

ituGraf®

Technical Brochure 2.61

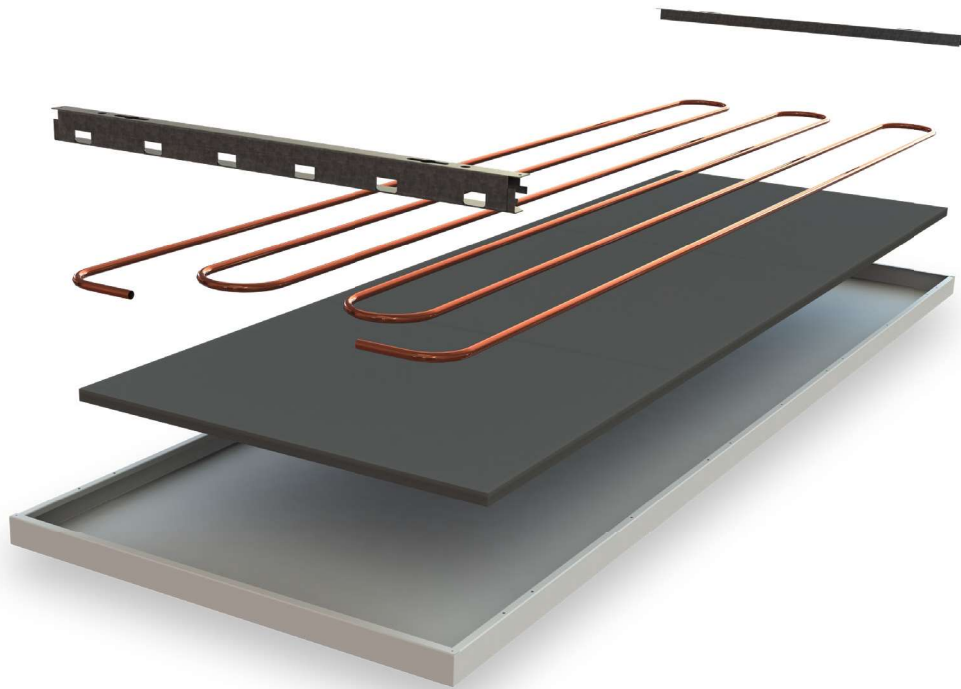


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Product Description



The ItuGraf® panel is made of thermally conductive graphite with an embedded copper meander 10 millimeters in diameter. The panel's casing is formed from galvanized sheet steel and is available with a smooth or perforated surface. The panels can be painted using RAL colors (the standard color is RAL 9016). The panels can also be fitted with insulation on the top surface.

The ItuGraf standard sail module in free hanging installation is the most efficient in spot heating and cooling cases. The standard panel with one copper meander can be used in combination with a change-over system using e.g. a 6-port valve to allow for heating or cooling. Itula provides also panels in 2-circuit version with two totally independent cooling and heating networks working in parallel, without any risk of fluid mixing in the panel. The patented one layer graphite activation system makes sure that both circuits give the maximum possible output.

The thermal transfer rate of ItuGraf panels is optimized to provide maximum heating and/or cooling. The cooling capacity at $\Delta T=10$ K: average temperature of supply/return water - the desired room temperature) is 125 W/m² (insulated) and 160 W/m² (non-insulated) per active area of the panel. The cooling capacity is achieved with a turbulent flow in the panel's pipe. This usually leads to a temperature difference of between two and three degrees on the water side.

The standard widths of ItuGraf panels are 595 mm, 895 mm and 1190 mm. The standard lengths are 590 mm, 1190 mm, 1790 mm, 2390 mm, 2990 mm and 3590 mm. Panels are made to measure sizes upon request. The panels can be hung from the ceiling by adjustable cable wire mounting sets. For panels with a width of 595 mm, 895 mm and 1190 mm the patented surface bracket can also be used for installation. ItuGraf panels are CE marked and a Declaration of Performance is available upon request.

Project with Itula



1. Design



2. Positioning & Drawings



3. Production



4. Delivery Phase



5. Installation

The products are selected according to the customer's HVAC technical and architectural plan. Itula has developed ItuCalc design tool, which is used to calculate the number of panels required and the appropriate connection and installation method are selected based on the floor plan of the object. After the design phase, production drawings of the products are sent for customer approval. Drawings acceptance ensures that the right kind of products are ordered on site. ItuCalc design tool is available free of charge. [Read more from here.](#)

In the delivery phase products are packaged into right size lots is made according to customer specification and transported to the worksite. Itula has experience in a variety of installation methods and customer specified products please contact your local sales to find out how we can suit the needs of your project.

Environment & Sustainability

Itula Oy has sought to reduce losses and the amount of waste generated in production. The aim is to utilize all the pallets and packaging materials of the parts and materials coming into production in the packaging of the outgoing products, thus avoiding unnecessary procurement of packaging materials and the generation of packaging waste. ItuGraf radiant ceiling panels are made with materials with high recyclability rate.



Style and Architecture

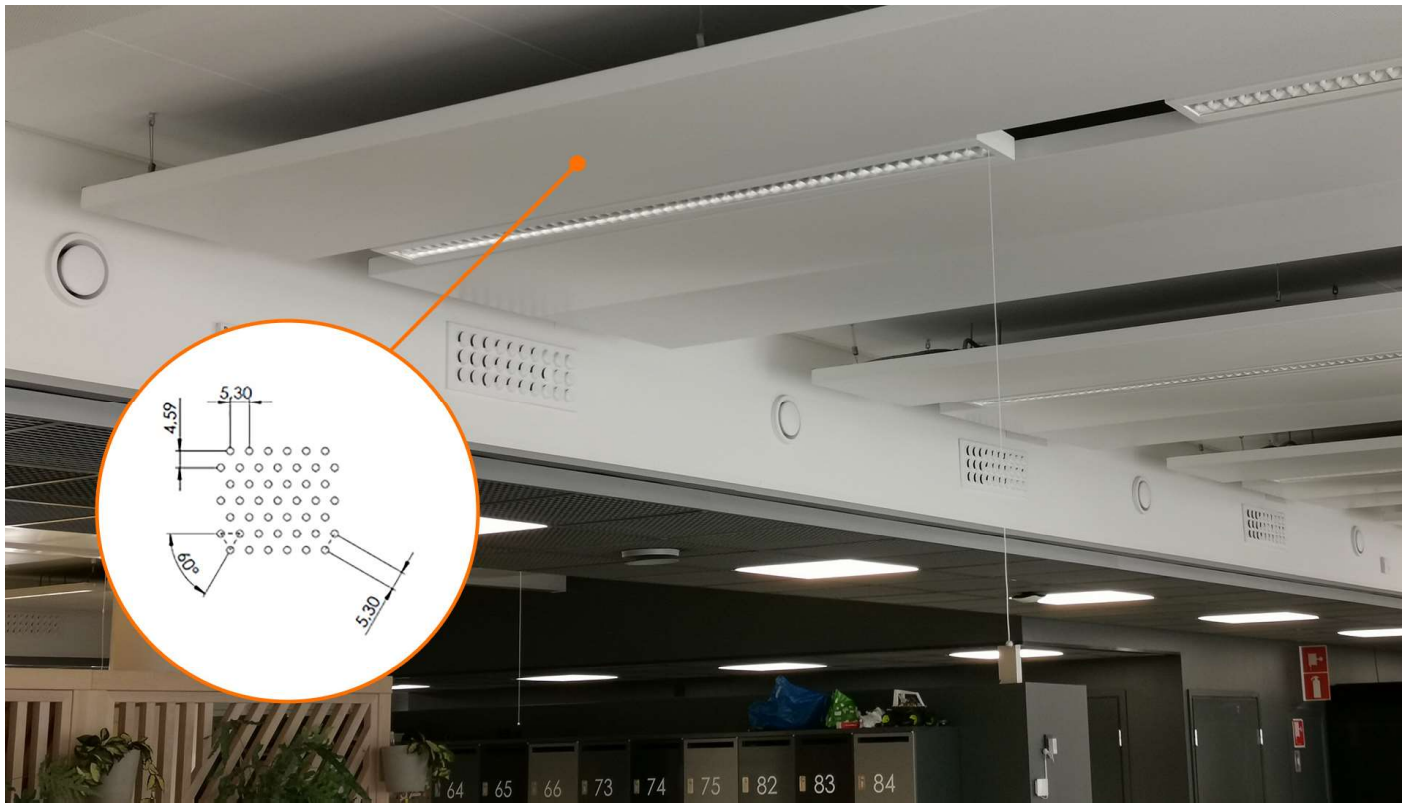


Itula's suspended ceiling collection currently extends to the product families of Saint-Gobain Ecophon and Rockfon acoustic T24 ceiling systems. The suitable Ecophon models are the A, Dg, Ds, E and Lp edge models in the Focus range and the A, Ds and E edge models in the Master range. ItuGraf panels match the Rockfon ceiling systems' edge models A, E, M, X and Z. ItuGraf ceiling panels are suitable for a 600-mm wide grid.

ItuGraf ceiling models allow the design of a space based on its architecture. The design has been based on the premise that the whole of the panels and suspended ceiling panels would be as harmonious as possible so that the panels integrate seamlessly into the selected suspended ceiling system. ItuGraf panels can be customized in numerous ways to suit different spaces. There are various size, color, and surface options as well as device integrations available.

Panels can be powder coated into the color specified in the project. The standard color of the Itula panels is RAL9016. The integration of lighting into the panels reduces the amount of installation work on site. Technology integrations also reduce on-site losses and breakages. Site logistics will improve when there are fewer component deliveries and suppliers. Security of supply is improved by getting a factory prepared set on site ready for installation.

Acoustics



The combination of radiant cooling and heating panels with acoustic ceilings is a good idea to improve the acoustics and sound attenuation of a room. The combination of ItuGraf suspended ceiling models and acoustic tile surfaces makes possible to highlight or hide the heating and cooling panels of the ceiling.

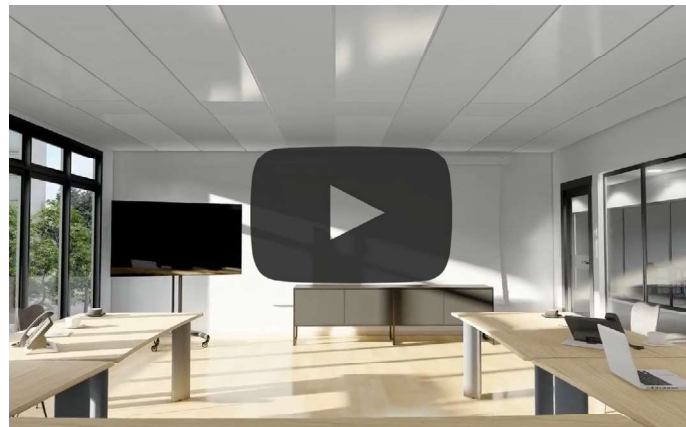
ItuGraf panels can be ordered as acoustic version where the panel is perforated and equipped with acoustic inlay improving the sound absorption values. Our standard perforation specification is full perforation $\varnothing 2.00$ T5.30 (13 %) according to above pattern detail. Acoustic values depend on the installation method and above insulation.

For acoustical performance information please contact our sales for more details.

ItuGraf Ecophon Ceiling Models

The Finnish ItuGraf® radiant ceiling heating and cooling system can be customised to suit a range of settings. Together with Saint-Gobain Rakennustuotteet Oy, Itula has developed a range of ItuAlu® panel models that perfectly match the Ecophon modular ceiling systems.

The ItuGraf® ceiling models are made to match the A, Dg, Ds, E and Lp edges in the Saint Gobain Ecophon T24 Focus range and the A, Ds and E edges in the T24 Master range. ItuGraf®suspended ceiling panels are suitable for a 600 mm wide suspended ceiling grid.



ItuGraf Model A



ItuGraf® Model A integrates with the A edge in the Focus and Master ceiling systems. The A edge has a visible grid and easily demountable tiles. Unlike with the other edges, the ItuGraf® Model A ceiling can be used with the T24 grid and also with the T15 grid.

ItuGraf Model DG



ItuGraf® Model Dg has been designed to match the Dg edge in the Focus range. The Dg edge design has concealed support edges to create a distinctive floating appearance. The suspension grid is approximately 14 mm above the visible surface of the tile, which gives the impression that each tile is individually suspended. All of the tiles are easily demountable.

ItuGraf Model DS



ItuGraf® Model Ds can be used with the Ds edge in the Focus and Master ranges. The Ds edge is suitable for applications where a suspended ceiling with a concealed grid is required. The tiles have a symmetrical edge design. The ceiling has an even appearance, with the bevelled edges forming a discreet groove between the tiles. The tiles are easily demountable.

ItuGraf Model Lp



ItuGraf® Model Lp fits together with the Lp edge in the Focus range. The Lp edge semi-concealed grid system can be used for highlighting direction in a room. The longer sides have a wide gap between the tiles while the tile connections on the shorter sides are concealed.

ItuGraf Model E



ItuGraf® Model E has been designed to match the E edge in the Focus and Master ranges. The E edge has a recessed visible grid, creating a ceiling with a shadow effect. The visible surface of each tile is 10 mm below the grid. All of the tiles are easily demountable.

ItuGraf Rockfon Ceiling Models

The Finnish ItuGraf® radiant ceiling heating and cooling system can be customised to suit a range of settings. Together with Rockfon, the provider of acoustic ceiling and wall systems, Itula has developed a range of ItuGraf panel models that perfectly match the Rockfon modular ceiling systems.

The ItuGraf® ceiling models are made to match the A24, A15, E24, M, X and Z edges. ItuGraf® ceiling models are suitable for a 600 mm wide suspended ceiling grid.



ItuGraf Model A



ItuGraf® Model A integrates with the A24 and A15 edge system. The A edge has a visible grid and easily demountable tiles.

ItuGraf Model M



ItuGraf® Model M has been designed to match the M edge. The M edge design has concealed support edges to create a distinctive floating appearance. The suspension grid is approximately 14 mm above the visible surface of the tile, which gives the impression that each tile is individually suspended. All of the tiles are easily demountable.

ItuGraf Model X



ItuGraf® Model X can be used with the X edge. The X edge is suitable for applications where a suspended ceiling with a concealed grid is required. The tiles have a symmetrical edge design. The ceiling has an even appearance, with the bevelled edges forming a discreet groove between the tiles. The tiles are easily demountable.

ItuGraf Model E



ItuGraf® Model E has been designed to match the E24 edge. The E edge has a recessed visible grid, creating a ceiling with a shadow effect. The visible surface of each tile is 10 mm below the grid.

ItuGraf Model Z



ItuGraf® Model Z fits together with the Z edge in the Rockfon range. The Z edge semi-concealed grid system can be used for highlighting direction in a room. The Z model is used when the T-bar system is designed for a sleek linear look that emphasizes the geometric directional effect of a room.

Technical Data

Standard widths	mm	595						895					1190				
Standard lengths	mm	590	1190	1790	2390	2990	3590	1190	1790	2390	2990	3590	1190	1790	2390	2990	3590
Number of parallel pipes	-	6						8					12				
Product weight without insulation	kg	4.1	7.4	10.6	14.1	17.4	20.9	12.6	18.5	23.8	29.2	35	16.7	24.3	31.2	38.1	45.7
Product weight with insulation	kg	4.3	7.8	11.2	14.9	18.4	22.1	13.2	19.4	25	30.7	36.8	17.4	25.5	32.8	40.1	48.1
Operating weight without insulation	kg	4.3	7.8	11.2	14.9	18.5	22.2	13.1	19.3	24.9	30.6	36.7	17.1	25.1	32.5	39.8	47.8
Operating weight with insulation	kg	4.5	8.2	11.8	15.7	19.5	23.4	13.7	20.2	26.1	32.1	38.5	17.8	26.3	34	41.8	50.2
Water content	kg	0.19	0.41	0.63	0.84	1.06	1.28	0.53	0.82	1.11	1.4	1.69	0.38	0.81	1.25	1.69	2.13
Activation technology	-	Expanded graphite and copper															
Panel casing	mm	Steel 0.7															
Pipe material	mm	Copper Ø10															
Pipe spacing	mm	100															
Maximum operating temperature	°C	Smooth 83 / Perforated 55															
Maximum operating pressure	bar	8															
Options		Perforation, special colours, cut-outs, integration of building components, insulation															

Dimensioning and System Design

The heating output of the radiant ceiling panel is distributed in the room as natural convection and radiation. Natural convection accounts for about 25% and radiation for about 75% of total heating output. The supply water temperature for heating radiant ceiling panel can be 30–55 °C and the temperature drop 3–10 °C. Radiant heating is most often designed for supply water temperature between 40 and 45 °C and a room temperature of 21 °C.

During cooling, the radiant ceiling panel receives heat from the room. The total cooling capacity is about 40 % from natural convection and about 60 % from radiation. The supply water temperature for radiant cooling can be 14–17 °C and temperature rise can be approximately 2–3 °C. Radiant cooling is most often designed for supply water temperature 15 °C and a room temperature between 25–26 °C.

Most of the energy sources on the market are suitable for radiant ceiling panels. For example, heat pumps can be used, which take their energy from the ground, air or water. The term coefficient of performance (COP) describes the efficiency of a heat pump. The low supply water temperature of the radiant ceiling panels during the heating season and the high supply water temperature during the cooling season help to increase the efficiency of the heat pumps, in other words the COP figure. The higher the COP figure, the more energy efficient the building's radiant heating and cooling system.

The aim of design for the radiant heating and cooling system are that the flow of one radiant ceiling panel should be between 72-90 l/h. The radiant ceiling panel size 595 mm x 2990 mm produces a pressure drop of about 4 to 6 kPa at flows of 72-90 l/h. Radiant ceiling panels can be connected to the water supply with flexible hoses. One end of the flexible hose has a 10 mm push-fitting connector for the radiant panel and the other end has a ½" connector with an external thread for the main pipe connection. The most common flexible hose lengths are 0.5 m, 0.8 m, and 1.5 m.

Radiant ceiling panels can be installed in series with a maximum of 2-5 pieces depending on pressure drop, flow rates and output requirements. The panels connected in series can be connected to each other with flexible hoses with 10 mm push-fitting connector at both ends.

The radiant ceiling panels mounted in parallel can be connected in two different ways, with- or without reverse return. When connected without reverse return, lockshield valves are installed in the return side of each radiant ceiling panel to ensure the correct flow for each panel.

In reverse return, the idea is to provide the same length of supply and return water pipes for one group of radiant ceiling panels, so that the pressure losses on the supply and return side are equal. In one radiant ceiling panel group, the circulating water is evenly distributed to all panels, eliminating the need for lockshield valves. This reverse return connection method, called also as Tichelmann loop-connection, needs no additional balancing between the panels in a panel group when all the panels have the same size.

The flow of the radiant ceiling panel groups can be adjusted to be correct by using pressure independent balancing and control valves with actuator or radiant panel valves with actuator.

The radiant ceiling panel group is controlled by means of a thermostat in the room. Several radiant ceiling panel groups can be installed behind one thermostat. The thermostat controls the actuator, which opens and closes according to the thermostat setup.

In humid climates, condensation on the radiant ceiling panel surface during cooling have to be avoided. To prevent condensation on the panel, the flow temperature should be adjusted according to the dew point. The dew point sensor is installed on the supply water pipe, and the controller calculates the dew point temperature considering the specific room air conditions at the measured supply water temperature. Thanks to the dew point monitor, the flow value always remains at least one degree higher than the dew point temperature in the room.

