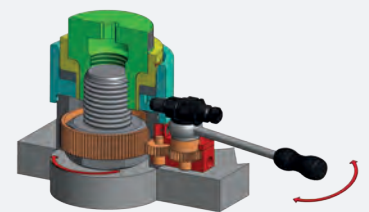
## Functional principle



The change bushing (light green) of the Bolt Tensioning Cylinder (BTC) is threaded onto the projecting thread of the bolt. The turning sleeve encloses the nut.



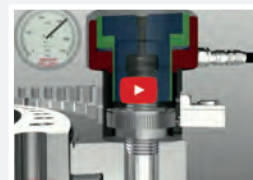
The required pressure  $p$  is generated by an ITH high pressure pump. This creates an elongation in the bolt ( $\Delta l$ ). The initial assembly preload  $F_{VM}$  is applied free of friction and free of torsion.



When the pressure has been achieved, the nut is threaded onto the support surface without friction by turning the turning sleeve. The Bolt Tensioning Cylinder can be removed once the pressure is released.

### See the explanation video on [www.ITH.com](http://www.ITH.com)

The 3D animation video explains the ITH stretch method in 40 seconds. Our responsive design website automatically adapts its size to smart phones, tablet computers or desktop computers.



To see the video scan the QR code with your smart phone or visit [www.ITH.com](http://www.ITH.com)

### Advantages of the ITH stretch method

- ✓ **No friction** effects between the nut / supporting surface or between nut thread / bolt thread.
- ✓ **High precision and high repeatability** of the target value assembly preload  $F_M$  because of no friction effects.
- ✓ **Linear relation** between pressure  $p$  and initial assembly preload  $F_{VM}$  ensures a high system accuracy and a high reproducibility.
- ✓ **No bending** stresses in the bolt, no torsion effects in the bolt because the force is applied in an only axial direction.
- ✓ **High preload forces** even in small tool dimensions (e.g. thread W 510 or M340; 45,000 kN).
- ✓ **Small  $\alpha_A$ -factors** up to 1.05\* when designing bolted joints.

- ✓ **High utilization of the proof stress** (up to > 90%  $R_{p0.2}$  possible).
- ✓ Bolted joints subject to high temperatures (e.g. on gas turbines) can be **disassembled easily and damage-free** even after long periods of time.
- ✓ Perfect for use with stainless steels as there is **no risk of cold soldering** (seizing) on the thread.
- ✓ **Well suited** for on-site assembly.
- ✓ **Simultaneous pre-tensioning of several bolts** at the same time possible (ITH Multi Tensioning System, see page 19).

\* **clamping length ratio must be  $l_k/d \geq 5$** , fasteners must be machine processed.

# Bolt Tensioning Cylinder (BTC) designs

The design of Bolt Tensioning Cylinders (BTC) can be divided into single-stage and multi-stage types. Single-stage BTCs have one effective piston area while multi-stage BTCs have

two or more piston areas. For this reason the multi-stage Bolt Tensioning Cylinders usually have a reduced outside diameter.

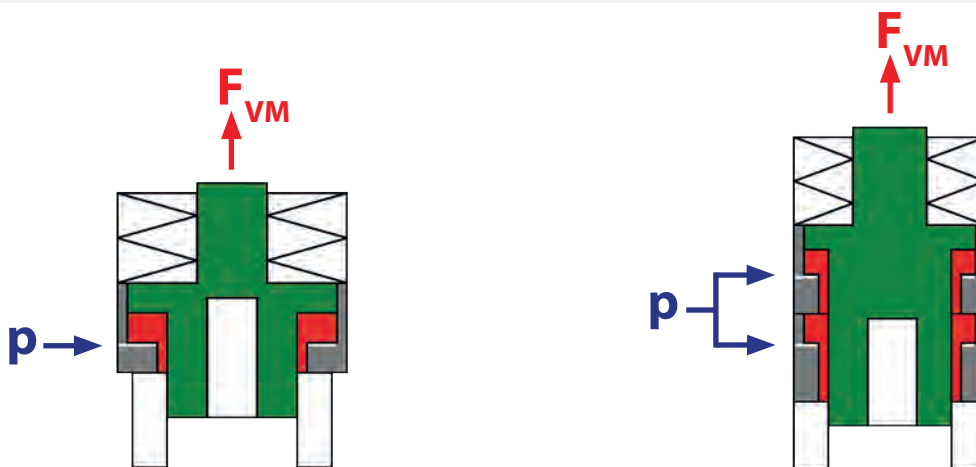
## Standard Bolt Tensioning Cylinders

### Type ES - Single-stage BTC

- ✓ One effective piston surface
- ✓ Short design for application with axially limited and radially free spaces.

### Type MS - Multi-stage BTC

- ✓ Parallel design of the piston surface
- ✓ Slim design for application with radially limited and axially free spaces.



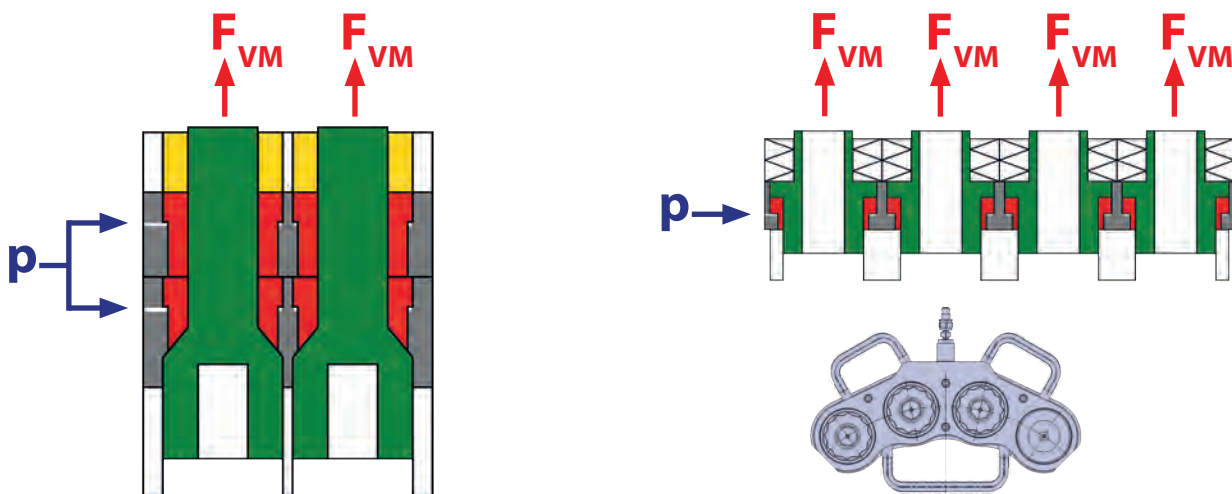
## Special design Bolt Tensioning Cylinders

### Type TWIN

- ✓ Two change bushings in one cylinder.
- ✓ For the simultaneous tightening and loosening of multiple bolt connections.
- ✓ Field of application: Engine and turbine construction.

### Type Segment

- ✓ Several change bushings in one cylinder
- ✓ For the simultaneous tightening and loosening of multiple bolt connections.
- ✓ Field of application: Turbine construction, heavy machinery and flange connections.

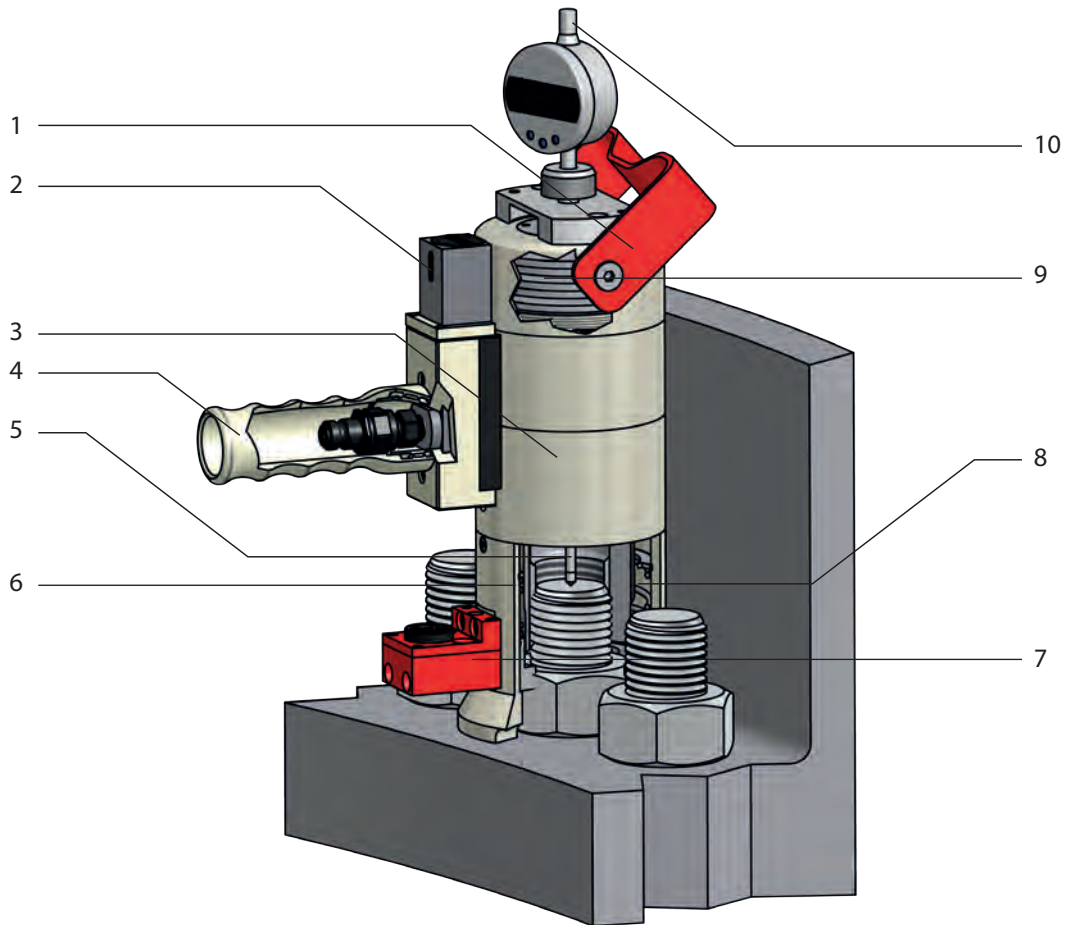


### Explanation:





## Features of ITH Bolt Tensioning Cylinder



### Safety Features

1. **Carrying strap:** Strong and flexible for an easy handling. Steel bar version optionally. Bigger BTCs can be equipped with balancers or other custom lifting devices (ring loops and more).
2. **Patented cycle counter:** Counts and displays pressure cycles and offers easy information regarding tool maintenance.
3. **NIOX coating:** Extra Nickel-Chromium coating offers extra protection from corrosion. Standard BTCs are protected by burnishing.
4. **Patented protection cap** with handle: Increasing work safety and ergonomic handling.
5. **Safety measurement pin** (PD-System only): Measuring bolt elongation after applying pressure.
6. **Patented safety fracture device:** Increasing safety by keeping the energy inside of the tool in case of wrong use.

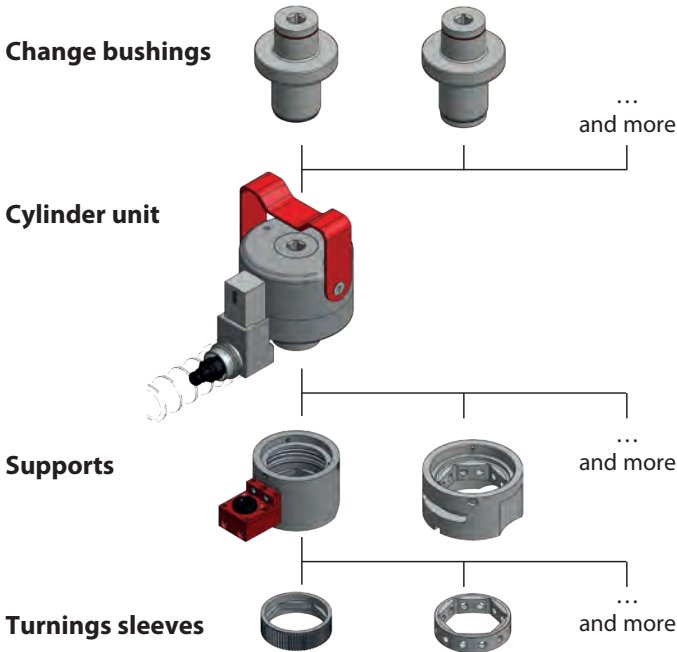
### Accelerating Features

7. **Heavy Duty direct gear drive** (  $\frac{1}{4}$ " -  $\frac{1}{2}$ " ).
8. **Spring loaded turning sleeve:** Speed up the assembling of the Bolt Tensioning Cylinder. The spring system pushes the turning sleeve over the nut when the nut aligns.
9. **Automatic piston return:** return of the piston to the starting position after pre-tensioning.

