

IHF

IHF-Stretch-System

$\Delta l = \text{constant}$

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DIBT
Deutsches Institut
für Bautechnik



IHF-Stretch-Connection

Purpose

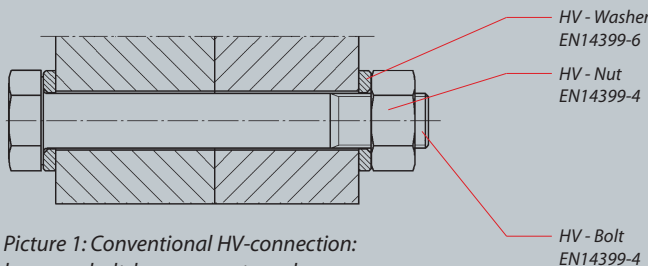
The IHF-Stretch-Connection is approved from the „Deutsches Institut für Bautechnik (DIBt)“ and generally used in steel constructions, especially with ring flanges. The bolted connection is designed for use with an axial hydraulic tensioning system. Here the necessary pretensioning force is applied completely free of friction. When using the tensioning process there are no additional strains introduced on the bolt from either bending or torsion. This allows for better utilization of the bolt with reduced strains on the joint. This in turn results in a more reliable connection.

The connection: Only 2 core elements

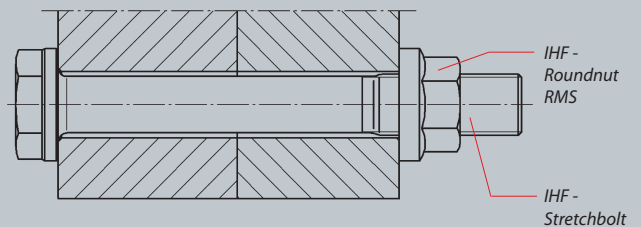
A conventional HV-bolt connection consists of one hexagon bolt, one hexagon nut and two washers. The innovative IHF-Stretch-System reduces the connection to two core elements: the **IHF-Stretchbolt** and the roundnut **RMS**.

Cost reduction by using the HV-tension-system

On conventional HV-connections the standard pretensioning force is applied by torquing the nut with a hydraulic wrench. It is not uncommon to have very different friction coefficients from bolt to bolt with the torquing process. This in turn can lead to big fluctuations in pretensioning forces. Therefore it is possible that the pretensioning force on some of the connections is below the minimum pretensioning force required. With dynamic loads a bigger stress intensity factor appears which can lead to bolt failures. By using the IHF-Stretch-System a higher repeatability (Diagram 2) of the pretensioning force on the bolt is guaranteed. This improved connection permits for longer maintenance intervals and therefore reduces maintenance costs. The more compact tensioning tool (bolt tensioning cylinder) makes it possible to reduce the center distance "A" from the center of the bolt to the casing inner wall. Thus the flange diameter of the ring can be reduced which leads to a considerable cost reduction.



Picture 1: Conventional HV-connection: hexagon bolt, hexagon nut, washers



Picture 2: Innovative method: the IHF-Stretchbolt with Roundnut RMS

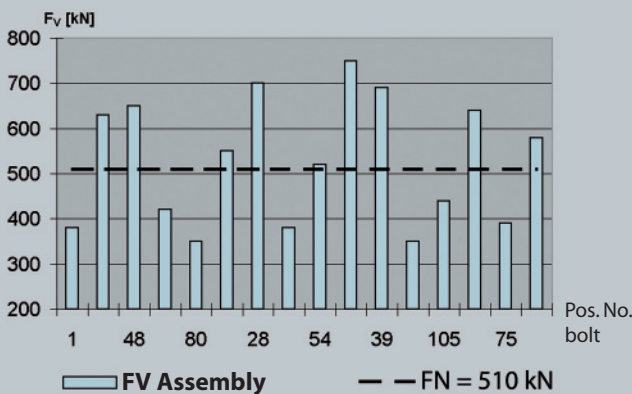


Diagram 1: Applied pretensioning forces (M36) after assembly by means of torquing method measured at tower flanges

