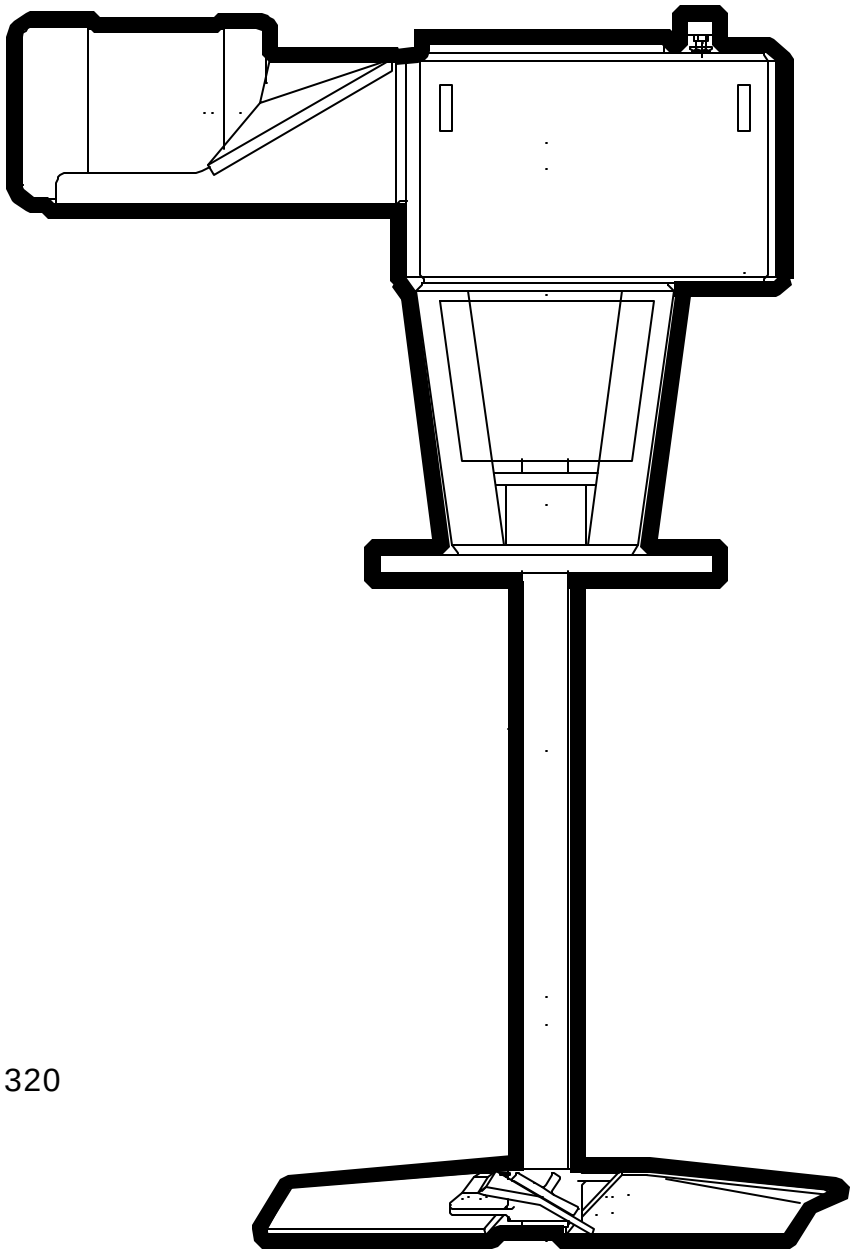
ChemInnoer

Supplement 310.1

HTA/HTAL/HTL Turbine Agitators
HTN/HTNS Turbine Agitators
Mounting Supplement



Reference IOM Manual 310 and 320

MOUNTING

HTA, HTAL HTL, HTN and HTNS style units are designed to mount on an ANSI flange, nozzle or pad located on the vessel top head. See *Figure 1, page 3*.

Unless otherwise specified on the agitator assembly drawing, the agitator extension shaft is designed to run in a true vertical position. The agitator drive assembly must be **level within 1/4 degree.** The angular misalignment may be corrected by machining the nozzle or pad level and flat. In extreme cases, a tapered adapter will be required (supplied by others). Call *Chemineer Field Service* for assistance. *Do not angle or side mount.*

