

* For dimensions see general arrangement drawing.

[Modified On: 29/08/2008]

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1 General**1.1 Scope**

This general specification applies to fractionating trays for columns. The scope of supplies covers the complete fractionating trays including supports, bolts and nuts, washers, sealing material, and - unless otherwise specified - the installation of the fractionating trays.

Welded-in support rings shall be supplied and welded in by the vessel manufacturer.

In addition to this general specification and the codes and standards specified in the purchase order, the accepted standards of technology shall apply.

1.2 Contradictions and deviations

If the requirements of this general specification are in contradiction with the contents of the relevant technical specification, the latter shall apply. If the manufacturer intends or has to deviate from the codes and standards cited in this specification, he shall obtain the written approval from the purchaser.

2 Calculation

Unless otherwise specified in the drawings or purchase order documents, the fractionating trays and transverse baffles as well as their supports shall be calculated for the corroded state.

Normally, the transverse baffles are not covered by an appreciable level of liquid during operation.

The following loads shall be taken into consideration for calculating the plate thickness of the trays and for the design and arrangement of the supports:

a) Loads on fractionating trays at operating temperature.

Between inlet and outlet weir:

- a uniform load of 60 kg/m²,
- the weight of the water column at the height of the outlet weir plus 50 mm,

whichever is the greater load.

Under normal operating loads, the deflection, i.e. the deviation from the horizontal line, shall not exceed 1/900 of the column diameter.

Below the outlet cross-section:

- a uniform load of 310 kg/m²,
- the weight of the water column at half the height of the outlet weir,

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whichever is the greater load.

b) Loads on the liquid seal and draw-off pans at operating temperature.

- a uniform load of 310 kg/m²,
- weight of the water column up to max. liquid level,

whichever is the greater load.

c) Loads on the transverse baffles at operating temperature:

- 100 kg/m², with a max. permissible deflection of 3 mm.

d) Loads on the fractionating trays and transverse baffles when being walked upon for assembly, inspection or cleaning:

- a concentrated load of 135 kg at any point of the supports.

3 Design

3.1 Drawings and technical documents

The manufacturer shall submit all workshop drawings to the purchaser in triplicate for checking and approval. Fabrication shall not be started until the drawings bearing the clearance stamp of the purchaser have been returned to the manufacturer.

Not later than four weeks after order placement, the manufacturer of the fractionating trays shall furnish the vessel manufacturer with drawings showing the exact position and dimensions of the welded-in supports, support rings, etc.

3.2 Corrosion allowance

No corrosion allowance is required for corrosion-resistant materials.

Unless otherwise specified, removable parts of non-corrosion-resistant materials, such as tray plates, supports, weirs, bubble cap necks, downcomer plates, etc. shall have the same corrosion allowance as the vessel. However, this allowance shall be added to one side only. Internals welded into the vessel shall have a corrosion allowance on each side coming in contact with the process fluid. No corrosion allowance is required for bubble caps of bubble cap trays.

3.3 Materials

Refer to the technical specification or drawings as regards the materials for tray plates, downcomer plates, weirs, supporting members, bubble cap necks, bubble caps, and clamps.

A suitable material shall be selected for plates which are to be bordered.

Gaskets shall be of the braid tape type of 2 mm thickness.

3.3.1 Materials for bolts

Bolts for fractionating trays of unalloyed steel shall be made of material 5.6 according to DIN 267 or ASTM A 307.

Bolts for fractionating trays of alloyed steel shall be made of the same material as the trays.

In all cases, at least ANSI Type 410 shall be selected for the bolts used for removable tray sections.

3.4 Construction

Fractionating trays shall be constructed to permit installation and removal of the individual tray components through the manholes of the vessel. In addition, the components shall be dimensioned to facilitate easy installation into a vessel with tolerances according to Uhde standard UN 2000-02 Part 1 (M). Installation shall be performed from bottom to top.

All fractionating trays shall be provided with removable sections for the passage of workmen, these sections being superimposed in a vertical line.

Two-pass fractionating trays with a central outlet weir shall be provided with removable sections on both sides of the weir.

Unless otherwise specified, each tray section, on which liquid might collect, shall be provided with at least one drain hole of 12 mm diameter.

Removable tray sections shall be attached to the support rings and supports by means of bolts or clamps and, if necessary, be sealed.

The max. spacing between the bolts on the tray plates shall be 180 mm and 100 mm on the downcomer cross-sections and plates.

If necessary, the downcomers and downcomer plates shall be sealed.

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Risers or bubble cap necks shall be

- rolled into upwardly bordered openings of the tray plate and tackwelded in the case of tray plate thicknesses of ≤ 5 mm,
- attached to the tray plate by a continuous weld in the case of tray plate thicknesses of > 5 mm.

The bubble caps shall be annealed. Installation and dismantling shall be performed from the top side of the tray.

Unless otherwise specified, the outlet weirs shall be of the adjustable and removable type. It must be possible to adjust the adjustable weirs by ± 12 mm of the nominal dimension.