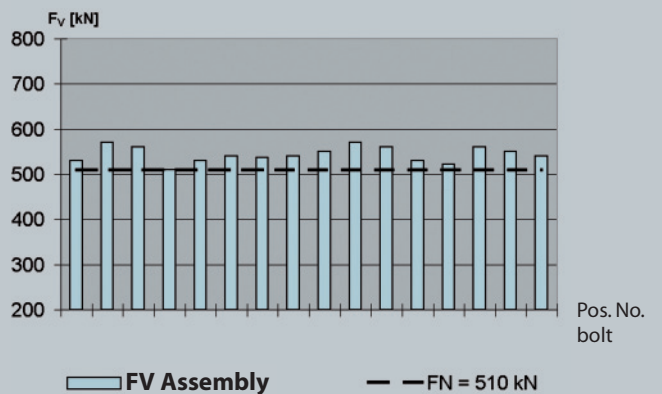


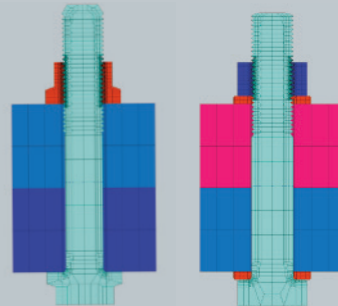
Diagram 2: Applied pretensioning forces after assembly by means of IHF-Stretch-System

Innovation of production

Tensioning optimized design

All IHF-fastening elements are designed with the use of "Finite Element Analysis".

Thus it was possible to reduce the maximum stresses in the stud bolt and in the nut compared to standard HV-hardware. This reduced maximum stress guarantees that IHF-bolt connections have a higher life time than standard HV-connections.



Picture 3: FE calculation IHF-Stretch-System (left) comparing to HV-Standard (right)

The JUMBOTECH® production process:

The "IHF-Stretchbolt" is produced according to the patented JUMBOTECH® production process by the company SBE. This is the only cold forming process which allows production accuracies with a small tolerance value of 0,05 mm for stud bolts up to M48. Compared to hot forming the modern SBE-extruding process makes it possible to produce the stud bolt directly out of the drawn coil with a length from 150 to 200 m. By using the cold forming process other expensive processes such as sand blasting, turning and heat treatment can be dropped. All production steps are documented at SBE. By doing this a complete traceability from the bolt to the raw material is possible.



Picture 4: JUMBOTECH® Production Process, Hexagon Stud M36

DIBt-Approval

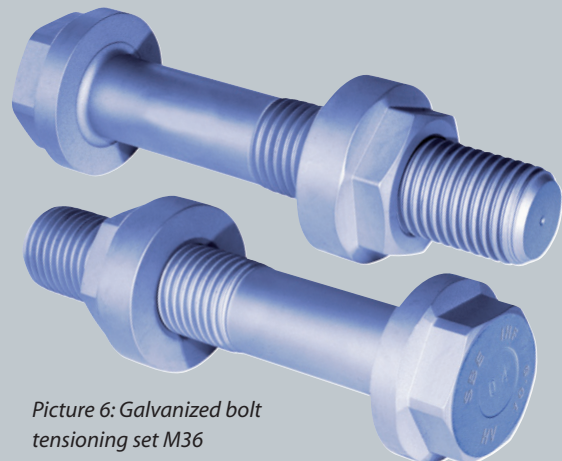
The "Deutsche Institut für Bautechnik" (DIBt) granted IHF GmbH the general building approval for the IHF-Stretch-System (approval number: Z-14.4-592). The DIBt is the registration authority for general building approvals. Approval is required for building products and techniques that don't have standardization or require huge deviations to existing standardizations. A precondition for obtaining this approval was scientific testing of various bolted connections. The testing was done by a leading university in Germany, which is specialized in bolting technology.