During operation of the agitator, the fluid motion in the vessel produced by the rotation of the turbine impeller can exert significant forces and moments on the agitator extension shaft. The forces and moments produced by the turbine rotating in a fluid are; torque, turbine thrust and turbine hydraulic (side) force. Torque implies an unchanging load, but the actual operating torque will show plus or minus 10 to 20 percent variability due to turbulent conditions within the agitated fluid. Start up of the agitator with the turbine impacted in solids is beyond the scope of these recommendations. Hydraulic forces acting on the turbine generate moments, which act on the shaft and are transmitted to the agitator drive. Because of the random nature of the forces and the rotation of the shaft, the direction of these forces is constantly changing. A pitched blade or axial flow turbine normally pumps downward and generates and upward thrust. The thrust force is generally less than the weight of the unit. Upward pumping turbine thrust force will add to the unit weight. The net effect of the turbine thrust force is to offset or add to the unit weight, contributing to the variability of the support structure loading. The agitator has been designed to accommodate these forces, and as a result, the forces are transmitted directly to the agitator mounting nozzle or pad. The nozzle or pad and vessel top head must be rigid enough support the agitator weight and limit the angular displacement of the agitator drive to .05 degrees as a result of the torque and bending moment. Refer to the agitator assembly drawing for the nozzle or pad size and design loads.

See *Tables 3 and 4, pages 6 and 7,* for the recommended vessel head thickness vs. vessel diameter, agitator case size and mounting nozzle or pad size. These tables are to be used as a guide for determining when vessel head reinforcement is required.

The tables are based upon the use of ASME flanged and dished heads, atmospheric design pressures and ChemScale® agitation levels of 6 to 7. Elliptical or hemispherical heads of the same diameter and thickness are more rigid than ASME flanged and dished heads. Design pressures greater than atmospheric may required vessel head thicknesses greater than the table values.

MOUNTING

Very high ChemScale agitation levels may require vessel head thicknesses greater than the table values. If the vessel head is not rigid enough, the head thickness can be increased or a reinforcement pad (*Figure 2, page 4)* can be added.

This information is intended as a guide and does not relieve the user of completely analyzing the entire mounting system.

CAUTION! Optional pad type steady bearing (see IOM Manual 310, page 42 or Manual 320, page 36) may require the agitator mounting nozzle or pad to be precisely level and concentric with the steady bearing nozzle or pad. Call Chemineer Field Service for assistance.

