PEINER Umformtechnik

our partner in Romania: SAGITTA

MANUAL for

„PEINER HV-Structural bolt sets“

according to

DIN EN 14399

DIN EN 1090-2

DIN EN 1993-1-8/NA

preload forces

tightening moments

nominal dimensions

application instructions

01/2020

PEINER Umformtechnik

Market leader in HV screws in steel construction

The factory of PEINER Umformtechnik is producing bolts, nuts and other fastening elements for steel structures and bridges, fasteners for wind turbines as well as high-end automotive parts for well-known car and truck makers throughout the world for more than 90 years.
We are the market leader for HV bolt sets and sold over 26 million HV bolt sets in 2018.

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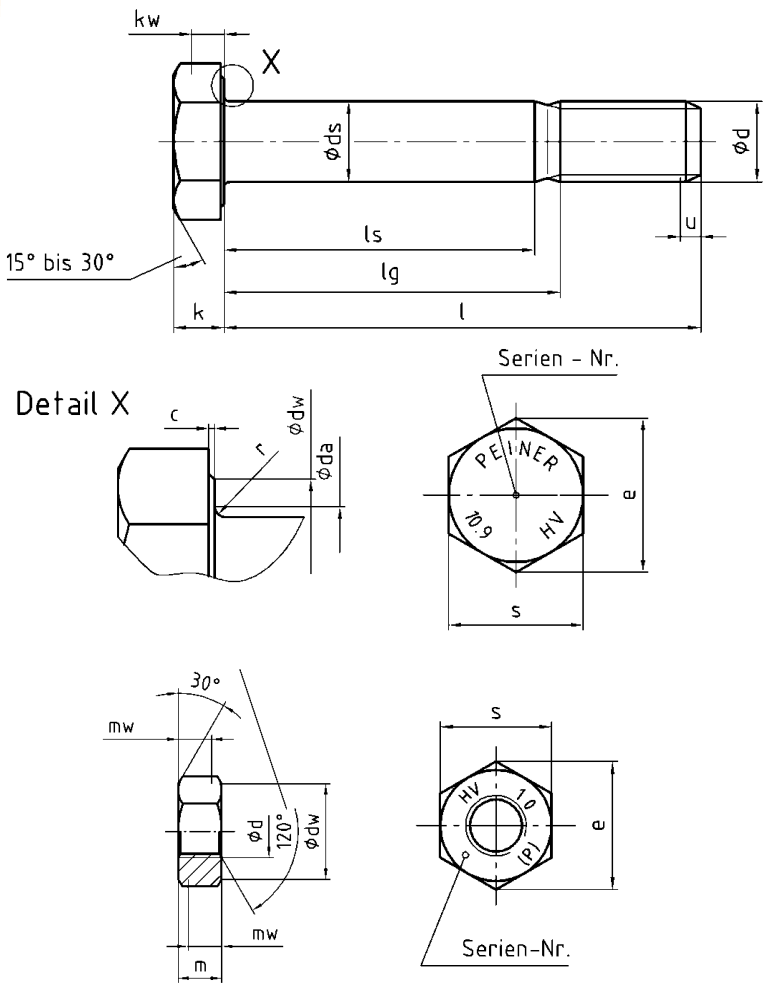
Special features of HV-bolt sets



HV-bolt

head marking HV

strength class 10.9

big under-head radius

serial identification

short thread length

large wrench size

HV-nut

marking HV

strength class 10

thread max. 6AZ

serial identification

The applicable standard for HV-bolts and HV-nuts is DIN EN 14399-4

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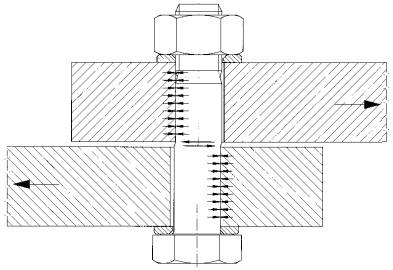
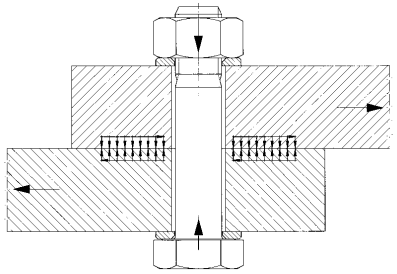
Classification of bolt connections

