

U-Shaped Sheet Piles

At a glance

Severstal is a reliable supplier of materials and steel-based ready-made solutions for infrastructure projects.

Being a reliable partner, we guarantee to our clients:

Comprehensive approach

With our company's capabilities and a proven network of partners, we offer a comprehensive cooperation model comprising design of facilities, manufacturing and supply of steel products, as well as other steel-based products and solutions.

A wide range of materials and ready-made solutions are available to our customers to meet their key demands when implementing large infrastructure projects.

Innovativeness

State-of-the-art R & D center and established cooperation with major industry research and design institutes allow us to develop new products and offer customized solutions for the most technically challenging projects. Innovative products offer additional opportunities to our customers in their efforts to reduce capital expenditures and operating costs while maintaining reliability of facilities.

Customer focus

Severstal is focused on in-depth study of customer needs. We engage the best expertise and unique competencies of our partners, offer effective solutions, provide technical support and improve additional services. One of them is advanced engineering which allows us to develop optimal solutions for our customers via designing new products or improving the existing ones.

Location of our assets



Sheet piles

Severstal offers sheet piles which applications include hydraulic engineering, transport and industrial construction, civil engineering when constructing both permanent and temporary barriers

- **Grani cold-formed sheet piles**

Designed for low and medium load applications, for construction in light and medium complexity soils.

- **Grani Pro multi-sided sheet piles**

Sheet piles with improved technical and economic performance. They show highest performance in complex geology projects, as well as in severe natural and climatic conditions, e.g. in the Arctic coastal conditions.

Advantages of Severstal sheet piles

- Stability of technical performance due to quality inspection at all stages of the production cycle
- Reduced metal intensity vs. alternative solutions
- Unprecedented technical support
- Unique quality certificate for each sheet pile batch
- Protective coatings can be applied



Sheet piles are produced from steel flat products of Cherepovets Steel Mill, which meet the requirements of all applicable regulatory documents. Our specialists are ready to provide technical support and consulting on sheet pile application.

The service includes:

- engineering support
- optimization of design solutions
- feasibility studies of Severstal sheet piling solutions
- design and re-design of facilities (in case of concluding a supply contract)

Cold-formed sheet piles

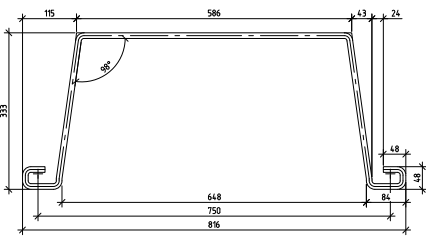
Applications

- **General civil construction**
Construction of trenches, excavation pits, repair of utilities lines
- **Road construction**
Fences of bridge supports, roads and highways
- **Shoreline protection**
Preventing slumping, soil retention

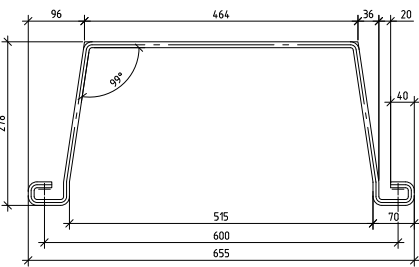
Advantages

- Low lead time, high delivery rate
- Constant profile thickness — metal intensity reduction
- Increased operating efficiency due to reduced driving and removal operations
- Reduced logistics costs

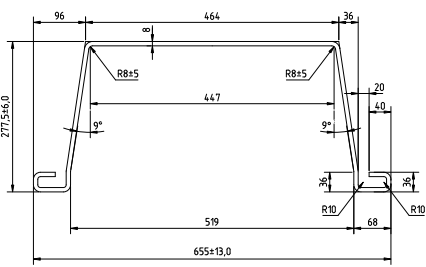
GRANI type I



GRANI type II



GRANI type III



Profile	Calculated width, mm	Height to axis O-O, mm	Thickness, mm	Cross-sectional area, cm²	Weight		Moment of resistance, cm³/m	Moment of inertia, cm⁴/m	Anticorrosive protection application area*	
					kg/1 run. m	kg/m²			One side, m²	Two sides, m²
Grani type 1	750	300	12	176	138	184	3530	105850	1.61	2.78
Grani type 2	600	250	10	119	94	156	2450	61280	1.21	2.25
Grani type 3	600	250	8	95	74	123,9	1978,6	49366,5	1,21	2,25