### Precision Features

10. **Direct pressure stretch documentation system** (PD / PSD-System): Digital documentation of all bolting applications by operation with Bolt Tensioning Cylinders.
11. **ITH Multi Tensioning:** 4 or more BTCs can be used simultaneously
12. **Reproducible pre-tensioning force** with a tight tolerance of  $\pm 2.0\%$

# Modular design of Bolt Tensioning Cylinders



## Change bushings

- ✓ One BTC can be equipped with several change bushings to adapt different thread profiles or bolt diameters.

## Supports

- ✓ One BTC can be equipped with several supports to match the nut and washer design.
- ✓ ITH BTCs cover all nut / washer set ups like:
  1. DIN ISO standards,
  2. heavy hex nuts,
  3. HV-standard,
  4. ITH round nuts RMS/RMZ and IHF Roundnuts
  5. any hexagonal nut designs, any radial hole nut designs and any customized nut designs.

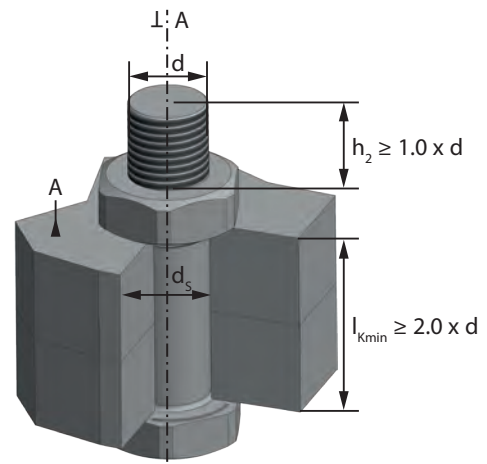
## Turnings sleeves

- ✓ The turning sleeve is the part of the support which contacts the nut radially.
- ✓ The turning sleeve can be exchanged to fit any nut and washer set-ups (hexagonal nut designs or radial nut designs).

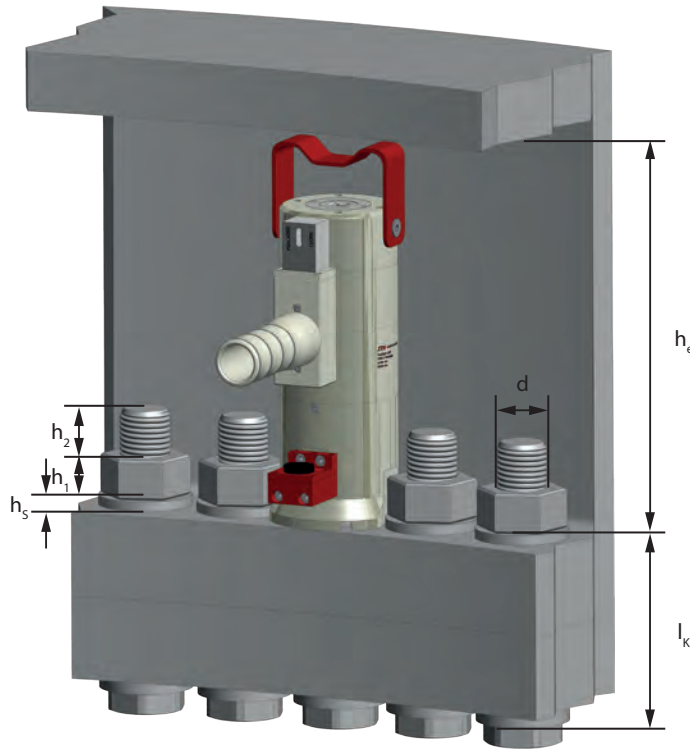
## Recommendations for designing bolted joints

To use the benefits of the ITH stretch method most efficiently certain design parameters can be recommended:

- ✓ Ratio between thread projection above the nut ( $h_2$ ) should be bigger than 1.0 times the bolt diameter ( $d$ ) ( $h_2 \geq 1.0 \times d$ ). Depending on the required preload force also  $h_2 \geq 0.8 \times d$  possible.
- ✓ A certain thread flank of the bolts should be considered (ITH recommends the design according to DIN 2510, part 2).
- ✓ The ratio between clamping length  $l_k$  to outer thread diameter  $d$  should be bigger than 2.0 ( $l_{kmin} \geq 2.0 \times d$ ).
- ✓ The initial assembly preload  $F_{VM}$  may not extend the bolt load at the 0,2 % proof stress  $F_{0.2}$ .
- ✓ Perpendicularity  $\perp$  between bolt and supporting surface (tolerance is  $1^\circ$ ). Alternatively the use of cardanic washers is recommended.
- ✓ The number of split joints should be kept as low as possible (avoid using washers). If washers are necessary their outer diameter should be big enough for the Bolt Tensioning Cylinder to stand on.
- ✓ Consider the form tolerances and positional tolerances of the fasteners and further components.
- ✓ The limiting surface pressure  $p_g$  at the supporting area should be checked.
- ✓ Please consider that surface quality or coatings can affect the bolting result.

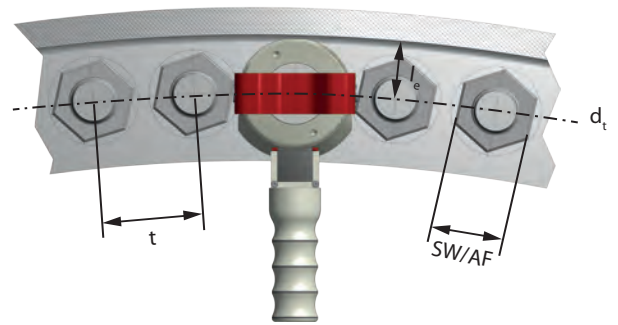


# Technical Requirements for the use of Bolt Tensioning Cylinders



### To choose the right BTC the following issues should be clarified:

- ✓ Bolt diameter  $d$ , thread pitch  $P$ , bolt quality
- ✓ The required assembly preload  $F_M$
- ✓ Fastener dimensions ( $h_3, h_1, h_2$ ) and clamping length  $l_k$
- ✓ The surrounding dimensions of the bolted joint ( $l_e, t, d_t, h_e$ )



Pos.	Bolt-Ø d x pitch P	Bolt quality	Required assembly preload $F_M$	Width across flat SW   AF	Nut height $h_1$	Thread Projection $h_2$	Washer thickness $h_3$	Clearance Height $h_e$	Clamping Length $l_k$	Radial Distance $l_e$	Bolt Spacing $t$	Pitch Diameter $d_t$	Number of bolts $n_s$

Fill in the columns and send it to us, preferably via email to [sales@ith.com](mailto:sales@ith.com). We would be happy to help you choosing the right ITH Bolt Tensioning Cylinder for your application.

#### Indexes:

- |           |   |       |   |
|-----------|---|-------|---|
| $F_M$     | (Residual) assembly preload                                   | $t$   | Bolt spacing in a multi-bolted joint    |
| $F_{VM}$  | (Initial) assembly preload = bolt load created by BTC         | $d_t$ | Pitch diameter                          |
| $F_{0.2}$ | Bolt load at the 0,2% proof stress                            | $n_s$ | Number of bolts in a multi-bolted joint |
| $d$       | Bolt diameter = outside diameter of thread (nominal diameter) | $d_s$ | Diameter at stress cross section $A_3$  |
| $P$       | Pitch of the thread   | $p_G$ | Limiting surface pressure               |
| SW   A/F  | Width across flats of the nut                                 |       |   |
| $H_1$     | Tool height of the BTC  |       |   |
| $D_3$     | Tool diameter of the BTC                                      |       |   |
| $h_1$     | Nut height  |       |   |
| $h_2$     | Thread projection above the nut                               |       |   |
| $h_3$     | Washer thickness  |       |   |
| $h_e$     | Clearance height  |       |   |
| $l_e$     | Radial distance   |       |   |
| $l_k$     | Clamping length   |       |   |

# Preload forces

## Design parameters

For the use of Bolt Tensioning Cylinders ITH recommends a thread projection above the nut of  $1.0 \times$  bolt diameter  $d$ , depending on the required preload force ( $h_2 \geq 1.0 \times d$ ). The ratio between clamping length  $l_K$  to bolt diameter  $d$  should be bigger than 2.0 ( $l_{Kmin} \geq 2.0 \times d$ ).

## Defining the preload force

The required preload force is usually determined in the bolted joint design. For a bolted joint design ITH recommends to use the fundamental German bolting guideline VDI 2230. The following preload forces are an ITH recommendation for shank bolts and reduced shank bolts based on a 90% utilization of the stress at 0,2% non-proportional elongation ( $R_{p0,2}$ ).

Property class acc. to DIN EN ISO 898-1		6.8		8.8		10.9		12.9	
Lower yield stress $R_{eL}$ [N/mm <sup>2</sup> ]		480							
Stress at 0,2% non-proportional elongation $R_{p0,2min}$ [N/mm <sup>2</sup> ]				660		940		1100	
Thread size acc. to DIN 2510	A/F width*	$F_{Vs}$ [kN]	$F_{VD}$ [kN]	$F_{Vs}$ [kN]	$F_{VD}$ [kN]	$F_{Vs}$ [kN]	$F_{VD}$ [kN]	$F_{Vs}$ [kN]	$F_{VD}$ [kN]
M 16x2	24	64	49	88	67	125	96	146	112
M 20x2,5	30	100	76	138	105	196	150	230	175
M 22x2,5	34	125	92	172	127	245	181	286	212
M 24x3	36	145	110	199	151	284	215	332	252
M 27x3	41	190	143	261	196	372	279	435	327
M 30x3,5	46	232	179	319	247	454	351	532	411
M 33x3,5	50	288	221	397	303	565	432	661	506
M 36x4	55	340	257	467	353	665	502	779	588
M 39x4	60	407	316	560	434	797	618	933	723
M 42x4,5	65	468	358	643	493	916	702	1072	821
M 45x4,5	70	546	428	751	588	1070	837	1252	980
M 48x5	75	616	477	847	656	1207	934	1412	1093
M 52x5	80	737	570	1014	784	1444	1117	1689	1307
M 56x5,5	85	852	657	1171	903	1668	1286	1951	1505
M 60x5,5	90	993	766	1365	1053	1944	1499	2275	1754
M 64x6	95	1123	882	1544	1213	2198	1728	2573	2022
M 68x6	100	1284	1008	1766	1386	2515	1974	2943	2310
M 72x6	105	1457	1161	2003	1597	2852	2274	3338	2661
M 76x6	110	1640	1304	2255	1793	3211	2554	3758	2989
M 80x6	115	1834	1478	2522	2032	3592	2894	4203	3387
M 85x6	120	2092	1710	2876	2352	4097	3349	4794	3920
M 90x6	130	2367	1909	3254	2624	4635	3738	5424	4374
M 95x6	135	2659	2171	3656	2986	5207	4252	6093	4976
M 100x6	145	2965	2394	4077	3292	5806	4688	6795	5486
M 110x6	155	3631	2903	4992	3992	7110	5685	8320	6653
M 120x6	170	4366	3530	6004	4854	8551	6913	10006	8090
M 125x8	180	4590	3812	6311	5242	8989	7466	10519	8736
M 130x8	185	4993	4218	6866	5800	9778	8261	11443	9667
M 140x8	200	5850	4724	8044	6496	11457	9252	13407	10827
M 150x8	210	6775	5472	9316	7525	13268	10717	15527	12541
M 160x8	220	7761	6276	10671	8629	15199	12290	17786	14381
M 170x8	230	8819	7134	12126	9809	17271	13970	20210	16348
M 180x8	255	9947	8047	13677	11064	19479	15758	22795	18440

\*SW/AF width from M16 to M 68 according to ISO 4032. SW/AF width > M68 according to DIN 2510

## Preload forces for shaft bolts and reduced shaft bolts with a 90% utilization of the stress at 0,2% non-proportional elongation $R_{p0,2}$ :

Preload forces for shank bolts  $F_{Vs}$

Preload forces for reduced shank bolts  $F_{VD}$



# Bolt Tensioning Cylinder Type ES - Single-stage

- ✓ Short design for application with axially limited and radially free spaces.
- ✓ Minimum thread projection ( $h_2$ ) above the nut  $\geq 1.0 \times d$  (depending on the initial assembly preload  $F_{VM}$ ).
- ✓ Use for hexagon nut, heavy hex nuts, ISO 4032, DIN 2510, EN 14399, Roundnuts, ITH Roundnuts RMS/RMZ, and IHF Roundnuts.

