Steel tubes

Hollow sections

Optim HS 700 MH

Ruukki's extra high-strength OPTIM HS hollow sections have been developed for advanced engineering workshop applications. The properties of the OPTIM HS are at their best in highly stressed products that require high strength. OPTIM HS hollow sections are available in rectanqular, square and round shapes.

Applications

- Cranes
- Machinery frameworks
- Transport vehicles
- Load handling equipment
- Pumping equipment

Ruukki is a metal expert you can rely on all the way, whenever you need metal based materials, components, systems or total solutions. We constantly develop our product range and operating models to match your needs.

- **Indentification**
  Optim HS hollow sections are ink jet marked with the following information: the Ruukki emblem, Optim HS product, product dimensions and identification number. Based on this information, it is possible to trace back the manufacturing and raw material data, if needed.

- **Inspection certificate**
  Mechanical properties of OPTIM HS are tested from the finished hollow sections and they are supplied with an EN 10204-3.1 inspection certificate.

- **Weldability**
  There is no special requirement for welding of structures made with Optim HS hollow sections. The structures can be welded by all common welding procedures because the hollow sections are manufactured of thermomechanically hot-rolled steel. This is due to low carbon equivalents and levels of alloying that are low in relation to the strength of the hollow section. Elevated working temperatures are not needed under normal workshop conditions.

  In such a high strength steel grade a narrow zone softer than the base material can be generated in the weld zone. However, in many cases it has no significant effect on the behaviour of the structure. The width of the softened zone can be restricted by avoiding the use of excess high arc energy. The longitudinal HF-weld seam of Optim HS 700 MH hollow sections with greater wall thicknesses may also have a softer zone. If needed, as a conservative design value for yield strength of the longitudinal HF-weld seam of Optim HS 700 MH with wall thickness over 5 mm the value of 500 MPa can be used.

- **Hot-dip galvanizing**
  The effect of hot-dip galvanizing on extra high strength steels has not been sufficiently studied so far. Therefore Ruukki does not recommend hot-dip galvanizing Optim HS 700 MH products.

- **Availability**
  The series of recommended dimensions of the HS hollow sections are presented in tables 6 – 8. Optim HS hollow sections can be delivered square and rectangular as cut-to-size, depending on the size to up to 12 or 24 metres and the round shapes can be delivered, depending on the size, to up to 12 or 16 metres.

- **Mechanical properties** *Table 1*

	$R_{p0.2}$ MPa Minimum	R_m MPa Minimum	A_5 % Minimum	Impact test temperature °C [2]
Optim HS 700 MH	700 [1]	750 [1]	12	-20

[1] If relation between diameter/wall thickness of the circular hollow section is bigger than 25, minimum strength is 50 MPa lower.
If relation between sides/wall thickness (H + B / T) of square or rectangular hollow sections is bigger than 40, minimum strength is 50 MPa lower.
[2] The impact energy requirement is minimum 27 J with a 10 x 10 mm² V-notch specimen in accordance with EN 10045-1.

- **Chemical composition** *Table 2*

	Content % C maximum	Si	Mn maximum	P maximum	S maximum	Al minimum	CEV maximum
Optim HS 700 MH	0.10	0.15 – 0.25	2.00	0.02	0.01	0.015	0.41

In addition, niobium (Nb), vanadium (V), molybdenum (Mo) and titanium (Ti), or combinations of these, are used as microalloying elements.

CEV = C + Mn/6 + (Cr + Mo + V)/5 + (Ni + Cu)/15

Standard comparability

Table 3

	Dimensions	Technical delivery conditions
Optim HS 700 MH	EN 10219-2 [1)]	EN 10219-1

[1)] If wall thickness is < 6 mm, corner radius is 2-3 x T. If wall thickness is > 6 mm, the corner radius is 2.4-3.6 x T. (T is wall thickness of the hollow section).

Steel grades with the same yield strength

Table 4

[1), 5)]	EN 10149-2 [2)]	ISO 5951 [3)]	SEW 092 [3)]
Optim HS 700 MH	S700MC	–	QStE 740 TM [4)]

Original standards must be used when making accurate comparisons.

[1)] Mechanical properties are tested longitudinally from the finished OPTIM HS hollow section.

[2)] Tensile test piece longitudinally to the direction of rolling.

[3)] Tensile test piece transverse to the direction of rolling. (Yield strength is always higher transverse to the direction of rolling.)

[4)] The standard in question does not include this strength category.