* area of anticorrosive protection application is given without taking into account the paint of the internal surface of the interlocks



Production

Grani sheet piles are produced at the roll forming mill of Severstal TPZ Sheksna Pipe & Section Mill. Sheet piles have a constant profile thickness and increased width compared to hot-rolled piles, which allows for up to 30% reduction of metal intensity for the design compared to hot-rolled piles, without compromising the quality and strength of the structure.

Cold-formed sheet piles are produced via continuous gradual forming of hot rolled strip through rolls without preheating. This allows to significantly increase the rate of finished product release. Steel strip is shaped into trough and interlocks during forming, and then the product is cut by plasma cutting machine into 6 to 19 m sheet piles.

Since we have our own facilities for manufacturing cold-rolled coils, we can produce high-strength sheet piles (up to 420 strength class), thus enhancing sheet pile strength characteristics.

Technical capabilities of the facility

Line performance	Yield strength	Length
60 ktpa	up to 420 MPa	6-19 m

Successful tests

In 2023, Grani sheet piles were field tested at the Research Institute of Transportation Construction. The purpose of the test was to determine the reliability of sheet piles and interlocks during driving to design levels and removal to the surface. The test results showed high strength of Grani cold-formed sheet piles and proved high turnover rate of the product without changes in sheet pile geometry.

Operating experience

- Fencing of the excavation pit during the construction of the production complex, St. Petersburg;
- Arrangement of excavation pits for the placement of engineering communications during the construction of the tram line Underground Station Kupchino – Settlement Shushary – Slavyanka, St. Petersburg;
- Arrangement of a retaining wall for soil retention during the construction of the CherMK Pelletizing Plant, Cherepovets;
- Strengthening of the excavation pit walls when laying engineering communications of the Shaft Kiln Plant; Arrangement of excavation pits and retaining walls in CIS countries.

GRANI PRO

Multi-sided sheet piles

Grani Pro — is a trough type sheet pile, a patented innovative development of Severstal. The production technology allows to choose the optimal characteristics of the sheet pile for a specific project: the number and length of faces, wall thickness, metal strength class, steel grade, etc. This is a more efficient design that provides resistance to loads higher than Larsen’s sheet pile, and allows to reduce metal intensity and total cost when installing a sheet pile wall.

Applications

- **Hydraulic structures**
Construction of flood-gates and dams, coastline strengthening, mooring, banking and construction of other port infrastructure
- **Road construction**
Construction of tunnels, highways, bridges, strengthening of railway tracks
- **General civil construction**
Excavation support while constructing buildings and structures

Advantages

Customized approach to each project

- The products can be customized to specific project requirements
- The variability of all geometric characteristics allows not to produce shaped piles, and the rotation angles of the pile walls are provided by a special profile manufactured by Severstal Metiz

Improved reliability

- Grani Pro sheet piles can endure higher stress than Larssen sheet piles
- Resistance to breaking of interlock joints during driving is 2 times higher than that of Larsen pile
- Maintainability: a damaged interlock segment can be replaced for further use

Metal intensity reduction by 20–38%

- Comparing to Larssen sheet piles, less metal is used with Grani Pro piling to ensure stress resistance

Reduction of construction time by a factor of two

- Reduced number of motor vehicle runs — Grani Pro sheet piles have smaller weight, so larger quantities can be loaded into motor vehicles
- Reduced time for driving preparation and driving operations due to the increased dimensions of Grani Pro sheet piles

Production

Grani Pro sheet piles are manufactured from Severstal hot-rolled sheets using Severstal Metiz interlocks which have the highest resistance to tearing forces compared to all known trough piles in the global market. Interlocks have passed subsoil erosion tests and prevent soil washout.