Picture 5: DIBt certificate

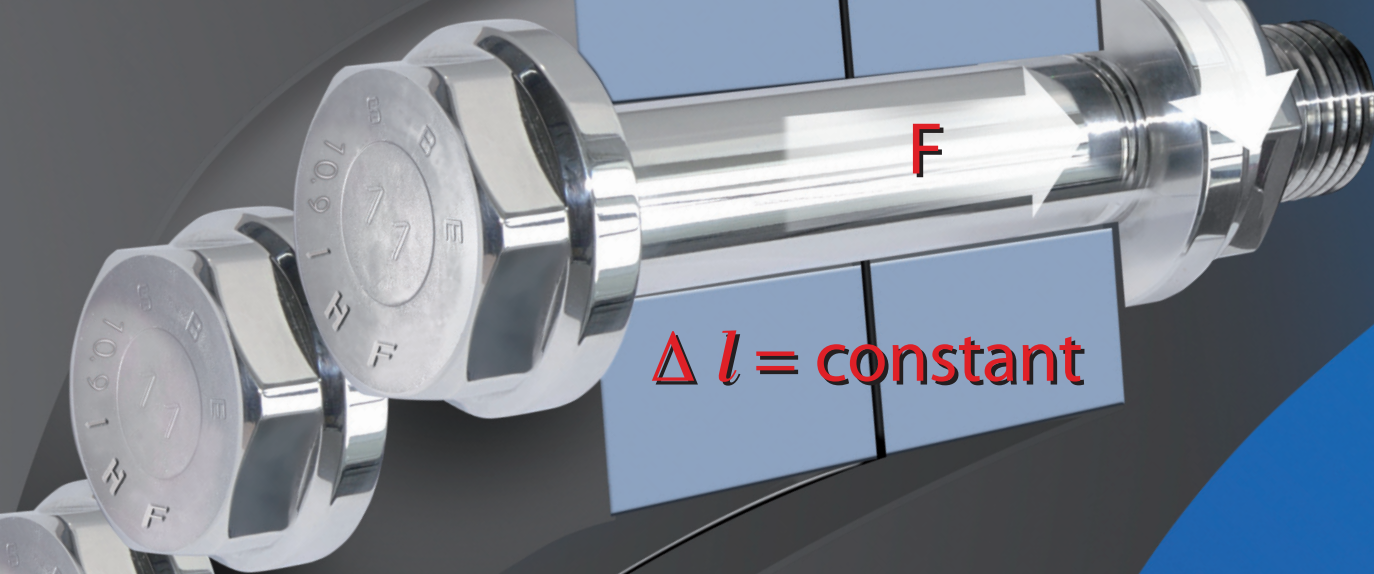
Corrosion protection: less restricted

Because the HV-tension-system works free of torsion and friction, there is no restriction on the choice of surface coating. All types of corrosion protection can be used on the connection including hot-dip galvanizing, Dacromet and Deltaton among others.



Picture 6: Galvanized bolt tensioning set M36

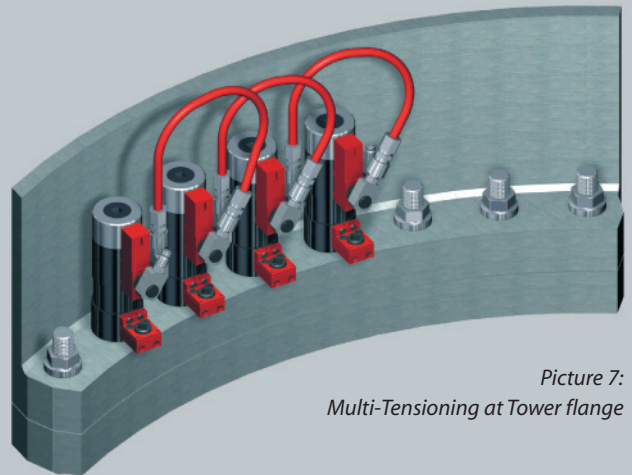
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Stretch-Method

Multi-tensioning system

To achieve an even distribution of the pretensioning forces in the bolts and therefore an even tension of the ring flanges you can use the "multi-tensioning-system". It is possible to connect several bolt-tensioning cylinders in series or one after another. By doing this you are guaranteed a balanced loading of the components and a high repeatability of the pretensioning force. Compared to the torquing method the IHF-Stretch-System has gained more acceptance because of its higher accuracy, better safety and faster speed.



Picture 7:
Multi-Tensioning at Tower flange

Direct elongation measurement system

The direct elongation measurement system developed by ITH enables a direct measurement of the length change to the bolt. The digitally recorded length change is then passed on to the pump controller by means of a transmitter. This recorded data can then be sent to a printer or a computer as record of the pretensioning force for all the bolted connections.