ItuGraf Heating & Cooling Outputs

Module width 600 - Output in free hanging installations

The following tables show the heating output and cooling capacity for open ceiling installation according to EN 14037-2/3 (heating) and EN 14240 (cooling).

$$\Delta t = \left(\frac{t_1 + t_2}{2} \right) - t_i$$

t_1 = Inlet Water Temperature °C
 t_2 = Outlet Water Temperature °C
 t_i = Indoor Temperature °C

Heating output for 6-pipe activation Free hanging installation without insulation						
	595x590	595x1190	595x1790	595x2390	595x2990	595x3590
K	2.544	5.792	9.040	12.288	15.536	18.784
n	1.185					
Δ t (K)	W	W	W	W	W	W
70	391	890	1389	1888	2387	2886
68	378	860	1342	1824	2306	2788
66	365	830	1295	1761	2226	2691
64	351	800	1249	1698	2146	2595
62	338	771	1203	1635	2067	2499
60	326	741	1157	1573	1988	2404
58	313	712	1111	1511	1910	2309
56	300	683	1066	1449	1832	2215
55	294	669	1044	1418	1793	2168
54	287	654	1021	1388	1755	2122
52	275	626	976	1327	1678	2029
50	262	597	932	1267	1602	1937
48	250	569	888	1207	1526	1845
46	238	541	844	1148	1451	1755
44	225	513	801	1089	1377	1664
42	213	486	758	1030	1303	1575
40	201	458	716	973	1230	1487
38	189	431	673	915	1157	1399
36	178	405	632	858	1085	1312
34	166	378	590	802	1014	1226
32	155	352	549	747	944	1141
30	143	326	509	692	874	1057
28	132	300	469	637	806	974
26	121	275	429	584	738	892
24	110	250	391	531	671	812
22	99	226	352	479	606	732
20	89	202	315	428	541	654
18	78	178	278	378	477	577
16	68	155	242	328	415	502
14	58	132	206	280	354	429
12	48	110	172	234	295	357
10	39	89	138	188	238	288

Heating output for 6-pipe activation Free hanging installation with insulation						
	595x590	595x1190	595x1790	595x2390	595x2990	595x3590
K	1.563	3.559	5.555	7.550	9.546	11.541
n	1.176					
Δ t (K)	W	W	W	W	W	W
70	231	526	821	1116	1411	1706
68	223	509	794	1079	1364	1649
66	216	491	766	1042	1317	1592
64	208	474	739	1005	1270	1536
62	200	456	712	968	1224	1479
60	193	439	685	931	1177	1424
58	185	422	658	895	1131	1368
56	178	405	632	859	1086	1313
55	174	396	618	841	1063	1285
54	170	388	605	823	1040	1258
52	163	371	579	787	995	1203
50	156	354	553	752	950	1149
48	148	338	527	716	906	1095
46	141	321	501	681	861	1042
44	134	305	476	647	818	988
42	127	289	450	612	774	936
40	120	272	425	578	731	884
38	113	257	400	544	688	832
36	106	241	376	511	646	781
34	99	225	351	478	604	730
32	92	210	327	445	562	680
30	85	194	303	412	521	630
28	79	179	280	380	480	581
26	72	164	256	348	440	532
24	66	149	233	317	401	485
22	59	135	211	286	362	437
20	53	121	188	256	323	391
18	47	107	166	226	286	346
16	41	93	145	197	249	301
14	35	79	124	168	213	257
12	29	66	103	140	177	214
10	23	53	83	113	143	173

Cooling capacity for 6-pipe activation Free hanging installation without insulation						
	595x590	595x1190	595x1790	595x2390	595x2990	595x3590
K	3.169	7.214	11.259	15.304	19.349	23.394
n	1.1177					
Δt (K)	W	W	W	W	W	W
15	65	149	232	316	399	483
14	61	138	215	292	370	447
13	56	127	198	269	340	411
12	51	116	181	246	311	376
11	46	105	164	223	282	341
10	42	95	148	201	254	307
9	37	84	131	178	226	273
8	32	74	115	156	198	239
7	28	63	99	135	170	206
6	23	53	83	113	143	173
5	19	44	68	92	117	141
4	15	34	53	72	91	110
3	11	25	38	52	66	80
2	7	16	24	33	42	51
1	3	7	11	15	19	23

Cooling capacity for 6-pipe activation Free hanging installation with insulation						
	595x590	595x1190	595x1790	595x2390	595x2990	595x3590
K	2.164	4.927	7.690	10.453	13.216	15.979
n	1.1757					
Δt (K)	W	W	W	W	W	W
15	52	119	186	252	319	386
14	48	110	171	233	294	356
13	44	101	157	213	270	326
12	40	91	143	194	245	297
11	36	83	129	175	222	268
10	32	74	115	157	198	239
9	29	65	102	138	175	212
8	25	57	89	121	152	184
7	21	49	76	103	130	157
6	18	41	63	86	109	131
5	14	33	51	69	88	106
4	11	25	39	53	67	82
3	8	18	28	38	48	58
2	5	11	17	24	30	36
1	2	5	8	10	13	16

Module width 600 - Output in closed ceiling installations

The following tables show the heating output and cooling capacity for closed ceiling and surface mounting installation according to EN14037-5 (heating) and EN14240 (cooling).

Heating output for 6-pipe activation Closed ceiling installation without insulation						
	595x590	595x1190	595x1790	595x2390	595x2990	595x3590
K	1.707	3.886	6.065	8.243	10.422	12.601
n	1.1534					
Δ t (K)	W	W	W	W	W	W
70	229	522	815	1107	1400	1693
68	222	505	788	1071	1354	1637
66	214	488	761	1035	1308	1582
64	207	471	735	999	1262	1526
62	199	454	708	963	1217	1471
60	192	437	682	927	1172	1417
58	185	420	656	891	1127	1363
56	177	403	630	856	1082	1308
55	174	395	617	838	1060	1282
54	170	387	604	821	1038	1255
52	163	370	578	786	994	1201
50	156	354	553	751	950	1148
48	148	338	527	717	906	1095
46	141	322	502	682	863	1043
44	134	306	477	648	819	991
42	127	290	452	614	777	939
40	120	274	427	581	734	888
38	113	258	403	547	692	837
36	106	242	378	514	650	786
34	100	227	354	481	609	736
32	93	212	330	449	568	686
30	86	196	307	417	527	637
28	80	181	283	385	487	588
26	73	167	260	353	447	540
24	67	152	237	322	407	492
22	60	137	214	291	368	445
20	54	123	192	261	330	399
18	48	109	170	231	292	353
16	42	95	148	202	255	308
14	36	82	127	173	219	264
12	30	68	107	145	183	221
10	24	55	86	117	148	179

Heating output for 6-pipe activation Closed ceiling installation with insulation						
	595x590	595x1190	595x1790	595x2390	595x2990	595x3590
K	1.605	3.654	5.702	7.751	9.800	11.849
n	1.1199					
Δ t (K)	W	W	W	W	W	W
70	187	426	664	903	1142	1380
68	181	412	643	874	1105	1336
66	175	399	622	845	1069	1292
64	169	385	601	817	1033	1249
62	163	372	580	788	997	1205
60	157	358	559	760	961	1162
58	151	345	538	732	925	1118
56	146	332	517	703	889	1075
55	143	325	507	689	871	1054
54	140	318	497	675	854	1032
52	134	305	476	647	818	990
50	128	292	456	619	783	947
48	123	279	435	592	748	905
46	117	266	415	564	713	863
44	111	253	395	537	679	821
42	106	240	375	510	644	779
40	100	227	355	483	610	738
38	94	215	335	456	576	696
36	89	202	315	429	542	655
34	83	190	296	402	509	615
32	78	177	276	376	475	574
30	72	165	257	350	442	534
28	67	153	238	324	409	495
26	62	140	219	298	377	455
24	56	128	200	272	344	416
22	51	116	182	247	312	378
20	46	105	163	222	281	339
18	41	93	145	197	249	302
16	36	82	127	173	219	264
14	31	70	110	149	188	228
12	26	59	92	125	158	192
10	21	48	75	102	129	156

Cooling capacity for 6-pipe activation Closed ceiling installation without insulation						
	595x590	595x1190	595x1790	595x2390	595x2990	595x3590
K	2.585	5.886	9.187	12.487	15.788	19.089
n	1.1296					
Δt (K)	W	W	W	W	W	W
15	55	125	196	266	336	407
14	51	116	181	246	311	376
13	47	107	167	226	286	346
12	43	97	152	207	261	316
11	39	88	138	187	237	287
10	35	79	124	168	213	257
9	31	70	110	149	189	228
8	27	62	96	131	165	200
7	23	53	83	112	142	172
6	20	45	70	95	119	144
5	16	36	57	77	97	118
4	12	28	44	60	76	91
3	9	20	32	43	55	66
2	6	13	20	27	35	42
1	3	6	9	12	16	19

Cooling capacity for 6-pipe activation Closed ceiling installation with insulation						
	595x590	595x1190	595x1790	595x2390	595x2990	595x3590
K	2.179	4.962	7.744	10.526	13.309	16.091
n	1.1367					
Δt (K)	W	W	W	W	W	W
15	47	108	168	229	289	349
14	44	100	156	211	267	323
13	40	92	143	194	246	297
12	37	84	131	177	224	271
11	33	76	118	161	203	246
10	30	68	106	144	182	220
9	26	60	94	128	162	196
8	23	53	82	112	141	171
7	20	45	71	96	122	147
6	17	38	59	81	102	123
5	14	31	48	66	83	100
4	11	24	37	51	64	78
3	8	17	27	37	46	56
2	5	11	17	23	29	35
1	2	5	8	11	13	16

Module width 900 - Output in free hanging installations

The following tables show the heating output and cooling capacity for open ceiling installation according to EN 14037-2/3 (heating) and EN 14240 (cooling).

$$\Delta t = \left(\frac{t_1 + t_2}{2} \right) - t_i$$

t_1 = Inlet Water Temperature °C
 t_2 = Outlet Water Temperature °C
 t_i = Indoor Temperature °C

Heating output for 8-pipe activation Free hanging installation without insulation					
	895x1190	895x1790	895x2390	895x2990	895x3590
K	8.425	13.149	17.874	22.598	27.322
n	1.1850				
Δ t (K)	W	W	W	W	W
70	1294	2020	2746	3471	4197
68	1251	1952	2653	3354	4055
66	1207	1884	2561	3238	3915
64	1164	1816	2469	3122	3774
62	1121	1749	2378	3006	3635
60	1078	1683	2287	2892	3496
58	1036	1616	2197	2778	3359
56	994	1551	2108	2665	3222
55	973	1518	2063	2609	3154
54	952	1485	2019	2552	3086
52	910	1420	1931	2441	2951
50	869	1356	1843	2330	2817
48	828	1292	1756	2220	2684
46	787	1228	1669	2111	2552
44	747	1165	1584	2002	2421
42	707	1103	1499	1895	2291
40	667	1041	1415	1789	2163
38	628	979	1331	1683	2035
36	589	919	1249	1579	1909
34	550	858	1167	1475	1784
32	512	799	1086	1373	1660
30	474	740	1006	1272	1538
28	437	682	927	1172	1417
26	400	625	849	1074	1298
24	364	568	772	976	1181
22	328	512	697	881	1065
20	293	458	622	787	951
18	259	404	549	694	839
16	225	351	478	604	730
14	192	300	408	516	623
12	160	250	340	429	519
10	129	201	274	346	418

Heating output for 8-pipe activation Free hanging installation with insulation					
	895x1190	895x1790	895x2390	895x2990	895x3590
K	5.177	8.079	10.982	13.885	16.788
n	1.1760				
Δ t (K)	W	W	W	W	W
70	765	1195	1624	2053	2482
68	740	1155	1569	1984	2399
66	714	1115	1515	1916	2316
64	689	1075	1461	1848	2234
62	664	1036	1408	1780	2152
60	638	997	1355	1713	2071
58	614	958	1302	1646	1990
56	589	919	1249	1579	1909
55	576	900	1223	1546	1869
54	564	880	1197	1513	1829
52	540	842	1145	1447	1750
50	515	804	1093	1382	1671
48	491	767	1042	1317	1593
46	467	729	991	1253	1515
44	443	692	941	1189	1438
42	420	655	890	1126	1361
40	396	619	841	1063	1285
38	373	582	792	1001	1210
36	350	546	743	939	1136
34	327	511	695	878	1062
32	305	476	647	818	989
30	283	441	599	758	916
28	261	407	553	699	845
26	239	373	507	641	774
24	217	339	461	583	705
22	196	306	416	526	636
20	175	274	372	470	569
18	155	242	329	416	503
16	135	211	286	362	438
14	115	180	245	309	374
12	96	150	204	258	312
10	78	121	165	208	252

Cooling capacity for 8-pipe activation Free hanging installation without insulation					
	895x1190	895x1790	895x2390	895x2990	895x3590
K	10.493	16.376	22.260	28.144	34.027
n	1.1177				
Δt (K)	W	W	W	W	W
15	216	338	459	581	702
14	200	313	425	538	650
13	184	288	391	495	598
12	169	263	358	452	547
11	153	239	325	411	496
10	138	215	292	369	446
9	122	191	259	328	397
8	107	167	227	288	348
7	92	144	196	248	299
6	78	121	165	209	252
5	63	99	135	170	206
4	49	77	105	133	160
3	36	56	76	96	116
2	23	36	48	61	74
1	10	16	22	28	34

Cooling capacity for 8-pipe activation Free hanging installation with insulation					
	895x1190	895x1790	895x2390	895x2990	895x3590
K	7.167	11.186	15.205	19.224	23.243
n	1.1757				
Δt (K)	W	W	W	W	W
15	173	270	367	464	561
14	160	249	338	428	517
13	146	228	310	392	474
12	133	208	282	357	432
11	120	188	255	322	390
10	107	168	228	288	348
9	95	148	201	255	308
8	83	129	175	222	268
7	71	110	150	189	229
6	59	92	125	158	191
5	48	74	101	128	154
4	37	57	78	98	119
3	26	41	55	70	85
2	16	25	34	43	53
1	7	11	15	19	23

Module width 900 - Output in closed ceiling installations

The following tables show the heating output and cooling capacity for closed ceiling and surface mounting installation according to EN14037-5 (heating) and EN14240 (cooling).

Heating output for 8-pipe activation Closed ceiling installation without insulation					
	895x1190	895x1790	895x2390	895x2990	895x3590
K	5.652	8.821	11.990	15.160	18.329
n	1.1534				
Δt (K)	W	W	W	W	W
70	759	1185	1611	2036	2462
68	734	1146	1558	1969	2381
66	709	1107	1505	1903	2300
64	685	1069	1452	1836	2220
62	660	1030	1400	1770	2140
60	635	992	1348	1705	2061
58	611	954	1297	1639	1982
56	587	916	1245	1574	1903
55	575	897	1219	1542	1864
54	563	878	1194	1510	1825
52	539	841	1143	1445	1747
50	515	804	1093	1381	1670
48	491	767	1042	1318	1593
46	468	730	992	1255	1517
44	444	694	943	1192	1441
42	421	657	893	1130	1366
40	398	621	845	1068	1291
38	375	586	796	1007	1217
36	353	550	748	946	1143
34	330	515	700	885	1070
32	308	480	653	826	998
30	286	446	606	766	927
28	264	412	560	708	856
26	242	378	514	650	786
24	221	345	469	592	716
22	200	312	424	536	648
20	179	279	380	480	580
18	158	247	336	425	514
16	138	216	294	371	449
14	119	185	252	318	385
12	99	155	211	266	322
10	80	126	171	216	261

Heating output for 8-pipe activation Closed ceiling installation with insulation					
	895x1190	895x1790	895x2390	895x2990	895x3590
K	5.314	8.294	11.274	14.254	17.234
n	1.1199				
Δt (K)	W	W	W	W	W
70	619	966	1313	1661	2008
68	599	935	1272	1608	1944
66	580	905	1230	1555	1880
64	560	874	1188	1502	1816
62	540	843	1147	1450	1753
60	521	813	1105	1397	1689
58	502	783	1064	1345	1627
56	482	753	1023	1293	1564
55	473	738	1003	1268	1533
54	463	723	982	1242	1501
52	444	693	942	1190	1439
50	425	663	901	1139	1377
48	406	633	861	1088	1316
46	387	604	821	1038	1255
44	368	574	781	987	1194
42	349	545	741	937	1133
40	331	516	702	887	1073
38	312	488	663	838	1013
36	294	459	624	789	953
34	276	430	585	740	894
32	258	402	547	691	836
30	240	374	509	643	777
28	222	346	471	595	720
26	204	319	433	548	662
24	187	291	396	501	605
22	169	264	359	454	549
20	152	238	323	408	494
18	135	211	287	363	439
16	119	185	252	318	384
14	102	159	217	274	331
12	86	134	182	230	279
10	70	109	149	188	227

Cooling capacity for 8-pipe activation Closed ceiling installation without insulation					
	895x1190	895x1790	895x2390	895x2990	895x3590
K	8.562	13.363	18.163	22.964	27.765
n	1.1296				
Δt (K)	W	W	W	W	W
15	182	285	387	489	592
14	169	263	358	453	547
13	155	242	329	416	503
12	142	221	301	380	460
11	129	201	273	345	417
10	115	180	245	309	374
9	102	160	217	275	332
8	90	140	190	241	291
7	77	120	164	207	250
6	65	101	137	174	210
5	53	82	112	141	171
4	41	64	87	110	133
3	30	46	63	79	96
2	19	29	40	50	61
1	9	13	18	23	28

Cooling capacity for 8-pipe activation Closed ceiling installation with insulation					
	895x1190	895x1790	895x2390	895x2990	895x3590
K	7.217	11.264	15.311	19.358	23.405
n	1.1367				
Δt (K)	W	W	W	W	W
15	157	245	333	420	508
14	145	226	307	389	470
13	133	208	283	357	432
12	122	190	258	326	394
11	110	172	234	296	357
10	99	154	210	265	321
9	88	137	186	235	284
8	77	120	163	206	249
7	66	103	140	177	214
6	55	86	117	148	179
5	45	70	95	121	146
4	35	54	74	94	113
3	25	39	53	67	82
2	16	25	34	43	51
1	7	11	15	19	23

Module width 1200 - Output in free hanging installations

The following tables show the heating output and cooling capacity for open ceiling installation according to EN 14037-2/3 (heating) and EN 14240 (cooling).

$$\Delta t = \left(\frac{t_1 + t_2}{2} \right) - t_i$$

t_1 = Inlet Water Temperature °C
 t_2 = Outlet Water Temperature °C
 t_i = Indoor Temperature °C

Heating output for 12-pipe activation Free hanging installation without insulation					
	1190x1190	1190x1790	1190x2390	1190x2990	1190x3590
K	11.584	18.080	24.576	31.072	37.568
n	1.1850				
Δt (K)	W	W	W	W	W
70	1780	2777	3775	4773	5771
68	1719	2684	3648	4612	5576
66	1660	2590	3521	4452	5382
64	1600	2498	3395	4292	5190
62	1541	2405	3270	4134	4998
60	1482	2314	3145	3976	4808
58	1424	2223	3021	3820	4618
56	1366	2132	2898	3664	4430
55	1337	2087	2837	3587	4337
54	1308	2042	2776	3510	4243
52	1251	1953	2654	3356	4058
50	1194	1864	2534	3204	3873
48	1138	1776	2414	3052	3691
46	1082	1689	2296	2902	3509
44	1027	1602	2178	2753	3329
42	971	1516	2061	2606	3150
40	917	1431	1945	2459	2973
38	863	1347	1830	2314	2798
36	809	1263	1717	2171	2624
34	756	1180	1604	2029	2453
32	704	1099	1493	1888	2283
30	652	1018	1383	1749	2115
28	601	938	1275	1612	1949
26	550	859	1168	1476	1785
24	501	781	1062	1343	1623
22	451	705	958	1211	1464
20	403	629	856	1082	1308
18	356	556	755	955	1154
16	310	483	657	830	1004
14	264	412	561	709	857
12	220	344	467	590	714
10	177	277	376	476	575

