Bolt tensioning device

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Performance variations - Examples

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Bolt tensioning devices for a forgin press

Bolt tensioning device for a extruding machine

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Areas of application, conditions and advantages with **AS Tech** bolt tensioning devices and hydraulic nuts

Areas of application

The field for bolt tensioning devices is almost unlimited. Bolts of 8 mm to 1000 mm are pretensioned in the most different threaded sizes in multiple industry areas with bolt tensioning devices. For example:
Apparatures-/ Tanks | Reactors | Turbines- and Generators Engineering | Pump Engineering | Motors | Chemical Industry | Compressors | Large Gear | On Shore/ Off Shore | Heat Exchangers | Materials-Handling Technology | Steel Industry | Wind Power Plants | Mining | asf.

Conditions

A number of conditions must be met when using bolt tensioning devices in order to work with a high degree of precision and safety.
The contact surfaces of the bolt tensioning device and the components to be tensioned must be clean, flat and at right angles to the axis of the bolt. The thread must likewise be clean and free of lubricant. The surface quality and the extent that the locating and contacting surfaces are parallel for all components are decisive factors for the quality and setting of the connection, in addition to the number of parting joints, the shape of the bodies that are deformed and the clamping length relationship.
Determination of the pre-tensioning force is done after a careful and detailed calculation (e.g. VDI2230). In the case of larger bolted connections we recommend a bolt thread as per DIN 2510. In general, the axial backlash of the nut should also be checked.
In order to minimise losses of the setting force, any washers that are needed should be strong enough to allow the bolt tensioning force. Tests have shown that the relationship of the diameter of the thread to the clamping length must be at least 1:5. The amount of thread protruding above the nut must be at least 0.6 -1 times the diameter of the thread, depending on the pretensioning force.

Advantages

Bolt tensioning devices and hydraulic nuts allow controlled tightening up to the yield point.
The force is produced and applied *without any torsion*, acting on the axial direction of the bolt or screw. Since this is also done *without friction* and the nut can be turned without any friction, it is not necessary to calculate a coefficient of friction.
Since materials can be used optimally, it is possible to use *bolts with a smaller diameter* or else to apply a greater pretensioning force to achieve a *higher degree of safety*.
The use of several such devices in sequence or in parallel produces a considerable *saving of time*, together with the advantage it is possible to *simultaneously apply exactly equal pretensioning forces* when applying the pressure.
The force applied within the calculation is taken into account insofar as the pretensioning force is applied *independently of the tensioning path,* thus eliminating and subordinating installation gaps while the force is being applied.
The use of bolt tensioning devices or hydraulic nuts makes it possible to determine the residual pretensioning force without undoing the connection.

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The purely axial process for the production of the pretensioning force or clamping force

Bolts are the most commonly used and versatile forms of machine and connecting elements.
In the case of pretensioned or preloaded connections, the bolts are already loaded or pretensioned before an actual operating load is applied, this being done by tightening up the nut.
A number of different processes are used to apply this pretensioning or preloading force, and these have to be taken into consideration at the design stage of the bolted connection.
The purely axial process is increasingly gaining in importance to achieve optimum utilisation of the material and thus avoiding friction effects and twisting stresses.
When this operating principle is applied to a tool, it is called a bolt tensioning device. It is referred to as a hydraulic nut when it is used as a machine element.
The purely axial process makes it possible to apply the design clamping or tensioning force very precisely at this connection. There are also economic aspects to be considered even at the basic engineering stage, such as optimisation of the installation time or minimising the dimensions of the machine.
The pretensioning of bolted connections without any friction has the special advantage that it avoids the risk of "jamming" with fine threads and austenitic materials in particular.
Since the pretensioning force is only exerted axially and not by turning the nut, the bolt is no longer stressed torsionally.

Operating principle of a bolt tensioning device

If the force calculated within the design of the connection is to be applied with a bolt tensioning device, first of all the holding nut and then the device are placed onto the end of the threaded part to be pretensioned (fig. 1). After connection to the pressure generator, the calculated pretensioning force is applied independently of the length by means of hydraulic pressure. The amount of force desired can be determined with precision by the piston area of the device and the pressure (fig.2).
The pressure can be read off directly from a measuring instrument. The holding nut is done up until it touches the contacting surface (fig. 3). The device can now be removed and applied to the next bolt or screw.