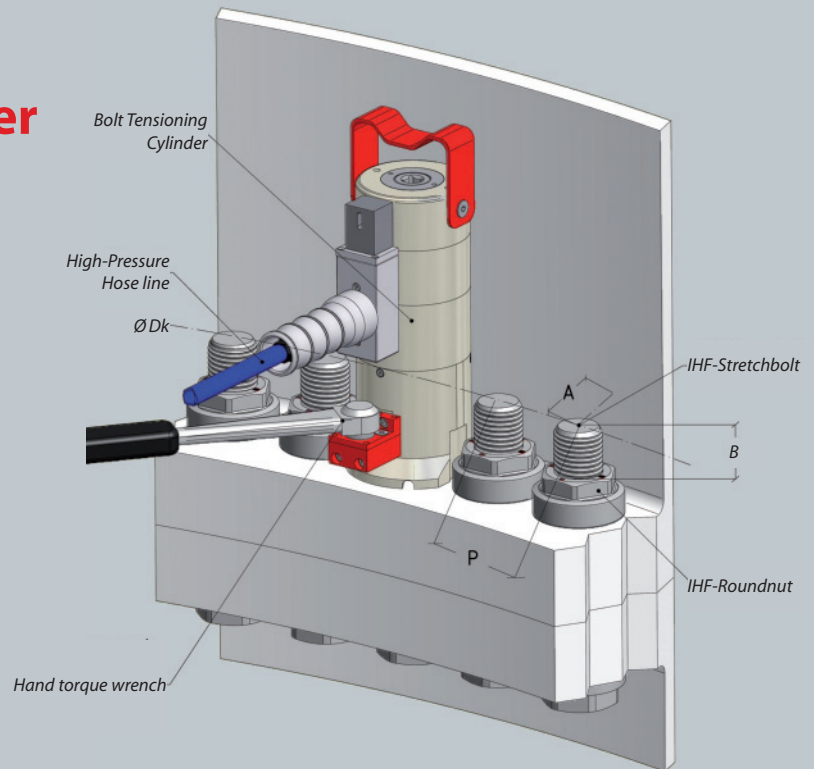
Easy handling, high security

For the pretensioning of the fastening elements a hydraulic ITH bolt-tensioning cylinder is used. The bolt tensioning cylinder is threaded on the extra thread above the nut by means of a hand ratchet. The tensioner is then pressurized with a predetermined hydraulic pressure. By doing this the stud bolt is elongated only in an axial direction. After the desired pressure is met the nut is tightened with a specific torque. The IHF-Stretch-System technology guarantees that joint settling is reduced to a minimum.



Picture 8: Tensioning of Foundation bolts

Bolt-Tensioning Cylinder



Typ	Order-No.	Tensioning force [kN]	Thread size Ø D1 standard / special	A [mm]	B min [mm]	B max [mm]	P _{min} [mm]	Total High [mm]
MS 30	33.04593	460	M 30	36	30	38	64	200
MS 33	33.04594	570	M 33	39	33	40	70	220
MS 36	33.04595	670	M 36	42	36	60	75	256
MS 39	33.04596	805	M 39	46	39	62	81	270
MS 42	33.04597	920	M 42	50	42	63	88	280
MS 45	33.04598	1080	M 45	55	45	65	95	275
MS 48	33.04599	1220	M 48	57	48	65	102	300
MS 52	33.04600	1450	M 52	62,5	52	75	112	335
MS 56	33.04601	1680	M 56	66,5	56	85	118	355
MS 60	33.04602	2010	M 60	68	60	75	122	355
MS 64	33.04603	2210	M 64	70	64	79	126	357

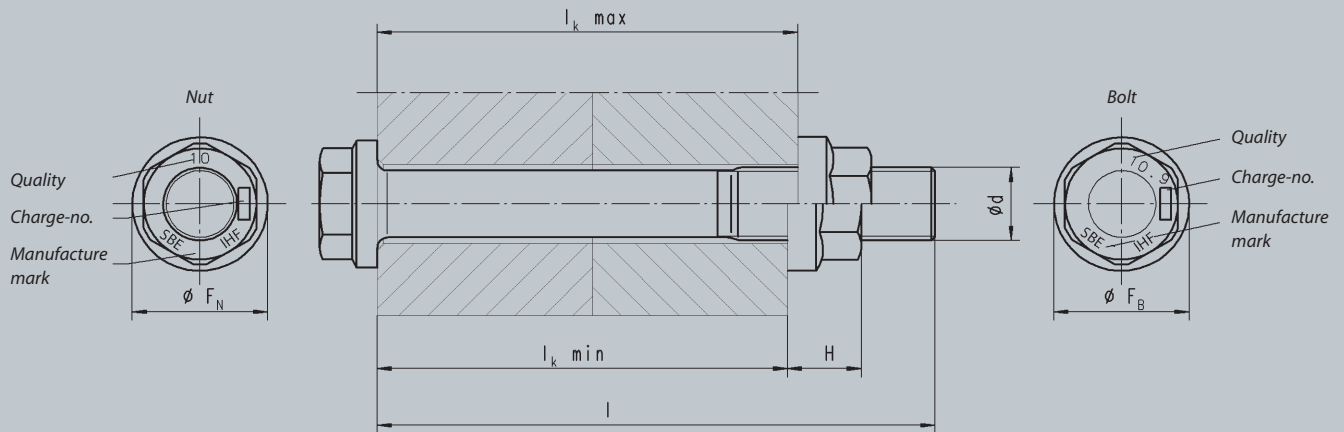
Technical advantages of the IHF-Stretch-System at a glance