[5)] If relation between diameter/wall thickness of the circular hollow section is bigger than 25, minimum strength is 50 MPa lower. If relation between sides/wall thickness (H + B / T) of square or rectangular hollow sections is bigger than 40, minimum strength is 50 MPa lower.

Dimensional tolerances

Table 5

Characteristic	Square and rectangular hollow section [2)]	Circular hollow sections [2)]
Outside dimensions (B and H)	B, H < 100 mm: ±1 %, with a minimum ±0.5 mm 100 mm ≤ B, H ≤ 200 mm: ±0.8 % B, H > 200 mm: ±0.6 %	
Outside diameter (D)		±1%, with a minimum ±0.5 mm and maximum ±10 mm
Out-of-roundness		2 %
Wall thickness (T)	-5 % / +10 %, with a minimum ±0.2 mm and maximum ±0.5 mm	-5 % / +10 %, with a minimum ±0.2 mm and maximum ±0.5 mm
External corner radius (R)	T ≤ 6 mm: 2,0T – 3,0T T > 6 mm: 2,4T – 3,6T	
Squareness	90° ± 1°	
Concavity, convexity [1)]	0.8 %, with a minimum 0.5 %	
Twist (V)	2 mm + 0,5 mm/m	
Straightness	0.15 % of hollow section length	0.20 % of hollow section length

[1)] The tolerance for convexity and concavity is independent of the tolerance for outside dimensions.

[2)] All external dimensions including out-of-roundness shall be measured at a distance from the end of the hollow section of not less than D for circular sections, B for square sections or H for rectangular sections, with a minimum of 100 mm. Bead scarfing of inner burrs can be carried out when agreed upon separately.

Dimensions (Recommended series) *Table 6*

◯ Hollow Sections

Outside dimension D	Weight kg/m Wall thickness T mm 3.0	4.0	5.0	6.0	8.0
42.4	2.91				
48.3	3.35				
60.3	4.24	5.55			
76.1	5.41	7.11			
88.9	6.36	8.38			
101.6	7.29	9.63			
108	7.77	10.3			
114.3	8.2	10.9			
127	9.17	12.1			
139.7	10.1	13.4	16.6	19.8	
168.3		16.2	20.1	24.0	31.6
193.7			23.3	27.8	36.6
219.1			26.4	31.5	41.6
273			33.0	39.5	52.3
323.9				47.0	62.3

Other dimensions can be produced when agreed upon separately.

Minimum yield strength is 650 MPa and minimum tensile strength 700 MPa.

Dimensions (Recommended series) *Table 7*

□ Hollow Sections

Outside dimension H x B	Weight kg/m Wall thickness T mm 3.0	4.0	5.0	6.0	8.0
40 x 40	3.24				
50 x 50	4.18	5.35			
60 x 60	5.13	6.60			
70 x 70	6.07	7.86			
80 x 80	7.01	9.11			
90 x 90	7.95	10.4			
100 x 100	8.89	11.6	14.2	16.7	
120 x 120		14.1	17.4	20.5	
140 x 140		16.7	20.5	24.3	31.0
150 x 150		17.9	22.1	26.2	33.5
160 x 160			23.7	28.0	36.0
180 x 180				31.8	41.1
200 x 200			29.9	35.6	46.1
250 x 250				45.0	58.6
300 x 300				54.4	71.2

Other dimensions can be produced when agreed upon separately.

Minimum yield strength is 650 MPa and minimum tensile strength 700 MPa.

Dimensions (Recommended series) *Table 8*

▯ Hollow Sections

Outside dimension H x B	Weight kg/m Wall thickness T mm 3,0	4,0	5,0	6,0	8,0
50 x 30	3.24				
60 x 40	4.18	5.35			
70 x 50	5.13	6.60			
80 x 40	5.13	6.60			
80 x 60	6.07	7.86			
90 x 50	6.07	7.86			
100 x 50	6.54	8.49	10.3		
100 x 60	7.01	9.11			
120 x 60	7.95	10.4			
120 x 80	8.89	11.6			
140 x 80		12.9	15.8		
150 x 100		14.8	18.2	21.4	
160 x 80		14.1	17.4	20.5	
200 x 100			22.1	26.2	33.5
200 x 120			23.7	28.0	36.0
250 x 100			26.0	30.9	39.8
250 x 150			29.9	35.6	46.1
260 x 180				39.3	51.1
300 x 200				45.0	58.6
400 x 200				54.4	71.2

Other dimensions can be produced when agreed upon separately.

Minimum yield strength is 650 MPa and minimum tensile strength 700 MPa.

Recommended dimensions.

Our Customer Service is happy to give you further information

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