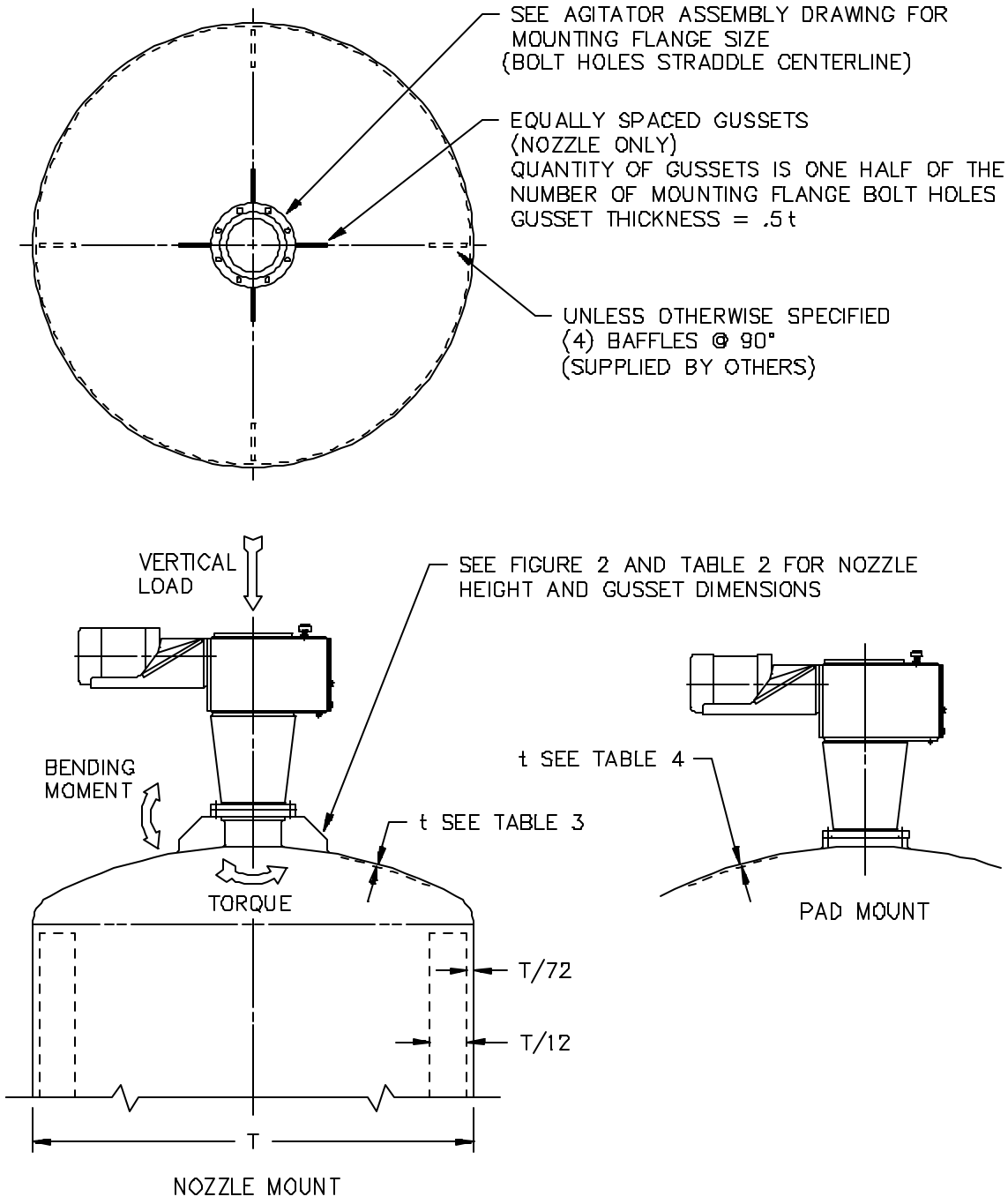


Figure 1: Agitator Mounting

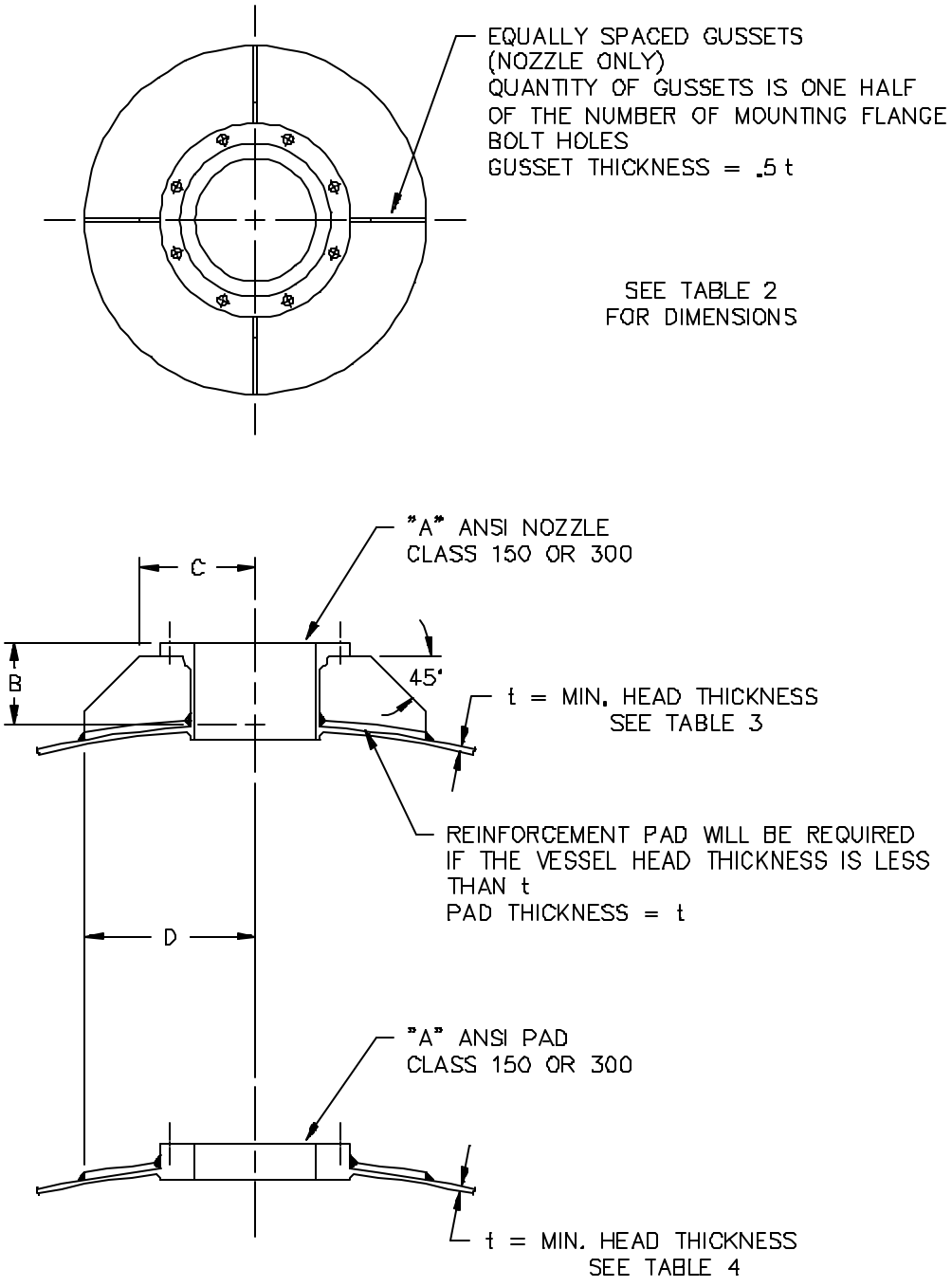


Figure 2: Agitator Mounting Nozzle/Pad

TABLE 2: AGITATOR MOUNTING NOZZLE/PAD REINFORCEMENT DIMENSIONS

Case Size	A	B	C	D
1, 2 & 3	8"	6" (152 mm)	8" (203 mm)	12" (305 mm)
4, 5 & 6	12"	8" (203 mm)	11.5" (292 mm)	17" (432 mm)
7 & 8	16"	8" (203 mm)	13.5" (343 mm)	19" (483 mm)
9	20"	12" (305 mm)	17.5" (445 mm)	26" (660 mm)
10 & 11	24"	12" (305 mm)	19.5" (495 mm)	28" (711 mm)
12 & 13	30"	12" (305 mm)	24" (610 mm)	31" (787 mm)

TABLE 3: VESSEL HEAD THICKNESS (t), NOZZLE MOUNT

Case Size	Nozzle Size	Vessel Diameter, Feet (Meters)				
		4 (1.22)	5 (1.52)	6 (1.83)	7 (2.13)	8 (2.44)
1	8"/10"	.125"(3.18mm)	.187"(4.76mm)	.187"(4.76mm)	.187"(4.76mm)	.250" (6.35 mm)
2	8"/10"	.187" (4.76mm)	.250"(6.35mm)	.250"(6.35mm)	.312"(7.92mm)	.312" (7.92 mm)
3	8"/10"	.312" (7.92mm)	.312"(7.92mm)	.375"(9.53mm)	.437"(9.53mm)	.437" (11.1 mm)
4	12"	.187" (4.76mm)	.250"(6.35mm)	.312"(7.92mm)	.312"(7.92mm)	.375" (9.53 mm)
5	12"	.250" (6.35mm)	.312"(7.92mm)	.375"(9.53mm)	.437"(11.1mm)	.500" (12.7 mm)
6	12"	.375" (9.53mm)	.437"(11.1mm)	.500"(12.7mm)	.562"(14.3mm)	.625" (15.9 mm)
7	16"	---	---	.375"(9.53mm)	.437"(11.1mm)	.500" (12.7 mm)
8	16"	---	---	.500"(12.7mm)	.562"(14.3mm)	.562" (14.3 mm)
