

Reactor tanks for biogas

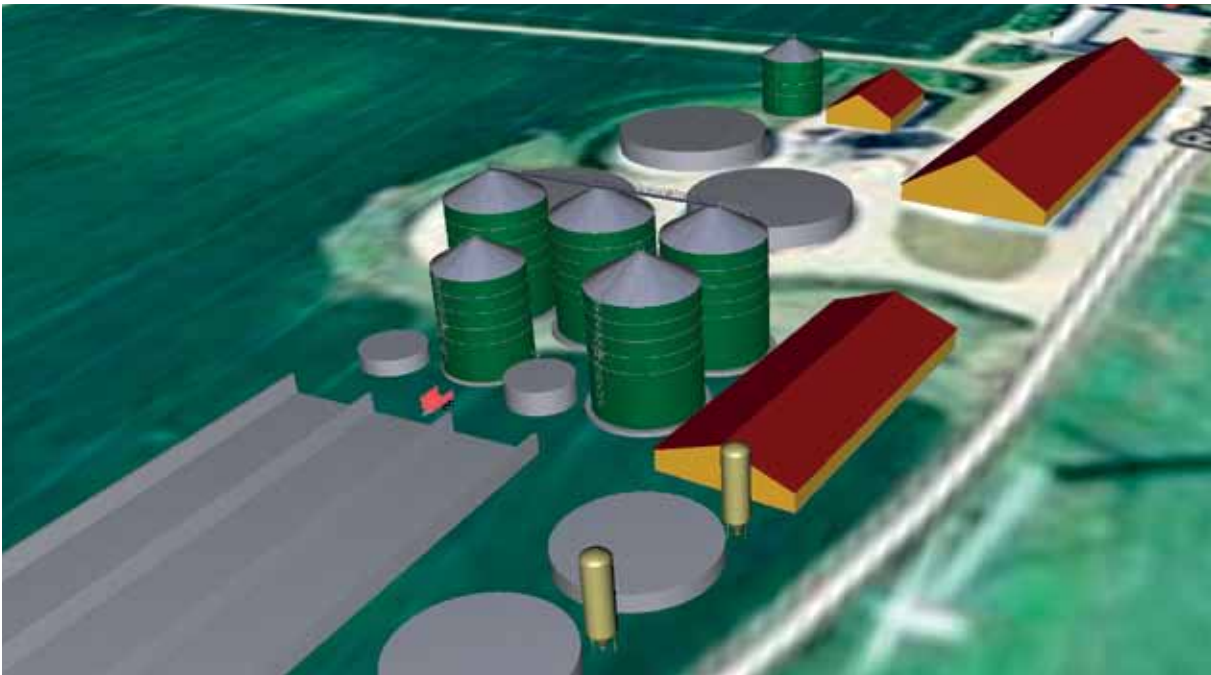


Biogas tanks from Assentoft Silo A/S

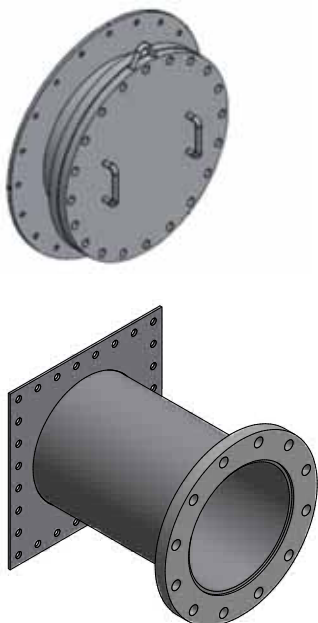
Assentoft Silo supplies biogas reactor and storage tanks made from bolted steel plates, insulated, if required. Twenty-five years of experience in biogas projects and other major industrial projects throughout Europe makes Assentoft Silo an attractive partner, providing active coaching and help in designing your complete system.

Design of your biogas plant

In the tender and design phase, we prepare 3D drawings and films to illustrate the plant.



We often perform many versions of a plant, before the final design is determined.



We help designing the plant and positioning the spools, components and equipment

In cooperation with our experienced project managers design and placement of connectors and components is determined and illustrated in detailed drawings.