The supports shall be bolted in place. If arranged transversely to the direction of flow, the depth of a support shall not exceed 15% of the tray spacing. The depth of supports arranged above the downcomer cross-sections shall not exceed 20% of the tray spacing.

Unless otherwise specified, the dimensions for welded-in support rings and downcomer bolting bars of fractionating trays shall be as follows:

Table 1.

Inside diameter of column mm	Width of support ring mm	Width of vertical downcomer bolting bars mm	Plate thickness without corrosion allowance	
			Support ring mm	Downcomer bolting bar mm
≤ 900	40	Lateral downcomer:	6	6
> 900 to 1700	50	2.5 - 3 x support ring width	6	6
> 1700 to 2600	60		6	6
> 2600 to 3600	70	Central downcomer:	8	6
> 3600 to 4700	80	2.5 x support ring width	8	6
> 4700	90		8	6

Dimensions specified by the tray manufacturer shall be observed.

3.4.1 Additional requirements for sieve trays

The supports shall preferably be arranged transversely to the direction of flow.

The width of the unperforated areas above the support rings and supports shall not exceed 75 mm.

For two-pass fractionating trays of ≥ 1500 mm diameter and for double-flow fractionating trays of ≥ 3000 mm diameter, the holes shall be distributed as follows:

- 55% over the inlet half,
- 45% over the outlet half.

The holes shall be punched from the top side.

3.5 Plate thicknesses

The minimum plate thicknesses, without corrosion allowance, shall not be less than the values listed below:

Table 2.

Components	Non-ferrous metals and corrosion-resistant steel	Non-corrosion resistant steel
Tray plates, inlet and draw-off pans	2 mm	2 mm
Removable downcomer plates and pipes	2 mm	2 mm
Welded-in downcomer plates	3 mm	3 mm
Discharge pipes	2 mm	3 mm
Weirs	2 mm	2 mm
Weir supports and seals	2 mm	2 mm
Bubble caps	1.5 mm	3.5 mm
Risers	2 mm	2 mm
Supports (steel plates)	2 mm	3 mm
Supports (sectional steel)	3 mm	3 mm
Bolts	M 10	M 10

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4 Fabrication

4.1 General

All components must be free of dirt, rust, slag, and scale.

Unless otherwise agreed upon, the manufacturer shall additionally supply the following:

- 4% of the bolts and nuts
- 8% of the washers
- 40% of the sealing material.

4.2 Tolerances

The following tolerances apply to fractionating trays, impingement plates and transverse baffles:

Table 3.

Inside diameter of column mm	Diameter of tray mm	Tolerance of tray diameter mm
≤ 900	0.99 x inside diameter of column minus 20 mm	0 / - 2
> 900 to 1700		0 / - 5
> 1700 to 2600		0 / - 8
> 2600 to 3600		0 / - 11
> 3600 to 4700		0 / - 14

Height from the tray plate to the upper edge of the riser: ± 1 mm

Height of the slots in bubble caps: ± 1 mm

The bottoms of the notches of notched weirs and the upper edge of plain weirs shall be within ± 1 mm of the horizontal.

The tolerances for welded-in weirs are specified in Uhde standard UN 2000-02 Part 1(M).

Adjustable weirs shall be adjustable by ± 12 mm of the nominal dimension.

Height from the tray plate or cup to the lower edge of the outlet weir: ± 3 mm.

Center distance between bubble caps: ± 3 mm.

Vertical distance between the lower edge of the outlet plate and the upper edge of the inlet weir: ± 3.5 mm.

Horizontal distance between adjacent tray supports: ± 3 mm.

Horizontal distance measured across several tray supports: ± 6 mm.

The tolerances of identical components shall be calculated to render the components interchangeable.

Sieve tray components without gaskets:

Maximum gap between tray plate and support ring or support: 0.4 mm. Outlet cross sectional areas shall be sealed.

Total perforated area of sieve trays: $\pm 1\%$.

5 Installation

Unless otherwise specified, the fractionating trays of all columns which are accessible to workmen (column diameter: ≥ 800 mm) shall be installed on site by the tray manufacturer, with the column in upright position.

6 Tests and inspections

One fractionating tray of each size and type shall be assembled and tested at the manufacturer's works in the presence of the inspector of the purchaser or the purchaser's client.

After installation on site, each tray shall be checked for proper installation.

In addition, random checks shall be performed on trays installed on site to ensure that the fixing bolts have been tightened. All fixing bolts shall be checked on trays installed at the manufacturer's works.

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Unless otherwise specified, bubble cap trays and cups shall be tested for leakage. For this purpose, the drain holes shall be closed and the trays and cups filled with liquid up to the upper edge of the weir. The liquid level shall not drop by more than 25 mm over a period of 5 minutes. These tests constitute part of the scope of work to be performed by the contractor installing the fractionating trays.

7 Packing and shipment

All fractionating trays not installed at the manufacturer's works shall be packed into suitable boxes to prevent damage to or loss of any component.

Manufacturer shall not dispatch the fractionating trays until they have been released for shipment by the purchaser in writing.

Reference Uhde standards

UN 2000-02 Part 1 (M) Dimensional tolerances for vessels.