9	20"	---	---	---	.437"(11.1mm)	.500" (12.7 mm)
10	24"	---	---	---	---	.500" (12.7 mm)
11	24"	---	---	---	---	.500" (12.7 mm)
12	30"	---	---	---	---	---
13	30"	---	---	---	---	---

Case Size	Nozzle Size	Vessel Diameter, Feet (Meters)				
		9 (2.74)	10 (3.05)	12 (3.66)	15 (4.57)	20 (6.10)
1	8"/10"	.250"(6.35mm)	.250"(6.35mm)	.312"(7.92mm)	.312"(7.92mm)	.375" (9.53 mm)
2	8"/10"	.375"(9.53mm)	.375"(9.53mm)	.375"(9.53mm)	.437"(11.1mm)	.437" (11.1 mm)
3	8"/10"	.500"(12.7mm)	.500"(12.7mm)	.500"(12.7mm)	.562"(14.3mm)	.562" (14.3 mm)
4	12"	.437" (11.1mm)	.437"(11.1mm)	.500"(12.7mm)	.562"(14.3mm)	.625" (15.9 mm)
5	12"	.500" (12.7mm)	.562"(14.3mm)	.625"(15.9mm)	.75" (19.1 mm)	.75" (19.1 mm)
6	12"	.625" (15.9mm)	.75" (19.1 mm)	.75" (19.1 mm)	.875"(22.2mm)	.875" (22.2 mm)
7	16"	.562" (14.3mm)	.562"(14.3mm)	.625"(15.9mm)	.75" (19.1 mm)	.875" (22.2 mm)
8	16"	.625" (15.9mm)	.687"(17.5mm)	.75" (19.1 mm)	.875"(22.2mm)	1.00" (25.4 mm)
9	20"	.562" (14.3mm)	.625"(15.9mm)	.687"(17.5)	.875"(22.2mm)	1.00" (25.4 mm)
10	24"	.562" (14.3mm)	.625"(15.9mm)	.75" (19.1 mm)	.875"(22.2mm)	1.00" (25.4 mm)
11	24"	.562" (14.3mm)	.625"(15.9mm)	.75" (19.1 mm)	.875"(22.2mm)	1.00" (25.4 mm)
12	30"	---	.625"(15.9mm)	.75" (19.1 mm)	.875"(22.2mm)	1.25" (31.7 mm)
13	30"	---	---	1.00"(25.4mm)	1.25"(31.7mm)	1.50" (38.1 mm)