Heating output for 12-pipe activation Free hanging installation with insulation					
	1190x1190	1190x1790	1190x2390	1190x2990	1190x3590
K	7.118	11.109	15.100	19.092	23.083
n	1.1760				
Δt (K)	W	W	W	W	W
70	1052	1643	2233	2823	3413
68	1017	1587	2158	2728	3299
66	982	1533	2083	2634	3185
64	947	1478	2009	2540	3072
62	912	1424	1936	2447	2959
60	878	1370	1862	2355	2847
58	844	1317	1790	2263	2736
56	809	1263	1717	2171	2625
55	793	1237	1681	2126	2570
54	776	1211	1645	2080	2515
52	742	1158	1574	1990	2406
50	708	1106	1503	1900	2298
48	675	1054	1433	1811	2190
46	642	1002	1363	1723	2083
44	610	951	1293	1635	1977
42	577	901	1224	1548	1872
40	545	851	1156	1462	1767
38	513	801	1088	1376	1664
36	481	751	1021	1291	1561
34	450	703	955	1207	1460
32	419	654	889	1124	1359
30	389	606	824	1042	1260
28	358	559	760	961	1162
26	328	512	697	881	1065
24	299	466	634	802	969
22	270	421	572	724	875
20	241	376	512	647	782
18	213	333	452	572	691
16	186	290	394	498	602
14	159	247	336	425	514
12	132	206	281	355	429
10	107	167	226	286	346

Cooling capacity for 12-pipe activation Free hanging installation without insulation					
	1190x1190	1190x1790	1190x2390	1190x2990	1190x3590
K	14.427	22.517	30.608	38.698	46.788
n	1.1177				
Δ t (K)	W	W	W	W	W
15	298	465	631	798	965
14	276	430	585	739	894
13	254	396	538	680	823
12	232	362	492	622	752
11	210	328	446	564	682
10	189	295	401	507	614
9	168	262	357	451	545
8	147	230	313	395	478
7	127	198	269	341	412
6	107	167	227	287	347
5	87	136	185	234	283
4	68	106	144	182	220
3	49	77	104	132	160
2	31	49	66	84	102
1	14	23	31	39	47

Cooling capacity for 12-pipe activation Free hanging installation with insulation					
	1190x1190	1190x1790	1190x2390	1190x2990	1190x3590
K	9.855	15.381	20.907	26.432	31.958
n	1.1757				
Δ t (K)	W	W	W	W	W
15	238	371	505	638	771
14	219	342	465	588	711
13	201	314	427	539	652
12	183	286	388	491	593
11	165	258	350	443	536
10	148	231	313	396	479
9	130	204	277	350	423
8	114	177	241	305	368
7	97	152	206	260	315
6	81	126	172	217	263
5	65	102	139	175	212
4	50	78	107	135	163
3	36	56	76	96	116
2	22	35	47	60	72
1	10	15	21	26	32

Module width 1200 - Output in closed ceiling installations

The following tables show the heating output and cooling capacity for closed ceiling and surface mounting installation according to EN14037-5 (heating) and EN14240 (cooling).

Heating output for 12-pipe activation Closed ceiling installation without insulation					
	1190x1190	1190x1790	1190x2390	1190x2990	1190x3590
K	7.771	12.129	16.487	20.845	25.202
n	1.1534				
Δ t (K)	W	W	W	W	W
70	1044	1629	2215	2800	3385
68	1010	1576	2142	2708	3274
66	975	1522	2069	2616	3163
64	941	1469	1997	2525	3053
62	907	1416	1925	2434	2943
60	874	1364	1854	2344	2834
58	840	1312	1783	2254	2725
56	807	1259	1712	2164	2617
55	790	1234	1677	2120	2563
54	774	1208	1642	2076	2509
52	741	1156	1572	1987	2403
50	708	1105	1502	1899	2296
48	676	1054	1433	1812	2191
46	643	1004	1364	1725	2086
44	611	954	1296	1639	1982
42	579	904	1229	1553	1878
40	547	854	1161	1468	1775
38	516	805	1095	1384	1673
36	485	757	1028	1300	1572
34	454	708	963	1217	1472
32	423	660	898	1135	1372
30	393	613	833	1054	1274
28	363	566	770	973	1177
26	333	520	707	893	1080
24	304	474	644	815	985
22	275	429	583	737	891
20	246	384	522	660	798
18	218	340	462	585	707
16	190	297	404	510	617
14	163	255	346	437	529
12	137	213	290	366	443
10	111	173	235	297	359

Heating output for 12-pipe activation Closed ceiling installation with insulation					
	1190x1190	1190x1790	1190x2390	1190x2990	1190x3590
K	7.307	11.405	15.502	19.600	23.697
n	1.1199				
Δ t (K)	W	W	W	W	W
70	851	1329	1806	2283	2761
68	824	1286	1748	2210	2673
66	797	1244	1691	2138	2585
64	770	1202	1634	2065	2497
62	743	1160	1577	1993	2410
60	716	1118	1520	1921	2323
58	690	1076	1463	1850	2236
56	663	1035	1407	1778	2150
55	650	1014	1379	1743	2107
54	637	994	1351	1707	2064
52	610	952	1295	1637	1979
50	584	912	1239	1566	1894
48	558	871	1184	1496	1809
46	532	830	1129	1427	1725
44	506	790	1074	1358	1641
42	480	750	1019	1289	1558
40	455	710	965	1220	1475
38	429	670	911	1152	1393
36	404	631	858	1084	1311
34	379	592	804	1017	1230
32	354	553	752	950	1149
30	330	514	699	884	1069
28	305	476	647	818	989
26	281	438	596	753	911
24	257	401	545	689	833
22	233	363	494	625	755
20	209	327	444	561	679
18	186	290	395	499	603
16	163	254	346	437	529
14	140	219	298	377	455
12	118	184	251	317	383
10	96	150	204	258	312

Cooling capacity for 12-pipe activation Closed ceiling installation without insulation					
	1190x1190	1190x1790	1190x2390	1190x2990	1190x3590
K	11.772	18.374	24.975	31.576	38.177
n	1.1296				
Δt (K)	W	W	W	W	W
15	251	391	532	673	813
14	232	362	492	622	752
13	213	333	453	572	692
12	195	304	414	523	632
11	177	276	375	474	573
10	159	248	337	426	515
9	141	220	299	378	457
8	123	192	262	331	400
7	106	166	225	284	344
6	89	139	189	239	289
5	73	113	154	194	235
4	56	88	120	151	183
3	41	64	86	109	132
2	26	40	55	69	84
1	12	18	25	32	38

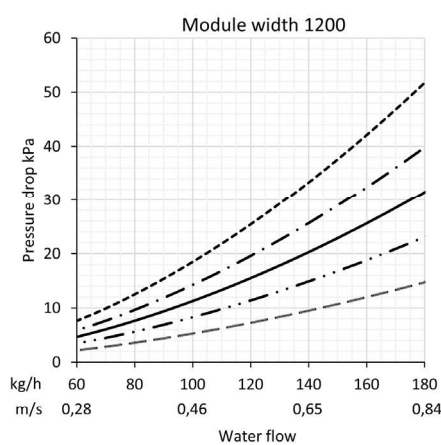
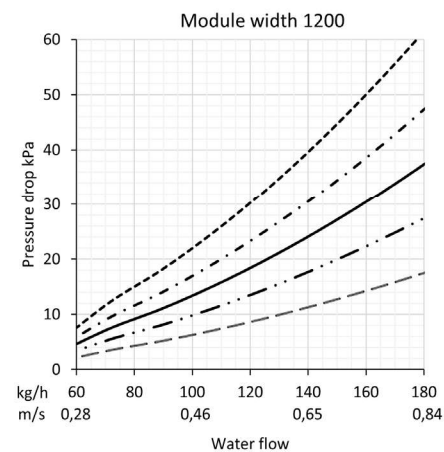
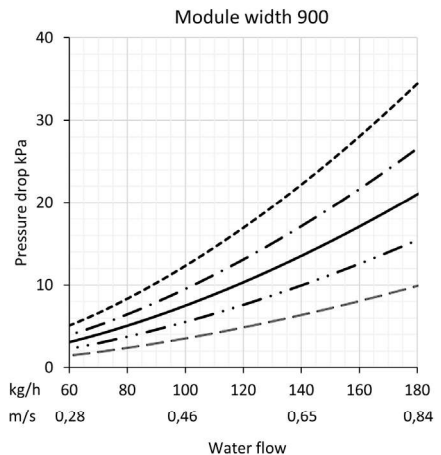
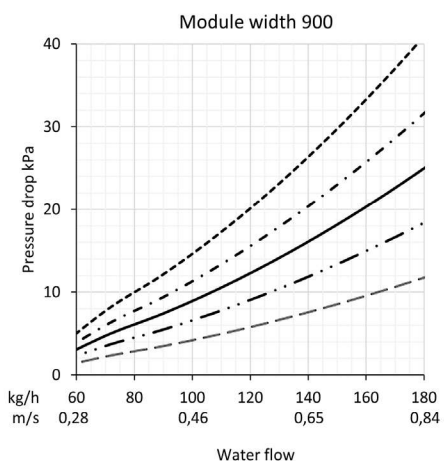
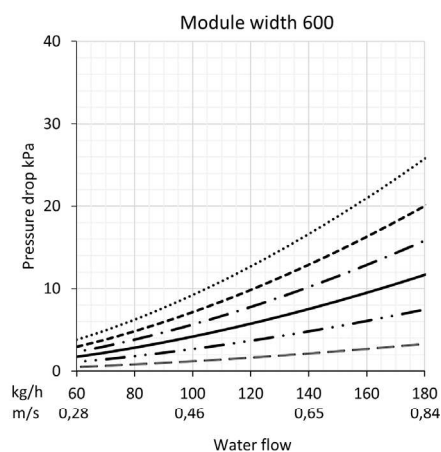
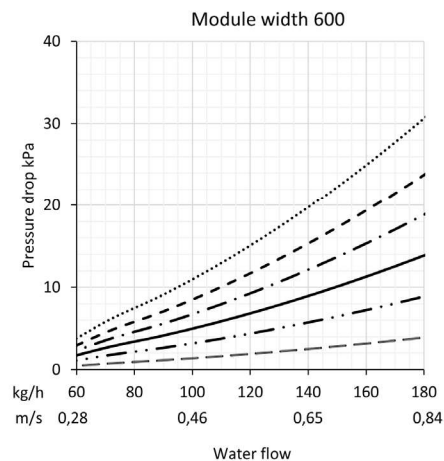
Cooling capacity for 12-pipe activation Closed ceiling installation with insulation					
	1190x1190	1190x1790	1190x2390	1190x2990	1190x3590
K	9.923	15.488	21.053	26.617	32.182
n	1.1367				
Δt (K)	W	W	W	W	W
15	216	336	457	578	699
14	199	311	423	535	646
13	183	286	389	491	594
12	167	261	355	449	542
11	152	236	321	406	491
10	136	212	288	365	441
9	121	188	256	323	391
8	105	165	224	283	342
7	91	141	192	243	294
6	76	119	161	204	247
5	62	96	131	166	201
4	48	75	102	129	156
3	35	54	73	93	112
2	22	34	46	59	71
1	10	15	21	27	32

Pressure Loss & Minimum Flow

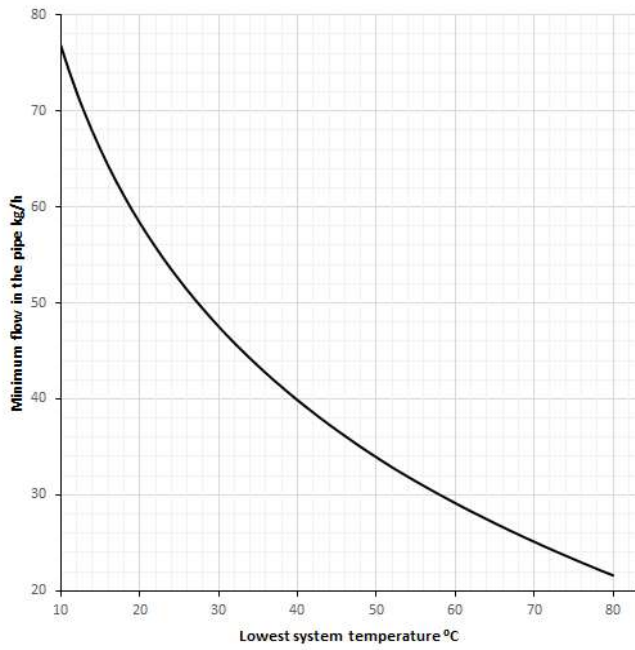
The following diagram represents the minimum mass flow in 10 mm pipe in order to achieve turbulent flow. A turbulent flow must be ensured within the pipes to obtain the rated output. This minimum mass flow depends on the lowest system temperature. When heating, this corresponds to the return temperature. When cooling, this corresponds to the supply water temperature. Maximum accepted flow speed in the pipe is 0.8 m/s.

15 °C water

55 °C water



Minimum flow rate for turbulent flow



ItuCalc Calculation Tool



The ItuCalc design tool makes it quick and easy to calculate the heating and cooling outputs of ItuGraf and ItuString+ panels.

Itula has developed a comprehensive calculation tool for projects with radiant heating and cooling panel solutions. The tool can be used for heating and cooling output calculation for Itula products as well for hydraulics calculations. It includes the specifics of standards visually for the designer for easy use. The calculation tool also provides the product codes to be included in the HVAC drawings so that the chain from design into production stays clear and transparent.

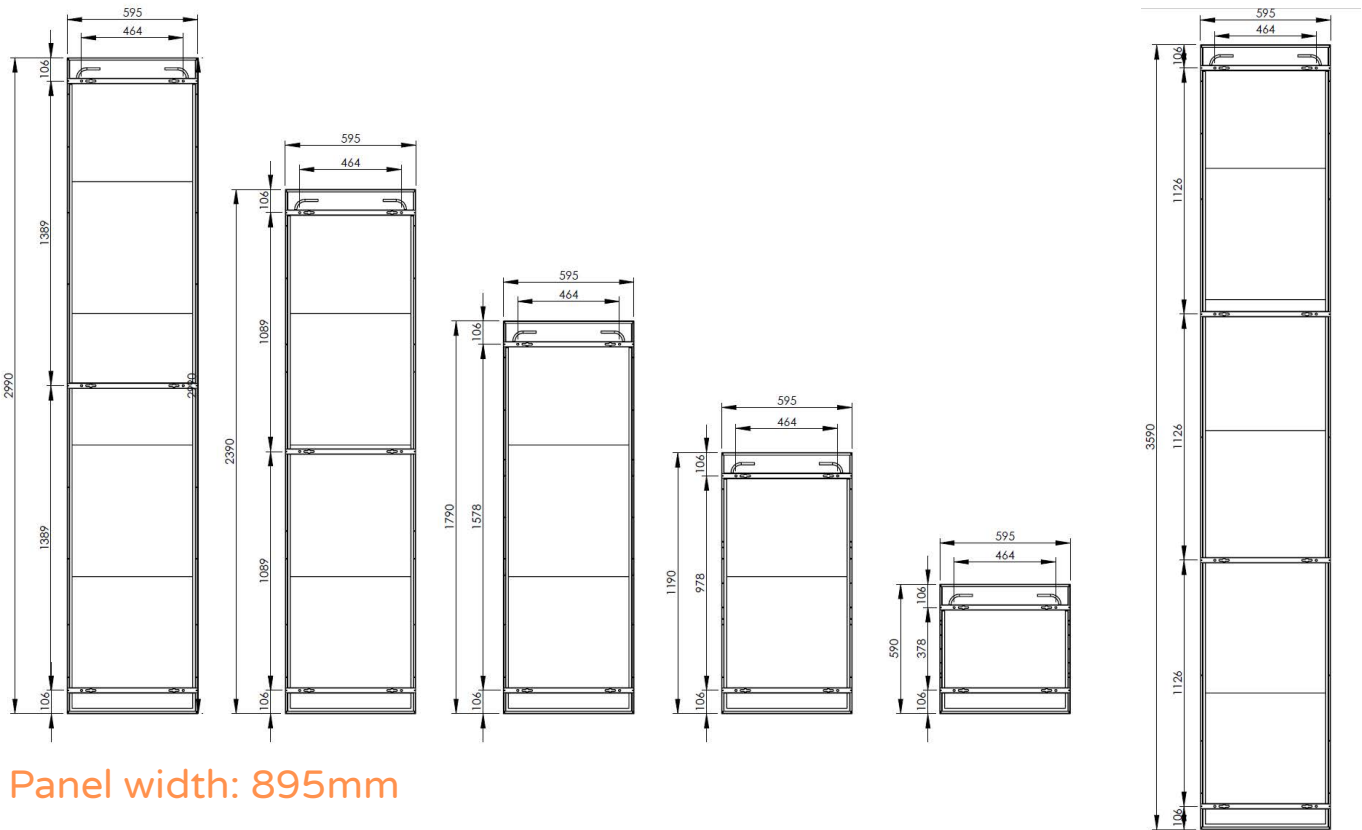
Read more from [here](#).

Fixing Options with Cable Wires

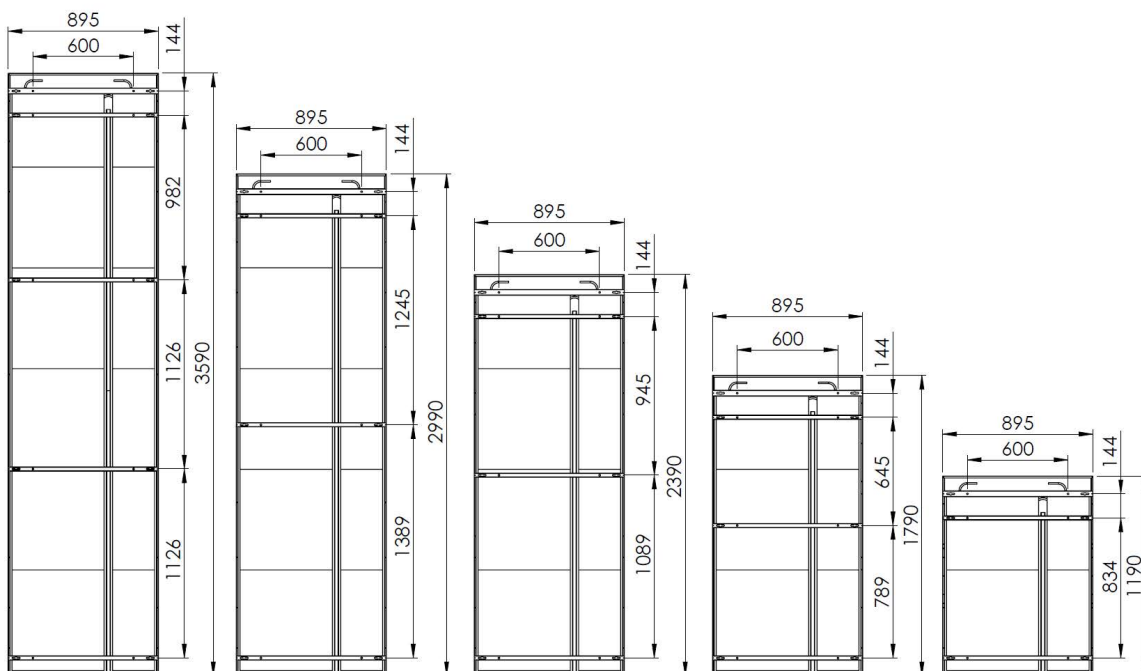
Mounting locations for ItuGraf panels

The following figures and tables show the number and positioning of the fixing points for panels with widths of 595 mm, 895 mm and 1190 mm. Wires or threaded rods can be used to fix the panels into the ceiling through holes located in the fixing points.