[Modified On: 29/08/2008]

1 Standard requirements for design/construction

For design data, please see technical specification and/ or vessel drawing. When the stress analysis is performed it is essential to duly consider the pressure loss in the packing as a load. Support grid and support beams shall be designed with a safety factor of 1.5 to the yield point. The deflection shall not exceed 1/300 of the length.

In the case of support grid and support beams of ferritic steel, the corrosion allowance shall be added to one side but it can be discarded in case of corrosion resistant steel.

1.1 Materials

Wire mesh:

Corrosion-resistant steel (e.g. SS 304)

Support grid and connecting elements:

see vessel specification or drawing

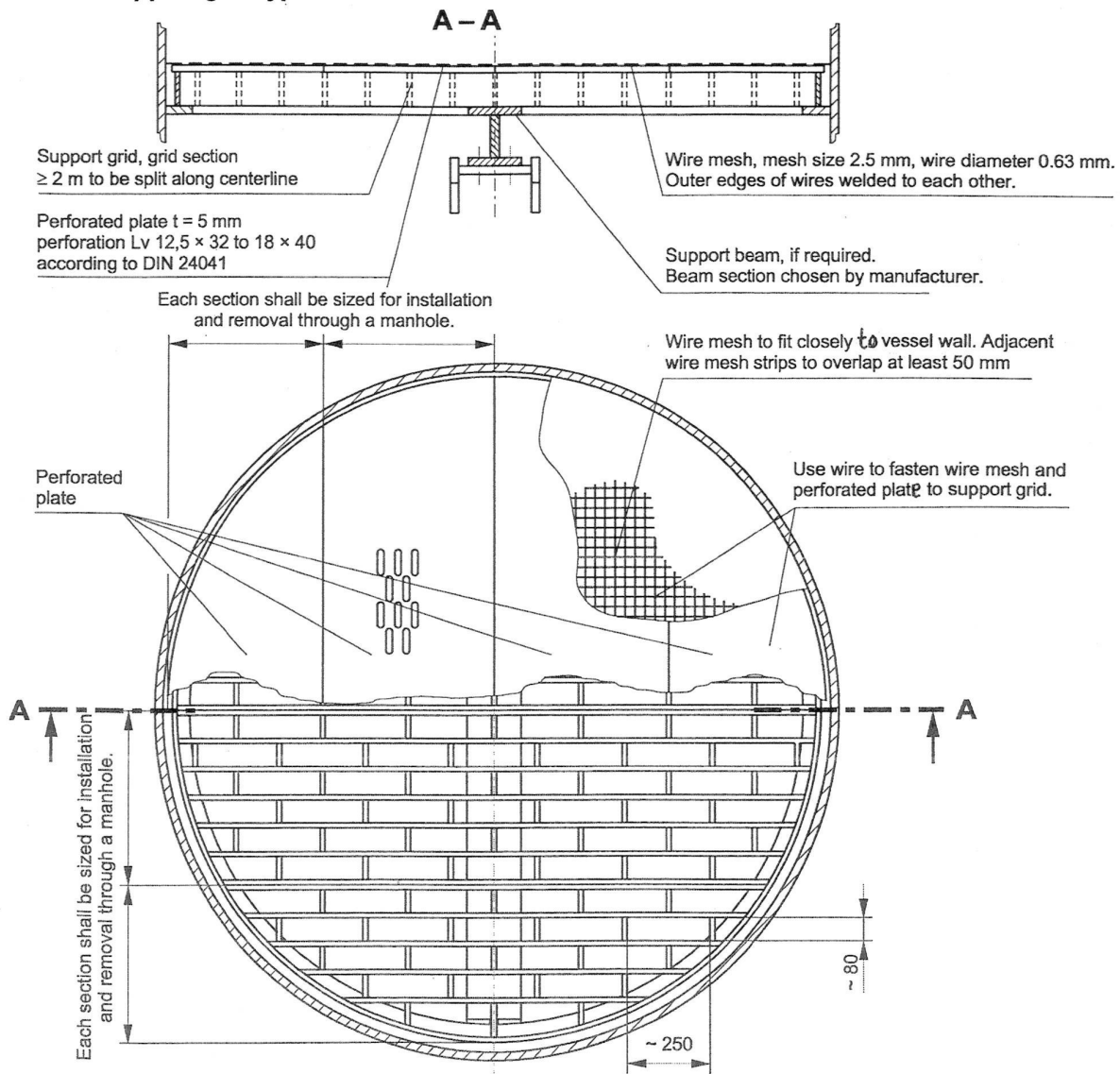
1.2 Support grid type A

Figure 1.