Choosing the right reactor tank

Assentoft Silo's reactor tanks provide maximum flexibility in:

- Selection and composition of materials - glass enameled, stainless steel, epoxy coated or galvanized steel sheets - as well as a choice between insulated steel roof or membrane roof.
- Sizes from 500 m³ to 7,000 m³ with optional combination of height and diameter.
- Suitable for center stirrer, side mounted stirrer and gasmix.
- Used as both primary and secondary reactor vessels and storage tanks.
- Minimization of heat loss by effectively insulation of the tank wall and the roof.

Documentation of the plant

A thorough static calculation is provided with every tank according to current Eurocodes standards, taking local wind loads, snow loads, operating pressure, vacuum, and influences from stirrer into consideration. This static calculation can be used for project approval by the authorities.



Help calculating operating and construction costs for a plant

In collaboration with the two leading manufacturers of insulation, Assentoft Silo has developed a calculation of heat losses in the steel and concrete reactor tanks. To be used when comparing total costs for a project.

Comparison of a 4030 m³ steel tank and a 4020 m³ concrete tank

Enter the following	Steel reactor tank	Concrete reactor tank
The price for heating i kW	DKK 0.25	DKK 0.25
Price pr. kW	DKK 0.25	DKK 0.25
Interest rate	6%	6 %
The cost of the tank is amortized over	20 years	20 years
Diameter	17.01 m	32.00 m
Hight - tank wall	17.75 m	5.00 m
Insulation thickness: roof	200 mm	20 mm
Insulation thickness: wall	200 mm	100 mm
Insulation thickness: foundation	150 mm	150 mm
Tank price incl. insulation, foundation and agitator	DKK 3,300,000	DKK 2,700,000
Construction grants	30 %	30 %

Total yearly expenses for the whole tank	Steel reactor tank		Concrete reactor tank	
	Thermophillic	Mesophillic	Thermophillic	Mesophillic
Volume gross	4030 m ³		4020 m ³	
Volumes net with 0.5 mm freeboard	3890 m ³		3620 m ³	
Price, deducting the construction grant	DKK 2,310,000.00		DKK 1,890,000.00	
Costs,tank investment ,amort.over: 20 years	DKK 201,396	DKK 201,396	DKK 164,779	DKK 164,779
Costs for heat loss per year, roof	DKK 5,771	DKK 2,918	DKK 140,403	DKK 89,311
Costs for heat loss per year, tank wall	DKK 23,296	DKK 11,780	DKK 19,396	DKK 12,274
Costs for heat loss per year, foundation	DKK 10,961	DKK 5,549	DKK 31,034	DKK 19,639
Cost of power for stirring per year	DKK 31,536	DKK 31,536	DKK 78,840	DKK 78,840
Cost for pumping the biomass, per year				
Cost for pumping the gas, per year				
Cost of maintenance, per year				
Other operating expenses, per year				
Annual expenditure, total	DKK 272,960	DKK 253,180	DKK 434,453	DKK 364,842

Note. You will need 3 stirrers for a concrete tank but only one top-mounted stirrer for a steel tank.

Above is an example of a complete estimate for a customer in Denmark.