- ✓ No bending or torsional stresses in the bolt
- ✓ Higher utilization of the yield point
- ✓ Exact setting of the pretensioning force
→ System is working free of friction
- ✓ Repeat accuracy in working
→ High repeatability of the pretensioning force at several bolt connections
- ✓ Fast and safe assembly

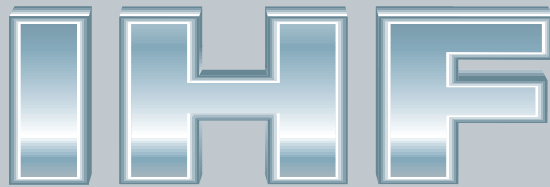
Cost advantages of the IHF-Stretch-System at a glance

- ✓ Less expensive ring flanges
- ✓ Less expensive tool costs
- ✓ Lower costs of the fastening elements
- ✓ Less Expensive maintenance-costs by higher repeatability during pretensioning
- ✓ Smaller bolt dimensions at same pretensioning force
- ✓ Fast assembly
→ Reduced Crane- and assembly costs

Fastening Elements IHF-Stretch-System

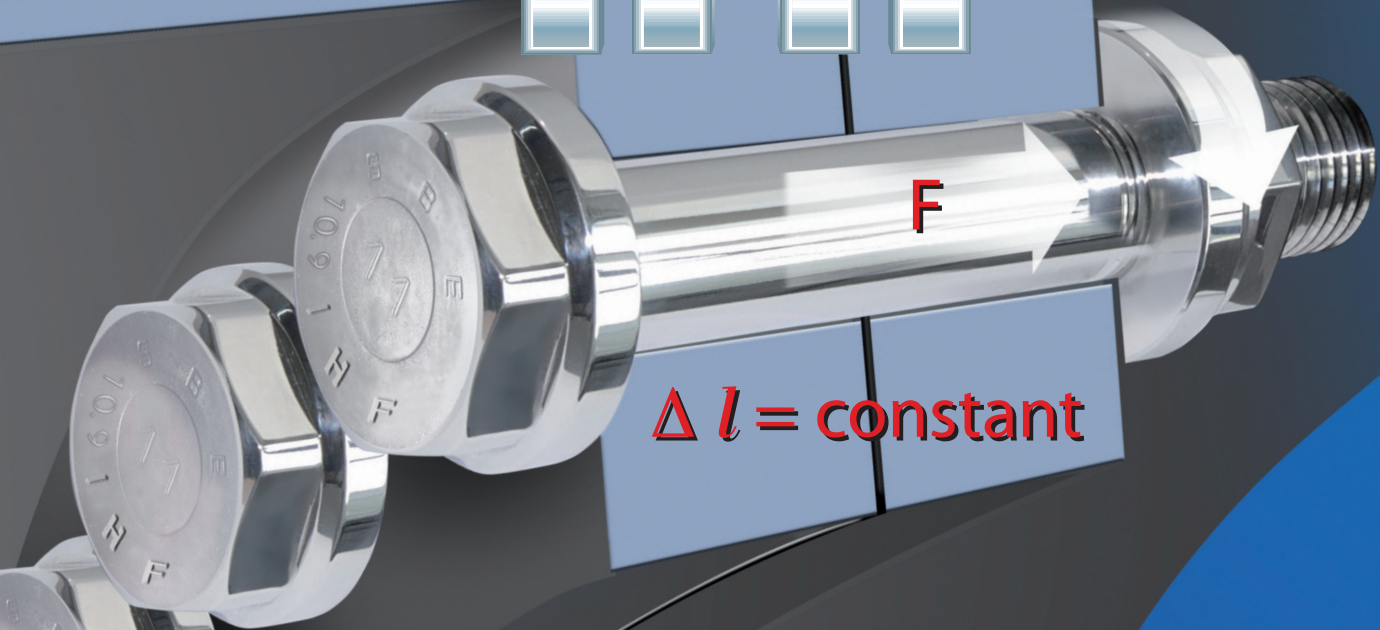


Ø d	M30	M36	M39	M42	M45	M48	M56	M64								
Stud																
Ø F _B	55,9	65,25	70,5	77	83,5	91	104	114								
Nut																
Ø F _N	55,9	65	70,5	77	83,5	91	104	114								
Flange																
Ø df	32	39	42	45	52	52	60	68								
Flange length l	Flange thickness															
	l _k min	l _k max	l _k min	l _k max	l _k min	l _k max	l _k min	l _k max	l _k min	l _k max	l _k min	l _k max	l _k min	l _k max	l _k min	l _k max
135	70	75														
140	75	80														
145	80	85														
150	85	90	75	80												
155	90	95	80	85												
160	95	100	85	90												
165	100	105	90	95												
170	105	110	95	100												
175	110	115	100	105												
180	115	120	105	110	100	105										
185	120	125	110	115	105	110										
190	125	130	115	120	110	115	100	105								
195	130	135	120	125	115	120	105	110								
200	135	140	125	130	120	125	110	115								
205	140	145	130	135	125	130	115	120	110	115						
210	145	150	135	140	130	135	120	125	115	120						
215	145	150	135	140	130	135	125	130	120	125	110	115				
220	145	150	135	140	130	135	130	135	125	130	115	120				
225	145	150	135	140	130	135	135	140	130	135	120	125				
230	145	150	135	140	130	135	140	145	135	140	125	130				



Ø d	M30	M36	M39	M42	M45	M48	M56	M64								
Stud Ø F _B	55,9	65,25	70,5	77	83,5	91	104	114								
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Flange Ø df	32	39	42	45	48	52	60	68								
Flange length l	Flange thickness															
	lk min	lk max	lk min	lk max	lk min	lk max	lk min	lk max	lk min	lk max	lk min	lk max	lk min	lk max	lk min	lk max
235	170	175	160	165	155	160	145	150	140	145	170	175				
240	175	180	165	170	160	165	150	155	145	150	175	180				
245	180	185	170	175	165	170	155	160	150	155	180	185	125	130		
250	185	190	175	180	170	175	160	160	155	160	185	190	130	140		