Shear Connections

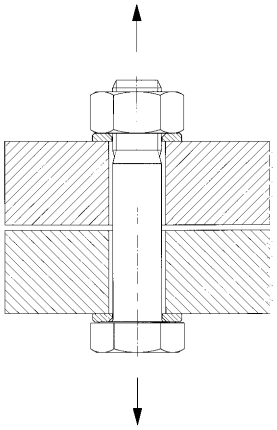


Category A

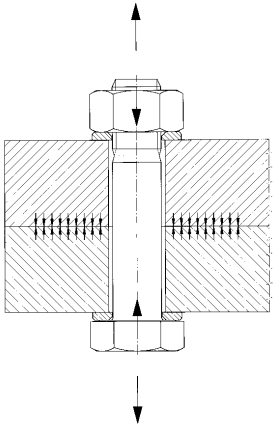


Category B & C
(preloaded)

Tension Connections



Category D



Category E
(preloaded)

Division of the screw connections according to DIN EN 1993-1-8: 2010 (Eurocode 3)

Category shear connections

A shear bearing connection (no preload required)

B Slidable connection in the limit state of Serviceability (preloaded)

C Slidable compound in the limit state of Load capacity (prestressed)

Tension connections

D not biased

E biased

High-strength pre-tensioned screw connections (for categories B, C and E) must comply with DIN EN 14399-1!

Sets (screw / nut and washers) from one manufacturer
Suitability test for prestressing according to DIN EN 14399-2
Definition k-classes (functional characteristic of the clothing)
Certificate of conformity CE

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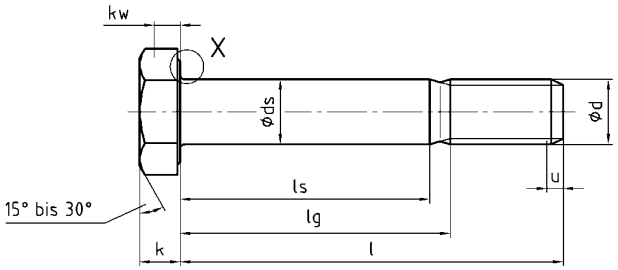
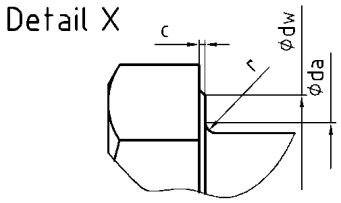
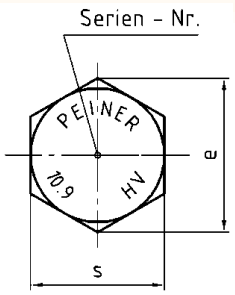
Nominal dimensions of HV-bolts







Nominal dimension	M12	M16	M20	M22	M24	M27	M30	M36
ds nom.	12	16	20	22	24	27	30	36
e min.	23,91	29,56	35,03	39,55	45,2	50,85	55,37	66,44
k nom.	8	10	13	14	15	17	19	23
r min.	1,2	1,2	1,5	1,5	1,5	2	2	2
s max.	22	27	32	36	41	46	50	60
h nom.	3	4	4	4	4	5	5	6
m max.	10	13	16	18	20	22	24	29

*diameter in mm

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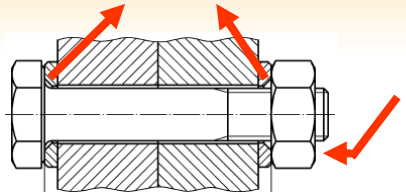
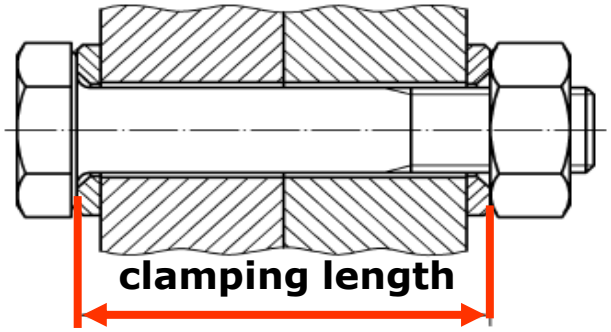
Big bevel of the washer to the outside