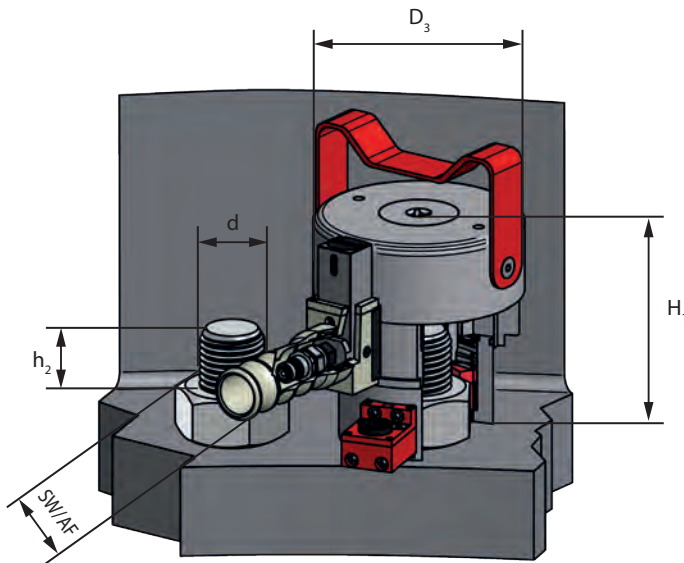


Fig. with optional features

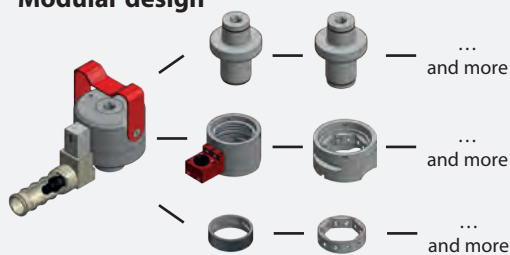
## Features

1. Patented safety fracture device
2. Automatic piston return
3. Interchangeable parts for different thread and nut profiles
4. Pre-configured for optional bolt elongation measurement
5. Direct gear drive with internal gear
6. Spring loaded turning sleeve
7. Stroke limitation (Over-stroke limiter)
8. Control notch
9. Patented safety carrying handle
10. Patented cycle counter

## Optional

1. Chrome-nickel surface coating NIOX
2. Safety measurement pin for thread projection
3. Swivel connection for high pressure couplings and nipples
4. Multi Tensioning high pressure coupling
5. Patented protection cap with handle

## Modular design



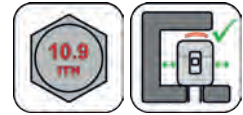
- ✓ One Cylinder can be equipped with several change bushings, supports & turning sleeves
- ✓ See page 5 for details



Assembling of BTC type ES on an ANSI flange.



Foundation bolt connection.



# Type ES for Bolt Quality 10.9 – Standard 150

Type	Order no.	Preload force		Bolt diameter d		SW   A/F-width		Tool diameter D <sub>3</sub>		Tool height H <sub>1</sub>	
		[kN]	[lbs]	[mm]	["]*	[mm]	["]	[mm]	["]	[mm]	["]
ES 16 - 10.9 ES 20 - 10.9 ES 22 - 10.9	Contact us for technical specifications with an email to: sales@ith.com										
ES 24 - 10.9	33.05441	306.2	68837	M 24 x 3	1	36	1 4/9	77.5	3,05	116.5	4.59
ES 27 - 10.9	33.05442	399.6	89834	M 27 x 3	-	41	1 5/8	87.5	3.44	116.5	4.59
ES 30 - 10.9	33.05443	486.1	109280	M 30 x 3,5	1 1/8	46	1 4/5	96.0	3.78	121.0	4.76
ES 33 - 10.9	33.05444	604.4	135875	M 33 x 3,5	1 1/4	50	2	105.0	4.13	137.3	5.41
ES 36 - 10.9	33.05445	712.0	160053	M 36 x 4	1 3/8	55	2 1/5	115.0	4.53	132.4	5.21
ES 39 - 10.9	33.05446	848.7	190787	M 39 x 4	1 1/2	60	2 3/8	124.5	4.90	139.2	5.48
ES 42 - 10.9	33.05447	980.9	220516	M 42 x 4,5	1 5/8	65	2 4/7	134.0	5.28	156.7	6.17
ES 45 - 10.9	33.05448	1145.9	257599	M 45 x 4,5	1 3/4	70	2 3/4	144.0	5.67	153.0	6.02
ES 48 - 10.9	33.05449	1290.0	290005	M 48 x 5	1 7/8	75	3	154.0	6.06	157.2	6.19
ES 52 - 10.9	33.05450	1540.0	346207	M 52 x 5	2	80	3 1/8	167.0	6.57	176.3	6.94
ES 56 - 10.9	33.05451	1775.0	399038	M 56 x 5,5	2 1/4	85	3 1/2	177.7	7.00	179.0	7.05
ES 60 - 10.9	33.05452	2075.6	466618	M 60 x 5,5	2 3/8	90	3 3/4	193.0	7.60	190,5	7.50
ES 64 - 10.9	33.05453	2325.2	522728	M 64 x 6	2 1/2	95	3 7/8	204.0	8.03	239.4	9.43
ES 68 - 10.9	33.05454	2685.4	603700	M 68 x 6	-	100	4 1/4	219.5	8.64	193.3	7.61
ES 72 - 10.9	33.05455	3010.1	676694	M 72 x 6	2 3/4	105	4 5/8	231.5	9.11	221.4	8.72
ES 80 - 10.9 Up to ES 110 - 10.9	Contact us for technical specifications with an email to: sales@ith.com										

Technical enhancements and modifications reserved. \*Inch dimensions for a pitch of 8 UN, any further pitches available.



**Most of ITH Bolt Tensioning Cylinders are designed due to customer specification**

ITH BTCs are designed according to nearly all bolt qualities, any bolt/nut-configurations or customer specific requirements. Contact us and we would be pleased to help you to find the right ITH Bolt Tensioning Cylinder or when having technical questions.

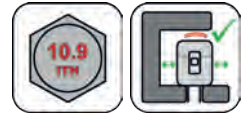


Foundation bolt connection.




Cylinder head assembly.

# Type ES for Bolt Quality 10.9 – Slim Line 225\*



Type	Order no.	Preload force		Bolt diameter d		SW   A/F-width		Tool diameter D <sub>3</sub>		Tool height H <sub>1</sub>	
		[kN]	[lbs]	[mm]	["]**	[mm]	["]	[mm]	["]	[mm]	["]
ES 16 - 10.9 ES 20 - 10.9 ES 22 - 10.9	Contact us for technical specifications with an email to: sales@ith.com										
ES 24 - 10.9	33.05541	307.6	69152	M 24 x 3	1	36	1 4/9	73.0	2.87	114.2	4.49
ES 27 - 10.9	33.05542	400.5	90036	M 27 x 3	-	41	1 5/8	81.0	3.19	121.8	4.80
ES 30 - 10.9	33.05543	489.6	110067	M 30 x 3,5	1 1/8	46	1 4/5	88.5	3.48	122.8	4.83
ES 33 - 10.9	33.05544	604.4	135873	M 33 x 3,5	1 1/4	50	2	97.0	3.82	134.7	5.30
ES 36 - 10.9	33.05545	713.7	160449	M 36 x 4	1 3/8	55	2 1/5	106.5	4.19	135.1	5.32
ES 39 - 10.9	33.05546	850.9	191300	M 39 x 4	1 1/2	60	2 3/8	115.0	4.53	137.2	5.40
ES 42 - 10.9	33.05547	979.2	220138	M 42 x 4,5	1 5/8	65	2 4/7	124.0	4.88	145.9	5.74
ES 45 - 10.9	33.05548	1146.3	257697	M 45 x 4,5	1 3/4	70	2 3/4	132.0	5.20	155.5	6.12
ES 48 - 10.9	33.05549	1291.4	290324	M 48 x 5	1 7/8	75	3	142.0	5.59	151.5	5.96
ES 52 - 10.9	33.05550	1540.8	346396	M 52 x 5	2	80	3 1/8	153.0	6.02	173.1	6.81
ES 56 - 10.9	33.05551	1781.2	400420	M 56 x 5,5	2 1/4	85	3 1/2	165.0	6.50	181.7	7.15
ES 60 - 10.9	33.05552	2121.5	476925	M 60 x 5,5	2 3/8	90	3 3/4	178.0	7.01	189.5	7.46
ES 64 - 10.9	33.05553	2350.7	528454	M 64 x 6	2 1/2	95	3 7/8	189.0	7.44	198.9	7.83
ES 68 - 10.9	33.05554	2684.5	603498	M 68 x 6	-	100	4 1/4	201.0	7.91	202.0	7.95
ES 72 - 10.9	5533.055	3011.4	676995	M 72 x 6	2 3/4	105	4 5/8	214.0	8.43	216.7	8.53
ES 80 - 10.9 Up to ES 150 - 10.9	Contact us for technical specifications with an email to: sales@ith.com										

\*Slim Line: Reduced dimensions of BTC type ES. \*\*Inch dimensions for a pitch of 8 UN, any further pitches available. Technical enhancements and modifications reserved.

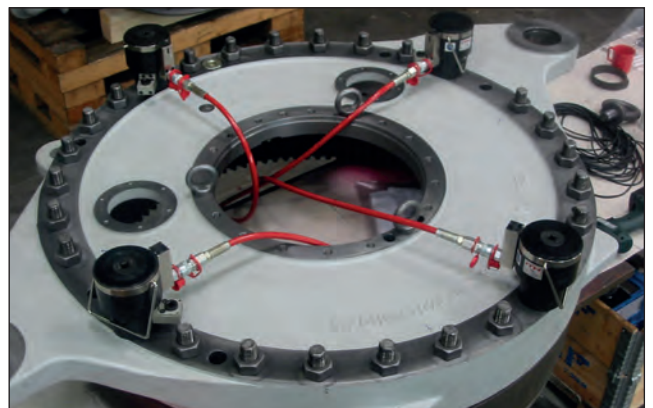


**Most of ITH Bolt Tensioning Cylinders are designed due to customer specification**

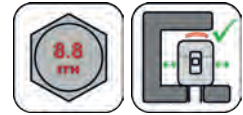
ITH BTCs are designed according to nearly all bolt qualities, any bolt/nut-configurations or customer specific requirements. Contact us and we would be pleased to help you to find the right ITH Bolt Tensioning Cylinder or when having technical questions.



Casing bolt connection.



Multi-Tensioning at gearbox housing.



# Type ES for Bolt Quality 8.8 – Standard 150

Type	Order no.	Preload force		Bolt diameter d		SW   A/F-width		Tool diameter D <sub>3</sub>		Tool height H <sub>1</sub>	
		[kN]	[lbs]	[mm]	["]*	[mm]	["]	[mm]	["]	[mm]	["]
ES 16 - 8.8	33.05638	88.0	19783	M 16 x 2	5/8	24	1 1/16	50.0	1.97	115.8	4.56
ES 20 - 8.8	33.05639	138.0	31024	M 20 x 2,5	3/4	30	1 1/4	58.0	2.28	122.8	4.83
ES 22 - 8.8	33.05640	172.0	38667	M 22 x 2,5	7/8	34	1 7/16	67.0	2.64	122.1	4.81
ES 24 - 8.8	33.05641	200.3	45025	M 24 x 3	1	36	1 4/9	69.0	2.72	114.2	4.49
ES 27 - 8.8	33.05642	260.7	58608	M 27 x 3	-	41	1 5/8	73.6	2.90	127.3	5.01
ES 30 - 8.8	33.05643	320.0	71939	M 30 x 3,5	1 1/8	46	1 4/5	81.7	3.22	122.0	4.80
ES 33 - 8.8	33.05644	400.3	89991	M 33 x 3,5	1 1/4	50	2	92.0	3.62	125.6	4.94
ES 36 - 8.8	33.05645	470.0	105661	M 36 x 4	1 3/8	55	2 1/5	98.6	3.88	131.1	5.16
ES 39 - 8.8	33.05646	560.0	125894	M 39 x 4	1 1/2	60	2 3/8	106.5	4.19	136.2	5.36
ES 42 - 8.8	33.05647	640.0	143878	M 42 x 4,5	1 5/8	65	2 4/7	115.0	4.53	142.7	5.62
ES 45 - 8.8	33.05648	754.0	169507	M 45 x 4,5	1 3/4	70	2 3/4	123.2	4.85	144.7	5.70
ES 48 - 8.8	33.05649	854.0	191988	M 48 x 5	1 7/8	75	3	132.5	5.22	147.9	5.82
ES 52 - 8.8	33.05650	1016.0	228407	M 52 x 5	2	80	3 1/8	142.0	5.59	169.5	6.67
ES 56 - 8.8	33.05651	1176.0	264377	M 56 x 5,5	2 1/4	85	3 1/2	155.0	6.10	179.8	7.08
ES 60 - 8.8	33.05652	1400.0	314734	M 60 x 5,5	2 3/8	90	3 3/4	166.0	6.54	180.8	7.12
ES 64 - 8.8	33.05653	1550.0	348456	M 64 x 6	2 1/2	95	3 7/8	176.0	6.93	211.5	8.32
ES 68 - 8.8	33.05654	1678.0	377231	M 68 x 6	-	100	4 1/4	187.0	7.36	185.8	7.31
ES 72 - 8.8	33.05655	1800.0	404658	M 72 x 6	2 3/4	105	4 5/8	191.0	7.52	214.2	8.43
ES 80 - 8.8	33.05656	2276.8	511843	M 80 x 6	-	115	5	215.0	8.46	221.9	8.73
ES 90 - 8.8	33.05657	2450.0	550785	M 90 x 6	3 1/2	130	5 3/8	225.0	8.86	233.3	9.19
ES 100 - 8.8	33.05658	2750.0	618228	M 100 x 6	4	145	6 1/8	243.0	9.57	271.0	10.67
ES 110 - 8.8	33.05659	3350.0	753114	M 110 x 6	4 1/4	155	6 1/2	268.0	10.55	297.7	11.72

Technical enhancements and modifications reserved. \*Inch dimensions for a pitch of 8 UN, any further pitches available.



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Tower bolt connection.