- Breaking force is 3600 kN/m
- Degree of freedom is $\pm 12^\circ$
- All-metal design

The interlocking joint of the Grani Pro pile is manufactured by Severstal Metiz from all-metal profiles of a unique design providing a breaking force in the range from 2600 to 3600 kN/m.

Successful tests

Grani Pro sheet piles successfully passed the tests conducted by the Central Research Institute of Transport Construction in 2022. The tests demonstrated high strength of structure, weld joints and interlocks, and, as a result, a high turnover of such piling.

After 4 hours of sedimentation with finely dispersed fractions, 100% water penetration of the interlock joints is achieved, which increases the reliability of the pile structure due to prevention of soil washing.

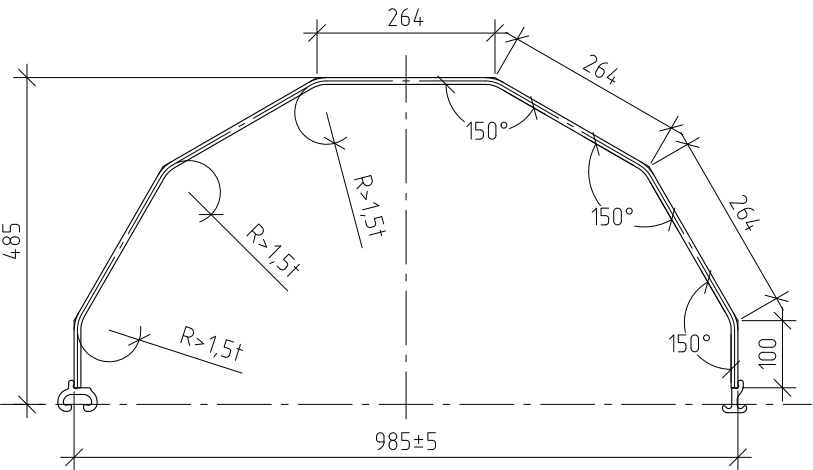
The breaking force of 3600 kN/m of the GRANI Pro interlock confirms the possibility of its use in the combined wall with welded pipe pile according to GOST R 52664 - 2010.

Operating experience

- Construction of mooring in Ust Luga
- Strengthening the bridge supports across the river Ob, M12 highway



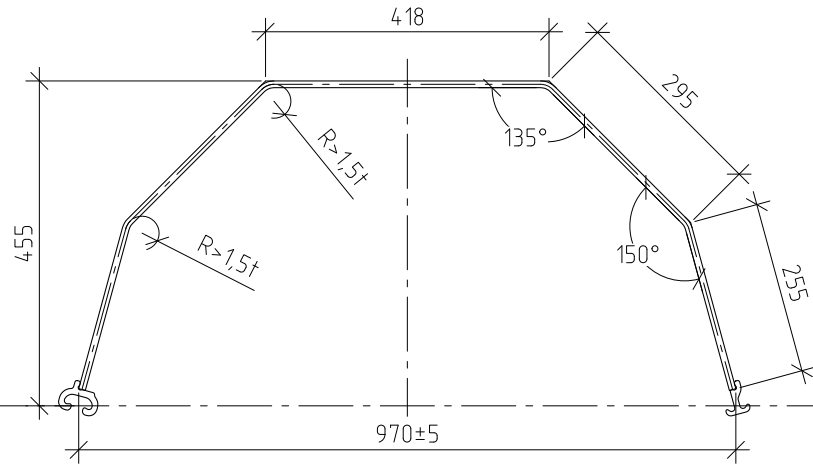
GRANI PRO 975×t×7



Profile	Calculated Width, mm	Height to axis 0-0 , mm	Thickness, mm	Cross-sectional area, cm²	Weight¹		Moment of resistance², cm³/m	Moment of inertia², cm⁴/m	Anticorrosive protection application area³ on run. m	
					kg/ 1 run. m	kg/m²			One side, m²	Two sides, m²
GRANI PRO 975×10×7	976	485	10	167	133	136	3873	187854	1.90	3.39
GRANI PRO 975×12×7			12	197	156	160	4619	224038	1.90	3.38
GRANI PRO 975×14×7			14	227	180	184	5356	259770	1.89	3.37
GRANI PRO 975×16×7			16	256	203	208	6084	295055	1.89	3.37
GRANI PRO 975×18×7			18	285	226	232	6802	329896	1.89	3.36
GRANI PRO 975×20×7			20	314	249	255	7511	364298	1.89	3.35