Marking of the nut to outside



Important NOTE:
With the clamping length, the washer must be taken into account. In this clamping length table, the washer is already taken into account, so that only the clamping length of the components to be bridged must be taken into account.

bolt lenght	Clamping length for HV screws, the washers are not taken into account							
	M12	M16	M20	M22	M24	M27	M30	M36
30	11-16							
35	16-21	12-17						
40	21-26	17-22						
45	26-31	22-27	18-23					
50	31-36	27-32	23-28	22-27				
55	36-41	32-37	28-33	27-32				
60	41-46	37-42	33-38	32-37	29-34			
65	46-51	42-47	38-43	37-42	34-39			
70	51-56	47-52	43-48	42-47	39-44	36-41		
75	56-61	52-57	48-53	47-52	44-49	41-46	39-44	
80	61-66	57-62	53-58	52-57	49-54	46-51	44-49	
85	66-71	62-67	58-63	57-62	54-59	51-56	49-54	43-48
90	71-76	67-72	63-68	62-67	59-64	56-61	54-59	48-53
95	76-81	72-77	68-73	67-72	64-69	61-66	59-64	53-58
100	81-86	77-82	73-78	72-77	69-74	66-71	64-69	58-63
105	86-91	82-87	78-83	77-82	74-79	71-76	69-74	63-68
110	91-96	87-92	83-88	82-87	79-84	76-81	74-79	68-73
115	96-101	92-97	88-93	87-92	84-89	81-86	79-84	73-78
120	101-106	97-102	93-98	92-97	89-94	86-91	84-89	78-83
125	106-111	102-107	98-103	97-102	94-99	91-96	89-94	83-88
130	111-116	107-112	103-108	102-107	99-104	96-101	94-99	88-93
135	116-121	112-117	108-113	107-112	104-109	101-106	99-104	93-98
140	121-126	117-122	113-118	112-117	109-114	106-111	104-109	98-103
145	126-131	122-127	118-123	117-122	114-119	111-116	109-114	103-108
150	131-136	127-132	123-128	122-127	119-124	116-121	114-119	108-113
155	136-141	132-137	128-133	127-132	124-129	121-126	119-124	113-118
160	141-146	137-142	133-138	132-137	129-134	126-131	124-129	118-123
165	146-151	142-147	138-143	137-142	134-139	131-136	129-134	123-128
170	151-156	147-152	143-148	142-147	139-144	136-141	134-139	128-133
175	156-161	152-157	148-153	147-152	144-149	141-146	139-144	133-138
180	161-166	157-162	153-158	152-157	149-154	146-151	144-149	138-143
185	166-171	162-167	158-163	157-162	154-159	151-156	149-154	143-148
190	171-176	167-172	163-168	162-167	159-164	156-161	154-159	148-153
195	176-181	172-177	168-173	167-172	164-169	161-166	159-164	153-158
200	181-186	177-182	173-178	172-177	169-174	166-171	164-169	158-163
210			183-188	182-187	179-184	176-181	174-179	168-173
220			193-198	197-197	189-194	186-191	184-189	178-183
230			203-208	202-207	199-204	196-201	194-199	188-193
240			213-218	212-217	209-214	206-211	204-209	198-203

The clamping lengths in this table are including the height of the two washers.

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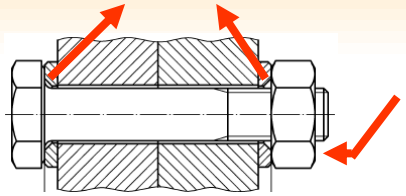
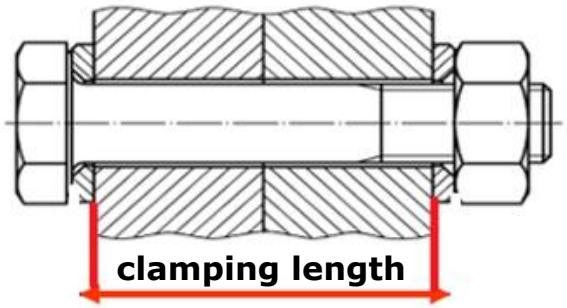
Big bevel of the washer to the outside



Marking of the nut to outside



Important NOTE:
With the clamping length, the washer must be taken into account. In this clamping length table, the washer is already taken into account, so that only the clamping length of the components to be bridged must be taken into account.