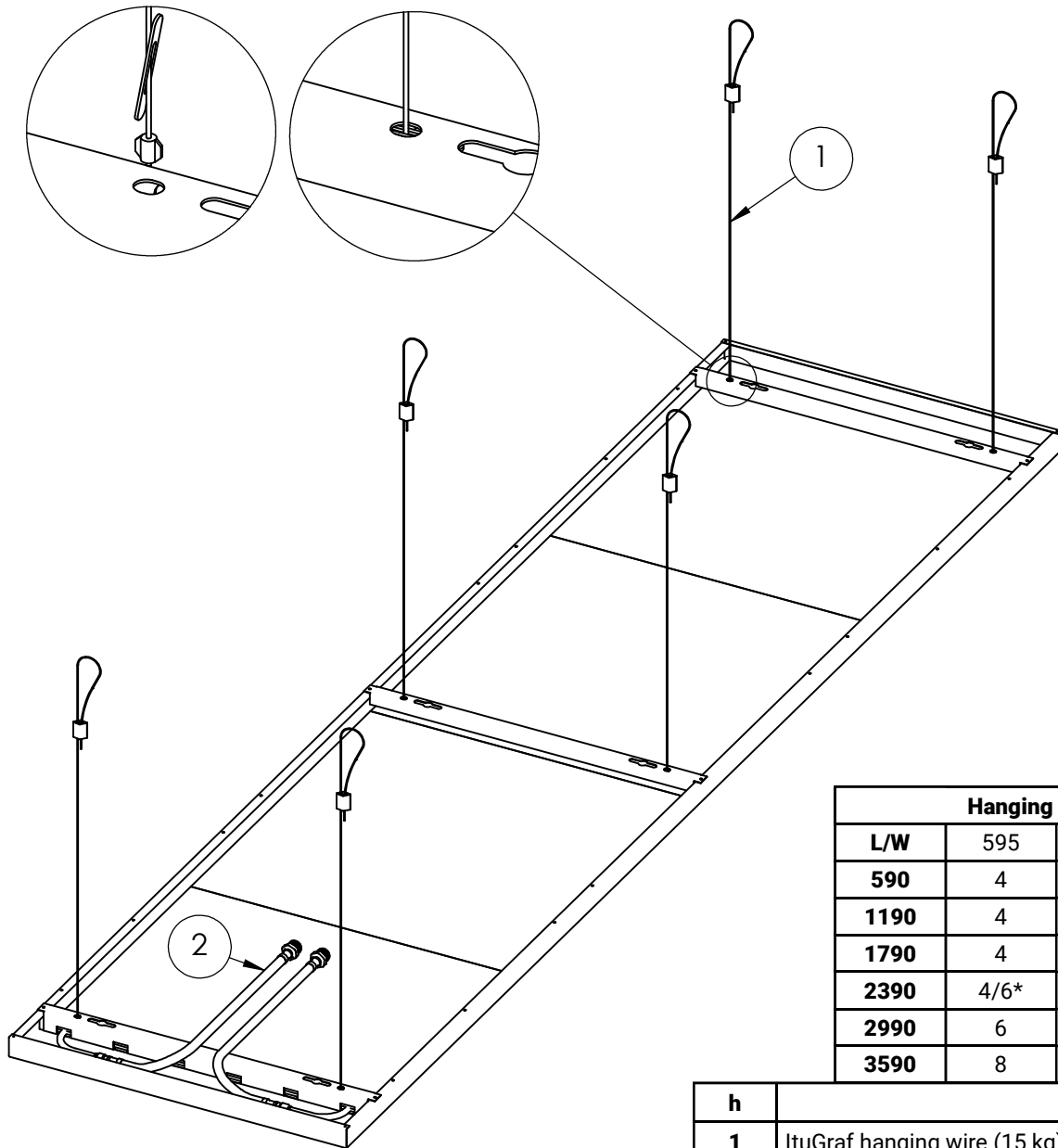
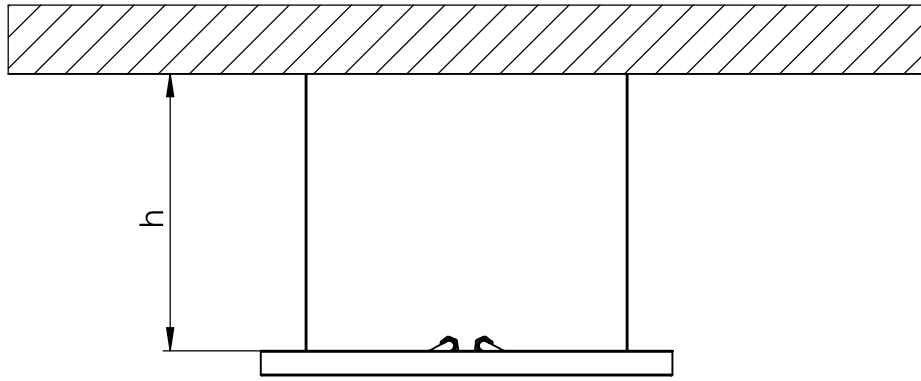
Panel width: 595mm



Panel width: 895mm



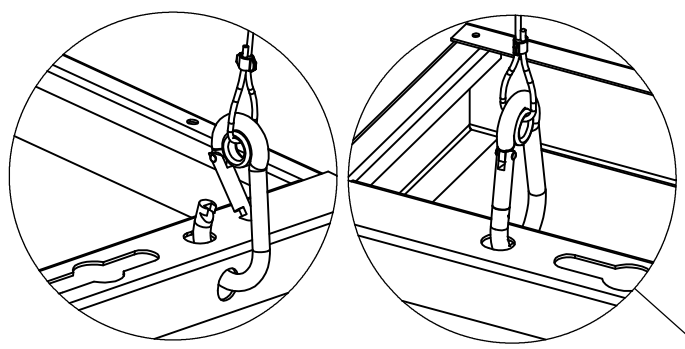
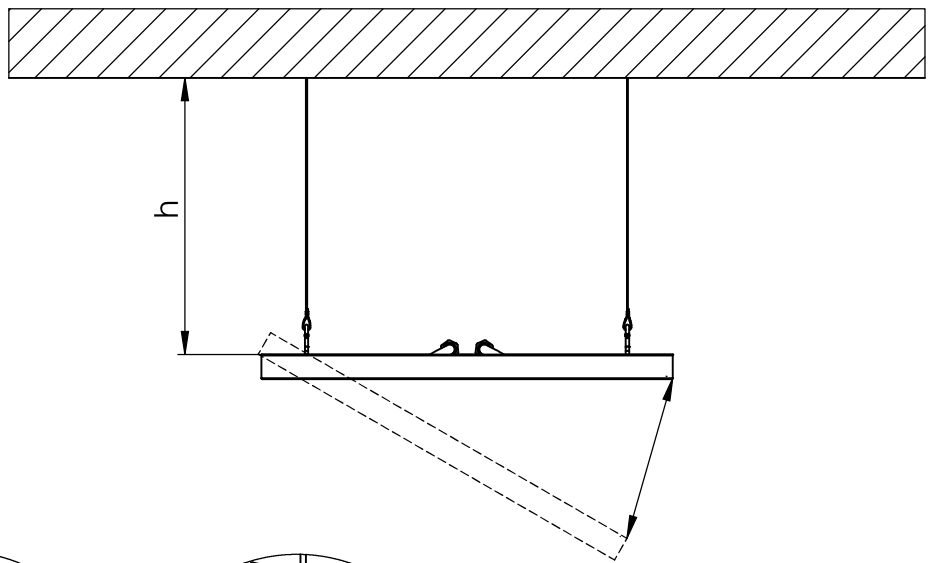
Panel width: 1190mm



Hanging wire qty.			
L/W	595	895	1190
590	4	4	4
1190	4	4	4
1790	4	6	6
2390	4/6*	6	6
2990	6	6	6
3590	8	8	8

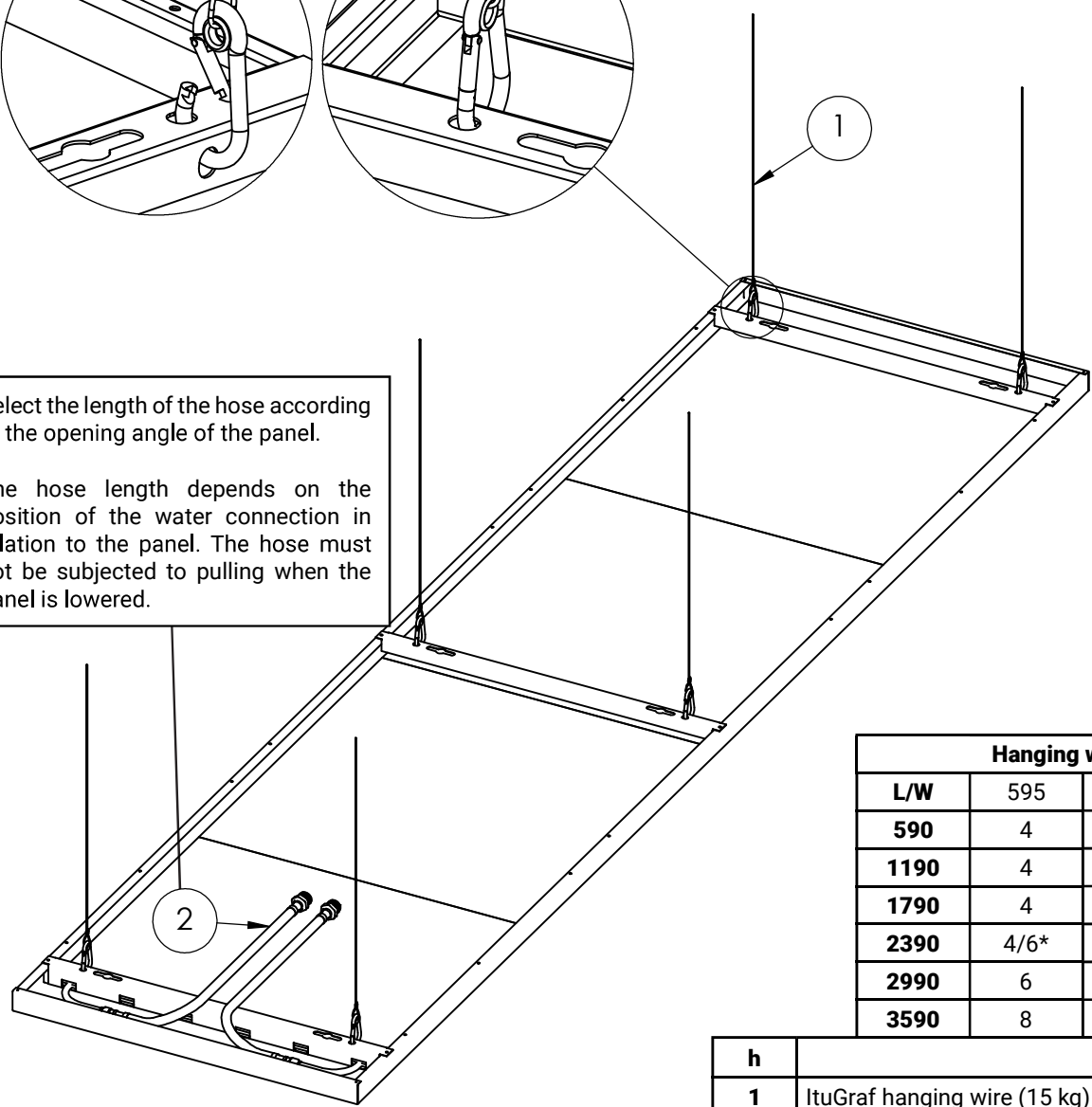
h	
1	ItuGraf hanging wire (15 kg)
2	Flexible connection hose DN10 x 1/2" M

*Quantity of wire depends on the accepted vertical deflection/sagging on site.



Select the length of the hose according to the opening angle of the panel.

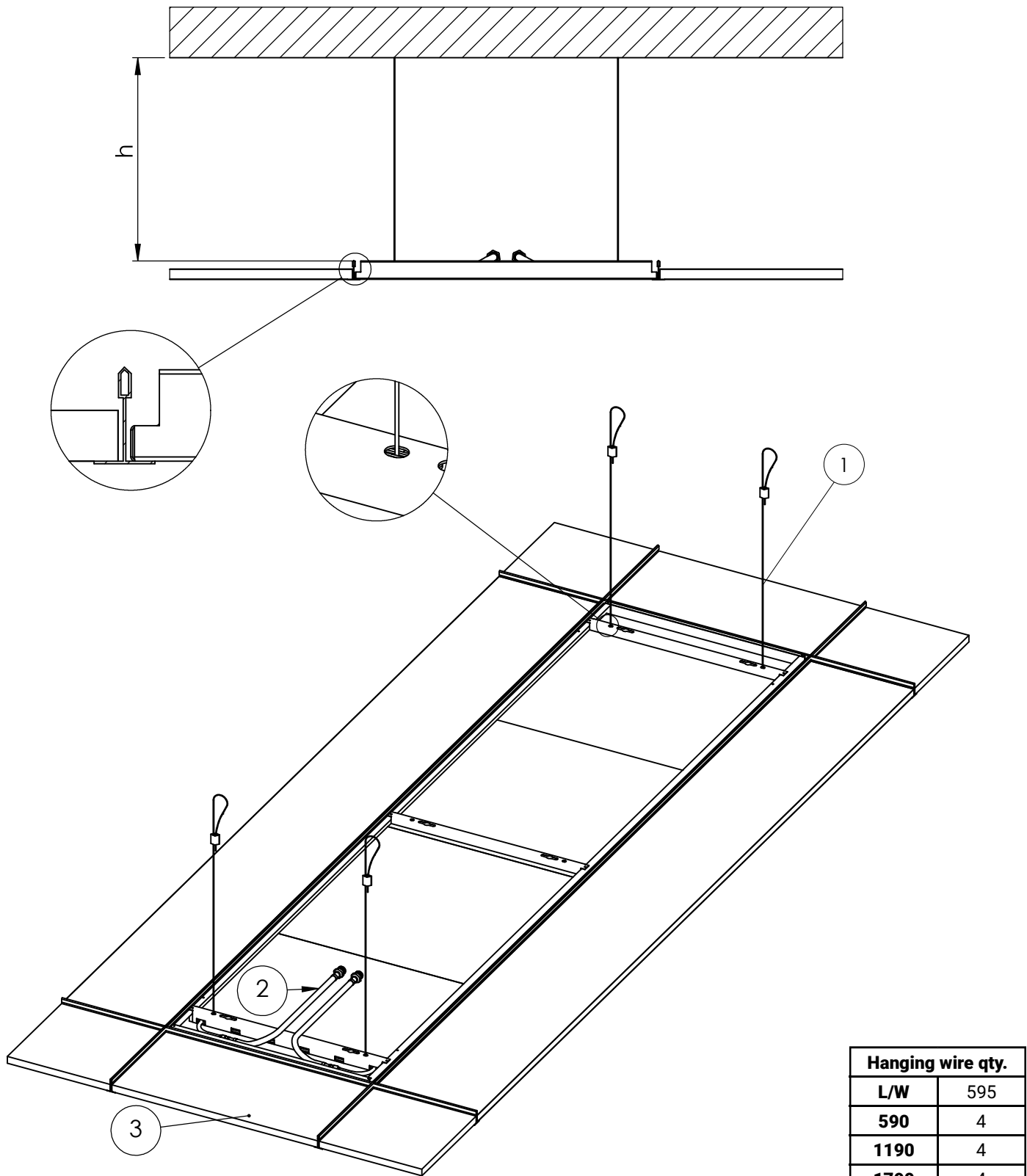
The hose length depends on the position of the water connection in relation to the panel. The hose must not be subjected to pulling when the panel is lowered.



Hanging wire qty.			
L/W	595	895	1190
590	4	4	4
1190	4	4	4
1790	4	6	6
2390	4/6*	6	6
2990	6	6	6
3590	8	8	8

h	
1	ItuGraf hanging wire (15 kg)
2	Flexible connection hose DN10 x 1/2" M

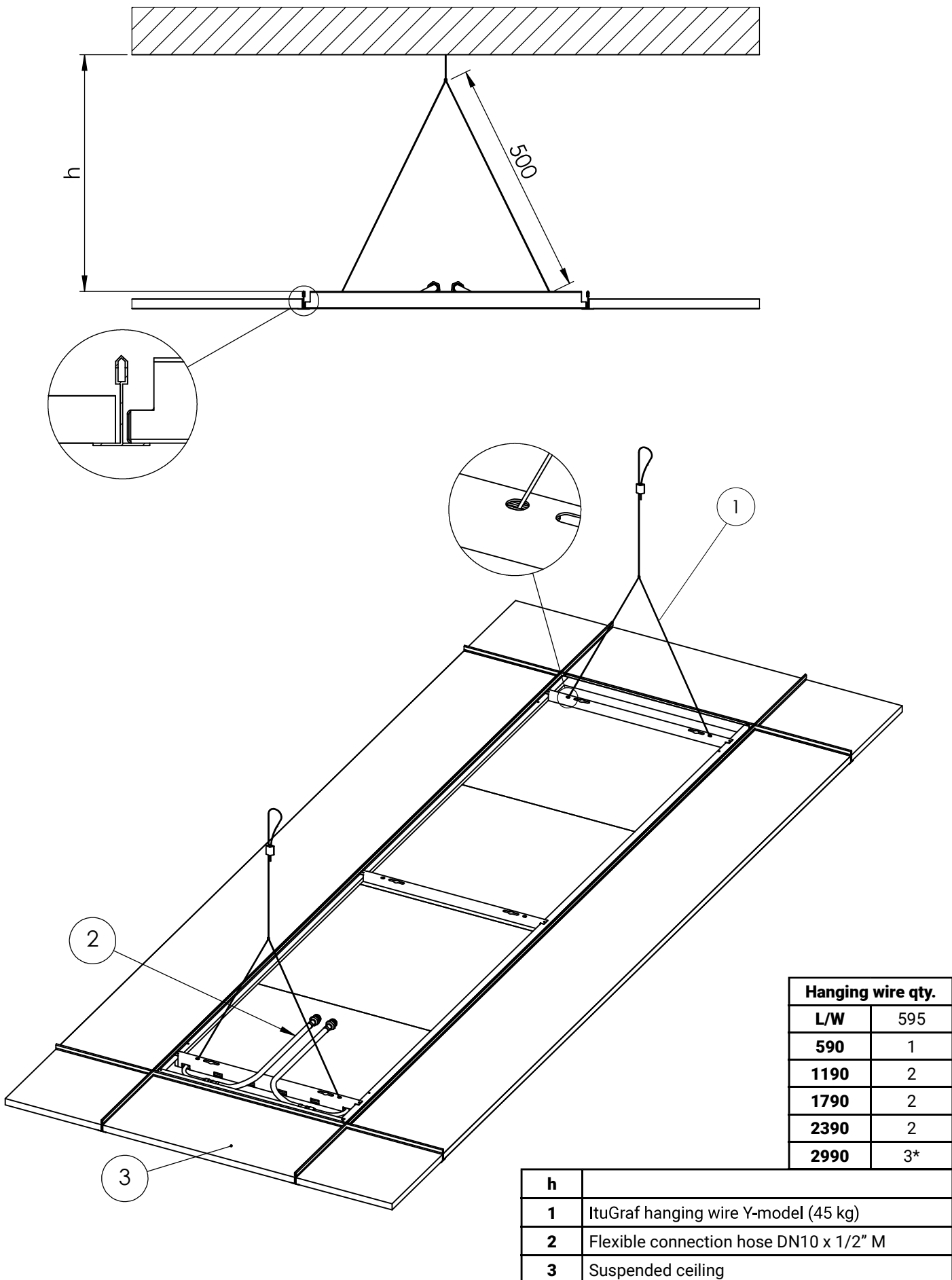
*Quantity of wire depends on the accepted vertical deflection/sagging on site.