1. tensioning nut 2. piston 3. cylinder 4. bridge 5. main nut 6. adjusting rod
7. connector 8. sealing set 9. hexagonal nut

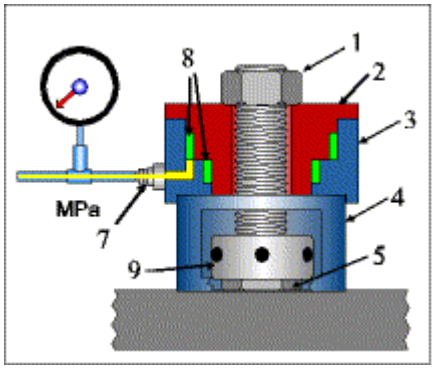

fig. 1: Basic setup

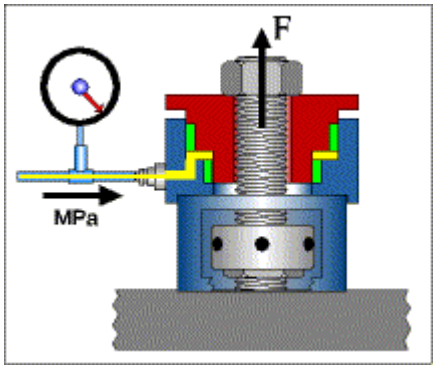

fig. 2: Pressurization

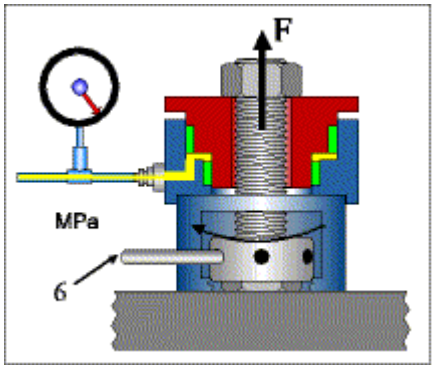

fig. 3: Finishing

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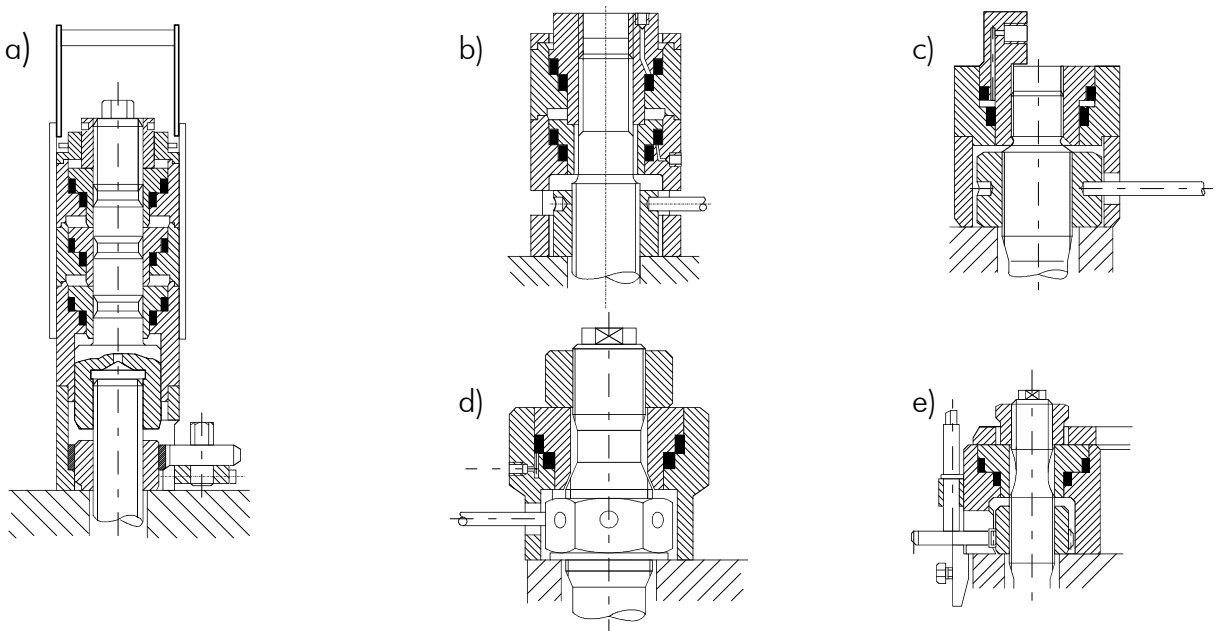
Performance variations