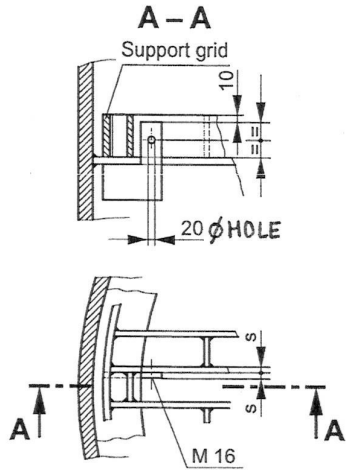


Figure 2. Support grid fixed by two clamps per grid segment

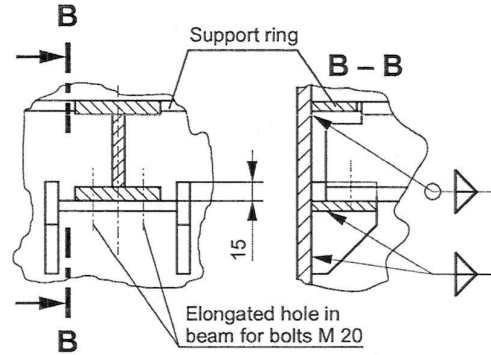


Figure 3. Bracket for support beam compliant with sectional drawing or equivalent

1.3 Support grid type B

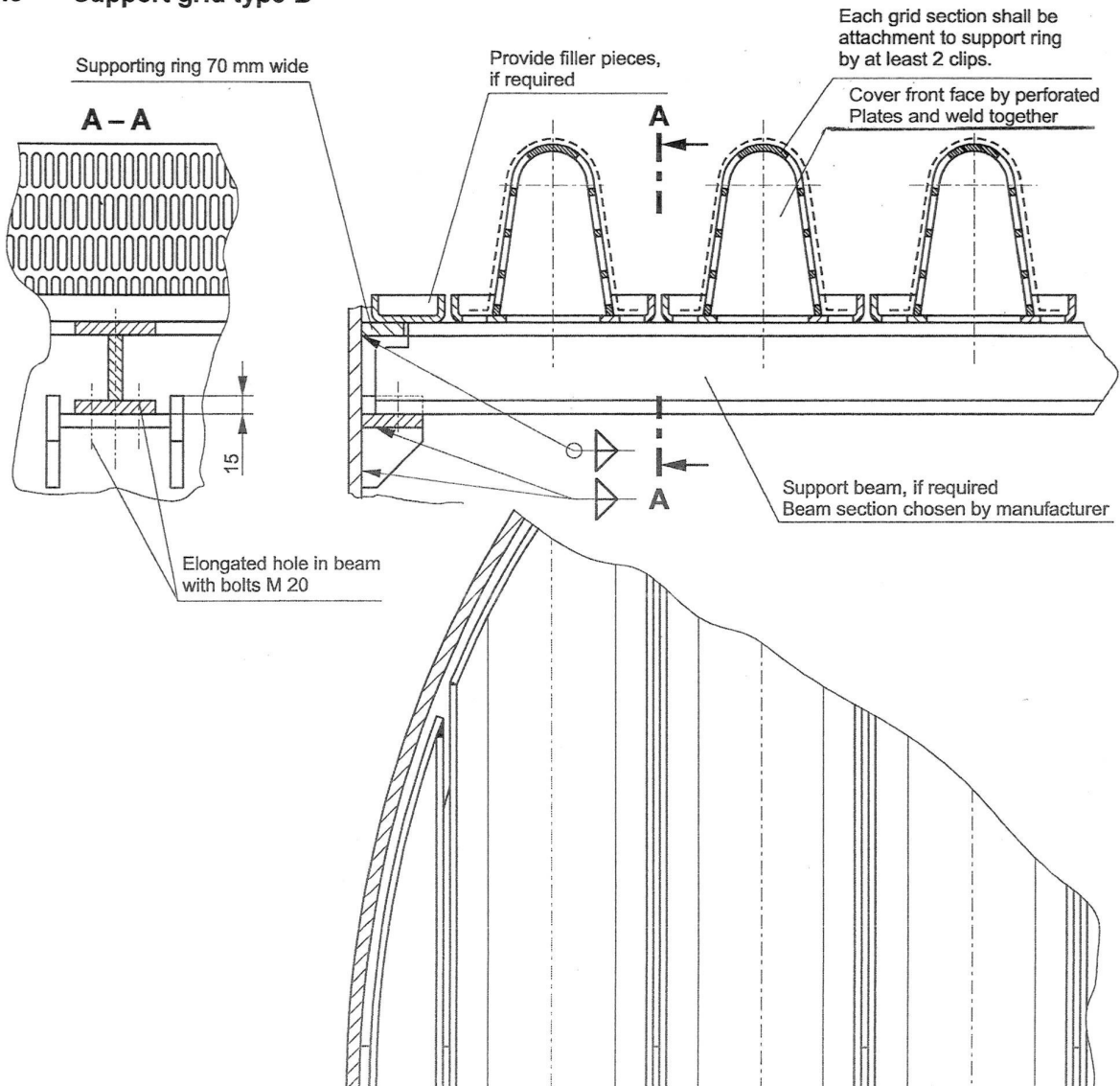


Figure 4.

Wire mesh only if specifically required, mesh size 2.5 mm, wire diameter 0.5 to 0.63 mm. End faces of supporting profile to be covered. Outer edges of wires welded to each other. Use wire to fasten wire mesh and perforated plate to support grid.