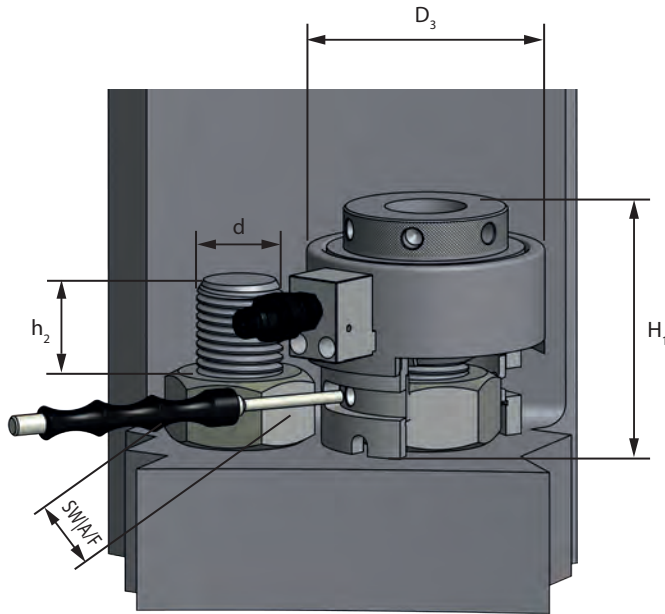


Turbine casing bolt connection.

# Type SES – Single-stage Bolt Tensioning Cylinder simple

- ✓ For radially open but vertical limited clearance applications.
- ✓ Standard for bolt quality 8.8, further bolt qualities are available.
- ✓ Minimum thread projection ( $h_2$ ) above the nut  $\geq 1.0 \times d$  (depending on the initial assembly preload  $F_{VM}$ ).

- ✓ The SES can be used for the following fastener configurations: Hexagon nuts, Heavy Hex Nuts, ISO 4032, DIN 2510, EN 14399, Roundnuts, ITH Roundnuts RMS/RMZ, and IHF Roundnuts.



Figured with optional features

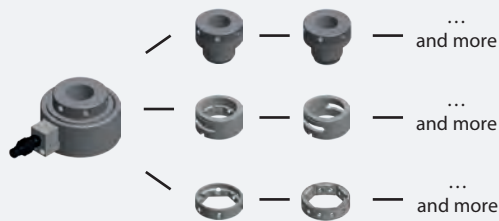
## Features

1. Patented safety fracture device inside
2. Exchangeable change bushings
3. Bore hole to use the optional bolt elongation measurement
4. Deviation distance limitation
5. Control notch for the nut
6. Burnished surface treatment (blackening)

## Optional

1. Patented cycle counter
2. NIOX coating (Nickel-Chromium) offers extra protection from corrosion
3. Two direction swivel for the hydraulic connector
4. Multi Tensioning high pressure coupling
5. Patented safety cap with handle
6. Spring loaded turning sleeve

## Modular design



- ✓ One Cylinder can be equipped with several change bushings, supports & turning sleeves

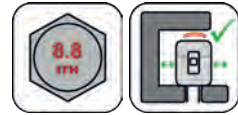
- ✓ See page 5 for details



The flexible change bushing gets run down onto the BTC body.




Foundation bolt tensioning.



# SES for Bolt Quality 8.8 – Standard 150

Type	Order no.	Preload force		Bolt diameter d		SW   A/F-width		Tool diameter D <sub>3</sub>		Tool height H <sub>1</sub>	
		[kN]	[lbs]	[mm]	["]*	[mm]	["]	[mm]	["]	[mm]	["]
SES 16 - 8.8	33.10390	125	28101	M 16 x 2	5/8	24	1 1/16	50.9	2.00	75.5	2.97
SES 20 - 8.8	33.10391	150	33722	M 20 x 2.5	3/4	30	1 1/4	56.9	2.24	81.5	3.21
SES 22 - 8.8	33.10389	150.0	33722	M 22 x 2.5	7/8	34	1 7/16	60.0	2.36	81.2	3.20
SES 24 - 8.8	33.10392	200	44962	M 24 x 3	1	36	1 4/9	65.6	2.58	81.2	3.20
SES 27 - 8.8	33.10393	260	58451	M 27 x 3	-	41	1 5/8	73.0	2.87	84.0	3.31
SES 30 - 8.8	33.10394	320	71939	M 30 x 3.5	1 1/8	46	1 4/5	82.0	3.23	90.0	3.54
SES 33 - 8.8	33.10395	400	89924	M 33 x 3.5	1 1/4	50	2	91.5	3.60	100.0	3.94
SES 36 - 8.8	33.10396	470	105661	M 36 x 4	1 3/8	55	2 1/5	98.9	3.89	109.7	4.32
SES 39 - 8.8	33.10397	560	125894	M 39 x 4	1 1/2	60	2 3/8	108.0	4.25	109.0	4.29
SES 42 - 8.8	33.10398	640	143878	M 42 x 4.5	1 5/8	65	2 4/7	116.0	4.57	119.0	4.69
SES 45 - 8.8	33.10399	750	168608	M 45 x 4.5	1 3/4	70	2 3/4	123.0	4.84	119.0	4.69
SES 48 - 8.8	33.10400	854	191988	M 48 x 5	1 7/8	75	3	132.0	5.20	127.0	5.00
SES 52 - 8.8	33.10401	1016	228407	M 52 x 5	2	80	3 1/8	145.0	5.71	135.0	5.31
SES 56 - 8.8	33.10402	1175	264152	M 56 x 5.5	2 1/4	85	3 1/2	155.5	6.12	145.0	5.71
SES 60 - 8.8	33.10403	1400	314734	M 60 x 5.5	2 3/8	90	3 3/4	166.0	6.54	140.0	5.51
SES 64 - 8.8	33.10404	1550	348456	M 64 x 6	2 1/2	95	3 7/8	176.0	6.93	161.0	6.34
SES 68 - 8.8	33.10405	1678	377231	M 68 x 6	-	100	4 1/4	184.5	7.26	169.0	6.65
SES 72 - 8.8	33.10406	1800	404658	M 72 x 6	2 3/4	105	4 5/8	191.0	7.52	181.0	7.13
SES 80 - 8.8	33.10408	2350	528304	M 80 x 6	-	115	5	215.0	8.46	193.0	7.60
SES 90 - 8.8	33.10409	2450	550785	M 90 x 6	3 1/2	130	5 3/8	225.9	8.89	198.0	7.80
SES 100 - 8.8	33.10411	2750	618228	M 100 x 6	4	145	6 1/8	245.0	9.65	242.0	9.53
SES 110 - 8.8	33.10414	2500	562025	M 110 x 6	4 1/4	155	6 1/2	245.0	9.65	216.0	8.50
SES 120 - 8.8 Up to SES 150 - 8.8	Contact us for technical specifications with an email to: <a href="mailto:sales@ith.com">sales@ith.com</a>										

Technical enhancements and modifications reserved. \*Inch dimensions for a pitch of 8 UN, any further pitches available.



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BTC type SES together with an ITH Eco-MAX 18.



Typical ANSI flange application at a heat exchanger.



# Type MS - Multi-stage Bolt Tensioning Cylinder

- ✓ Slim design for application with radially limited and axially free spaces.
- ✓ Minimum thread projection ( $h_2$ ) above the nut  $\geq 1.0 \times d$  (depending on the initial assembly preload  $F_{VM}$ ).

- ✓ Use for hexagon nut, heavy hex nuts, ISO 4032, DIN 2510, EN 14399, Roundnuts, ITH Roundnuts RMS/RMZ, and IHF Roundnuts.

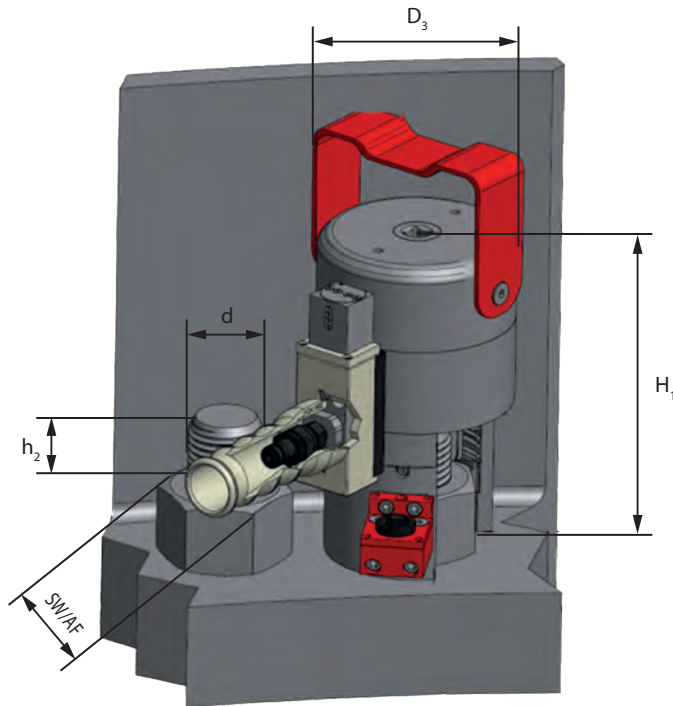


Fig. with optional features

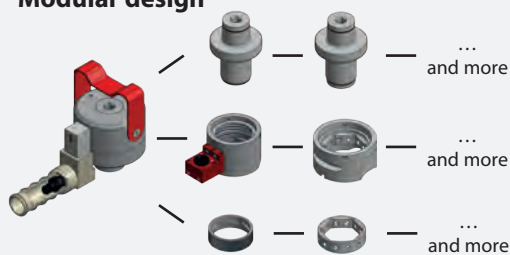
## Features

1. Patented safety fracture device
2. Automatic piston return
3. Interchangeable parts for different thread and nut profiles
4. Pre-configured for optional bolt elongation measurement
5. Direct gear drive with internal gear
6. Spring loaded turning sleeve
7. Stroke limitation (Over-stroke limiter)
8. Control notch
9. Patented safety carrying handle
10. Patented cycle counter

## Optional

1. Chrome-nickel surface coating NIOX
2. Safety measurement pin for thread projection
3. Swivel connection for high pressure couplings and nipples
4. Multi Tensioning high pressure coupling
5. Patented protection cap with handle

## Modular design



- ✓ One Cylinder can be equipped with several change bushings, supports & turning sleeves

- ✓ See page 5 for details



Slewing bearing.




Casing bolt connection.

# Type MS for Bolt Quality 10.9 – Slim Line 180 / 225

Type	Order no.	Design	Preload force		Bolt diameter d		SW   A/F-width		Tool diameter D <sub>3</sub>		Tool height H <sub>1</sub>	
			[kN]	[lbs]	[mm]	["]*	[mm]	["]	[mm]	["]	[mm]	["]
MS 16 - 10.9 MS 20 - 10.9 MS 22 - 10.9	Contact us for technical specifications with an email to: sales@ith.com											
MS 24 - 10.9	33.02791	Slim line 180	322.0	72389	M 24 x 3	1	36	14/9	66.0	2.60	172.0	6.77
MS 27 - 10.9	33.02792		379.3	85270	M 27 x 3	-	41	15/8	71.5	2.81	166.5	6.56
MS 30 - 10.9	33.02793		457.6	102873	M 30 x 3,5	1 1/8	46	14/5	77.0	3.03	192.2	7.57
MS 33 - 10.9	33.02794		567.0	127467	M 33 x 3,5	1 1/4	50	2	84.5	3.33	181.5	7.15
MS 36 - 10.9	33.02795		666.0	149723	M 36 x 4	1 3/8	55	2 1/5	93.4	3.68	197.5	7.78
MS 39 - 10.9	33.02796		800.0	179848	M 39 x 4	1 1/2	60	2 3/8	99.5	3.92	210.0	8.27
MS 42 - 10.9	33.02797		924.0	207724	M 42 x 4,5	1 5/8	65	2 4/7	107.0	4.21	220.0	8.66
MS 45 - 10.9	33.02798		1080.0	242795	M 45 x 4,5	1 3/4	70	2 3/4	113.0	4.45	226.0	8.90
MS 48 - 10.9	33.02799	1221.4	274583	M 48 x 5	1 7/8	75	3	121.5	4.78	231.0	9.09	
MS 52 - 10.9	33.12800	Slim line 225	1450.0	325975	M 52 x 5	2	80	3 1/8	127.0	5.00	259.8	10.23
MS 56 - 10.9	33.12801		1682.2	378166	M 56 x 5,5	2 1/4	85	3 1/2	137.8	5.43	287.9	11.33
MS 60 - 10.9	33.12802		1966.0	441976	M 60 x 5,5	2 3/8	90	3 3/4	149.5	5.89	274.1	10.79
MS 64 - 10.9	33.12803		2213.0	497505	M 64 x 6	2 1/2	95	3 7/8	156.5	6.16	294.6	11.60
MS 68 - 10.9	33.12804		2545.0	572141	M 68 x 6	-	100	4 1/4	169.5	6.60	305.0	11.95
MS 72 - 10.9	33.12805		2882.0	647902	M 72 x 6	2 3/4	105	4 5/8	179.0	7.05	318.9	12.56
MS 80 - 10.9 Up to MS 110 - 10.9	Contact us for technical specifications with an email to: sales@ith.com											

Technical enhancements and modifications reserved. \*Inch dimensions for a pitch of 8 UN, any further pitches available.



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Tower segment bolt connection at wind turbine.