In addition to the range of configurations shown in the catalogue, it is also possible to produce bolt tensioning devices in the following variants on request:



a) Multi-stage tensioning device with exchangeable tension nut
b) Multi-stage tensioning device with thread in piston
c) Single-stage tensioning device with thread in piston
d) Single-stage tensioning device with tensioning nut
e) Single- or multi stage tensioning device on a supporting ring or -plate

Equipment variations

- **Materials**
- **Pressure medium**
  – HFC
  – Oil
  – Water
  – Emulsions
- **Thread**
  – All thread types,
  –standard and –sizes
- **Forces**
  – Depending on requirement and material
- **Pressure**
  – Depending on pressure generator up to 3,000 bar
- **Stroke**
  – Depending on requirement
- **Stroke ratio**
  – Optical
  – Audible
  – Electrical
- **Stroke limiting**
  – Mechanical
  – Hydraulical
- **Stroke return**
  – Manual
  – Hydraulical
  – Automatical
- **Turning of the main nut**
  – Depending on carrying out of the main nut, manual or motor-driven
- **Connector variations**
  – Single- or series line
  – All thread types,
  –standard and –sizes
  – Rotary or solid
- **Surface treatment**
  – Blackened
  – Varnished
  – Nickel-plated
  – Chrome-plated
- **Certificates and acceptances**
  – Depending on requirement

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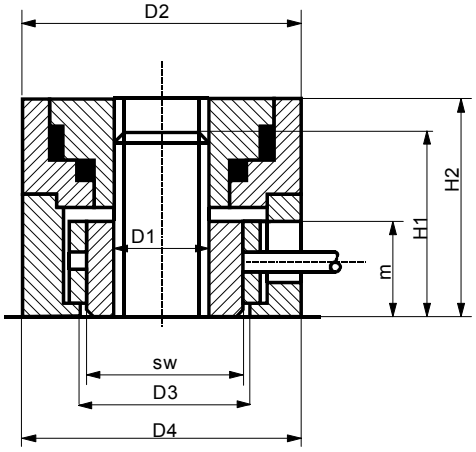
Bolt tensioning device, single-stage with thread in piston



HWS16112

Specification:
- ⇨ Thread in piston
- ⇨ Max. pressure **1,600** bar
- ⇨ Suitable for screw quality **10.9** (at 90% from $R_{P0,2}$) with thread overhang ca. 1 x D1

Article-number	Thread		Tension force	Hexagonal nut DIN 934		D2	Stroke	Bridge		H1	H2
	D1	Pitch	in kN	sw	m	mm	mm	D3 mm	D4 mm	mm	mm
HWS16112001	M 20	2,5	198	30	20	65	5	44	55	40	80
HWS16112002	M 24	3,0	286	36	24	75	5	51	64	48	90
HWS16112003	M 27	3,0	372	41	27	83	5	57	72	54	95
HWS16112004	M 30	3,5	454	46	30	90	5	61	78	60	105
HWS16112005	M 33	3,5	562	50	33	100	5	67	86	66	110
HWS16112006	M 36	4,0	662	55	36	105	6	73	94	72	120
HWS16112007	M 39	4,0	790	60	39	115	6	80	103	78	130
HWS16112008	M 42	4,5	908	65	42	127	6	84	109	84	135
HWS16112009	M 45	4,5	1058	70	45	135	6	91	117	90	145
HWS16112010	M 48	5,0	1193	75	48	145	8	96	124	96	155
HWS16112011	M 52	5,0	1424	80	52	155	8	103	134	104	170
HWS16112012	M 56	5,5	1644	85	56	173	8	109	143	112	180
HWS16112013	M 60	5,5	1913	90	60	183	8	115	152	120	185
HWS16112014	M 64	6,0	2168	95	64	193	8	121	161	128	195
HWS16112015	M 68	6,0	2475	100	68	203	10	127	170	136	205
HWS16112016	M 72	6,0	2802	105	72	213	10	133	179	144	220
HWS16112017	M 76	6,0	3150	110	76	228	10	139	189	152	235
HWS16112018	M 80	6,0	3519	115	80	250	10	145	198	160	255
HWS16112019	M 90	6,0	4529	130	90	275	10	165	225	180	280
HWS16112020	M 100	6,0	5666	145	100	330	12	180	248	200	325
HWS16112021	M 110	6,0	6930	155	110	355	12	191	268	220	350
HWS16112022	M 120	6,0	8322	170	120	395	15	211	295	240	400
HWS16112023	M 125	6,0	9065	180	125	410	15	225	312	250	410
HWS16112024	M 140	6,0	11486	200	140	470	15	246	345	280	450