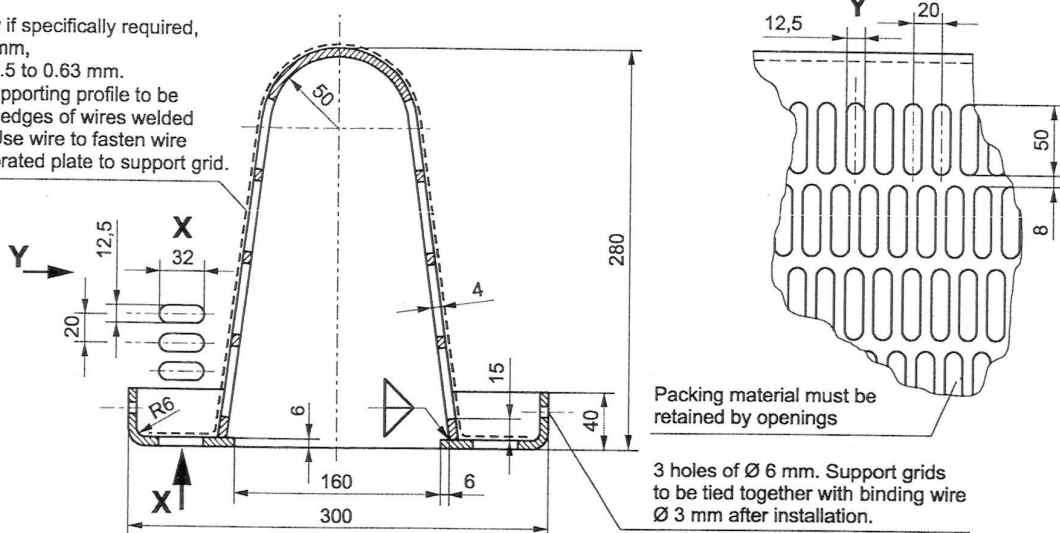


Figure 5.

Free cross section of support grid (without wire mesh) shall be approx. 85 % of vessel cross-sectional surface.

Free cross section of wire mesh (acc. to DIN ISO 4783-1):

- for 0.5 mm wire diameter = 69 %
- for 0.63 mm wire diameter = 64 %

Static characteristics of support grid for 4 mm thick metal sheet $e_x = 15.7 \text{ cm}$, $I_x = 1918 \text{ cm}^4$, $W_x = 122 \text{ cm}^3$.

For other plate thicknesses, the values of I_x and W_x vary in approximately linear proportion to plate thickness. (Add corrosion allowance).

Reference Standards

DIN ISO standards:

DIN ISO 4783-1

Industrial wire screens and woven wire cloth; Guide to the choice of aperture size and wire diameter combinations; Generalities

DIN standards:

DIN 24041

Perforated plates; Dimensions

[Modified On: 29/08/2008]

1 Standard requirements for design/ construction

In the case of upwards stream flow, the force by weight of the grid in corroded condition must exceed by at least 50 % of the pressure loss of the packing less force by weight of the packing.

If the weight force of the hold-down grid is too low, increase thickness of the flat steel members or provide fixing arrangement for the hold-down grid.

1.1 Materials

Wire mesh packing:

Corrosion-resistant steel (e.g. SS 304)

Support grid and connecting elements:

see technical specification of vessel

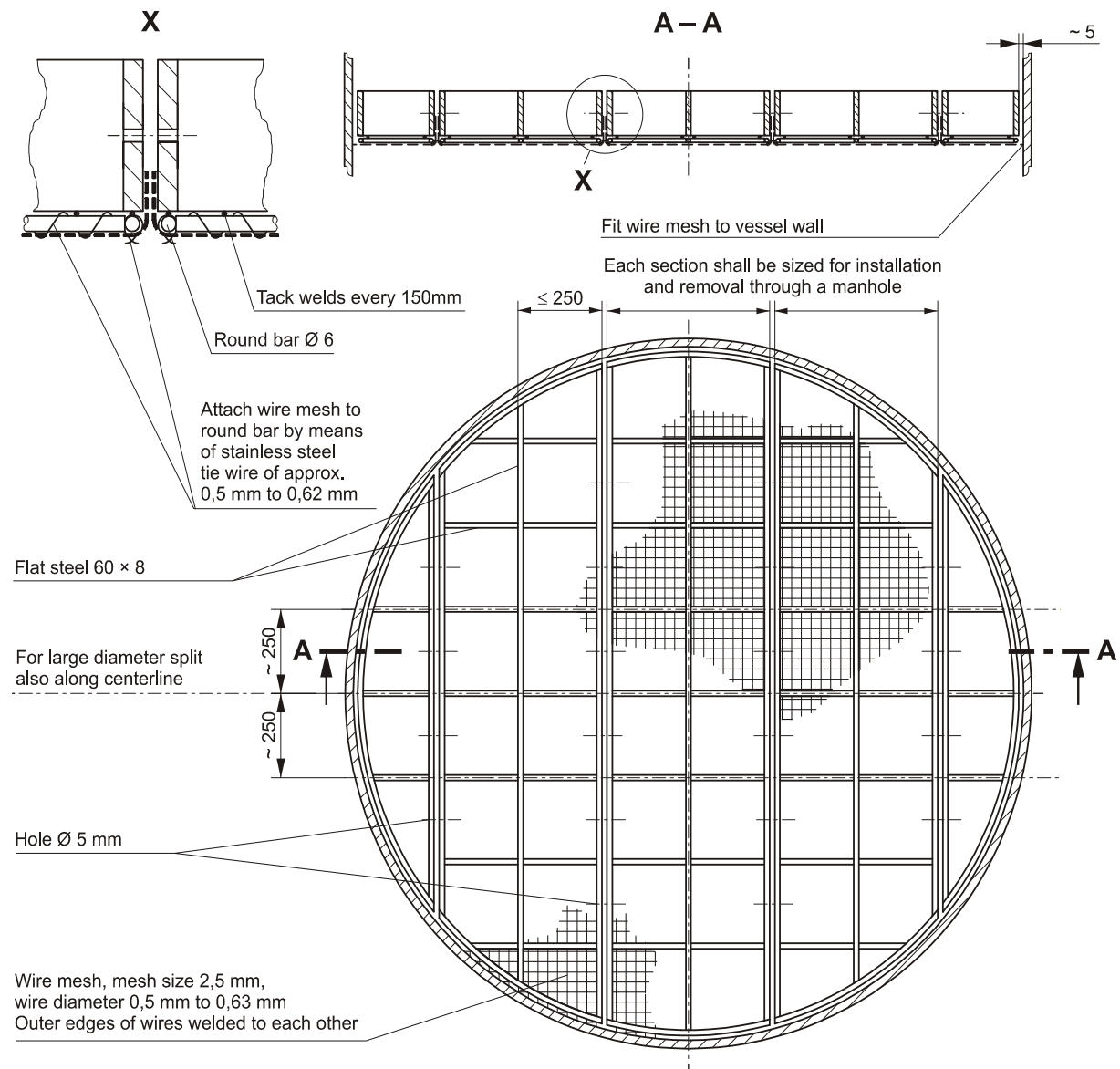


Figure 1.

Uhde**Complementary material
HOLD DOWN GRID****UN
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Free cross section of wire mesh packing (acc. to DIN ISO 4783-1):

- for 0.5 mm wire diameter = 69 %
- for 0.63 mm wire diameter = 64 %

Reference Standards

DIN ISO 4783-1 : 1996-10 Industrial wire screens and woven cloth; Guide to the choice of aperture size and wire diameter combinations; Generalities

A	B	C	D	E	F			G	H				I		K				L	UAN :	Z-Nr.:	
					Welding process			Procedure qualification test	Exam. of welding Groove faces				Back chipping		Exam. root pass before welding reverse side				preheat-inter-pass temp.	TON :		
Seam-No	Sketch of joint, seam and preparation with dimensions	Part-No. to part-No.	Material to material	Joint efficiency	Filler metals / make and brand			Number	Liquid penetr. exam.	Magnetic partic. exam.	Ultrasonic exam.	Visual exam.	Yes	No	Liquid penetr. exam.	Magnetic partic. exam.	Radiographic exam.	Visual exam.	°C min.	Designation		
					DIN- or ASME designation			Date					Procedure						°C max.		Manufacturer	
					Wire diameter root pass	Wire diameter filler passes	Wire diameter seal run	Yet to be done											Order-No.			
																			Year of construction	Work-No.		
					mm	mm	mm												Vessel sketch with seam-No.			
																			WELDING PROCEDURE AND TESTING SCHEDULE			
																			We reserve all rights relating to this technical documents Krupp Uhde			
					mm	mm	mm												Drawing-No.	Sheet	1	Rev.
																				from	2	

[Modified on: 29/08/2008]

1 Scope

This Uhde standard applies to horizontal steel vessels supported by saddles according to Uhde standard UN 2000-05 Part 1 (M), said vessels operating at temperatures below 0° C.

In the case of vessels mounted on steel structures, the sliding plate and the concrete foundation with grouting layer shown in the Figure 1 are not required.

2 Construction

The wooden plates of 55 mm thickness shall be of synthetic-resin compressed wood or hard wood (such as beech, oak, etc. laminated in three layers and treated with anti-rot liquor).

Said wooden plates shall be marked with the Uhde order and vessel number, using indelible white paint.

The sheet steel pad of 2 mm thickness shall be fixed to the wooden plate of the sliding saddle, using flat-head screws spaced at 100 to 130 mm.

The sliding plate shall be included in the vessel supply (Exemption see chapter 1).

For wooden plate dimensions and spacing of the bolts refer to columns "Base plate" and "Anchor bolts" in the related tables, Uhde standard UN 2000-05 Part 1 (M).