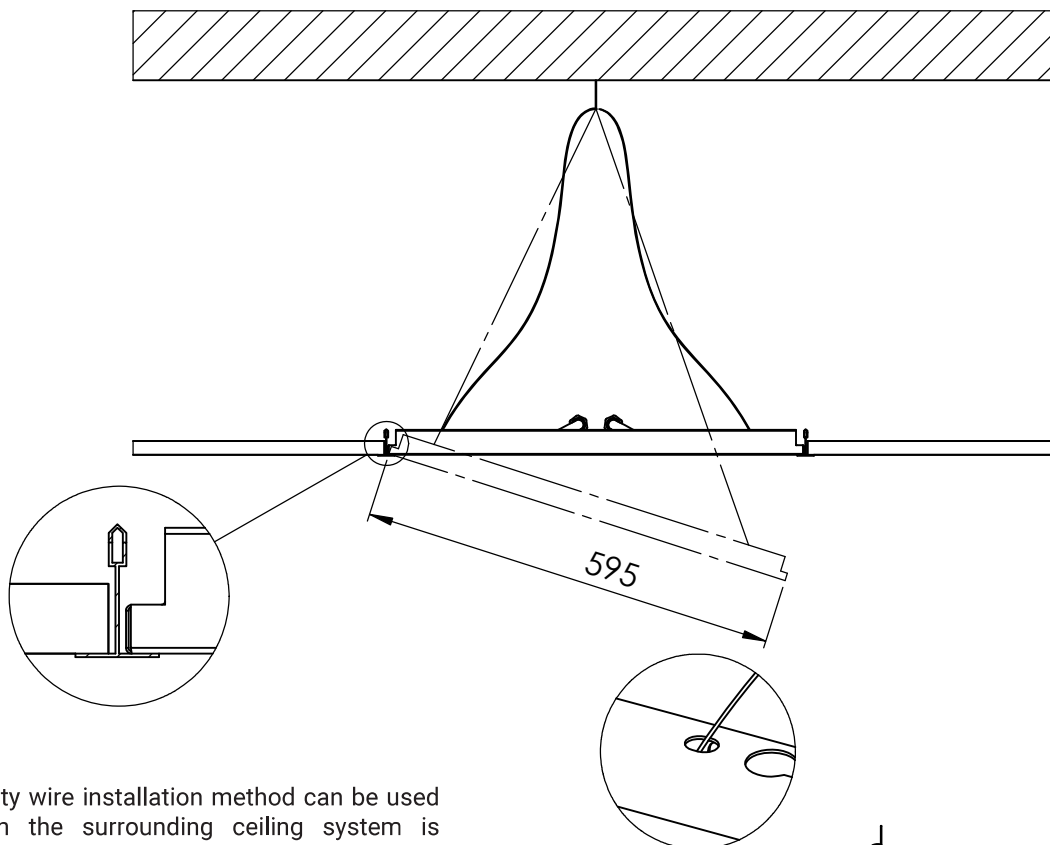
Hanging wire qty.	
L/W	595
590	4
1190	4
1790	4
2390	4
2990	6*

h	
1	ItuGraf hanging wire (15 kg)
2	Flexible connection hose DN10 x 1/2" M
3	Suspended ceiling

*Add 2 hangers on the middle bar when the length is 2990 mm



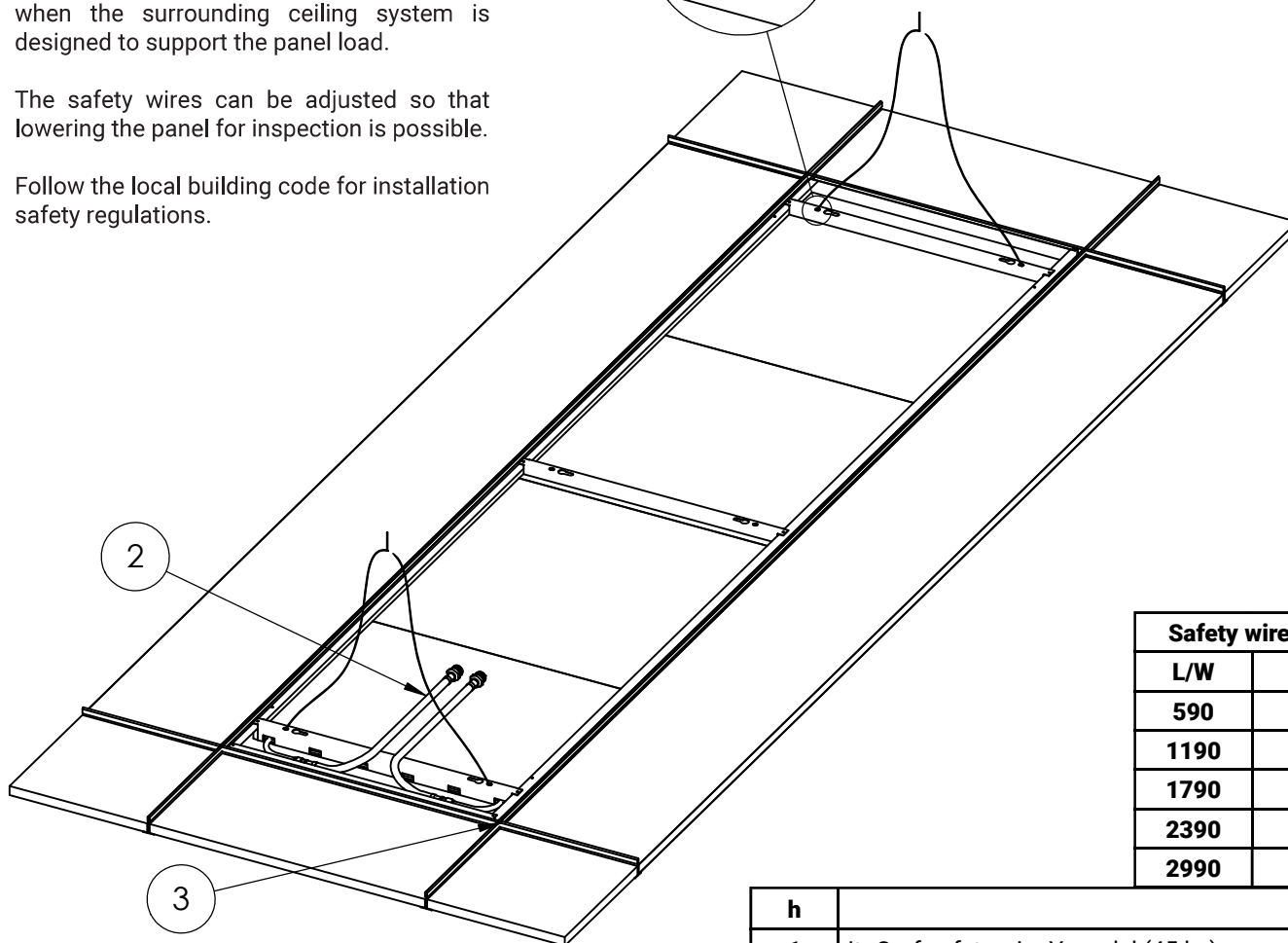
*Add one Y hanger on the middle bar when the length is 2990 mm



Safety wire installation method can be used when the surrounding ceiling system is designed to support the panel load.

The safety wires can be adjusted so that lowering the panel for inspection is possible.

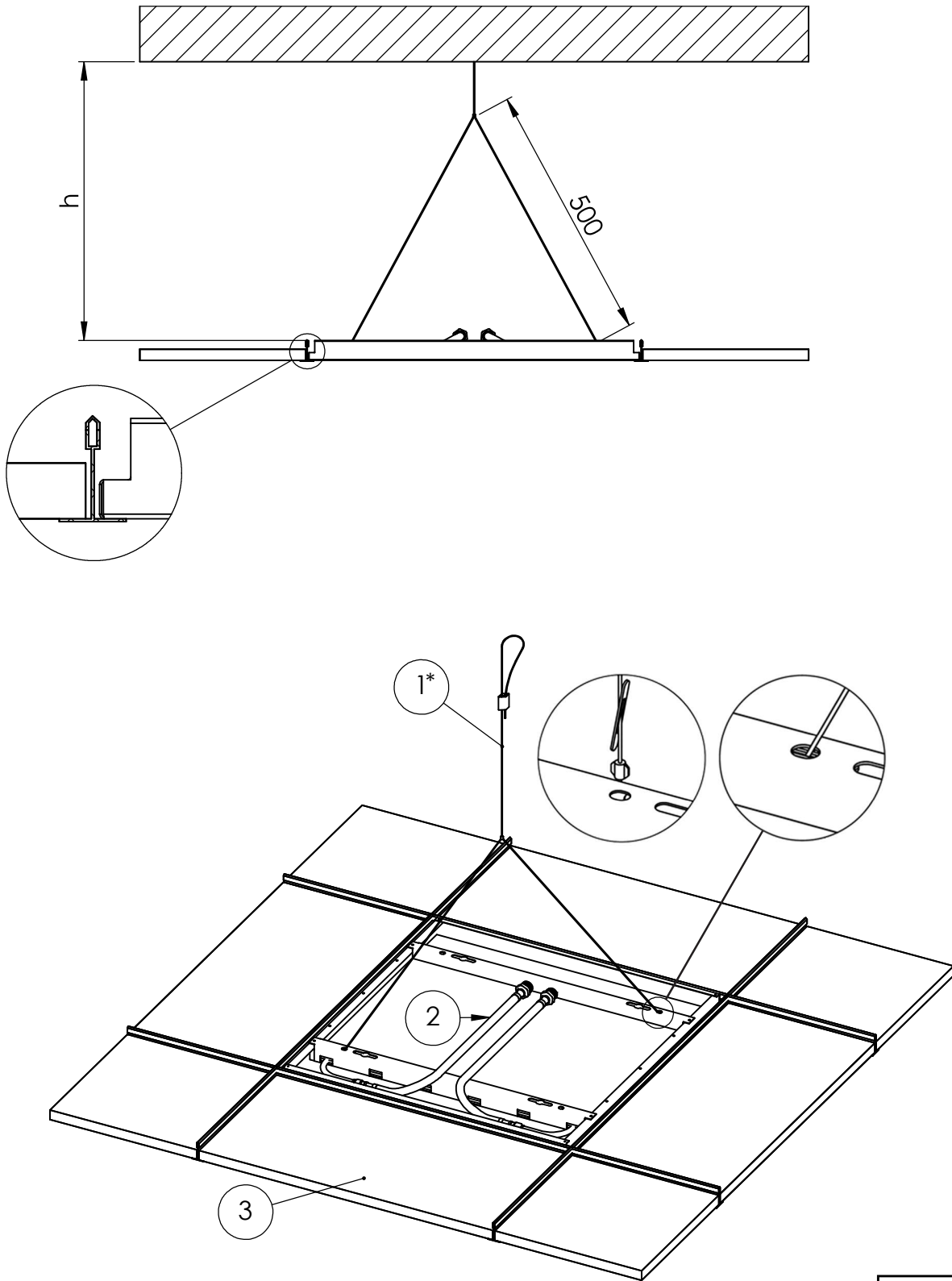
Follow the local building code for installation safety regulations.



Safety wire qty.	
L/W	595
590	1
1190	2
1790	2
2390	2
2990	3*

h	
1	ItuGraf safety wire Y-model (45 kg)
2	Flexible connection hose DN10 x 1/2" M
3	Suspended ceiling

*Add one Y hanger on the middle bar when the length is 2990 mm



Hanging wire qty.	
L/W	595
590	1

h	500 mm
1	ItuGraf hanging wire Y-model (45 kg)
2	Flexible connection hose DN10 x 1/2" M
3	Suspended ceiling

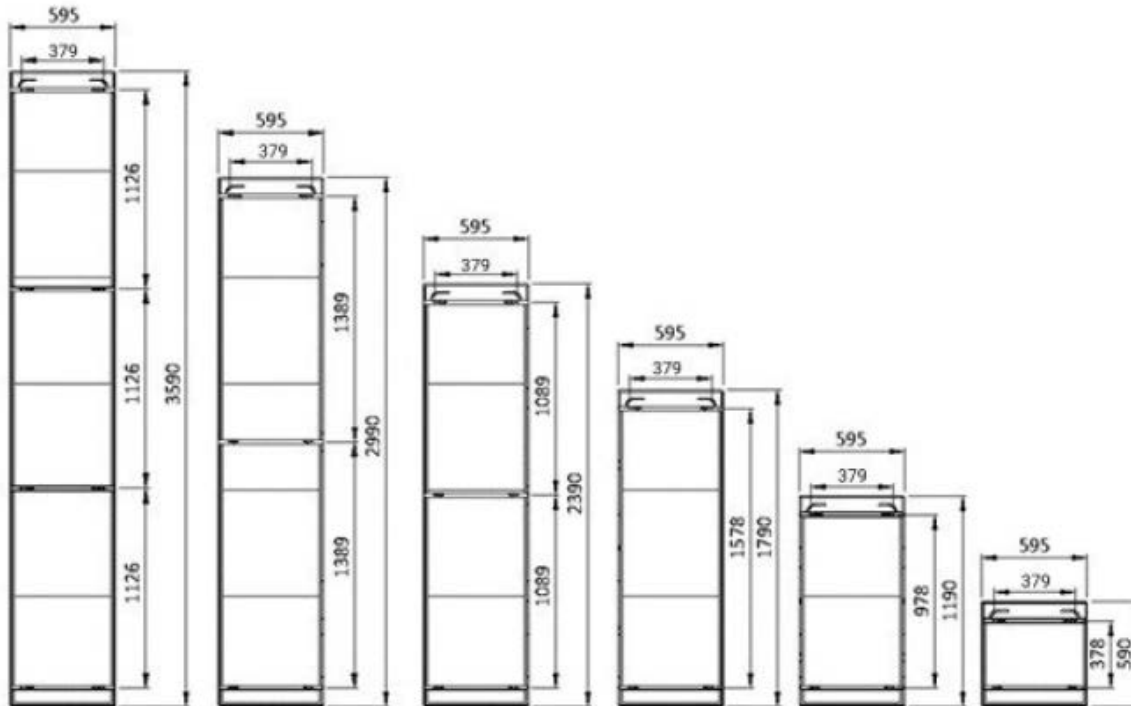
*Only for 600x600 modules.

Fixing Options with Threaded Rods

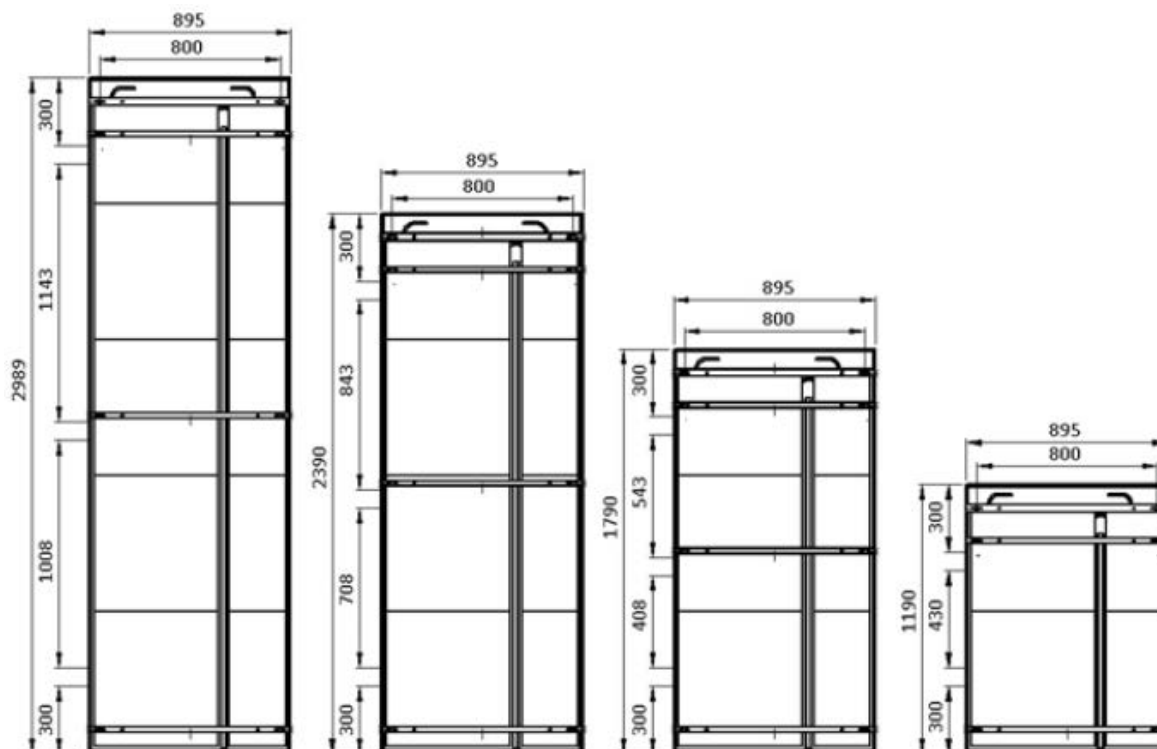
Fixing points of ItuGraf panels

The following figures and tables show the number and positioning of the fixing points for panels with widths of 595 mm, 895 mm and 1190 mm. Threaded rods can be used to fix the panels into the ceiling through holes located in the fixing cross bar.