This clamping length is called "Grip length (t_{s2})" in the standard.

bolt lenght	Clamping length ("Grip lenght") - the washers are already taken into account							
	M12	M16	M20	M22	M24	M27	M30	M36
30	5 - 10							
35	10 - 15	4 - 9						
40	15 - 20	9 - 14						
45	20 - 25	14 - 19	10 - 15					
50	25-30	19 - 24	15 - 20	14 - 19				
55	30 - 35	24 - 29	20 - 25	19 - 24				
60	35 - 40	29 - 34	25 - 30	24 - 29	21 - 26			
65	40 - 45	34 - 39	30 - 35	29 - 34	26 - 31			
70	45 - 50	39 - 44	35 - 40	34 - 39	31 - 36	26 - 31		
75	50 - 55	44 - 49	40 - 45	39 - 44	36 - 41	31 - 36	29 - 34	
80	55 - 60	49 - 54	45 - 50	44 - 49	41 - 46	36 - 41	34 - 39	
85	60 - 65	54 - 59	50 - 55	49 - 54	46 - 51	41 - 46	39 - 44	31-36
90	65 - 70	59 - 64	55 - 60	54 - 59	51 - 56	46 - 51	44 - 49	36 - 41
95	70 - 75	64 - 69	60 - 65	59 - 64	56 - 61	51 - 56	49 - 54	41 - 46
100	75 - 80	69 - 74	65 - 70	64 - 69	61 - 66	56 - 61	54 - 59	46 - 51
105	80 - 85	74 - 79	70 - 75	69 - 74	66 - 71	61 - 66	59 - 64	51 - 56
110	85 - 90	79 - 84	75 - 80	74 - 79	71 - 76	66 - 71	64 - 69	56 - 61
115	90 - 95	84 - 89	80 - 85	79 - 84	76 - 81	71 - 76	69 - 74	61 - 66
120	95 - 100	89 - 94	85 - 90	84 - 89	81 - 86	76 - 81	74 - 79	66 - 71
125	100-105	94 - 99	90 - 95	89 - 94	86 - 91	81 - 86	79 - 84	71 - 76
130	105-110	99 - 104	95 - 100	94 - 99	91 - 96	86 - 91	84 - 89	76 - 81
135	110-115	104-109	100 - 105	99 - 104	96 - 101	91 - 96	89 - 94	81 - 86
140	115-120	109-114	105 - 110	104-109	101-106	96 - 101	94 - 99	86 - 91
145	120-125	114-119	110 - 115	109-114	106-111	101-106	99 - 104	91 - 96
150	125-130	119-124	115 - 120	114-119	111-116	106-111	104-109	96 - 101
155	130-135	124-129	120 - 125	119-124	116-121	111-116	109-114	101-106
160	135-140	129-134	125 - 130	124-129	121-126	116-121	114-119	106-111
165	140-145	134-139	130 - 135	129-134	126-131	121-126	119-124	111-116
170	145-150	139-144	135 - 140	134-139	131-136	126-131	124-129	116-121
175	150-155	144-149	140 - 145	139-144	136-141	131-136	129-134	121-126
180	155-160	149-154	145 - 150	144-149	141-146	136-141	134-139	126-131
185	160-165	154-159	150 - 155	149-154	146-151	141-146	139-144	131-136
190	165-170	159-164	155 - 160	154-159	151-156	146-151	144-149	136-141
195	170-175	164-169	160 - 165	159-164	156-161	151-156	149-154	141-146
200	175-180	169-174	165 - 170	164-169	161-166	156-161	154-159	146-151
210			175 - 180	174-179	171-176	166-171	164-169	156-161
220			185 - 190	184-189	181-186	176-181	174-179	166-171
230			195 - 200	194-199	191-196	186-191	184-189	176-181
240			205 - 210	204-209	201-206	196-201	194-199	186-191

The clamping length („Grip lenght") in this table is exclusive the height of the two washers. The bolt length takes into account the height of the two washers.