Tower segment bolt connection at tower crane.



# Type MSK - Multi-stage Bolt Tensioning Cylinder with lock nut

- ✓ Slim design for application with radially limited and axially free spaces.
- ✓ Minimum thread projection ( $h_2$ ) above the nut  $\geq 1.0 \times d$  (depending on the initial assembly preload  $F_{VM}$ ).
- ✓ Use for hexagon nut, heavy hex nuts, ISO 4032, DIN 2510, EN 14399, Roundnuts, ITH Roundnuts RMS/RMZ, and IHF Roundnuts.

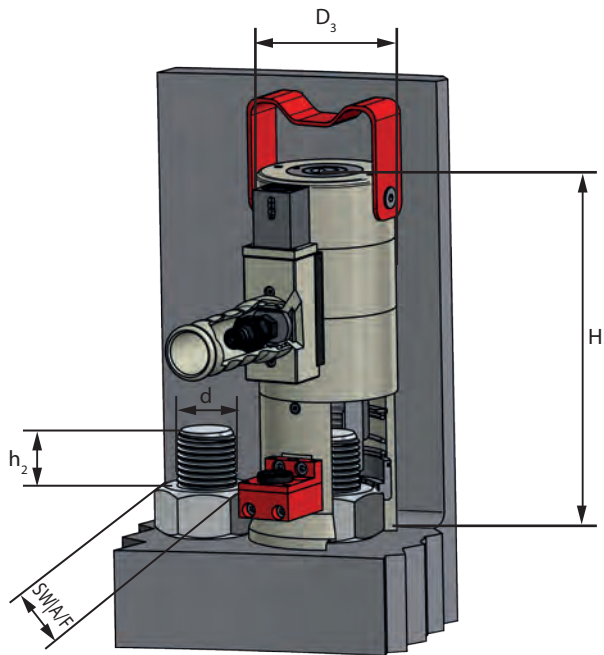


Fig. with optional features

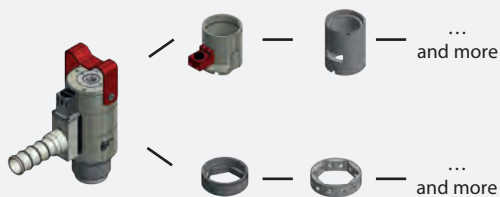
## Features

1. Patented safety fracture device
2. Automatic piston return
3. Interchangeable parts for different thread and nut profiles
4. Pre-configured for optional bolt elongation measurement
5. Direct gear drive with internal gear
6. Spring loaded turning sleeve
7. Stroke limitation (Over-stroke limiter)
8. Control notch
9. Patented safety carrying handle
10. Patented cycle counter

## Optional

1. Chrome-nickel surface coating NIOX
2. Safety measurement pin for thread projection
3. Swivel connection for high pressure couplings and nipples
4. Multi Tensioning high pressure coupling
5. Patented protection cap with handle

## Modular design



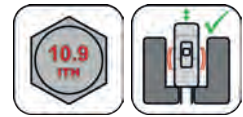
- ✓ One Cylinder can be equipped with several change bushings, supports & turning sleeves
- ✓ See page 5 for details



Rotor blade assembling.



Casing bolt connection.



# Type MSK for Bolt Quality 10.9 – Compact 150

Type	Order no.	Preload force		Bolt diameter d		SW   A/F-width		Tool diameter D <sub>3</sub>		Tool height H <sub>1</sub>	
		[kN]	[lbs]	[mm]	["]*	[mm]	["]	[mm]	["]	[mm]	["]
MSK 16 - 10.9 Up to MSK 22 - 10.9	Contact us for technical specifications with an email to: sales@ith.com										
MSK 24 - 10.9	33.50091	308.5	69354	M 24 x 3	1	36	1 4/9	57.0	2.24	190.5	7.50
MSK 27 - 10.9	33.50092	401.5	90261	M 27 x 3	-	41	1 5/8	63.5	2.50	199.6	7.86
MSK 30 - 10.9	33.50093	485.5	109152	M 30 x 3,5	1 1/8	46	1 4/5	70.0	2.76	202.7	7.98
MSK 33 - 10.9	33.50094	606.3	136302	M 33 x 3,5	1 1/4	50	2	78.3	3.08	224.6	8.84
MSK 36 - 10.9	33.50095	708.3	159233	M 36 x 4	1 3/8	55	2 1/5	82.6	3.25	237.0	9.33
MSK 39 - 10.9	33.50096	842.2	189335	M 39 x 4	1 1/2	60	2 3/8	90.8	3.57	259.4	10.21
MSK 42 - 10.9	33.50097	974.4	219044	M 42 x 4,5	1 5/8	65	2 4/7	98.0	3.86	263.0	10.35
MSK 45 - 10.9	33.50098	1140.5	256396	M 45 x 4,5	1 3/4	70	2 3/4	105.0	4.13	278.9	10.98
MSK 48 - 10.9	33.50099	1288.4	289645	M 48 x 5	1 7/8	75	3	111.5	4.39	293.8	11.57
MSK 52 - 10.9	33.50100	1529.7	343899	M 52 x 5	2	80	3 1/8	122.0	4.80	307.2	12.09
MSK 56 - 10.9	33.50101	1785	401286	M 56 x 5,5	2 1/4	85	3 1/2	130.5	5.14	350.4	13.80
MSK 60 - 10.9	33.50102	2125.8	477892	M 60 x 5,5	2 3/8	90	3 3/4	140.8	5.54	342.0	13.46
MSK 64 - 10.9	33.50103	2336.8	525336	M 64 x 6	2 1/2	95	3 7/8	147.8	5.82	352.4	13.87
MSK 68 - 10.9	33.50104	2745	617103	M 68 x 6	-	100	4 1/4	159.8	6.29	377.4	14.86
MSK 72 - 10.9	33.50105	3041.2	683697	M 72 x 6	2 3/4	105	4 5/8	168.0	6.61	387.0	15.24
MSK 80 - 10.9 Up to MSK 110 - 10.9	Contact us for technical specifications with an email to: sales@ith.com										

Technical enhancements and modifications reserved. \*Inch dimensions for a pitch of 8 UN, any further pitches available.



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Ladle turret bolt connection.



Casing bolt connection.

## Special designs

The Bolt Tensioning Cylinder (BTC) portfolio presented in this brochure is only the standard range. However, ITH has the competence and the know-how to design Bolt Tensioning Cylinders exactly to customer's requirements.

The following examples give you a snapshot of the ITH Bolt Tensioning Cylinders (BTC) solutions – and there is even more. Contact us for a free of charge technical consultation regarding your bolted joint.

### BTC type Segment



Several BTC segments are combined to a ring which allows simultaneous bolting of several bolts. The even preload distribution leads to a high precision – useful on ANSI flanges or sensitive areas like this Nuclear Power Station.

### BTC type TWIN



Simultaneous pre-tensioning of 2 bolted connections within a close axial distance. ITH offers a scope from M16 to M52 (3/8" to 2").

### BTC type Large-Scale



Based on the single-stage design ITH delivers Bolt Tensioning Cylinders up to M 800 (31 1/2"). They are applied like on this main shaft of a gas turbine.

### Foundation BTC



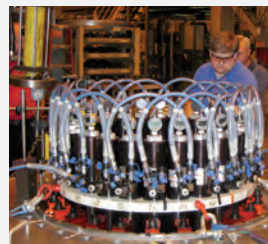
It is commonly recommended to tighten anchor rods or other foundation bolts with ITH Bolt Tensioning Cylinders. Because no bending effects and no torsion effects appear during their use.

### BTC type RPVH



ITH tightens and loosens the bolted joints in Nuclear Power Stations safely, precisely and reliably. Next to other solutions a special BTC set for the reactor pressure vessel head (RPVH) was designed (M150, 6").

### ITH Multi Tensioning



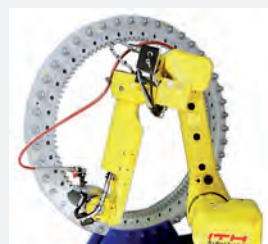
Simultaneous tensioning of several bolts at the same time like these 2.5" – 8 UN turbine rotor bolts.

### Pressure-Stretch-Documentation



The optional PD / PSD System (see page 19) offers automatic control and digital documentation of the bolting procedure with ITH Bolt Tensioning Cylinders.

### ITH Auto-Stretch



ITH developed a robot supported automation solution for Bolt Tensioning Cylinders which can be applied to tighten bolts in series production.

## Digital Documentation System: PD/PSD System



The ITH PD / PSD System is a digital management system for nearly all applications with ITH Bolt Tensioning Cylinders.

Functions:

- Digital management & digital documentation of all application data via industrial touch panel PC's (several designs).
- Automatic control of the hydraulic pump unit by Automatic Pressure Control (APC).
- Version 1: The PD system measures and records the hydraulic pressure.
- Version 2: The PSD System measures and records both the hydraulic pressure and the bolt elongation of the bolts.

Both systems offer direct feedback about the joint quality. All bolting procedures can be documented. The ITH software can be customized.

## ITH Multi Tensioning System

By using the ITH Multi Tensioning method, **multiple Bolt Tensioning Cylinders are used simultaneously** by connecting them to one hydraulic unit (connected in series or in parallel).

All bolts are tightened simultaneously and the required assembly preload are generated evenly. This leads to precise results: Using ITH Multi Tensioning repeatable assembly preload within a tolerance level of  $\pm 2\%$  can be reached.

This accurate and simultaneous loading provides a balanced load across the flange and increases its operating life significantly.

ITH Multi Tensioning reduces the risk of leakages significantly (**like on ANSI or ASME flanges, pictures on the right**) and decreases down times of machines and plant.



ITH Multi-Tensioning

## Hydro-MAX Electric High Pressure Pump

The electric high pressure pump Hydro-MAX, developed by ITH, is manufactured in different designs. The Hydro-MAX 18 is used for service jobs and the Hydro-MAX 37, 38 and 39 are used for shop applications. ITH Hydro-MAX pumps are

designed for high cycles and fast working processes. Additional features include user-friendly operation and increased safety because of the positioning of the hydraulic couplings.

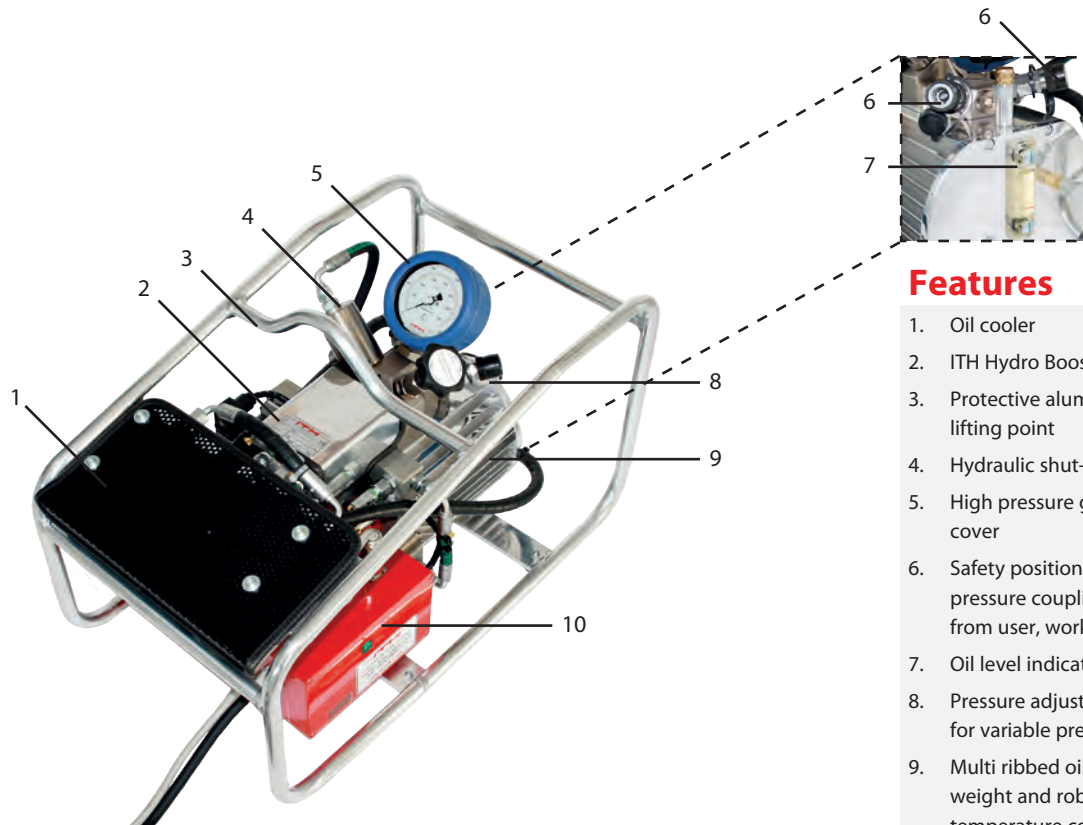


Fig.: Hydro-MAX 18

### Features

1. Oil cooler
2. ITH Hydro Booster
3. Protective aluminium frame with lifting point
4. Hydraulic shut-off valve
5. High pressure gauge with protective cover
6. Safety positioning of the two high pressure couplings (directed away from user, work safe design)
7. Oil level indicator
8. Pressure adjusting valve (PAV), for variable pressure adjusting
9. Multi ribbed oil tank, made of light-weight and robust aluminium (high temperature conductivity), for optimal cooling
10. Low voltage indicator light and electronic cycle counter at the control box

### Performance

- ✓ Max. operating pressure 2.500 bar.
- ✓ Voltage range from 90 V - 480 V for 50 Hz and/or 60 Hz.
- ✓ NIOX-Coating of all steel components (offshore ready).
- ✓ Safe positioning of the two high pressure couplings.
- ✓ Wear-free single rotor-eccentric shaft.
- ✓ **Standard:** Remote.
- ✓ **Optional:** Digital Remote displaying pressures.
- ✓ **Optional:** Constant digital automatic pressure control (APC, see page 23).
- ✓ **Optional:** Direct pressure stretch documentation system (PSD-System).
- ✓ **Optional for Hydro-MAX 18 and 38:** Suitable for offshore applications by NIOX-Coating and aluminium frame with protective cage.