This demonstrated performance is the mostly used application. If another equipment option should be required, we are gladly ready to develop the solution suitable for you. Also see equipment variations as well as accessories

Standard

- ➢ Hydraulic head
- ➢ Bridge with 2 windows and 2 nut control slots
- ➢ Hexagonal nut with 6 adjusting rod holes
- ➢ Adjusting rod
- ➢ Surfaces are burnished
- ➢ Quality tested for max. pressure and max. force
- ➢ Operating manual in English language

Options

- ➢ Stroke limiting
  - – Mechanical
  - – Hydraulical
- ➢ Piston return stroke
  - – Mechanical
  - – Automatical
- ➢ Gear
- ➢ Surface
  - – Chemical nickel-plated
  - – Varnished
- ➢ Various Designs for connecting nipple
  - – High pressure nipple
  - – Rotary angle connector

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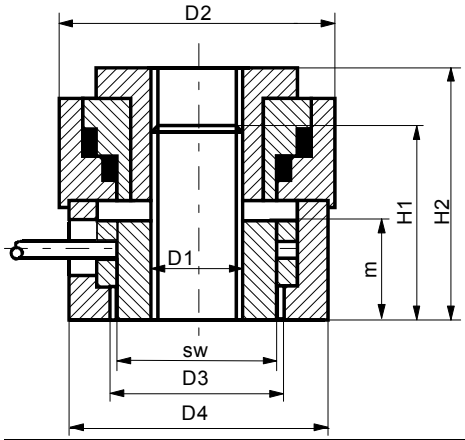
Bolt tensioning device , single-stage with exchangeable tension nut



HWS16212

Specification:
- ⇨ One hydraulic head
- ⇨ Exchangeable hexagonal nut
- ⇨ Exchangeable tension nut
- ⇨ Max. pressure **1,600** bar
- ⇨ Suitable for screw quality **10.9** (at 90% from $R_{P0,2}$) with thread overhang ca. 1 x D1

Article-number	Thread		Tension force	Hexagonal nut DIN 934		D2	Stroke	Bridge		H1	H2
	D1	Pitch	in kN	sw	m	mm	mm	D3 mm	D4 mm	mm	mm
HWS16212001	M 20	2,5	198	30	20	72	5	44	55	40	100
HWS16212002	M 24	3,0	286	36	24	82	5	51	64	48	115
HWS16212003	M 27	3,0	372	41	27	90	5	57	72	54	120
HWS16212004	M 30	3,5	454	46	30	100	5	61	78	60	135
HWS16212005	M 33	3,5	562	50	33	105	5	67	86	66	140
HWS16212006	M 36	4,0	662	55	36	112	6	73	94	72	155
HWS16212007	M 39	4,0	790	60	39	120	6	80	103	78	170
HWS16212008	M 42	4,5	908	65	42	135	6	84	109	84	175
HWS16212009	M 45	4,5	1058	70	45	145	6	91	117	90	190
HWS16212010	M 48	5,0	1193	75	48	150	8	96	124	96	205
HWS16212011	M 52	5,0	1424	80	52	160	8	103	134	104	230
HWS16212012	M 56	5,5	1644	85	56	170	8	109	143	112	235
HWS16212013	M 60	5,5	1913	90	60	193	8	115	152	120	245
HWS16212014	M 64	6,0	2168	95	64	203	8	121	161	128	260
HWS16212015	M 68	6,0	2475	100	68	213	10	127	170	136	270
HWS16212016	M 72	6,0	2802	105	72	223	10	133	179	144	290
HWS16212017	M 76	6,0	3150	110	76	233	10	139	189	152	310
HWS16212018	M 80	6,0	3519	115	80	255	10	145	198	160	335
HWS16212019	M 90	6,0	4529	130	90	285	10	165	225	180	370
HWS16212020	M 100	6,0	5666	145	100	335	12	180	248	200	425
HWS16212021	M 110	6,0	6930	155	110	365	12	191	268	220	460
HWS16212022	M 120	6,0	8322	170	120	405	15	211	295	240	520
HWS16212023	M 125	6,0	9065	180	125	420	15	225	312	250	535
HWS16212024	M 140	6,0	11486	200	140	480	15	246	345	280	590

This demonstrated performance is the mostly used application. If another equipment option should be required, we are gladly ready to develop the solution suitable for you. Also see equipment variations as well as accessories