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tightening method

Tightening procedure and applicable standards for the tightening process of the nuts

tightening	*Standard with tightening parameters*
1. Modified torque method	DIN EN 1993 - 1 - 8 NA
2. Torque method	DIN EN 1090 - 2
3. Modified combined rotation angle / tempering method	DIN EN 1993 - 1 - 8 NA
4. Combined turning angle / tempering method	DIN EN 1090 - 2
5. Angular momentum method	DIN EN 1993 - 1 - 8 NA

In the DIN EN 14399-1 "General requirements" a distinction is made in the three k-classes K0, K1 and K2

Screw-side tightening

If a tightening of the nut is not possible due to the design, the following peculiarity and procedure apply: An external process test will be necessary. The test will carry out a tightening into the nut or in a nut-like counterpart (base material analog real material). Once the test has been completed, a test report will be prepared; this test report is important for acceptance by the building control office.

Contact us PEINER Umformtechnik (accredited laboratory) +49 (0) 5171/545 250

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DIN EN 1993-1-8/NA

Preload forces and tightening torques for angular momentum, modified torque, and modified combined preloading procedure for sets of strength class 10.9 according to DIN EN 14399-4, DIN EN 14399-6 - k class K1 according to DIN EN 14399-1

Dimension	preload force Fp,c kN	Angular momentum method	Modified torque method	Modified combined process
		To be set biasing force Fv to reach the control biasing force Fp, c	Applied tightening torque MA to reach the control biasing force Fp, c	Pre-tightening torque Note the next table with the turning angles
		kN	Nm	Nm
M12	50	60	100	75
M16	100	110	250	190
M20	160	175	450	340
M22	190	210	650	490
M24	220	240	800	600
M27	290	320	1250	940
M30	350	390	1650	1240
M36	510	560	2800	2100

Required angle of rotation for the modified combined tempering method on trimmings of strength class 10.9		
Total thickness of the parts to be joined (including all lining plates and washers) d = screw diameter	During the second tightening step applied further rotation angle	
	Next turning angle	**rotation**
{t < 2d	45°	1/8
2d < {t < 6d	60°	1/6
6d < {t < 10d	90°	1/4
10d < {t	no recommendation	no recommendation

Important NOTE:
Surface condition hot dip galvanized and lubricated or as manufactured and lubricated
Nuts treated with molybdenum sulfide or equivalent lubricant

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DIN EN 1090-2

Preload forces and tightening torques for the combined tempering procedure for trimmings of strength class 10.9 according to DIN EN 14399-4, DIN EN 14399-6 - k class K1 according to DIN EN 14399-1

Dimension	Minimum preload force Fp,c kN	Combined method
		Pre-tightening torque, the next table with the following angles is to be observed
		Nm
M12	59	67
M16	110	165
M20	172	322
M22	212	439
M24	247	557
M27	321	815
M30	393	1107
M36	572	1935

Required angle of rotation for the modified combined tempering method on trimmings of strength class 10.9		
Total thickness of the parts to be joined (including all lining plates and washers) d = screw diameter	During the second tightening step applied further rotation angle	
	Next turning angle	**rotation**
{t < 2d	60°	1/6
2d < {t < 6d	90°	1/4
6d < {t < 10d	120°	1/3

Important NOTE:
If the surface under the screw head or the nut is not perpendicular to the screw axis (taking into account any wedges), the required angle of rotation should be determined by experiment.
A table for the tightening parameters of the regular torque method is not available in DIN EN 1090-2. This suit procedure is only permitted in Europe with the k-class K2 (not at all in Germany). Therefore, the torque must be calculated separately for each lot. The calculation may e.g. be carried out on request by our accredited testing laboratory.

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Design and tolerances for thermally cut and other holes (DIN EN 1090-2)

Nominal dimensions		M12	M16	M20	M22	M24	M27	M30	M36
bolt shaft	**ds nom.**	**12**	**16**	**20**	**22**	**24**	**27**	**30**	**36**
Normal round holes		13	18	22	24	26	30	33	39
Oversized round holes		15	20	24	26	30	35	38	44
Short longholes		16	22	26	28	32	37	40	46
Long longholes		30	40	50	55	60	67,5	75	90

*Angaben in Millimeter

Tolerances of hole diameters

Unless otherwise specified, hole diameters must comply with the following (DIN EN 1090-2):

- Thermally cut holes and other holes are to be designed according to the table above and have a tolerance of + - 0.5mm

If HV fitting screws are concerned, the hole must be designed with an H11 fit in accordance with EN ISO 286-2.