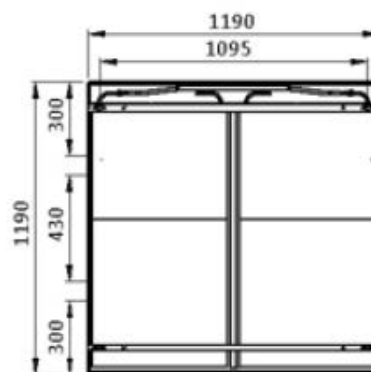
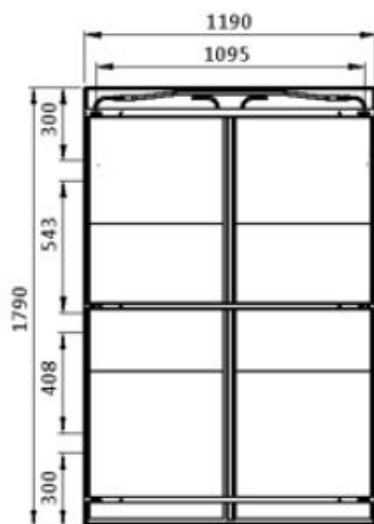
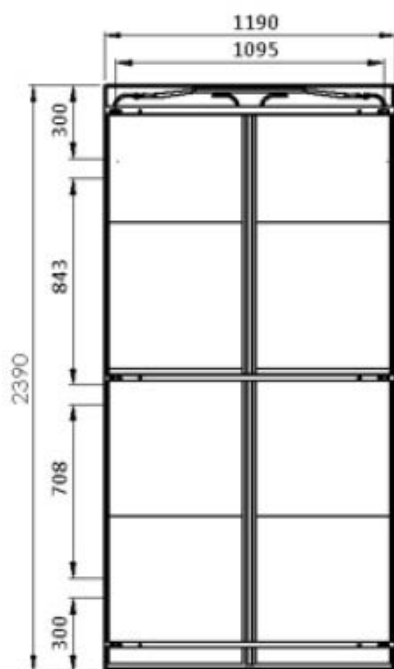
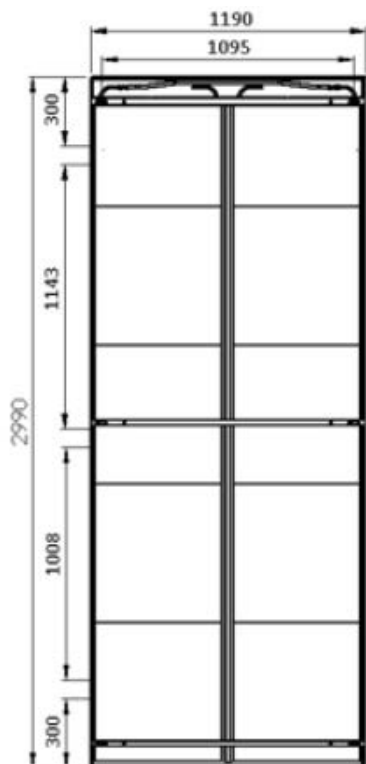
Panel width: 595mm



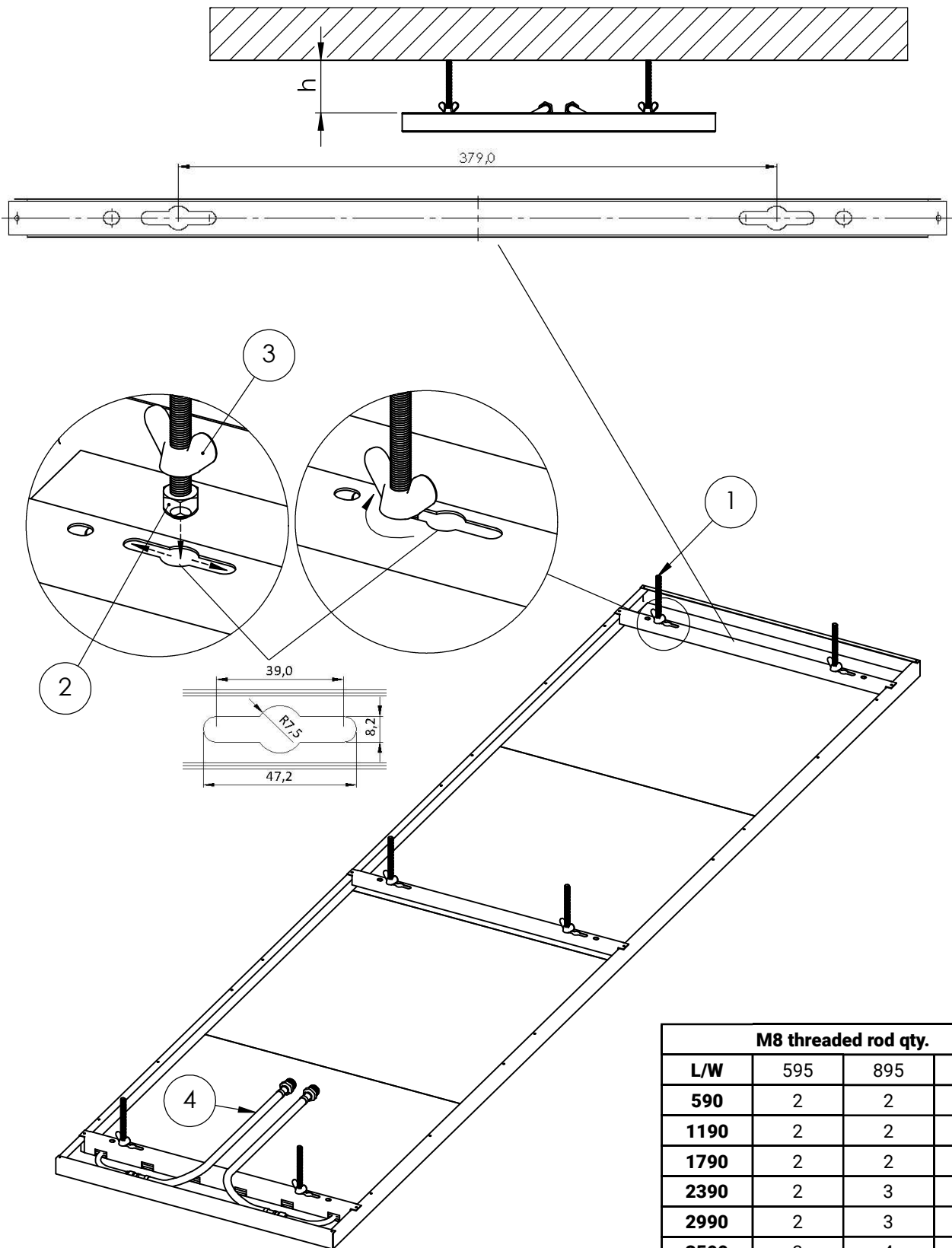
Panel width: 895mm



Panel width: 1190mm



Minimum installation height 100-150 mm (the tightening of wing nuts is still possible).

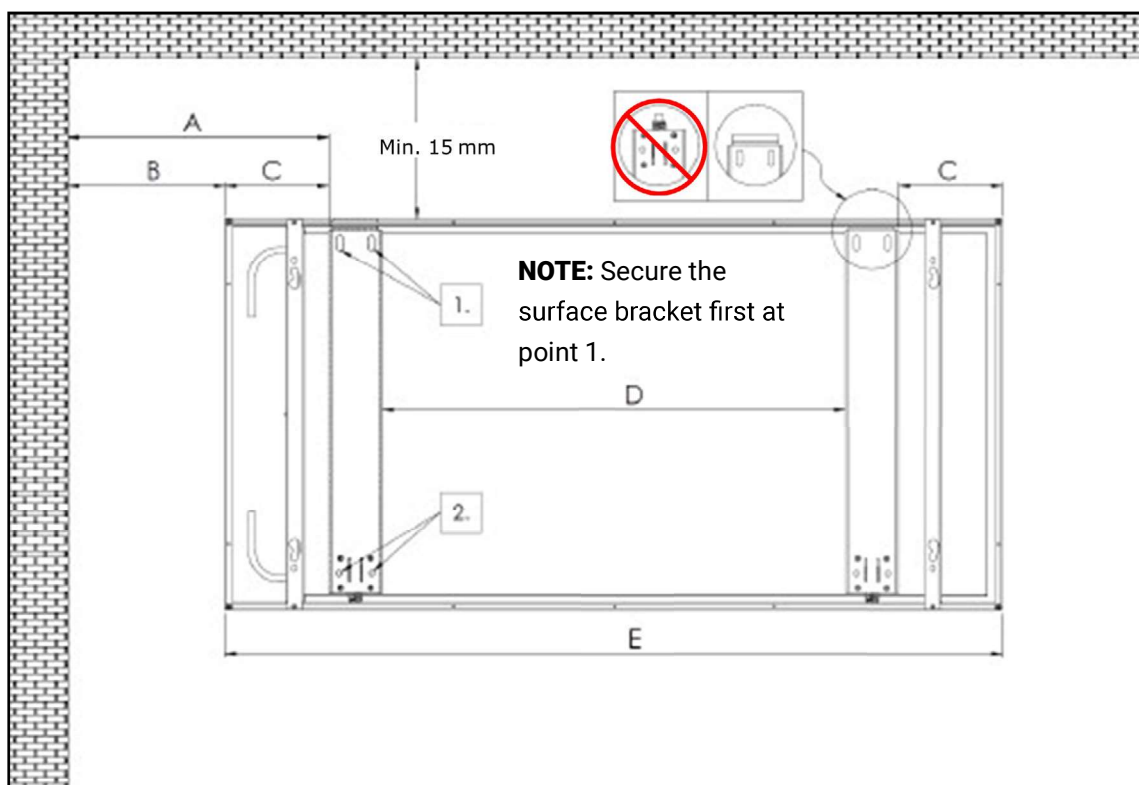


NOTE: Threaded rod cannot be used to install the panels in suspended ceiling.

NOTE: Number of used fixing points depends on the accepted vertical deflection/sagging on site.

h	
1	M8 threaded rod (not in our delivery)
2	M8 lock nut (not in our delivery)
3	M8 wing nut (not in our delivery)
4	Flexible connection hose DN10 x 1/2" M

Patented Surface Bracket Hanging Details



Dimensional drawing of ItuGraf surface bracket installation

SYMBOL	MEANING	VALUE (mm)
A	Distance between bracket and wall	B+C
B	Distance between panel end and wall	

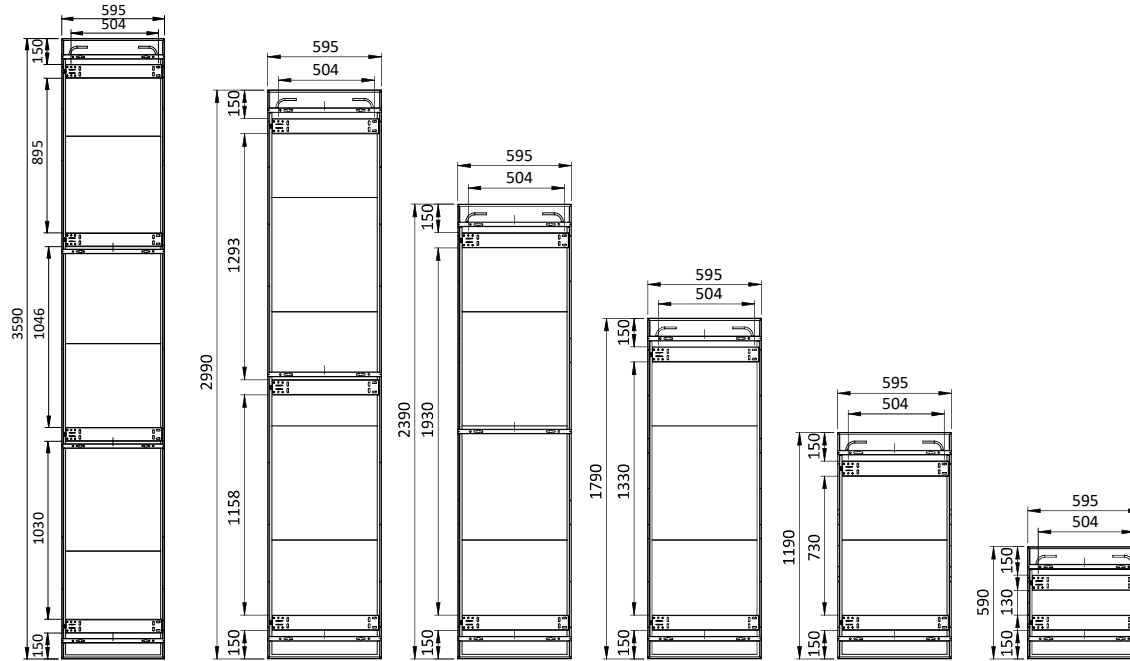
Length (mm)	Number of surface brackets Width 595 mm	Distance from the end of panel (mm) C = width 595mm	Number of surface brackets Width 895 mm	Distance from the end of panel (mm) C = width 895mm	Number of surface brackets Width 1190 mm	Distance from the end of panel (mm) C = width 1190mm
590	2	150	-	-	-	-
1190	2	150	2	300	2	300
1790	2	150	3	300	3	300
2390	2	150	3	300	3	300
2990	3	150	3	300	3	300
3590	4	150	-	-	-	-

Fixing Options with Patented Surface Bracket

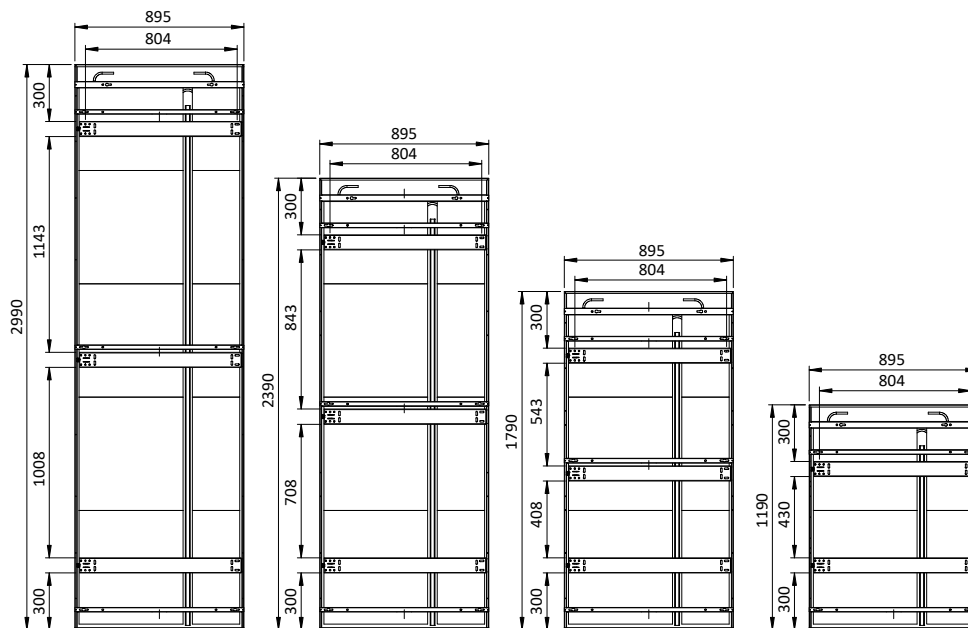
Mounting locations for ItuGraf panels with patented surface brackets

The following figures and tables show the number and mounting locations for panels with widths of 595 mm, 895 mm and 1190 mm.

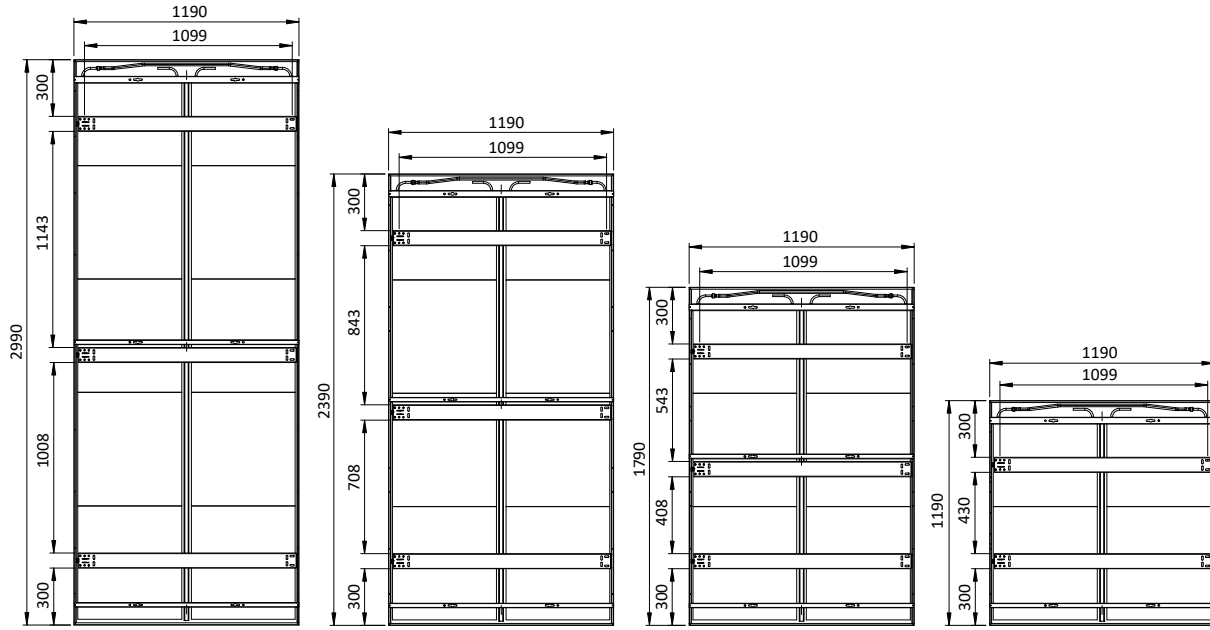
Panel width: 595mm



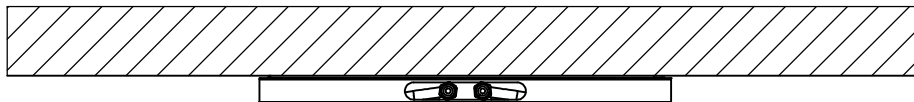
Panel width: 895mm



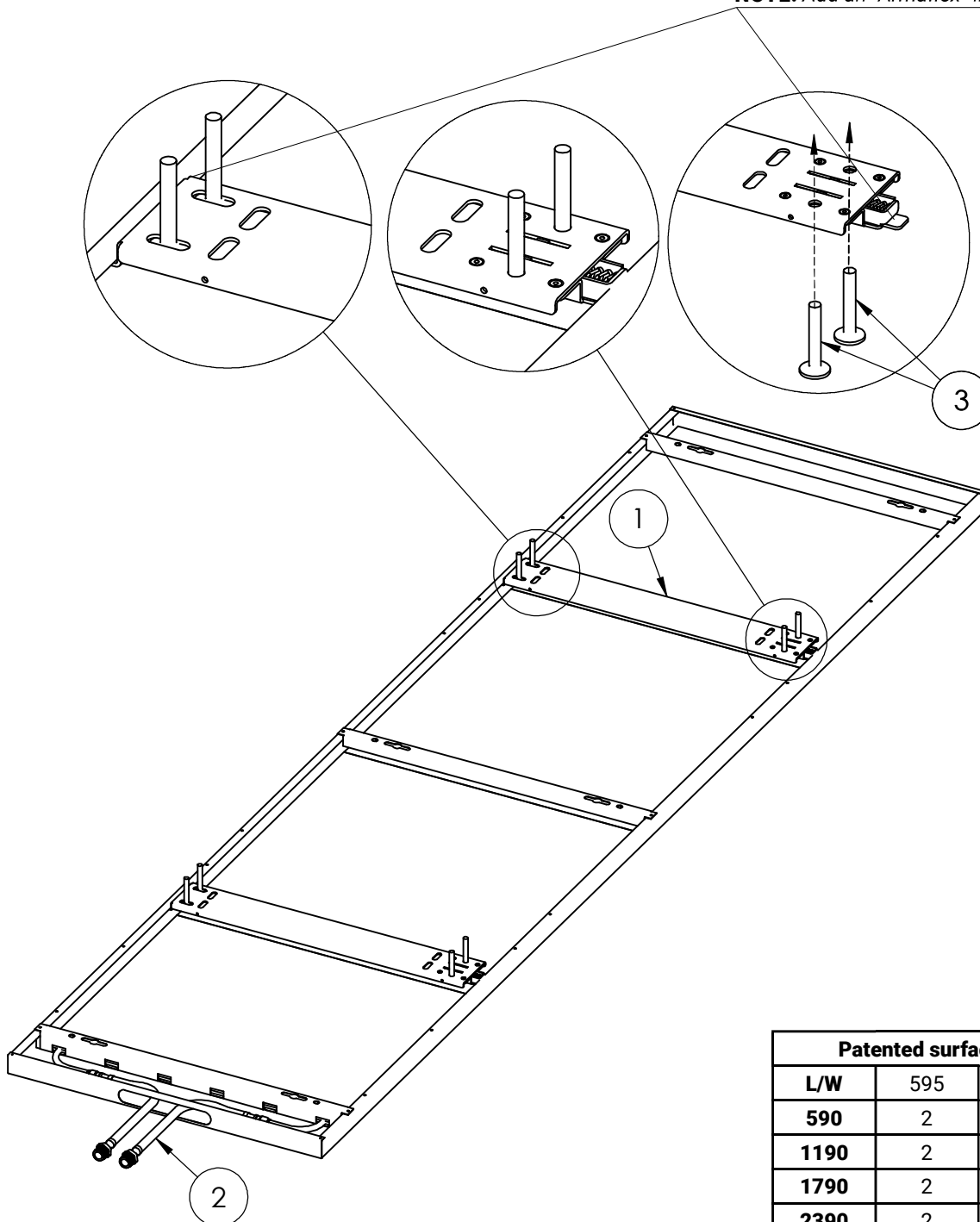
Panel width: 1190mm



NOTE: 35 mm height panels can be used when flexible hoses are fed through oblong holes in panel ends.