Standard

- ➢ Hydraulic head
- ➢ Tension nut
- ➢ Bridge with 2 windows and 2 nut control slots
- ➢ Hexagonal nut wit 6 adjusting rod holes
- ➢ Adjusting rod
- ➢ Surfaces are burnished
- ➢ Quality tested for max. pressure and max. force
- ➢ Operating manual in English language

Options

- ➢ Stroke limiting
  - – Mechanical
  - – Hydraulical
- ➢ Piston return stroke
  - – Mechanical
  - – Automatical
- ➢ Gear
- ➢ Surface
  - – Chemical nickel-plated
  - – Varnished
- ➢ Various designs for connecting nipple
  - – High pressure nipple
  - – Rotary angle connector

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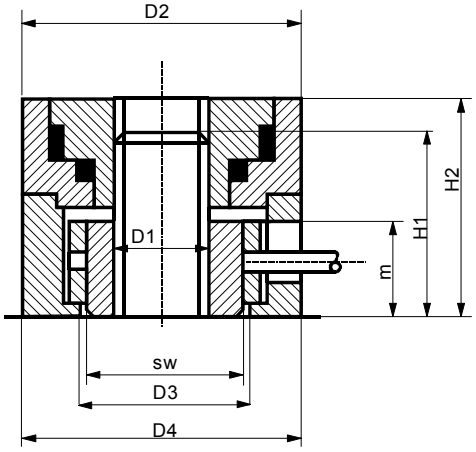
Bolt tensioning device, single-stage with thread in piston



HWS25112

Specification:
- ⇨ Small design with small weight
- ⇨ Thread in piston
- ⇨ Max. pressure **2,500** bar
- ⇨ Suitable for screw quality **10.9** (at 90% from $R_{P0,2}$) with thread overhang ca. 1 x D1

Article-number	Thread		Tension force	Hexagonal nut DIN 934		D2	Stroke	Bridge		H1	H2
	D1	Pitch	in kN	sw	m	mm	mm	D3 mm	D4 mm	mm	mm
HWS25112001	M 20	2,5	198	30	20	58	5	44	55	40	80
HWS25112002	M 24	3,0	286	36	24	67	5	51	64	48	90
HWS25112003	M 27	3,0	372	41	27	75	5	57	72	54	95
HWS25112004	M 30	3,5	454	46	30	83	5	61	78	60	105
HWS25112005	M 33	3,5	562	50	33	90	5	67	86	66	110
HWS25112006	M 36	4,0	662	55	36	95	6	73	94	72	120
HWS25112007	M 39	4,0	790	60	39	100	6	80	103	78	130
HWS25112008	M 42	4,5	908	65	42	115	6	84	109	84	135
HWS25112009	M 45	4,5	1058	70	45	125	6	91	117	90	145
HWS25112010	M 48	5,0	1193	75	48	130	8	96	124	96	155
HWS25112011	M 52	5,0	1424	80	52	140	8	103	134	104	170
HWS25112012	M 56	5,5	1644	85	56	153	8	109	143	112	180
HWS25112013	M 60	5,5	1913	90	60	163	8	115	152	120	185
HWS25112014	M 64	6,0	2168	95	64	173	8	121	161	128	195
HWS25112015	M 68	6,0	2475	100	68	183	10	127	170	136	205
HWS25112016	M 72	6,0	2802	105	72	193	10	133	179	144	220
HWS25112017	M 76	6,0	3150	110	76	203	10	139	189	152	235
HWS25112018	M 80	6,0	3519	115	80	225	10	145	198	160	255
HWS25112019	M 90	6,0	4529	130	90	245	10	165	225	180	280
HWS25112020	M 100	6,0	5666	145	100	295	12	180	248	200	325
HWS25112021	M 110	6,0	6930	155	110	320	12	191	268	220	350
HWS25112022	M 120	6,0	8322	170	120	355	15	211	295	240	400
HWS25112023	M 125	6,0	9065	180	125	370	15	225	312	250	410
HWS25112024	M 140	6,0	11486	200	140	425	15	246	345	280	450

This demonstrated performance is the mostly used application. If another equipment option should be required, we are gladly ready to develop the solution suitable for you. Also see equipment variations as well as accessories

Standard

- ➢ Hydraulic head
- ➢ Bridge with 2 windows and 2 nut control slots
- ➢ Hexagonal nut with 6 adjusting rod holes
- ➢ Adjusting rod
- ➢ Surfaces are burnished
- ➢ Quality tested for max. pressure and max. force
- ➢ Operating manual in English language