### Remotes



Standard (10m)

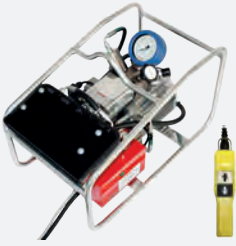


Optional:  
Digital (10m)



Multi-Function  
Remote for  
Automatic  
Pressure Control  
function (APC)

## Hydro-MAX 18

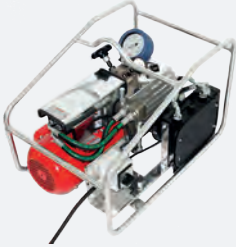


### Field of application:

- ✓ For service and assembling jobs
- ✓ Optimized weight
- ✓ Easy transport
- ✓ One-man operation with remote

Order no.	34.x1318- Motor-ID			
Type	1813	1815	1825	
Pressure max. [bar]	1.350	1.500	2.500	
Dimension (LxWxH)	620 x 360 x 400mm			
Weight	41.6 kg (without oil 37 kg)			
Connection	90-110 V	1	50+60 Hz	-09174
	190-230 V	1	50 Hz	-19150
	190-230 V	1	60 Hz	-19160
	200-230 V	3	50+60 Hz	-20370
	380-420 V	3	50+60 Hz	-40370
	480 V	3	60 Hz	-48360
Capacity	Phase	Frequency	Motor-ID	

## Hydro-MAX 37

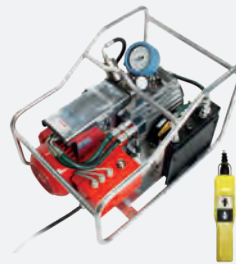


### Field of application:

- ✓ For shop applications
- ✓ Manual shut-off valve
- ✓ High performance motor
- ✓ Designed for high bolt cycles and large bolt dimensions

Order no.	34.x1337- Motor-ID			
Type	3713	3715	3725	
Pressure max. [bar]	1.350	1.500	2.500	
Dimension (LxWxH)	640 x 440 x 450mm			
Weight	61.0 kg			
Connection	230 V	1	50 Hz	-23150
	230 V	1	60 Hz	-23160
	230 V	3	50+60 Hz	-23370
	380-420 V	3	50+60 Hz	-40370
	480 V	3	60 Hz	-48360
	Capacity	Phase	Frequency	Motor-ID

## Hydro-MAX 38



### Field of application:

- ✓ For shop applications
- ✓ One-man operation with remote
- ✓ High performance motor
- ✓ Designed for high bolt cycles and large bolt dimensions

Order no.	34.x1338- Motor-ID			
Type	3813	3815	3825	
Pressure max. [bar]	1.350	1.500	2.500	
Dimension (LxWxH)	640 x 440 x 450mm			
Weight	66.4 kg			
Connection	230 V	1	50 Hz	-23150
	230 V	1	60 Hz	-23160
	230 V	3	50+60 Hz	-23370
	380-420 V	3	50+60 Hz	-40370
	480 V	3	60 Hz	-48360
	Capacity	Phase	Frequency	Motor-ID

## Hydro-MAX 39



### Field of application:

- ✓ For shop applications and service jobs
- ✓ One-man operation with remote
- ✓ High performance motor
- ✓ Optimized weight
- ✓ Designed for high bolt cycles and large bolt dimensions

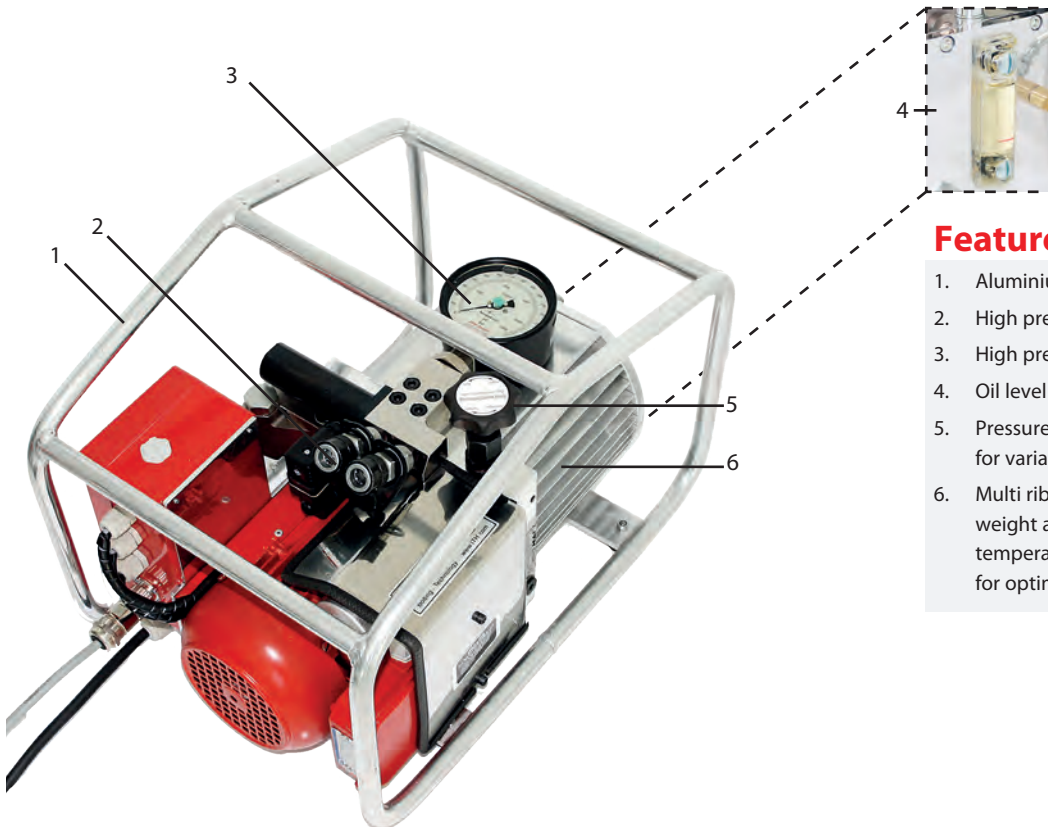
Order no.	34.x1339- Motor-ID			
Type	3913	3915	3925	
Pressure max. [bar]	1.350	1.500	2.500	
Dimension (LxWxH)	640 x 370 x 450mm			
Weight	64.3 kg			
Connection	230 V	1	50 Hz	-23150
	230 V	1	60 Hz	-23160
	230 V	3	50+60 Hz	-23370
	380-420 V	3	50+60 Hz	-40370
	480 V	3	60 Hz	-48360
	Capacity	Phase	Frequency	Motor-ID

# Eco-MAX

## Electric High Pressure Pump

For standard applications with high cycles ITH developed electric high pressure pumps Eco-MAX. A robust design is

obtained by aluminium protection and transport frame.



### Features

1. Aluminium Frame
2. High pressure couplings
3. High pressure gauge
4. Oil level sight glass
5. Pressure adjusting valve (PAV), for variable pressure adjusting
6. Multi ribbed oil tank, made of light-weight and robust aluminium (high temperature conductivity), for optimal cooling

Fig.: Eco-MAX 18  
with optional two hydraulic connectors (standard is one)

### Performance

- ✓ Max. operating pressure 1.500 bar.
- ✓ Voltage range from 90 V - 690 V for 50 Hz and/or 60 Hz.
- ✓ Wear-free single rotor-eccentric shaft.
- ✓ Service-friendly by small number of components → Reduction of Maintenance-costs.
- ✓ Easy transport.
- ✓ Standard for Eco-MAX 18: Remote.
- ✓ Optional for Eco-MAX18: Digital remote with displayed pressure.
- ✓ Optional for Eco-MAX 18: Constant digital automatic pressure control (APC, see page 23).

### Remotes for Eco-MAX 18



Standard (10m)



Optional:  
Digital (10m)



Multi-Function  
Remote for  
Automatic  
Pressure Control  
function (APC)

## Eco-MAX 17

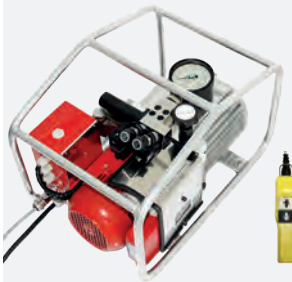


### Field of application:

- ✓ For service and assembling jobs
- ✓ Optimized weight
- ✓ Easy transport
- ✓ Manual shut-off valve

Order no.	34.x1117- Motor-ID			
Type	1713		1715	
Pressure max. [bar]	1.350		1.500	
Dimension (LxWxH)	495 x 350 x 375mm			
Weight	30.5 kg			
Connection	90-110 V	1	50 Hz	-09150-19
	90-110 V	1	60 Hz	-09160-19
	190-230 V	1	50 Hz	-19150-19
	190-230 V	1	60 Hz	-19160-19
	230 V	3	50+60 Hz	-2337x
	380-420 V	3	50+60 Hz	-4037x
	480 V	3	60 Hz	-4836x
	690 V	3	50+60 Hz	-6937x
	Capacity	Phase	Frequency	Motor-ID

## Eco-MAX 18



### Field of application:

- ✓ For service and assembling jobs
- ✓ Optimized weight
- ✓ Easy transport
- ✓ One-man operation

Order no.	34.x1218- Motor-ID			
Type	1813		1815	
Pressure max. [bar]	1.350		1.500	
Dimension (LxWxH)	495 x 350 x 375mm			
Weight	35.0 kg			
Connection	90-110 V	1	50 Hz	-09150-IS1
	90-110 V	1	60 Hz	-09160-IS1
	190-230 V	1	50 Hz	-19150-IS1
	190-230 V	1	60 Hz	-19160-IS1
	230 V	3	50+60 Hz	-2337x
	380-420 V	3	50+60 Hz	-4037x
	480 V	3	60 Hz	-4836x
	690 V	3	50+60 Hz	-6937x
	Capacity	Phase	Frequency	Motor-ID

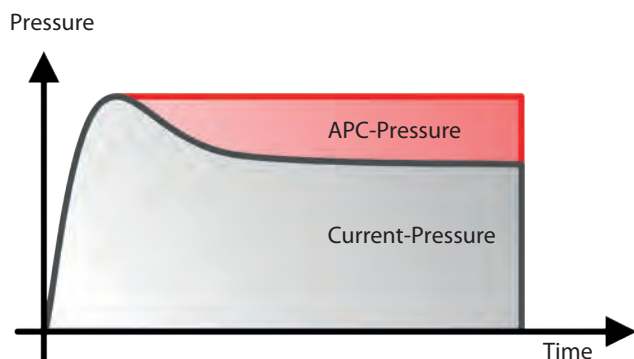
## Automatic-Pressure-Control APC

When operating ITH Bolt Tensioning Cylinders, it can happen that the pressure drops by stretching of the hose lines or settling of the construction. This has effects on the results of

the bolt connection. The digital automatic pressure control (APC) readjusts the pre-determined pressure constantly and ensures a high degree of accuracy at the bolt connection.