260			180	190	175	180	160	170	160	170	190	200	140	150		
270			190	200	180	190	170	180	170	180	200	210	190	200		
280			200	210	190	200	180	190	180	190	210	220	200	210	140	150
290			210	225	200	210	190	200	190	200	220	230	210	220	150	160
300			220	230	210	220	200	210	200	210	230	240	220	230	160	170
310					220	230	210	220	210	220	240	250	230	240	210	220
320					230	240	220	230	220	230	250	260	240	250	220	230
330							230	240	230	240	260	270	250	260	230	240
340							240	250	240	250	270	280	260	270	240	250
350							250	260	250	260	240	250	270	280	250	260
360									260	270	250	260	280	290	260	270
370									270	280	260	270	290	300	270	280
380									280	290	270	280	300	310	280	290
390									290	300	280	290	270	280	290	300
400									300	310	290	300	280	290	300	310
410											300	310	290	300	310	320
420											310	320	300	310	320	330
430											320	330	310	320	330	340
440											330	340	320	330	340	350
450											340	350	330	340	350	360
460													340	350	360	370
470													350	360	370	380
480													360	370	380	390
490													370	380	350	360
500													380	390	360	370
550													430	440	410	420
600													480	490	460	470
650													530	540	510	520
700													580	590	560	570
750													630	640	610	620

IHF



Leader in technology by partnership

IHF Combines Knowledge and Technology: Increased customer profits by a technically optimized design of the connection

The development of the IHF-Stretch-System came into existence by a cooperation between the German company ITH GmbH & Co. KG and the Italian Vescovini Group. In the common subsidiary IHF GmbH the know-how of both partners is brought together: ITH is the market leader of precise bolting tools for tighte-

ning and loosening large bolts. The company SBE – a subsidiary of the Vescovini Group – brings in its knowledge about the innovative production technology of bolts. The Vescovini Group with about 400 employees and an output of over 60.000 t per year is one of the biggest bolt producers in Europe. The customers profit from the combination of know-how and design optimized technology.



Picture 9: ITH GmbH & Co. KG, Headquarter Meschede, Germany



Picture 10: SBE, Vescovini Group, Italy



LEADING IN BOLTING TECHNOLOGY
High quality tools for tightening and loosening
large bolts by IHF-Stretch-System and Torque System

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COMBINES THE COMPETENCES OF

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process JUMBOTECH® in Vescovini Group.

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