1. Weight is given taking into account weld deposit metal
2. Characteristics are given for the profile as part of the pile system made along the sinusoidal line
3. Area of anticorrosive protection application is given taking into account full painting of interlock joints

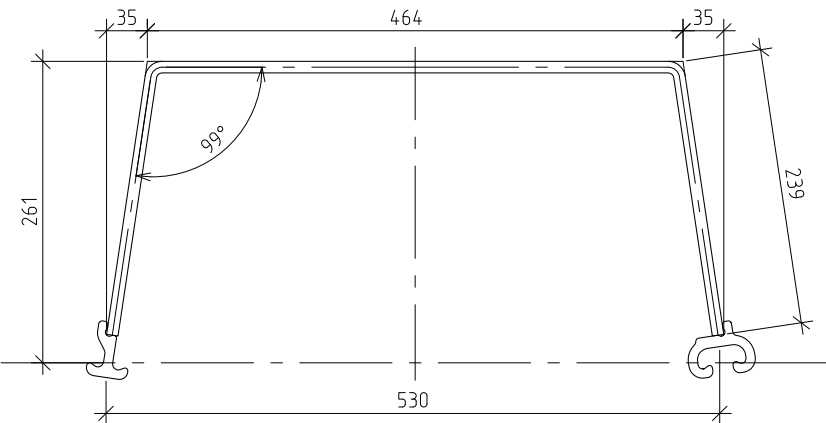
GRANI PRO 970×t×5



Profile	Calculated Width, mm	Height to axis 0-0 , mm	Thickness, mm	Cross-sectional area, cm²	Weight¹		Moment of resistance², cm³/m	Moment of inertia², cm⁴/m	Anticorrosive protection application area³ on run. m	
					kg/ 1 run. m	kg/m²			One side, m²	Two sides, m²
GRANI PRO 970×10×5	973	479	10	167	133	136	4040	193526	1.90	3.39
GRANI PRO 970×12×5			12	197	156	161	4818	230803	1.90	3.38
GRANI PRO 970×14×5			14	227	180	185	5587	267616	1.90	3.38
GRANI PRO 970×16×5			16	256	203	209	6346	303969	1.89	3.37
GRANI PRO 970×18×5			18	286	226	233	7095	339866	1.89	3.37
GRANI PRO 970×20×5			20	315	250	257	7835	375310	1.89	3.36

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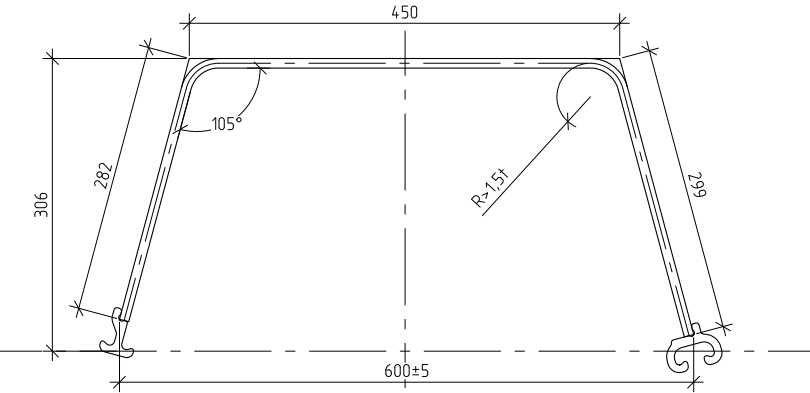
GRANI PRO 530×t×3