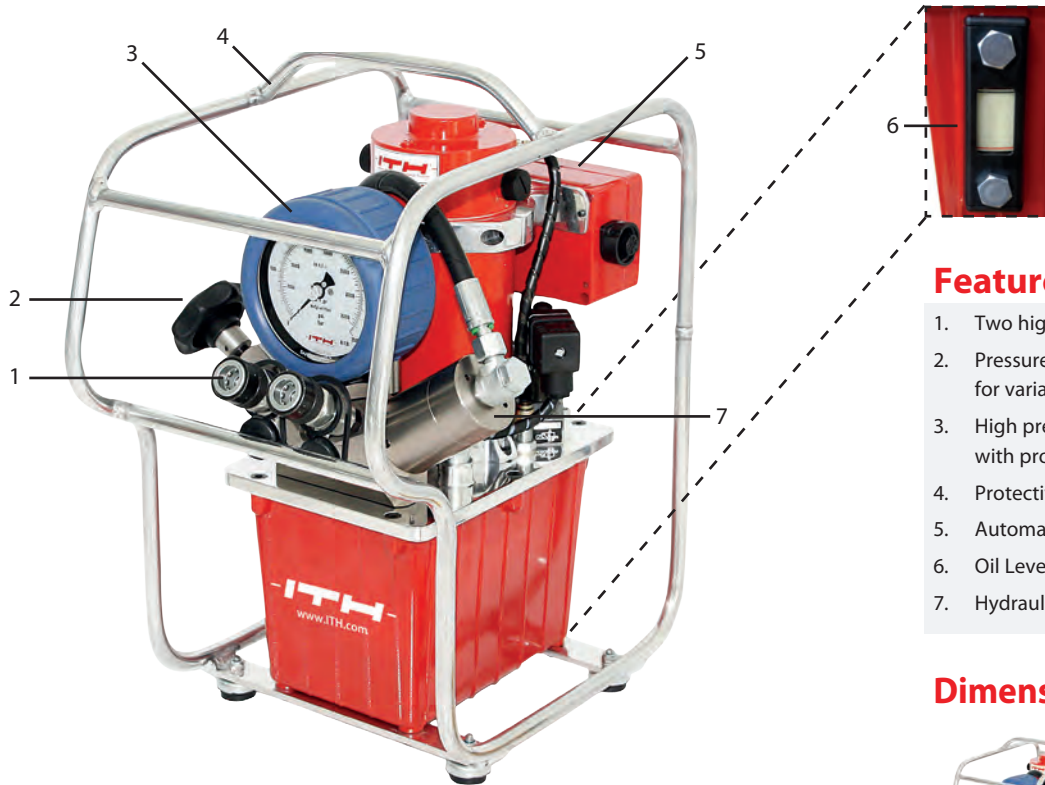
Pressure ITH High Pressure Pump with APC control



# Compact High Pressure Pumps Type Micro-MAX

ITH Micro-MAX Series were developed for service jobs for crane and wind turbine manufacturers. By a compact design, low weight and optimized dimensions the ITH Micro-MAX perfectly match the requirements for these applications.

In limited spaces or jobs of certain height the ITH Micro-MAX work reliable, quick, safe and comfortable. Battery version type Micro-MAX 72 even enables you to work independently from wired power supplies.



## Features

1. Two high pressure couplings
2. Pressure adjusting valve (PAV), for variable pressure adjusting
3. High pressure gauge with protection cover
4. Protective aluminium frame
5. Automatic Cycle counter integrated
6. Oil Level Sight Glass
7. Hydraulic Shut Off Valve

## Dimensioning compared



Easy handling by lightweight and compact design

Fig.: Micro-MAX 70

## Performance

- ✓ Easy transport by lightweight design.
- ✓ Maximum pressure: 1.500 bar.
- ✓ Worldwide use: motor works on both 50 Hz and 60 Hz with voltages from 90 V – 110 V or 190 V – 230 V.
- ✓ NIOX-Coating of all steel components (Offshore ready).
- ✓ Builds up pressure quickly – fast working process.
- ✓ Easy handling even in limited spaces.
- ✓ **Standard for Micro-MAX 70:** Remote.
- ✓ **Optional for Micro-MAX 70:** Digital remote with displayed pressure.
- ✓ **Optional for Micro-MAX 70:** Suitable for offshore applications by NIOX-Coating and aluminium frame with protective cage.

## Remotes for Micro-MAX 70



Standard (10m)

Optional:  
Digital (10m)

## Micro-MAX 70 - with remote



### Field of application:

- ✓ For service jobs
- ✓ Optimized weight
- ✓ Easy one-man operation with remote

Order no.	34.01070-Motor-ID		34.11070-Motor-ID	
Type	7013		7015	
Pressure max. [bar]	1.350		1.500	
Dimension (LxWxH)	390 x 290 x 450mm			
Oil tank volume	3 l / 1.5 l usable			
Weight	22.5 kg			
Connection	90-110 V	1	50+60 Hz	-09174
	190-230 V	1	50+60 Hz	-19174
	Capacity	Phase	Frequency	Motor-ID

## Micro-MAX 71 – with manual shut-off valve



### Field of application:

- ✓ For service jobs
- ✓ Optimized weight
- ✓ Manual adjusting of the pressure by PAV (Pressure Adjusting Valve)

Order no.	34.01071-Motor-ID		34.11071-Motor-ID	
Type	7113		7115	
Pressure max. [bar]	1.350		1.500	
Dimension (LxWxH)	390 x 290 x 450mm			
Oil tank volume	3 l / 1.5 l usable			
Weight	21.5 kg			
Connection	90-110 V	1	50+60 Hz	-09174
	190-230 V	1	50+60 Hz	-19174
	Capacity	Phase	Frequency	Motor-ID

## Micro-MAX 72 – Battery version



### Field of application:

- ✓ For service jobs
- ✓ High performance motor, long battery capacity
- ✓ Easy cordless operation
- ✓ Long life 28V-Li-Ion battery
- ✓ Fast pressure built-up for fast assembling jobs

Order no.	34.00072	34.10072
Type	7213	7215
Pressure max. [bar]	1.350	1.500
Dimension (LxWxH)	340 x 250 x 450mm	
Oil tank volume	3 l / 1.5 l usable	
Weight	14.8 kg	
Connection	28 V / Li-Ion	

### Included with:



Replacement battery



Quick-charger battery station

## ITH High Pressure Pumps for offshore applications



### Features:

- ✓ Suitable to all ITH High Pressure Pump units
- ✓ Coated components
- ✓ Aluminium frame with protective cage for protection of all important components

Fig.: Micro-MAX 70 with protective cage

# Pneumatic High Pressure Pumps

## Aero-MAX & Travel-MAX

For bolting jobs in areas where there is a risk of explosion or where there is no electric power supply ITH offers Pneumatic High Pressure Pumps „Aero-MAX“ in several types. Aero-MAX 9

and 10 are designed for shop applications while Aero-MAX 89 and 90 are made for service jobs because of their light-weight design and easy transport.

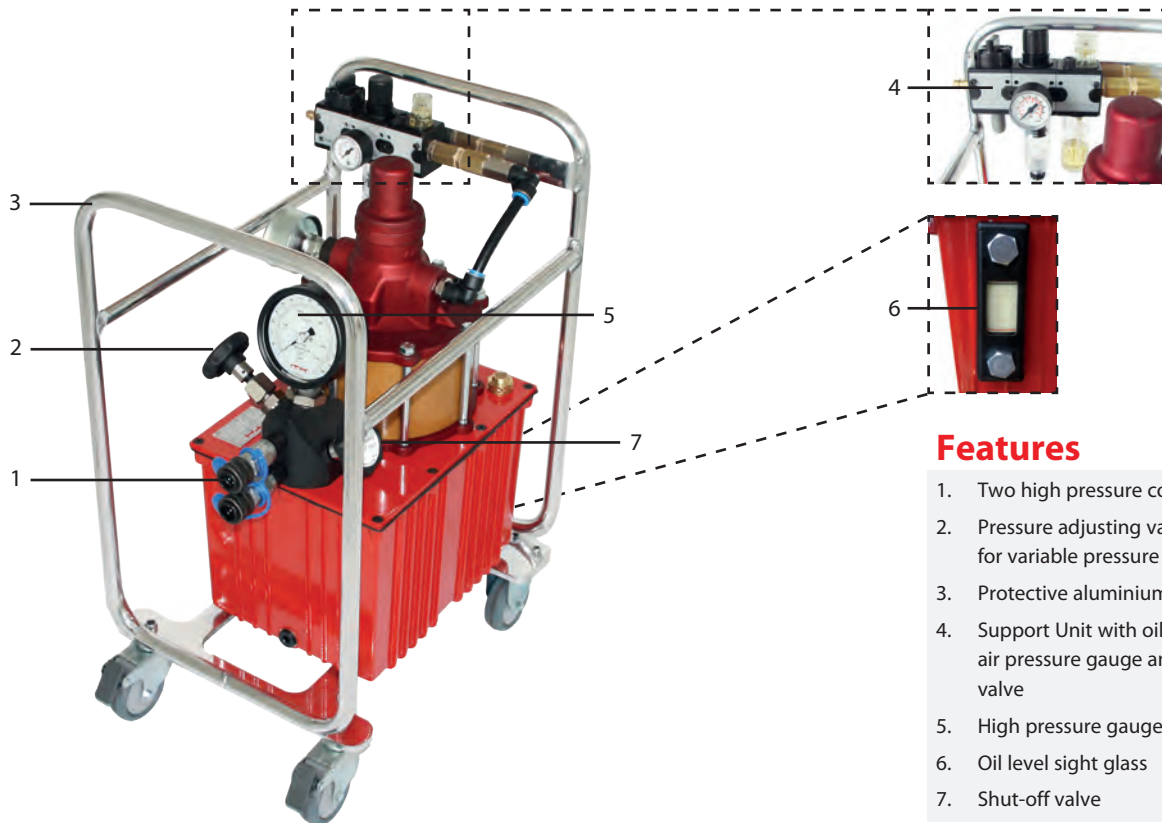


Fig.: Aero-MAX 9

### Features

1. Two high pressure couplings
2. Pressure adjusting valve (PAV), for variable pressure adjusting
3. Protective aluminium frame
4. Support Unit with oiler, water filter, air pressure gauge and air shut off valve
5. High pressure gauge
6. Oil level sight glass
7. Shut-off valve

### Performance

- ✓ Maximum Pressures up to 3.000 bar.
- ✓ No electric power supply required.
- ✓ Easy-to-service-design by optimized number of components, which leads to a reduction of maintenance costs.
- ✓ Easy transport.
- ✓ Movable and lockable wheels.
- ✓ Optional for Aero-MAX 179: Pneumatic remote.

### Pneumatic Remote



Only for Aero-MAX 179: Remote (5m) with pneumatic shut-off valve (No electric power supply required)

## Aero-MAX 9 - Shop-Version with PAV and Aero-MAX 10 – Shop version without PAV



**Field of application:**

- ✓ For shop applications
- ✓ Designed for high cycles

Order no.	34.x0009 / 34.x0010				
Type	0913 / 1013	0915 / 1015	0925 / 1025	1030	1040
Pressure max. [bar]	1.350	1.500	2.500	3.000	4.000
Min. air pressure [bar]	4.5	5.0	6.0	7.0	6.0
Air requirement	ca. 1400 l/min				
Dimension (LxWxH)	430 x 330 x 660mm				
Weight	35.0 kg				

## Aero-MAX 89 - Mini-Version with PAV and Aero-MAX 90 – mini version without PAV



**Field of application:**

- ✓ For service and assembling jobs
- ✓ Light-weight design
- ✓ Easy transport

Order no.	34.x0089 / 34.x0090			
Type	8913 / 9013	8915 / 9015	8925 / 9025	9030
Pressure max. [bar]	1.350	1.500	2.500	3.000
Min. air pressure [bar]	5.0	5.5	6.0	7.0
Air requirement	ca. 900 l/min			
Dimension (LxWxH)	430 x 330 x 660mm			
Weight	21.0 kg			

## Aero-MAX 179 - Shop-Version with pneumatic Remote



**Field of application:**

- ✓ For service and assembling jobs
- ✓ Light-weight design
- ✓ Easy transport
- ✓ Easy-to-use by pneumatic remote

Order no.	34.x0179			
Type	7913	7915	7925	7930
Pressure max. [bar]	1.350	1.500	2.500	3.000
Min. air pressure [bar]	6.0	6.0	6.0	7.0
Air requirement	ca. 1400 l/min			
Dimension (LxBxH)	430 x 400 x 660mm			
Weight	21.0 kg			

## Travel-MAX 41



**Field of application:**

- ✓ For service and assembling jobs
- ✓ Compact and light weight design
- ✓ Easy to maintain
- ✓ Easy transport by case with trolley function

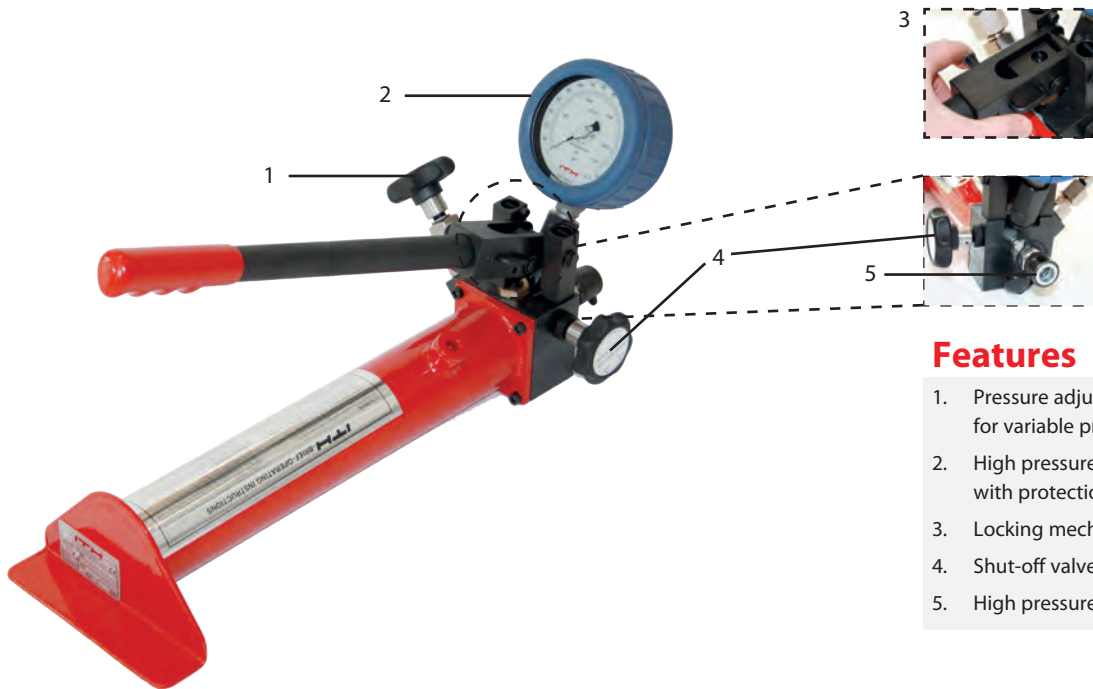
Order no.	34.x0041	
Type	4115	4125
Pressure max. [bar]	1.350	2.500
Min. air pressure [bar]	6.0	6.0
Air requirement	ca. 900 l/min	
Dimension (LxWxH)	500 x 305 x 457mm	
Weight	27.5 kg	

# Manual High Pressure Pumps Lever-MAX – Single-stage

## Lever-MAX 111 and 125

For service and assembling jobs, ITH offers the practical hand lever high pressure pumps. The compact design enables operating in difficult accessible working areas and an easy

transport. For hand lever high pressure pumps no power supply is required.