Options

- ➢ Stroke limiting
  - – Mechanical
  - – Hydraulical
- ➢ Piston return stroke
  - – Mechanical
  - – Automatical
- ➢ Gear
- ➢ Surface
  - – Chemical nickel-plated
  - – Varnished
- ➢ Various Designs for connecting nipple
  - – High pressure nipple
  - – Rotary angle connector

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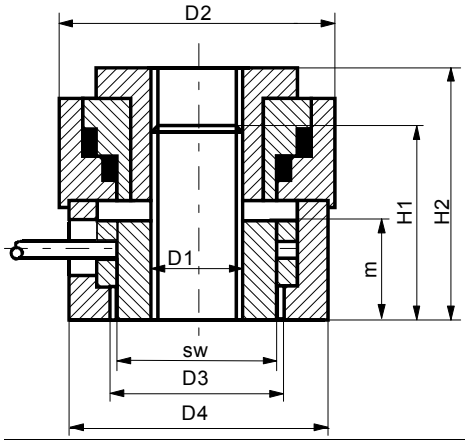
Bolt tensioning device, single-stage with exchangeable tension nut



HWS25212

Specification:
- ⇨ One hydraulic head
- ⇨ Exchangeable hexagonal nut
- ⇨ Exchangeable tension nut
- ⇨ Max. pressure **2,500** bar
- ⇨ Suitable for screw quality **10.9** (at 90% from $R_{P0,2}$) with thread overhang ca. 1 x D1

Article-number	Thread		Tension force	Hexagonal nut DIN 934		D2	Stroke	Bridge		H1	H2
	D1	Pitch	in kN	sw	m	mm	mm	D3 mm	D4 mm	mm	mm
HWS25212001	M 20	2,5	198	30	20	67	5	44	55	40	100
HWS25212002	M 24	3,0	286	36	24	75	5	51	64	48	115
HWS25212003	M 27	3,0	372	41	27	83	5	57	72	54	120
HWS25212004	M 30	3,5	454	46	30	90	5	61	78	60	135
HWS25212005	M 33	3,5	562	50	33	98	5	67	86	66	140
HWS25212006	M 36	4,0	662	55	36	105	6	73	94	72	155
HWS25212007	M 39	4,0	790	60	39	108	6	80	103	78	170
HWS25212008	M 42	4,5	908	65	42	125	6	84	109	84	175
HWS25212009	M 45	4,5	1058	70	45	130	6	91	117	90	190
HWS25212010	M 48	5,0	1193	75	48	135	8	96	124	96	205
HWS25212011	M 52	5,0	1424	80	52	145	8	103	134	104	230
HWS25212012	M 56	5,5	1644	85	56	155	8	109	143	112	235
HWS25212013	M 60	5,5	1913	90	60	173	8	115	152	120	245
HWS25212014	M 64	6,0	2168	95	64	183	8	121	161	128	260
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HWS25212017	M 76	6,0	3150	110	76	213	10	139	189	152	310
HWS25212018	M 80	6,0	3519	115	80	235	10	145	198	160	335
HWS25212019	M 90	6,0	4529	130	90	260	10	165	225	180	370
HWS25212020	M 100	6,0	5666	145	100	305	12	180	248	200	425
HWS25212021	M 110	6,0	6930	155	110	335	12	191	268	220	460
HWS25212022	M 120	6,0	8322	170	120	365	15	211	295	240	520
HWS25212023	M 125	6,0	9065	180	125	380	15	225	312	250	535
HWS25212024	M 140	6,0	11486	200	140	435	15	246	345	280	590

This demonstrated performance is the mostly used application. If another equipment option should be required, we are gladly ready to develop the solution suitable for you. Also see equipment variations as well as accessories

Standard

- ➢ Hydraulic head
- ➢ Tension nut
- ➢ Bridge with 2 windows and 2 nut control slots
- ➢ Hexagonal nut wit 6 adjusting rod holes
- ➢ Adjusting rod
- ➢ Surfaces are burnished
- ➢ Quality tested for max. pressure and max. force
- ➢ Operating manual in English language

Options

- ➢ Stroke limiting
  - – Mechanical
  - – Hydraulical
- ➢ Piston return stroke
  - – Mechanical
  - – Automatical
- ➢ Gear
- ➢ Surface
  - – Chemical nickel-plated
  - – Varnished
- ➢ Various designs for connecting nipple
  - – High pressure nipple
  - – Rotary angle connector

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