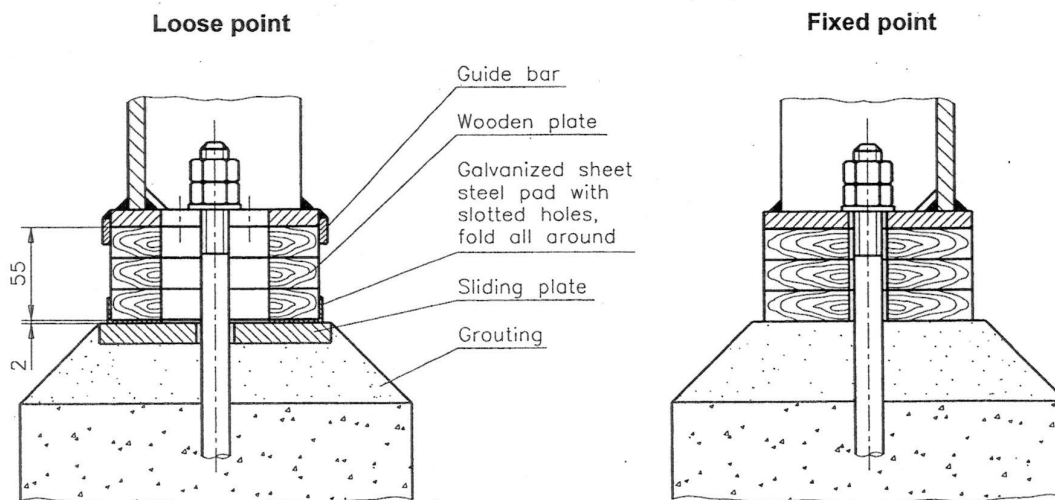
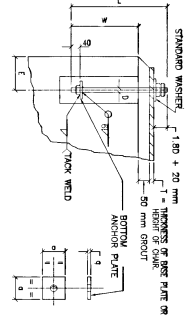


Figure 1

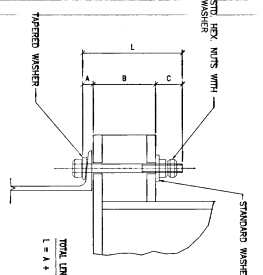
Reference standards

Uhde standards:

UN 2000-05 Part 1 (M) Vessels and equipment; Support saddles for horizontal steel vessels

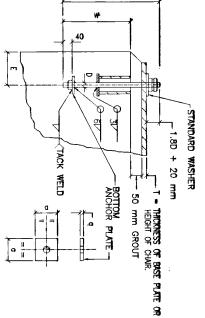


DIA OF BOLT (MM)	BOLT DETAILS			POCKET DETAILS		BOLT CAPACITY		W.T. OF ASSEMBLY (kg)
	L (MM)	W (MM)	Ø (MM)	Ø (MM)	Ø (MM)	Tension (kg)	Shear (kg)	
12	400	50	10	115	115	150	450	240
16	500	50	10	125	125	150	600	480
20	610	50	10	125	125	150	2250	680
24	720	60	10	150	150	200	3200	900
30	880	75	10	150	150	200	5000	1350
36	980	75	10	150	150	200	5000	1350
42	1100	80	10	200	200	250	7850	1900
48	1180	80	10	200	200	250	10250	2200
52	1270	80	10	225	225	250	11750	2450
56	1370	80	10	250	250	250	13250	2700
60	1460	80	10	275	275	250	14750	2950
64	1560	80	10	275	275	250	16250	3200
72	1800	80	10	300	300	250	18750	3450
80	1980	80	10	300	300	250	21250	3700
100	2420	80	10	300	300	250	23750	3950



BOLT DIA (MM)	SLEEVE DETAILS			BOLT CAPACITY		W.T. OF ASSEMBLY (kg)		
	L (MM)	W (MM)	Ø (MM)	Tension (kg)	Shear (kg)			
12	400	50	10	115	115	150	450	240
16	500	50	10	125	125	150	600	480
20	610	50	10	125	125	150	2250	680
24	720	60	10	150	150	200	3200	900
30	880	75	10	150	150	200	5000	1350
36	980	75	10	150	150	200	5000	1350
42	1100	80	10	200	200	250	7850	1900
48	1180	80	10	200	200	250	10250	2200
52	1270	80	10	225	225	250	11750	2450
56	1370	80	10	250	250	250	13250	2700
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72	1800	80	10	300	300	250	18750	3450
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100	2420	80	10	300	300	250	23750	3950

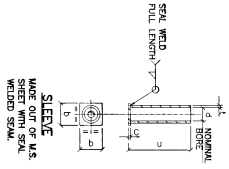
ANCHOR BOLTS (TYPE-A)
FOR EQUIPMENT ON CONCRETE FOUNDATION WITH POCKET



DIA OF BOLT (MM)	BOLT DETAILS			SLEEVE DETAILS		BOLT CAPACITY		W.T. OF ASSEMBLY (kg)
	L (MM)	W (MM)	Ø (MM)	Ø (MM)	Ø (MM)	Tension (kg)	Shear (kg)	
12	400	50	10	115	115	150	450	240
16	500	50	10	125	125	150	600	480
20	610	50	10	125	125	150	2250	680
24	720	60	10	150	150	200	3200	900
30	880	75	10	150	150	200	5000	1350
36	980	75	10	150	150	200	5000	1350
42	1100	80	10	200	200	250	7850	1900
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64	1560	80	10	275	275	250	16250	3200
72	1800	80	10	300	300	250	18750	3450
80	1980	80	10	300	300	250	21250	3700
100	2420	80	10	300	300	250	23750	3950

NOTE:
1. * APPROPRIATE STANDARD U.S. PIPES OR WELDED WAGON THICKNESS MAY BE USED.