Profile	Calculated Width, mm	Height to axis 0-0 , mm	Thickness, mm	Cross-sectional area, cm²	Weight¹		Moment of resistance², cm³/m	Moment of inertia², cm⁴/m	Anticorrosive protection application area³ on run. m	
					kg/ 1 run. m	kg/m²			One side, m²	Two sides, m²
GRANI PRO 530×10×3	532	261	10	109	87	163	2953	77357	1.32	2.23
GRANI PRO 530×12×3			12	127	101	189	3495	91565	1.32	2.22
GRANI PRO 530×14×3			14	145	115	216	4022	105371	1.31	2.22
GRANI PRO 530×16×3			16	162	129	242	4534	118782	1.31	2.21
GRANI PRO 530×18×3			18	179	142	267	5031	131803	1.31	2.20
GRANI PRO 530×20×3			20	197	156	293	5513	144440	1.31	2.20

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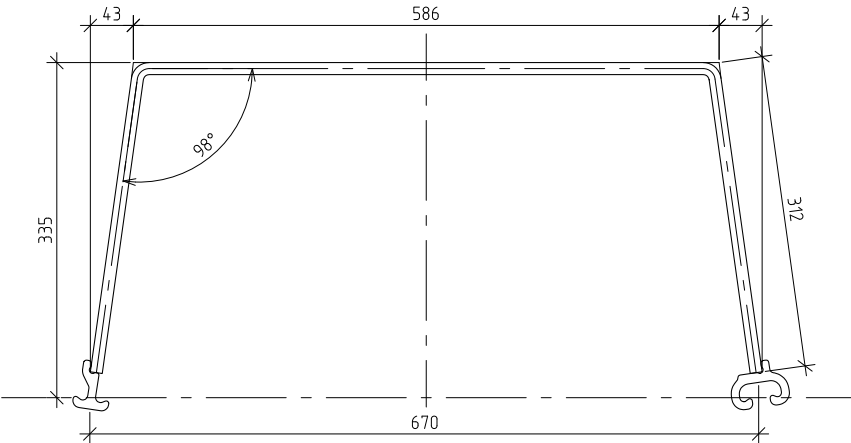
GRANI PRO 600×t×3



Profile	Calculated Width, mm	Height to axis 0-0, mm	Thickness, mm	Cross-sectional area, cm²	Weight¹		Moment of resistance², cm³/m	Moment of inertia², cm⁴/m	Anticorrosive protection application area³ on run. m	
					kg/1 run. m	kg/m²			One side, m²	Two sides, m²
GRANI PRO 600×10×3	604	306	10	117	93	154	3112	95236	1.40	2.39
GRANI PRO 600×12×3			12	137	109	180	3700	113215	1.40	2.38
GRANI PRO 600×14×3			14	157	124	206	4276	130853	1.39	2.38
GRANI PRO 600×16×3			16	176	140	231	4842	148153	1.39	2.37
GRANI PRO 600×18×3			18	196	155	257	5396	165121	1.39	2.37
GRANI PRO 600×20×3			20	215	170	282	5940	181760	1.39	2.36

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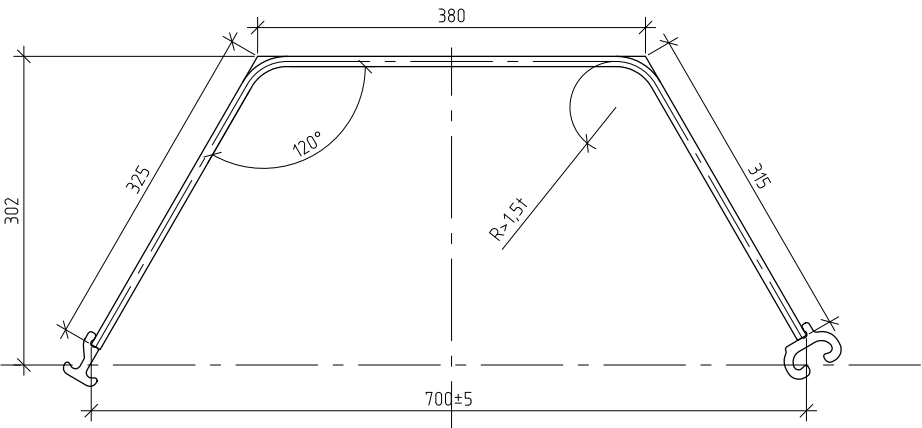
GRANI PRO 670×t×3