NOTE: Add an "Armaflex" insulation piece

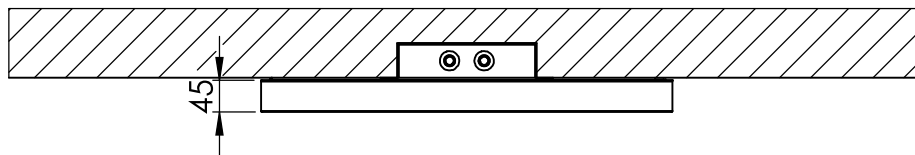


Patented surface bracket qty.			
L/W	595	895	1190
590	2	-	-
1190	2	2	2
1790	2	3	3
2390	2	3	3
2990	3	3	3
3590	4	-	-

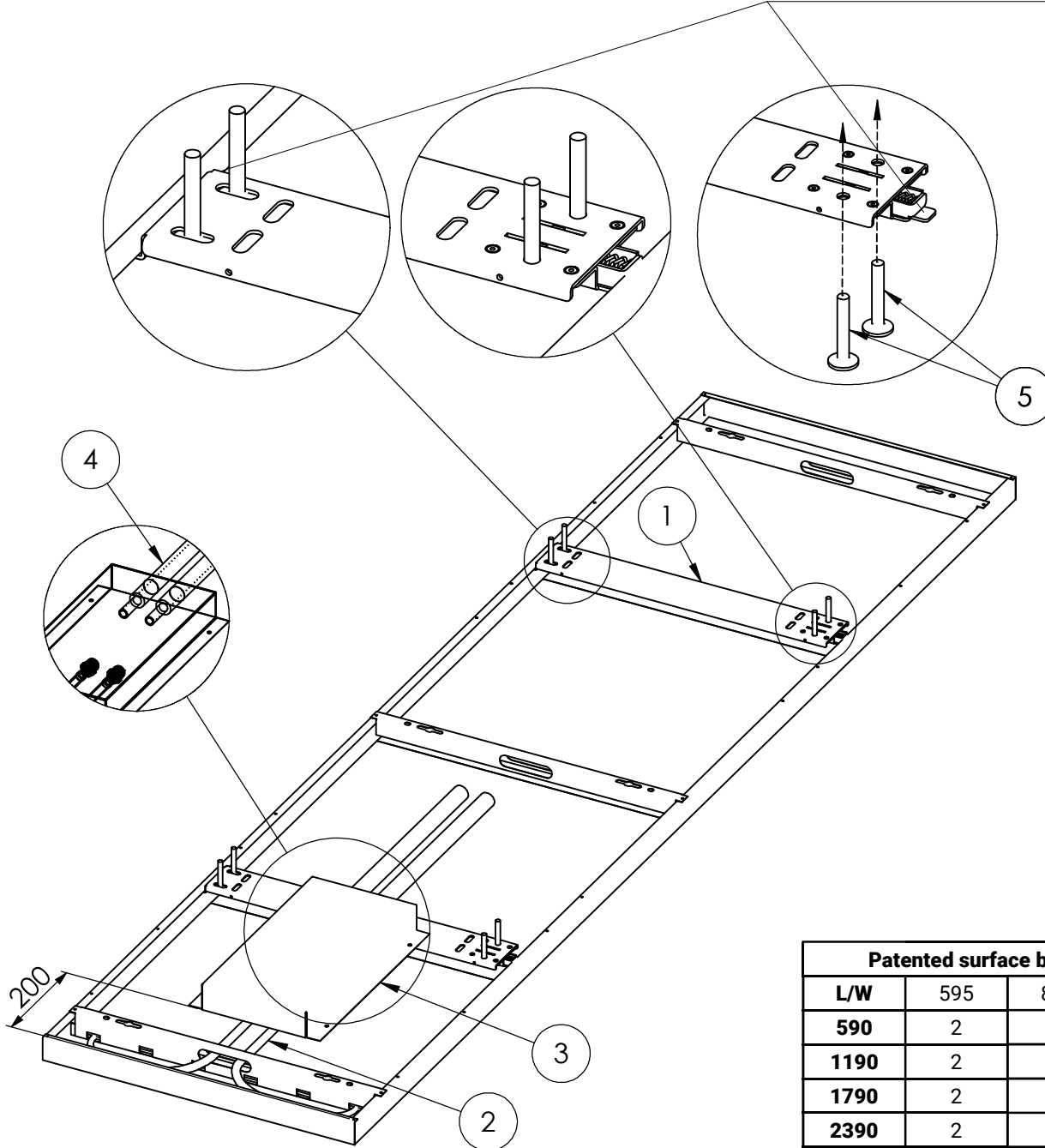
1	Patented surface bracket
2	*Flexible connection hose DN10 x 1/2" M
3	Screws and washers (not in our delivery)

*Flexible hoses need to be insulated to avoid noise due to expansion and/or pressure shocks.

NOTE: Panel height 45 mm must be used.



NOTE: Add an "Armaflex" insulation piece



Patented surface bracket qty.			
L/W	595	895	1190
590	2	-	-
1190	2	2	2
1790	2	3	3
2390	2	3	3
2990	3	3	3
3590	4	-	-

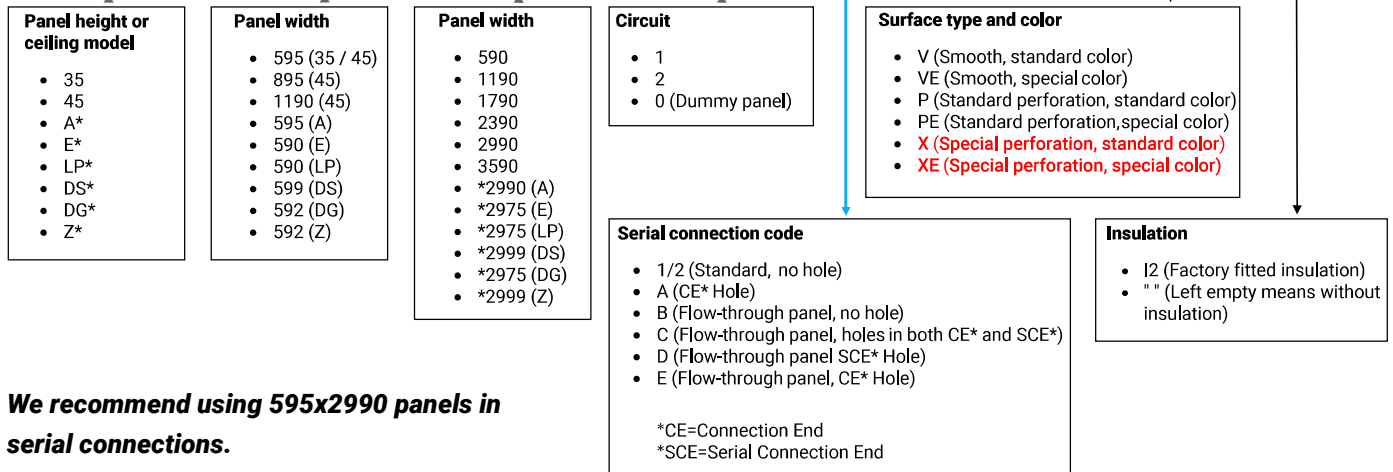
1	Patented surface bracket
2	*Flexible connection hose DN10 x 1/2" M
3	ItuGraf concrete casting box
4	Main pipes in concrete (not in our delivery)
5	Screws and washers (not in our delivery)

*Flexible hoses need to be insulated to avoid noise due to expansion and/or pressure shocks.

Legend for the Panel Product Codes

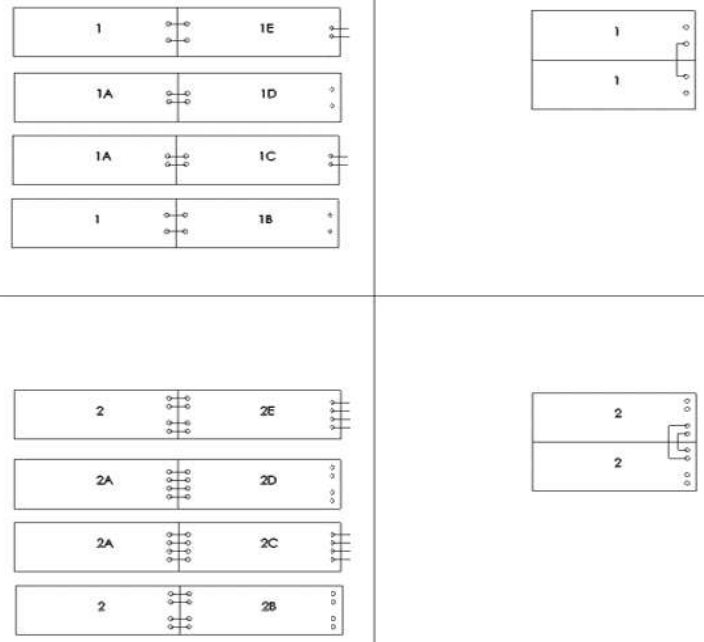
ItuGraf product codes are formed as shown below.

IG35-595-2990-1B-V-I2

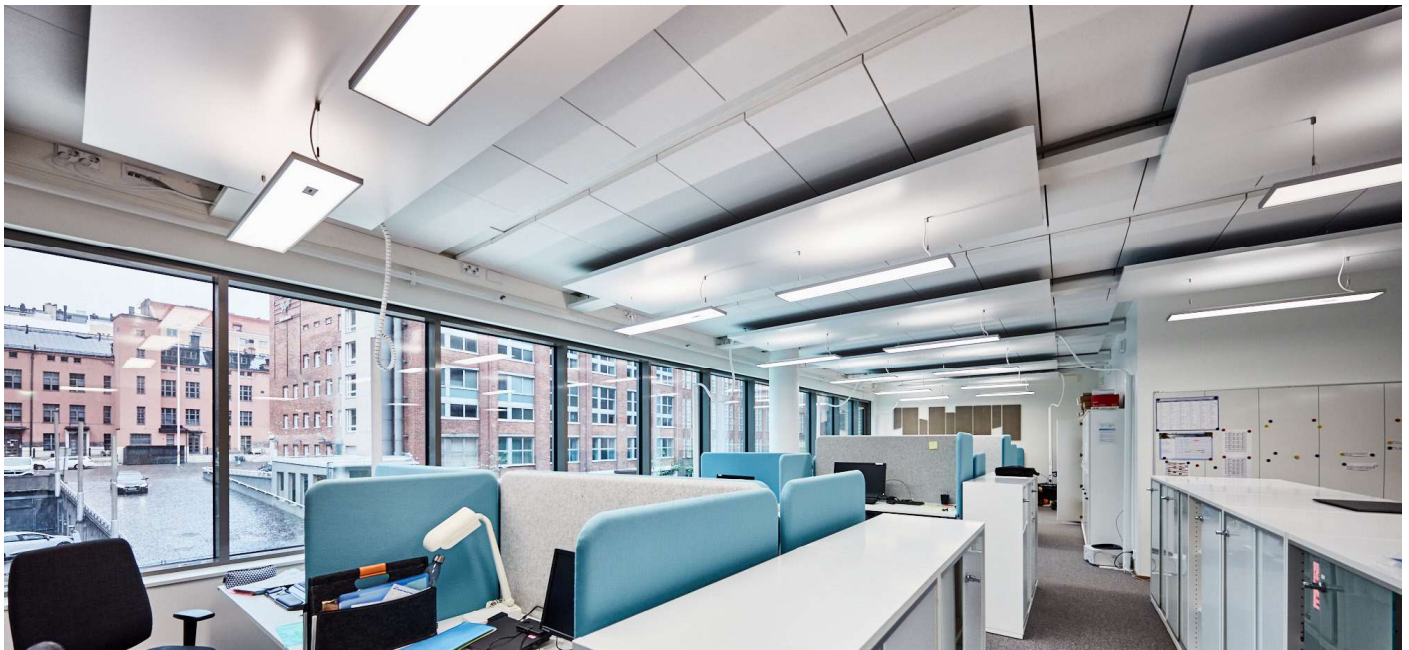


We recommend using 595x2990 panels in serial connections.

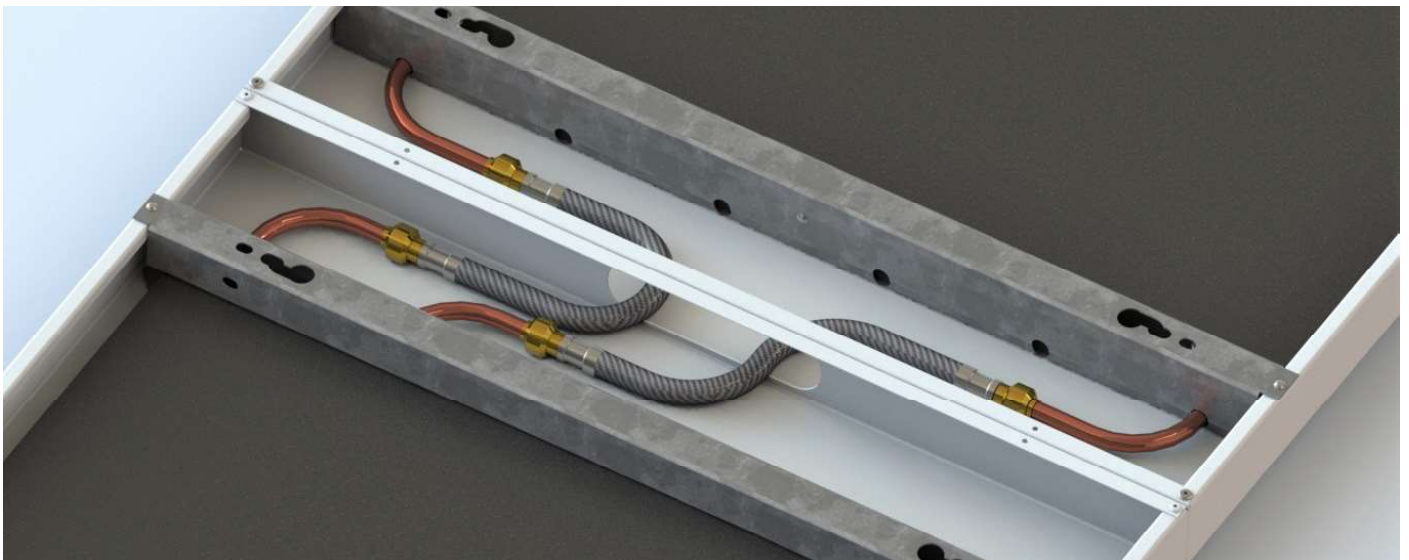
Serial Connection Code	Description: CE=Connection End SCE=Serial Connection End
1	1-Circuit, Standard No Hole
1A	1-Circuit CE Hole
1B	1-Circuit, Flow-through technology No Hole
1C	1-Circuit, Flow-through technology Holes in both CE and SCE
1D	1-Circuit, Flow-through technology SCE Hole
1E	1-Circuit, Flow-through technology CE Hole
2	2-Circuit, Standard No Hole
2A	2-Circuit CE Hole
2B	2-Circuit, Flow-through technology No Hole
2C	2-Circuit, Flow-through technology Holes in both CE and SCE
2D	2-Circuit, Flow-through technology SCE Hole
2E	2-Circuit, Flow-through technology CE Hole



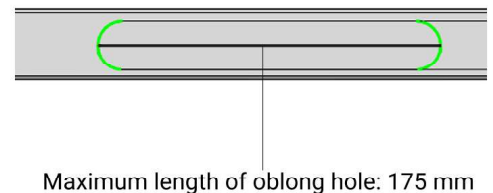
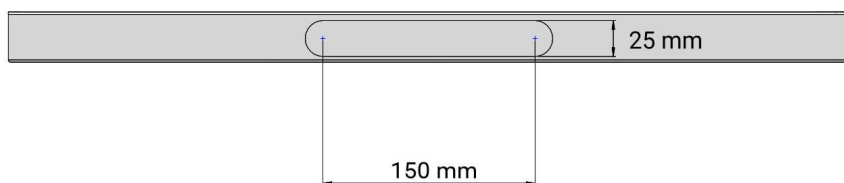
Serial & Parallel Panel Connections



ItuGraf panels can be connected in serie in according to room specifics. The used product type is influenced by the selected installation method. The standard panels can be used when they are hung with cable wires. When the patented surface bracket installation is used the panels should have holes in the ends for water connections. If the water supply is brought to the panel through the ceiling the panel height of 45 mm should be used so that the hoses fit through the crossbars see [page 43](#).

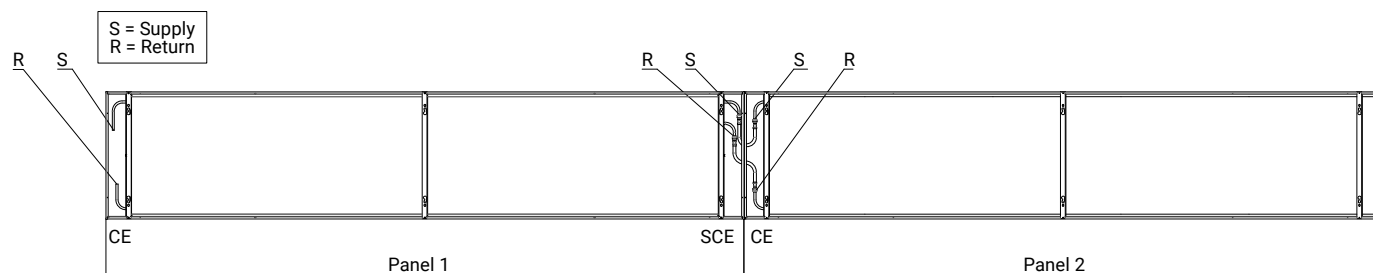


Section view of the connection end hole is seen below. The flexible hoses are installed through the holes connecting the panel pipes together.



Examples of ItuGraf Serial Panel Connections

1-Circuit - serial connection with two panels in line



Connection method		
Code	Connection end	Serial connection end (SCE)
1B	No hole	No hole
1D	No hole	Hole
1E	Hole	No hole
1C	Hole	Hole

Connection method	
Code	Connection end (CE)
1 (Standard)	No hole
1A	Hole

When the flexible connection hoses can be drawn over the panel edge

Connect the panel 1B or 1E (SCE no hole) to the panel 1 (Standard / no hole).