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Application notes and terminology for HV-bolt-sets

PEINER HV-screws must only be screwed together with PEINER HV-nuts and PEINER HV-washers to ensure the required tightening behavior and, in the case of hot-dip galvanized fasteners, additionally the thread compatibility. Peiner HV nuts, hot-dip galvanized and black, are lubricated ready to install. Additional lubrication is not permitted.

Storage of HV-sets
The elements of a bolt set must be stored to ensure no adversely affect to the surface condition and thus to the performance characteristics (for example, of additional lubricating film due to moisture or dirt). A popular phrase "Do not leave cartons out in the rain".

New installation
If a planned preloaded set is later loosened, it must be removed and replaced with a new one. After loosening a set, it is important to verify that the screw, which was prestressed by the modified torque method, was not permanently damaged during the first pretensioning. If this is the case, the re-pretensioning of the srew is permitted with a new nut and new washer from the same screw manufacturer.

Our recommendation: Loosened sets should be replaced with new components for safety reasons. It is mostly not clear if irregularities occurred during the first assembly. For example, tilting. This might cause high one-sided pressing and consequently local threading in the thread. Close inspection of the connection for permanent deformation under site conditions is not always possible, hence you should replace a set.

Supernatant of the thread
After tightening, the screw thread must protrude at least one complete thread over the nut at scheduled preloaded connections.

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Application notes and terminology for HV-bolt-sets

Campaign production of HV bolts
At PEINER the HV-screws are made in campaigns, this has the great advantage that no customer has to wait long for a dimension. If you intend to have a larger project, then the dimension you require can easily be included in the next campaign.

Using a plurality of washers on one side (DIN EN 1090-2)
To compensate for the clamping length, on the side that is not turned, up to three washers with a total thickness of max. 12mm is allowed.

Inclination of the bearing surfaces on the component against contact surfaces of the screw head and / or the nut
As specified in DIN EN 1090-2: 2018, wedge washers must be used if the surface of the materials of construction forms an angle to the plane perpendicular to the screw axis of more than 3 ° for d <= 20mm screws. When screwing U or I profiles, use the corresponding wedge washers according to DIN 6917 or 6918. (in addition or instead of the round washers according to DIN EN 14399-6)

Securing bolt connections
Planatically preloaded bolted connections require no additional securing measures, such as, for example, for non-predominantly static loads. a locknut. (With a clamping length ratio {t / d <5, possible transverse displacements must be sufficiently limited by design measures.)

Slotted holes
Slotted holes and planned oversized holes as well as any necessary shims (in addition to the slices) may only be made according to the specifications of the draftsman. They usually require a special static proof.

Use of HV bolts in components with internal thread
Determination of the required screw-in depth in accordance with DIN EN 1993-1-8 / NA, if applicable, using the specifications of VDI Guideline 2230. The thread tolerance must be agreed with us. Our accredited laboratory can carry out the necessary process test for you.

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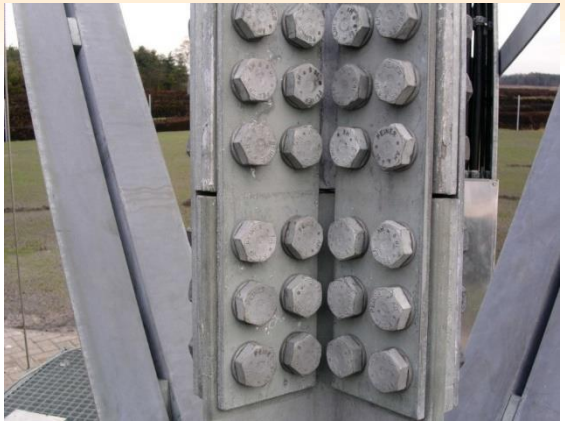
our partner in Romania: SAGITTA



Contact Details

PEINER Umformtechnik has a strong technical team, which will help you with any questions or problems.
We are very happy to help you.

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First league for bolts and nuts!

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