Profile	Calculated Width, mm	Height to axis 0-0, mm	Thickness, mm	Cross-sectional area, cm²	Weight¹		Moment of resistance², cm³/m	Moment of inertia², cm⁴/m	Anticorrosive protection application area³ on run. m	
					kg/1 run. m	kg/m²			One side, m²	Two sides, m²
GRANI PRO 670×10×3	669	335	10	136	108	161	3846	128852	1.58	2.76
GRANI PRO 670×12×3			12	159	126	189	4566	152973	1.58	2.75
GRANI PRO 670×14×3			14	182	144	216	5271	176562	1.58	2.75
GRANI PRO 670×16×3			16	205	162	243	5959	199626	1.58	2.74
GRANI PRO 670×18×3			18	228	180	270	6632	222172	1.58	2.73
GRANI PRO 670×20×3			20	250	198	296	7290	244204	1.57	2.73

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GRANI PRO 700×t×3

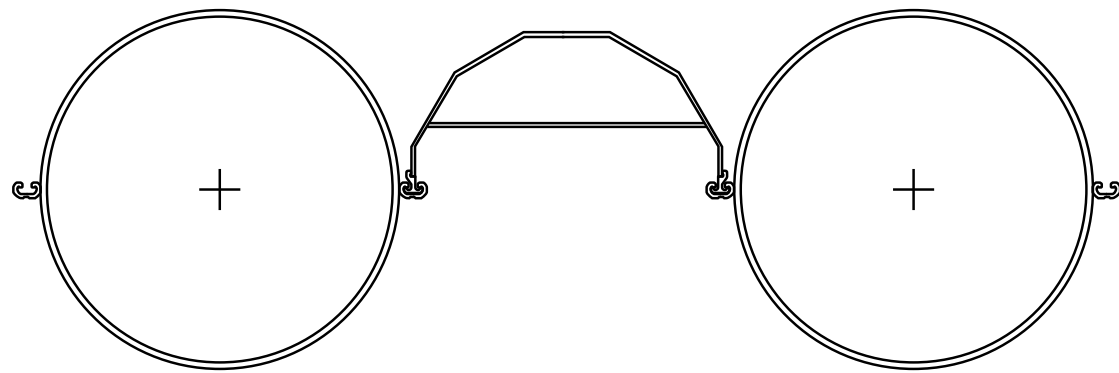


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					kg/1 run. m	kg/m²			One side, m²	Two sides, m²
GRANI PRO 700×10×3	716	302	10	117	93	130	2409	72754	1.39	2.38
GRANI PRO 700×12×3			12	137	109	152	2863	86468	1.39	2.38
GRANI PRO 700×14×3			14	157	124	174	3308	99917	1.39	2.37
GRANI PRO 700×16×3			16	176	140	195	3745	113103	1.38	2.37
GRANI PRO 700×18×3			18	196	155	217	4173	126030	1.38	2.36
GRANI PRO 700×20×3			20	215	171	238	4593	138701	1.38	2.36

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Combined design

Severstal offers a combined sheet piling design that can be applied depending on operating conditions, intended use, size of excavation pit and soil properties. Such design has a number of advantages. Mating of structural elements is ensured by specially designed shaped profiles.



Sheet pile wall comprising Grani Pro piles and tubular piles produced by Severstal

Combined design benefits

- Reduced steel intensity compared with a sheet pile wall made of tubular sheet piles
- Compensation for verticality deviation of tubular sheet piles in the site plane
- Avoiding unintended design costs associated with pipe ovality