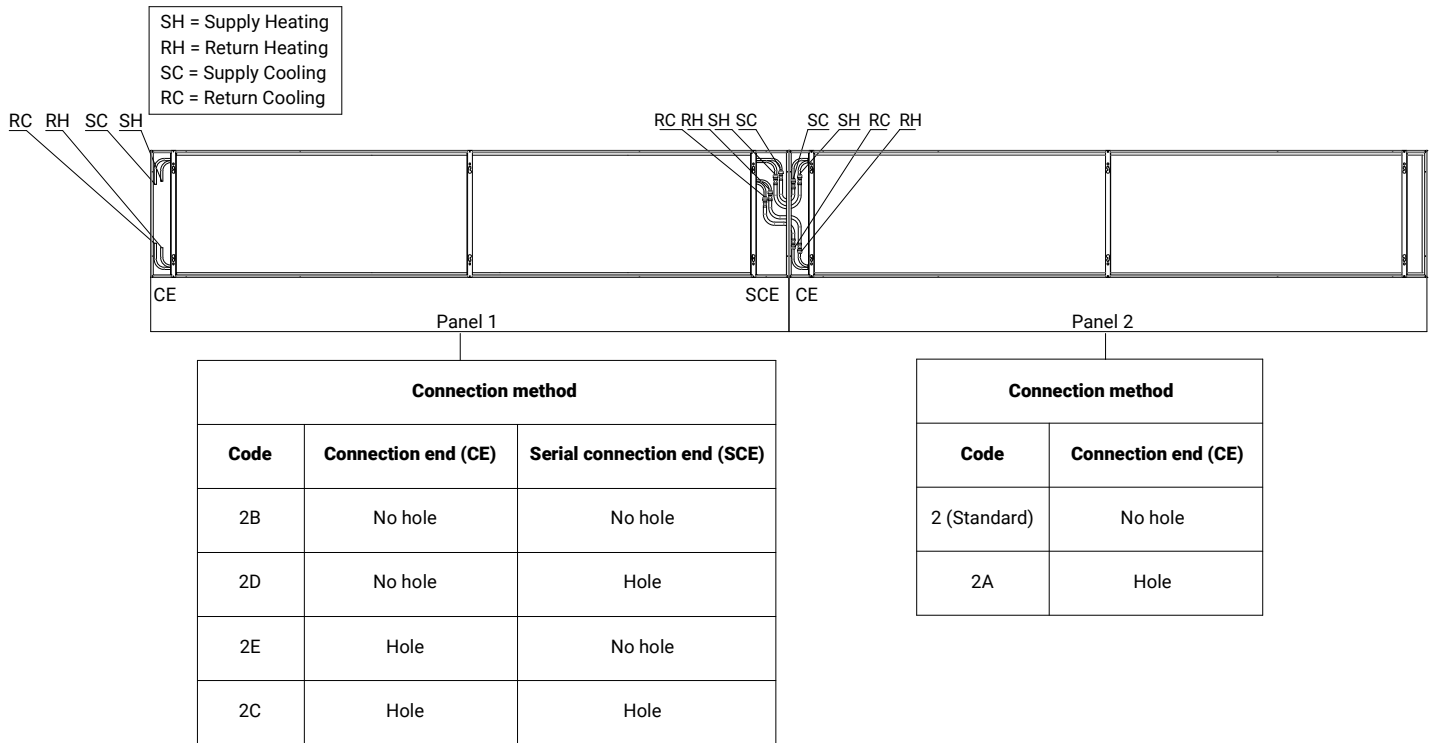
For example PANEL 1: IG35-595-2990-1B-V connected to the PANEL 2: IG35-595-2990-1-V

When the flexible connection hoses need to be drawn through the panel

Connect the panel 1D or 1C (SCE hole) to the panel 1A (CE hole).

For example PANEL 1: IG35-595-2990-1C-V connected to the PANEL 2: IG35-595-2990-1A-V

2 Circuits - serial connection with two panels in line



When the flexible connection hoses can be drawn over the panel edge

Connect the panel 2B or 2E (SCE no hole) to the panel 2 (Standard / no hole).

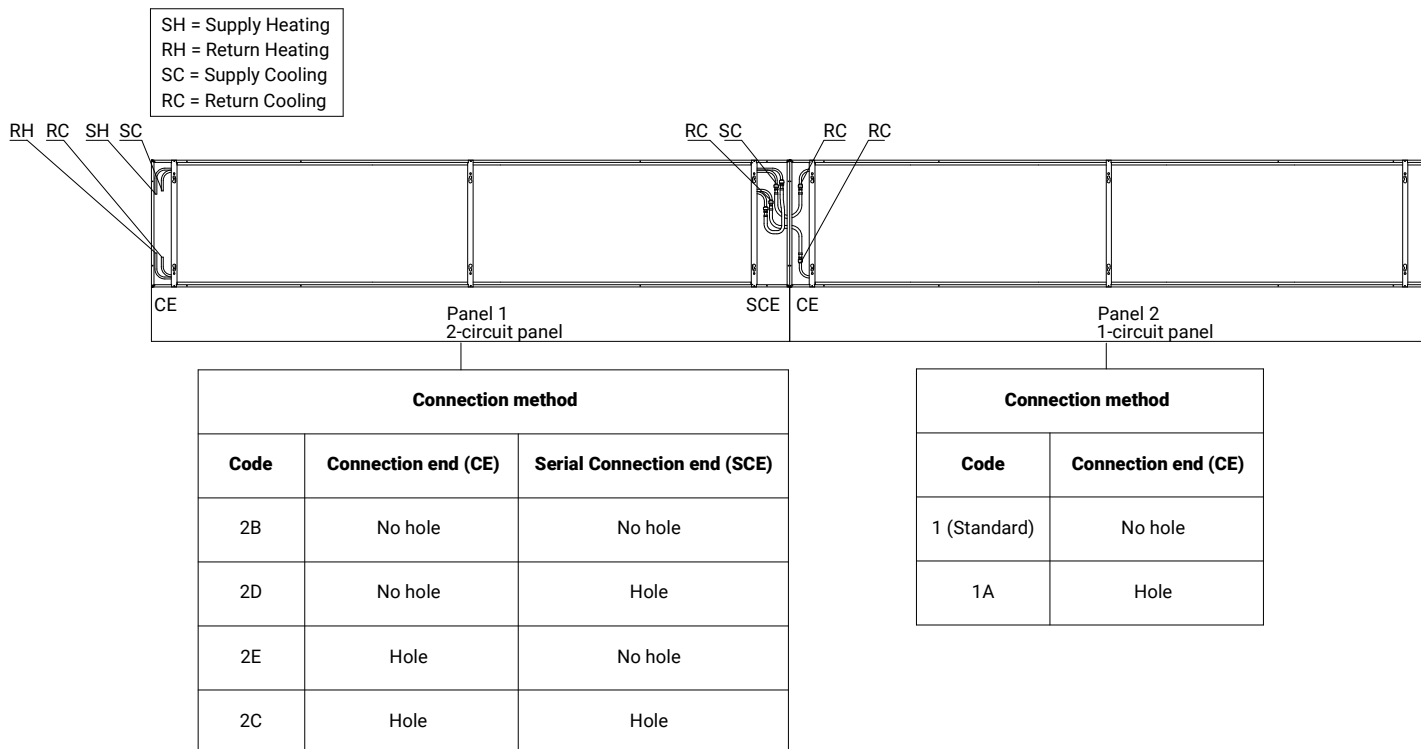
For example PANEL 1: IG35-595-2990-2B-V connected to the PANEL 2: IG35-595-2990-2-V

When the flexible connection hoses need to be drawn through the panel

Connect the panel 2D or 2C (SCE hole) to the panel 2A (CE hole).

For example PANEL1: IG35-595-2990-2C-V connected to the PANEL 2: IG35-595-2990-2A-V

1 & 2 Circuits combined - serial connection with two panels in line



First panel (on the left) with flow through technology for heating and for cooling with two meander pipes. Second panel (on the right) for extended cooling capacity with single meander pipe. First panel heating circuit will be short-cut closed at SCE (Serial Connection End) with a flexible hose.

When the flexible connection hoses can be drawn over the panel edge

Connect the panel 2B or 2E (SCE no hole) to the panel 1 (Standard / no hole).

For example PANEL 1: IG35-595-2990-2B-V connected to the PANEL 2: IG35-595-2990-1-V

When the flexible connection hoses need to be drawn through the panel

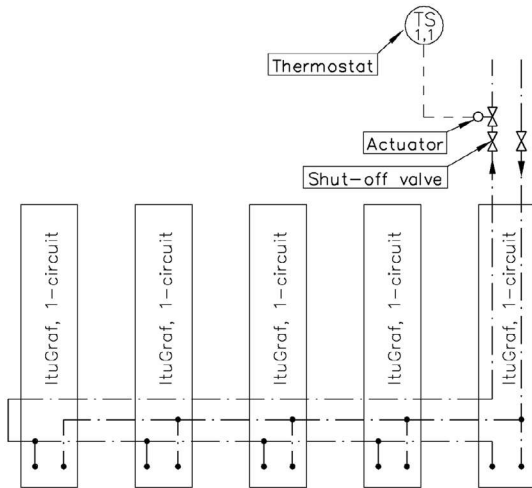
Connect the panel 2D or 2C (SCE hole) to the panel 1A (CE hole).

For example PANEL 1: IG35-595-2990-2C-V connected to the PANEL 2: IG35-595-2990-1A-V

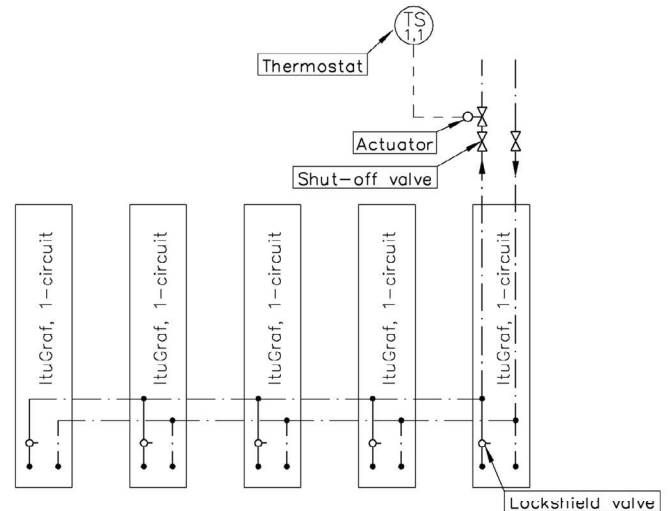
Examples of Controls for Various Panel Connections

Below are presented the most typical connections for ItuGraf panels.

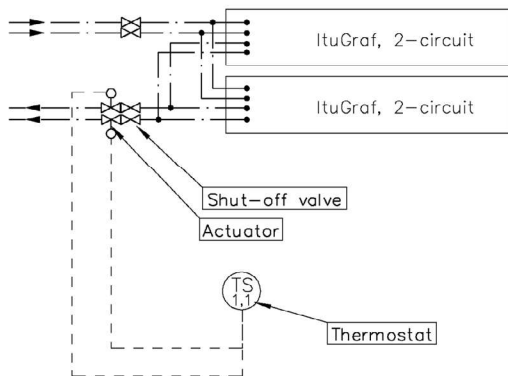
1-circuit panels
Parallel connection with reverse return
(Every panel are in balance)



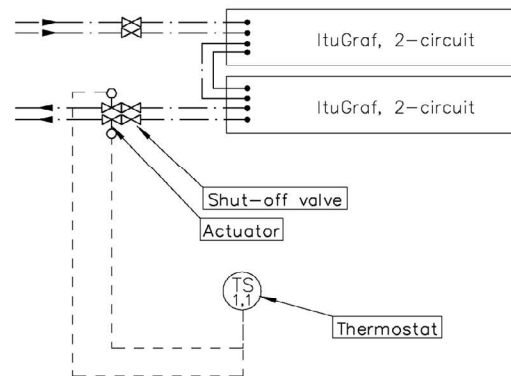
1-circuit panels
Parallel connection without reverse return
(Lockshield valves for balancing)



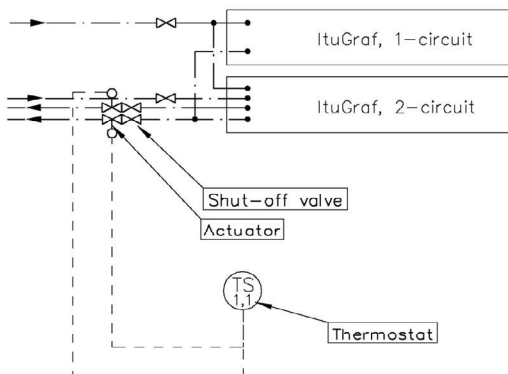
2-circuit panels
Parallel connection



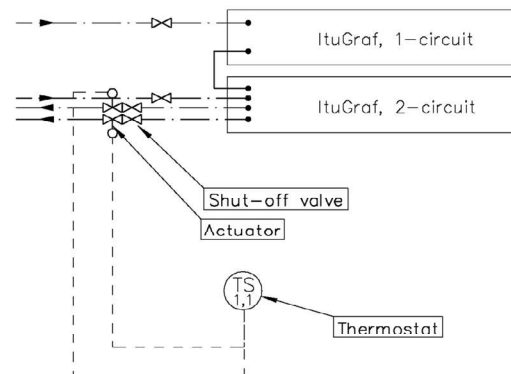
2-circuit panels
Serial connection



Optimized
1-circuit panel for heating
2-circuit panel for heating and cooling
Heating is with parallel connection



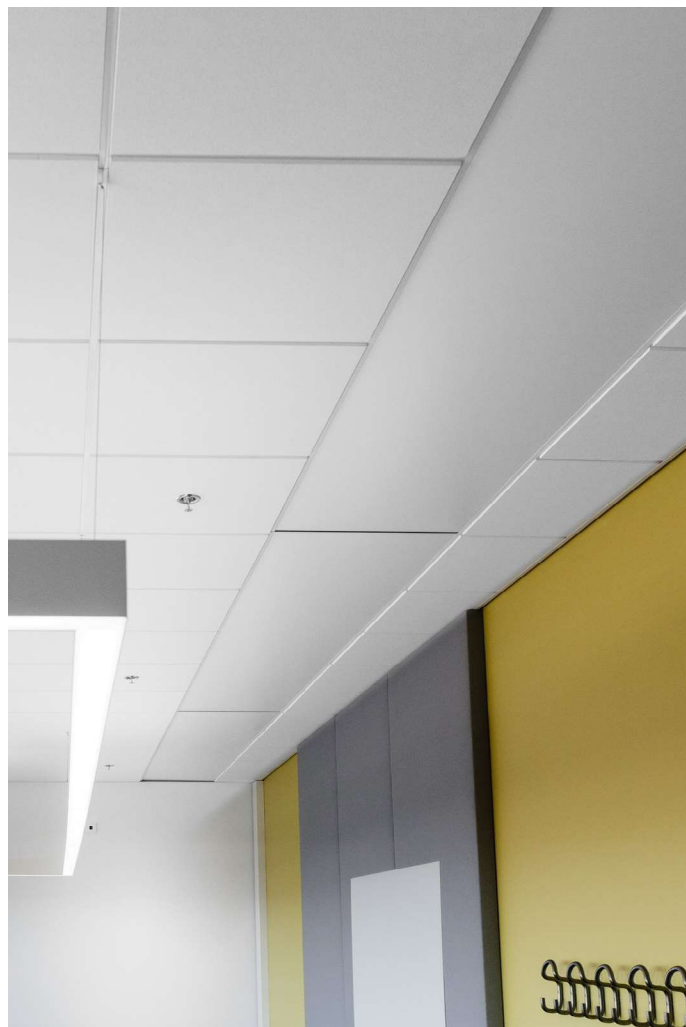
Optimized
1-circuit panel for heating
2-circuit panel for heating and cooling
Heating is with serial connection



ItuGraf Features and Benefits



- ◆ The most efficient radiant ceiling system on the market for heating and cooling. ItuGraf has the highest outputs and shortest system reaction times due to pipe fully embedded in graphite layer.
- ◆ Suitable to use with all energy sources in renovations and new buildings - ideally working in combination with heat pump systems! But can also be used for high temperature applications (*Smooth surface*)
- ◆ Maintain a pleasant, steady temperature across the whole space without generating draft, dust or noise and meets strict hygiene requirements - Best solution for hospitals and healthcare (*Smooth surface*)
- ◆ Panel does not draw attention on the building and interior design
- ◆ Maintenance-free and long service life
- ◆ Made of 100% recyclable materials
- ◆ Designed and Made in Finland by the highest quality standards



Tender Specification

ItuGraf® is a multifunctional panel system: heating, cooling and sound absorption in one system!

ItuGraf® -graphite panel has a 10 mm copper pipe meander embedded in a thermally conductive graphite layer. Panel's casing is formed from galvanized sheet steel 0.7 mm and is available with a smooth or a perforated surface. When the panel is perforated a nonwoven acoustic fabric is placed between the steel plate and the activation layer in order to get additional sound absorption effect. The air flow through has been structurally prevented in accordance with the EN 14037-1 standard. Panel can be painted in RAL colours (the standard colour is RAL 9016). Panels can also be fitted with insulation on the top surface in order to concentrate on the downward effect. ItuGraf standard insulation is made of glass wool with aluminium foil backing. Insulation material with thickness 20 mm is classified according to EN 14303, which thermal conductivity is λ (40°C) 0.040 W/(m•K) according to the standard EN 12667. Reaction to fire classification is A2 according to standard EN 13501-1.

The ItuGraf standard sail module in free hanging installation is the most efficient in spot heating and cooling cases. The standard panel with one copper meander can be used in combination with a change-over system using e.g. a 6-port valve to allow for heating or cooling. But Itula provides also panels in 2-circuit version, making it possible to connect the same panel to a four pipe net having so two totally independent cooling and heating networks working in parallel, without any risk of fluid mixing in the panel. The patented one layer graphite activation system makes sure that both circuits give the maximum possible output. The thermal transfer rate of ItuGraf panels is optimized to provide the maximum heating and/or cooling per unit:

ItuGraf® -graphite panel's cooling capacity (insulated) is 125 W/m² (160 W/m² non-insulated) per active area (at $\Delta T = 10$ K), which is in accordance with the EN 14240 standard. Cooling capacity is achieved with a turbulent flow in the panel's pipe meander, which leads in general to a temperature difference of 2-3 K on the water side.

ItuGraf® -graphite panel's heating output (insulated) is 182 W/m (305 W/m non-insulated) per active length of the panel (at $\Delta T = 30$ K), which is in accordance with the EN14037 standard. Heating output is achieved with a turbulent flow in the panel's pipe meander, which leads in general to a temperature difference of 5-10 K on the water side. The surface temperature of the perforated panel should not exceed 55°C.

The standard widths of the ItuGraf® panels are 595 mm, 895 mm and 1190 mm. The standard lengths are 590 mm, 1190 mm, 1790 mm, 2390 mm, 2990 mm and 3590 mm. Panels can also be made to measure upon request.

The panels can be hung from the ceiling by using adjustable cable wire mounting sets. The cassette can be adapted to the various existing suspended ceiling models such as Saint-Gobain Ecophon and Rockfon. The panels can also be easily installed directly on the ceiling using our patented surface bracket. The ItuGraf panels are CE marked and a Declaration of Performance is available upon request.

ItuGraf® panels can be connected in series of 2 to 5 pieces in serial or in parallel depending on the pressure losses of the selected product types and their combinations. The flows of individual or parallel-mounted panels can be standardized with adjustable inserts and flow control valves. The room temperature can be controlled by a thermostat located in the premises that changes the temperature or flow rate of the supply water using an actuator. Connections between panels can be realized using oxygen diffusion resistant flexible hoses with DN10 push-fit connectors on both ends. The connection to the main pipe can be realized using the same flexible hose type or another with ½" external thread on one end.