### Features

1. Pressure adjusting valve (PAV), for variable pressure adjusting
2. High pressure gauge with protection cover
3. Locking mechanism for easy transport
4. Shut-off valve
5. High pressure coupling

Fig.: Lever-MAX 125 - mini

## Lever-MAX 111 - Standard and Mini\*



Order no.	34.x0111			
Type	11113	11115	11125	11130
Pressure max. [bar]	1.350	1.500	2.500	3.000
Dimension (LxWxH)	760 x 180 x 305 mm			
Weight	10.0 kg			

## Lever-MAX 125 - Standard and Mini\* with PAV



Order no.	34.x0125		
Type	12513	12515	12525
Pressure max. [bar]	1.350	1.500	2.500
Dimension (LxWxH)	760 x 180 x 305 mm		
Weight	10.4 kg		

\*Mini for 1.350 bar and 1.500 bar: The hand lever high pressure pump mini-version has a shorter oil tank and therefore a lower weight.

**New Double-stage Development**  
for fastest bolting procedures



## Manual High Pressure Pumps Lever-MAX – Double-stage

### Lever-MAX 235 / 240 and Lever-MAX 255

To perform faster bolting procedures ITH offers a double-stage manual pump series. Lever-MAX 255 with high flow

rate per stroke for more faster and more efficient bolting procedures.



### Features

1. High pressure gauge with protection cover
2. Locking mechanism for easy transport
3. Shut-off valve
4. One high pressure coupling (standard), second coupling optional for ITH Multi Tensioning

Fig.: Lever-MAX 235 – with optional two high pressure couplings

### Lever-MAX 235 without PAV and Lever-MAX 240 with PAV



Order no.	34.x0235 / 34.x0240		
Type	23515 / 24015	23525 / 24025	23530
Pressure max. [bar]	1.500	2.500	3.000
Oil volume	1.75 l	1.75 l	1.75 l
(usable oil volume)	1.4 l	1.4 l	1.4 l
Oil flow rate / stroke	12.2 cm <sup>3</sup>		
Dimensions (LxWxH)	830 x 220 x 270 mm		
Weight	11.0 kg	13.5 kg	13.5 kg

### Lever-MAX 255 high oil flow rate pump



Order no.	34.x0255			
Type	25515	25525	25530	25540
Pressure max. [bar]	1.500	2.500	3.000	4.000
Oil volume	1.75 l	1.75 l	1.75 l	1.75 l
(usable oil volume)	1.4 l	1.4 l	1.4 l	1.4 l
Oil flow rate / stroke	26 cm <sup>3</sup>			
Dimensions (LxWxH)	1000 x 220 x 300 mm			
Weight	12.5 kg	17.5 kg	17.5 kg	17.5 kg

# Hydraulic equipment

## High Pressure Hose Lines

### Series 30 - Standard



- ✓ Inner: Polyamide
- ✓ Outer: Polyurethane

### Series 32 - Protection cover



- ✓ Material: PVC
- ✓ Abrasion resistant
- ✓ Chemical resistant

### Series 33 – Safety spring (kink protection)



- ✓ Hard drawn
- ✓ Galvanized

### Series 34 - Protection cover + safety spring



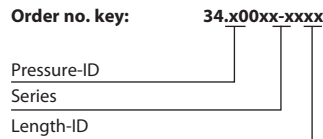
Fig.: 2.500 bar version

Series 30 high pressure hose line standard  
 Series 32 high pressure hose line with protection cover  
 Series 33 high pressure hose line with safety spring (kink protection)  
 Series 34 high pressure hose line with protection cover + safety spring

- High abrasion resistance
- Small bending radius
- Pressure cover of steel wire (across)
- High flexibility

Length	Length-ID
2.0 m	0020
3.0 m	0030
4.0 m	0040
5.0 m	0050
6.0 m	0060

Further lengths available



Pressure max.	Colour hose line	Pressure-ID
1.500 bar	Silver	1
2.500 bar	Blue with black letters	2
3.000 bar	Blue with white letters	3
4.000 bar	Red	4

## Nipples and Couplings

### Series 50:



- ✓ Galvanized steel
- ✓ With protection cap

### Series 52:



- ✓ Galvanized steel
- ✓ With protection cap

### Series 55:



- ✓ Galvanized steel
- ✓ With protection cap
- ✓ Lock ring

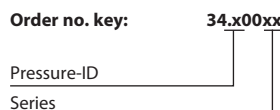
Series 50 high pressure coupling with internal thread\*  
 Series 52 high pressure coupling with internal thread\*  
 Series 54 high pressure coupling with lock ring 1.500 bar\*  
 Series 55 high pressure coupling with lock ring 2.500 bar\*

- Non-drip coupling
- Patented sealing system
- One-hand coupling
- With safety locking. Prevented inadvertently uncoupling.

Pressure-max.	Colour	Pressure-ID
1.500 bar*	Black	1
2.500 bar*	Blue	2
3.000 bar**	Red	3
4.000 bar*	Blue	4

\*:With outer and inner thread standard G - 1/4" deliverable.

\*\* : 3.000 bar coupling with safety ring as a standard feature.



# Hydraulic equipment

## Couplings

### Coupling elbow



Fig.: 34.20061

Pressure max.	Colour	Dimension [mm]	Order no.
1.500 bar*	Black	67 x 66 x 28.2	34.10061
2.500 bar*	Blue	67 x 79 x 28.2	34.20061
3.000 bar**	Red	113 x 95 x 32	34.30060

### Series 120 – Twin thread nipple



Pressure max.	Dimension [mm]	Thread Version	Order no.
2.500 bar	19 x 45	G 1/4"	34.20120
2.500 bar	19 x 45	G 1/4", M16 x 1.5	74.02702
3.000 bar	25 x 44	M16 x 1.5	74.02800

### Coupling distributor

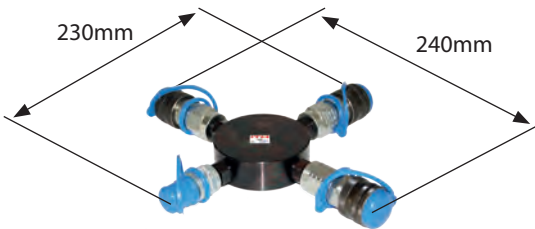


Fig.: 34.20076

Version	Version-ID
2-way	75
3-way	76
4-way	77
5-way	78

Order no. key: 34.x00xx  
 Pressure-ID  
 Series

Pressure max.	Colour	Pressure-ID
1.500 bar*	Black	1
2.500 bar*	Blue	2
3.000 bar**	Red	3

## High pressure gauges to test hydraulic pump units

### Series 112 – Test gauge (end)



### Series 150 – Test gauge (transition)



### Series 151 – Digital test gauge



- ✓ Up to 3.000 bar max. operating pressure
- ✓ Digital gauge: Accuracy classes from 0.25 to 1
- ✓ Analog gauges: Accuracy classes up to 1
- ✓ Series 112 and 150: Glycerin filling, scaling in 10 bar steps
- ✓ Find more detailed information on [www.ITH.com](http://www.ITH.com)

Pressure max.	Pressure-ID
1.500 bar	1
2.500 bar	2
3.000 bar	3

Accuracy class	Class-ID
1.0	C10
0.5	C05
0.25	C025

ø	ø-ID
100 mm	11
160 mm	17

Order no. key: 34.x0xxx-xxxx-xx  
 Pressure-ID  
 Series  
 Class-ID  
 ø-ID

\*:With outer and inner thread standard G - 1/4" deliverable.  
 \*\*: 3.000 bar coupling with safety ring as a standard feature.

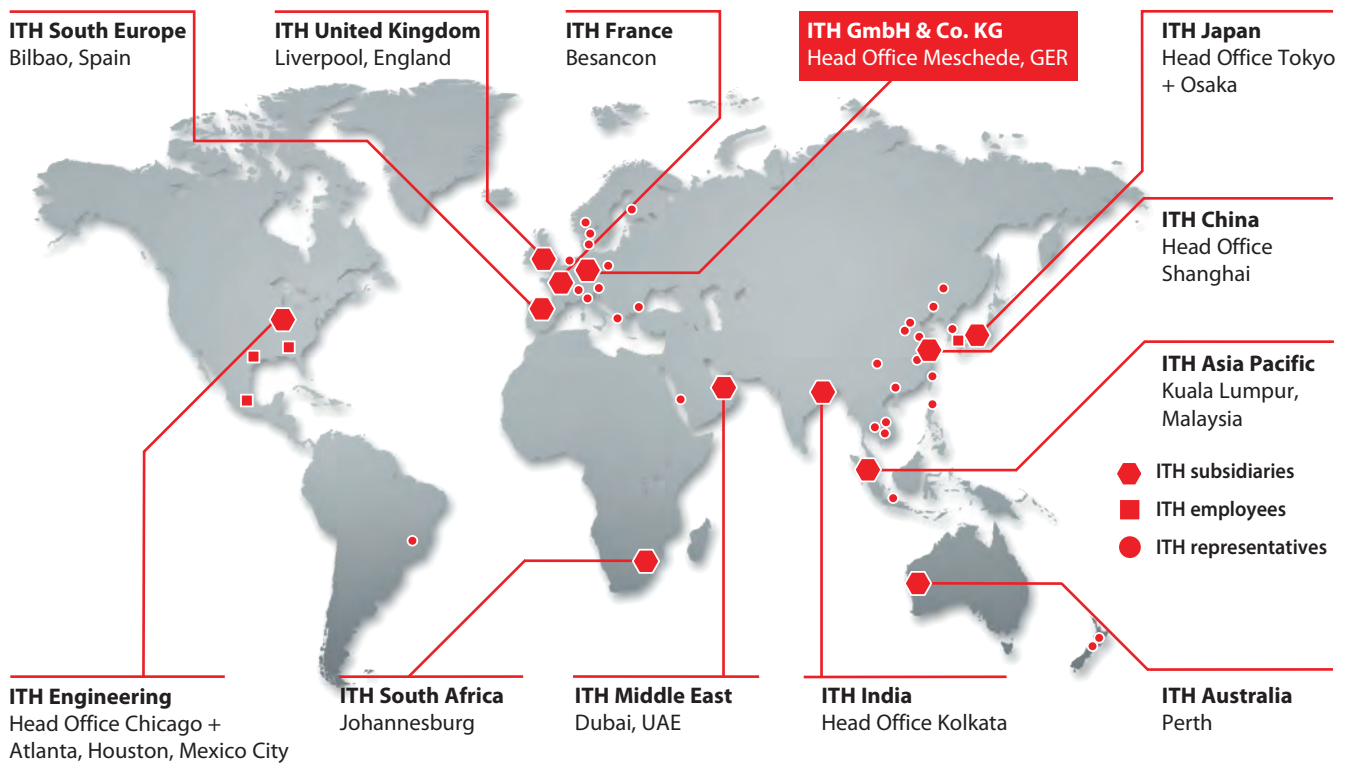


## Technical Sales & Service Offices Worldwide

### ITH drives innovation in Bolting Technology

With more than 30 years in the bolting industry, ITH continuously invests experience and know-how into new technical developments. More than 200 national and international patents prove the innovative capabilities of ITH. Many of these developments have become standards of bolting technology.

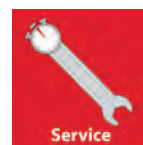
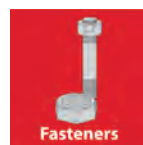
- ✓ Individual industry- and customer solutions
- ✓ Expert advisory service in all questions involving bolts
- ✓ Synergy effects being a whole system supplier
- ✓ Since 1995: ITH was the first mover to implement the international quality guideline DIN ISO 2008-9001
- ✓ Fast and qualified service, worldwide spare part availability



### ITH offers synergy effects as a system supplier

The quality of a bolted connection depends on several factors: design elements, fasteners, bolting method and assembly. As a system supplier only ITH offers complete bolting solutions by

analysing all 4 core components: tools, engineering, fasteners, service. These components are combined to create the best technical and cost-effective solutions for customers.



Find further information and your local person in charge on our website – mobile device optimized.  
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