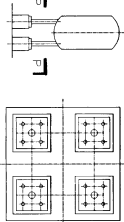
ANCHOR BOLTS (TYPE-B)
FOR EQUIPMENT ON CONCRETE FOUNDATIONS WITH BOLTS



SLEEVE: WELD OUT OF U.S. SHEET WITH SEAL WELDED SEAM.

ANCHOR BOLTS (TYPE-C)
FOR EQUIPMENT ON STEEL STRUCTURES (TYPE OF EQUIPMENT VARIETY)

NOTE:
1. THE BOLTS SHALL CONFORM TO BLACK GRADE-B AND THE PROPER CLASS 4.6, AND THE BOLTS AND THE LOCK NUTS SHALL CONFORM TO THE PROPER CLASS 4.6 AND 4.8 RESPECTIVELY.
2. TAPERED WASHERS CORRESPONDING TO R15372 OR R1741 SHALL BE PROVIDED CORRESPONDING TO THE BOLT SIZE AND THE TYPE OF SUPPORTING MEMBER, WHICH SHALL BE INDICATED TO THE EQUIPMENT SUPPLIER.
3. PLAN WASHERS TO CONFORM TO IS : 2018.



DIA OF BOLT (MM)	BOLT DETAILS			SLEEVE DETAILS		BOLT CAPACITY		W.T. OF ASSEMBLY (kg)
	L (MM)	W (MM)	Ø (MM)	Ø (MM)	Ø (MM)	Tension (kg)	Shear (kg)	
12	400	50	10	115	115	150	450	240
16	500	50	10	125	125	150	600	480
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24	720	60	10	150	150	200	3200	900
30	880	75	10	150	150	200	5000	1350
36	980	75	10	150	150	200	5000	1350
42	1100	80	10	200	200	250	7850	1900
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64	1560	80	10	275	275	250	16250	3200
72	1800	80	10	300	300	250	18750	3450
80	1980	80	10	300	300	250	21250	3700
100	2420	80	10	300	300	250	23750	3950

GENERAL NOTES:

- ALL DIMENSIONS & SIZES INDICATED ARE IN MM.
- EACH BOLT SHALL BE SUPPLIED WITH DOUBLE NUTS AND A WASHER.
- MINIMUM OF THE ANCHOR BOLTS / NUTS SHALL CONFORM TO IS 2002 (2010).
- MINIMUM SPACING OF BOLTS SHALL BE "FOUR SUBJECT TO 75 MM MINIMUM
- TAPERED LENGTH OF BOLTS SHALL BE MINIMUM 4.80 + 20 mm.
- FOR EQUIPMENTS LOCATED ON UPPER FLOOR OR S.C.C. SLABS THE PROTECT SHALL BE ACCOMPANIED IN A FLOOR BEAM OR ANCHORING TECHNIQUE SHALL BE ADOPTED TO SURT THE HEIGHT OF FOOTING IN CONSULTATION WITH CIVIL ENGINEERING DEPARTMENT.
- E = MINIMUM DISTANCE FROM THE CENTER OF POCKET / BOLT TO THE EDGE OF THE FLOOR SLAB.
- ANCHOR BOLTS SHALL BE EMBEDDED IN FOUNDATION CONCRETE ALONG WITH STEEL REINFORCEMENT.
- ANCHOR BOLTS SHALL BE EMBEDDED IN FOUNDATION CONCRETE ALONG WITH STEEL REINFORCEMENT.
- THE DRAWING SHALL BE USED ONLY FOR GUIDE UNLESS OTHERWISE SPECIFIED.
- VERTICAL EQUIPMENT MOUNTED ON SHIMS OR LESS OF ANGLE / CHANNEL AND PIPES.
- WEIGHT OF ANCHOR BOLT ASSEMBLY IS CALCULATED ON THE ASSUMPTION THAT THE THICKNESS "T" OF EQUIPMENT BASE PLATE IS 20 mm, FOR EQUIPMENT WITH CLAMP OR HEIGHT OR THICKNESS OF BASE PLATE MORE THAN 20 mm, 4.80 (180) (T-0.02) kg, WHERE "T" IS IN CM AND "T" IS IN MM.
- THIS DRAWING SUPPLEMENTS ALL THE PREVIOUS ANCHOR BOLT STANDARDS.

UOHOE
 SHEET NO. 889
 DRAWING NO. 889
 DATE: 15/05/2018
 PROJECT: [BLANK]
 SHEET: 11
 SCALE: 1:1
 DESIGNED BY: [BLANK]
 CHECKED BY: [BLANK]
 APPROVED BY: [BLANK]
 UOHOE
 SHEET NO. 889
 DRAWING NO. 889
 DATE: 15/05/2018
 PROJECT: [BLANK]
 SHEET: 11
 SCALE: 1:1
 DESIGNED BY: [BLANK]
 CHECKED BY: [BLANK]
 APPROVED BY: [BLANK]