TABLE 4: VESSEL HEAD THICKNESS (t), PAD MOUNT

Case Size	Pad Size 150#	Vessel Diameter, Feet (Meters)				
		4 (1.22)	5 (1.52)	6 (1.83)	7 (2.13)	8 (2.44)
1	8"/10"	.125"(3.18mm)	.125"(3.18mm)	.125"(3.18m m)	.125"(3.18mm)	.125" (3.18 mm)
2	8"/10"	.125" (3.18mm)	.125"(3.18mm)	.125"(3.18mm)	.187"(4.76mm)	.187" (4.76 mm)
3	8"/10"	.187" (4.76mm)	.187"(4.76mm)	.187"(4.76mm)	.250"(6.35mm)	.250" (6.35 mm)
4	12"	.187" (4.76mm)	.187"(4.76m)	.187"(4.76m)	.187"(4.76m)	.187" (4.76 mm)
5	12"	.250" (6.35mm)	.250"(6.35mm)	.250"(6.35mm)	.250"(6.35mm)	.250" (6.35 mm)
6	12"	.250" (6.35mm)	.250"(6.35mm)	.250"(6.35mm)	.312"(7.92mm)	.312" (7.92 mm)
7	16"	---	---	.250"(6.35m)	.250"(6.35mm)	.250" (6.35 mm)
8	16"	---	---	.312"(7.92mm)	.312"(7.92mm)	.312" (7.92 mm)
9	20"	---	---	---	.312"(7.92mm)	.312" (7.92 mm)
10	24"	---	---	---	---	.375" (9.53 mm)
11	24"	---	---	---	---	.375" (9.53 mm)
12	30"	---	---	---	---	---
13	30"	---	---	---	---	---

Case Size	Pad Size 150#	Vessel Diameter, Feet (Meters)				
		9 (2.74)	10 (3.05)	12 (3.66)	15 (4.57)	20 (6.10)
1	8"/10"	.125"(3.18mm)	.125"(3.18mm)	.125"(3.18mm)	.187"(4.76mm)	.250" (6.35 mm)
2	8"/10"	.187" (4.76mm)	.187"(4.76mm)	.250"(6.35mm)	.312"(7.92mm)	.375" (9.53 mm)
3	8"/10"	.250" (6.35m)	.312"(7.92mm)	.312"(7.92mm)	.375"(9.53mm)	.437" (11.1 mm)
4	12"	.250" (6.35mm)	.250"(6.35mm)	.250"(6.35mm)	.375"(9.53mm)	.500" (12.7 mm)
5	12"	.312" (7.92mm)	.312"(7.92mm)	.375"(9.53mm)	.437"(11.1mm)	.500" (12.7 mm)
6	12"	.375" (9.53mm)	.375"(9.53mm)	.437"(11.1mm)	.500"(12.7mm)	.625" (15.9 mm)
7	16"	.312" (7.92mm)	.312"(7.92mm)	.375"(9.53mm)	.437"(11.1mm)	.562" (14.3 mm)
8	16"	.375" (9.53mm)	.375"(9.53mm)	.437"(11.1mm)	.500"(12.7mm)	.625" (15.9 mm)
9	20"	.375" (9.53mm)	.375"(9.53mm)	.437"(11.1mm)	.500"(12.7mm)	.625" (15.9 mm)
10	24"	.437" (11.1mm)	.437"(11.1mm)	.437"(11.1mm)	.562"(14.3mm)	.687" (17.5 mm)
11	24"	.375" (9.53mm)	.437"(11.1mm)	.437"(11.1mm)	.562"(14.3mm)	.687" (17.5 mm)
12	30"	---	.500"(12.7mm)	.500"(12.7mm)	.625"(15.9mm)	.75" (19.1 mm)
13	30"	---	---	.625"(15.9mm)	.75" (19.1 mm)	1.00" (25.4 mm)