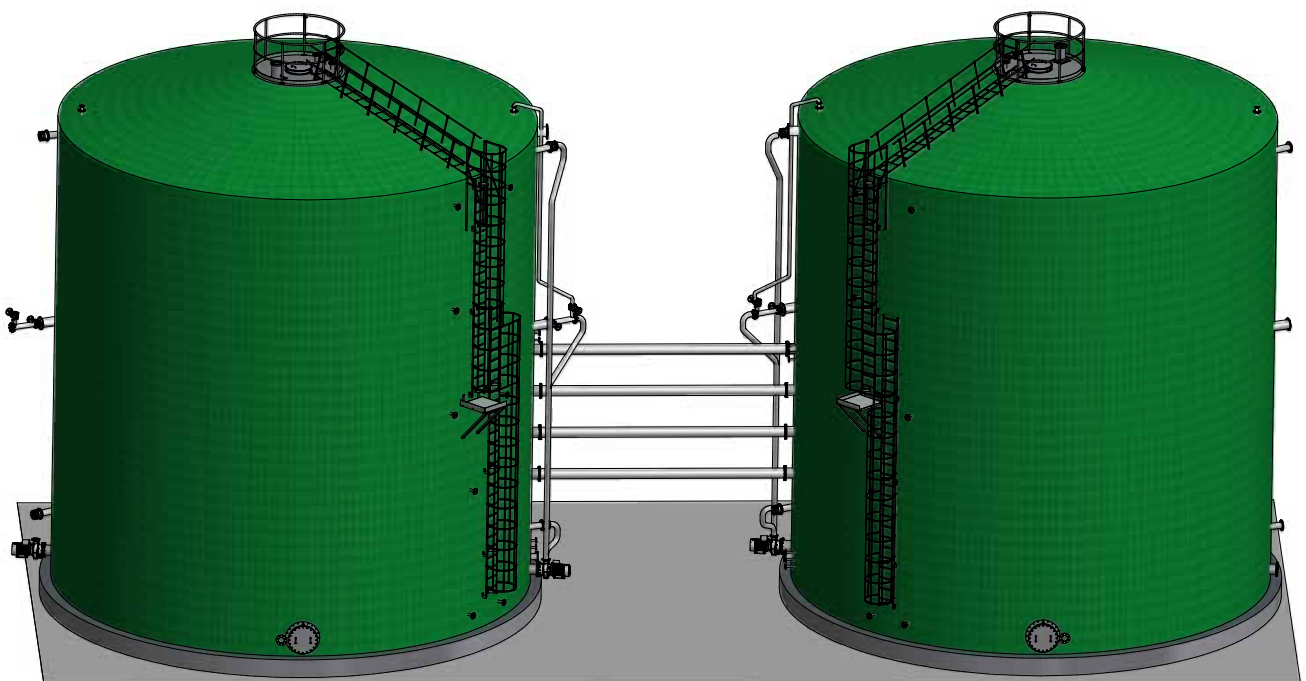
In-house production of components for biogas plants

When buying tanks from Assentoft Silo, you are as close as possible to the tank manufacturer. Therefore, the quality is high - and the price reasonable.

- Assentoft Silo buys steel in large quantities, directly at the steel mills.
- Angle iron, ladders, platforms, railings, spools, flanges, etc. are efficiently produced in our own workshop.
- Flanges are welded on to pipes and bends, galvanized or sandblasted and coated on our own plant.
- Electric control is designed and produced in our own electrical workshop.

Purchasing services from Assentoft Silo includes

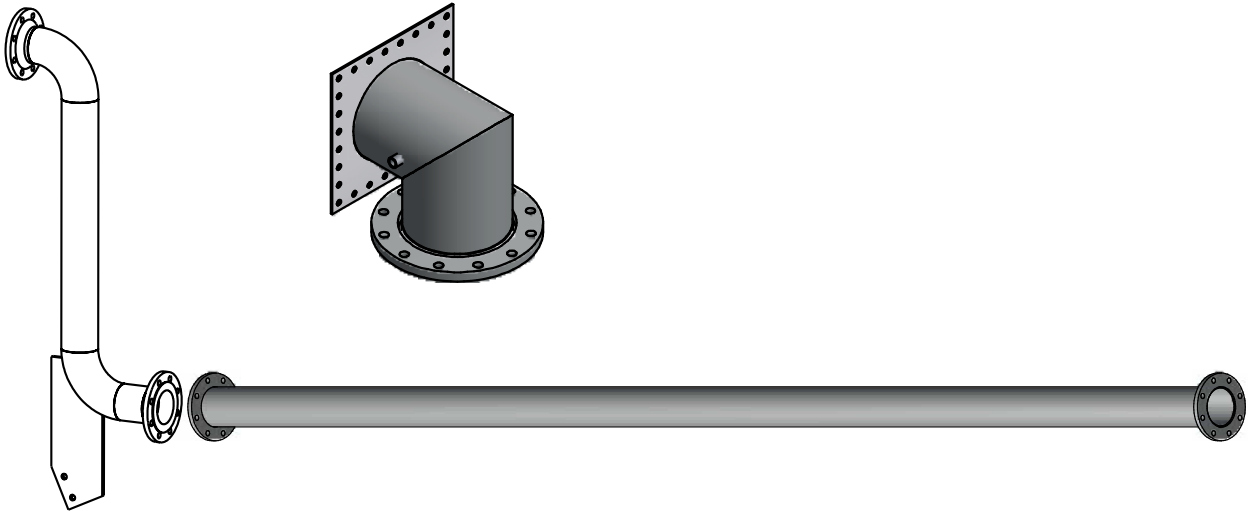
25 years of experience in building biogas tanks, including Denmark's first tank from 1988 to Nordvestjysk Folkecenter, and more than 30 reactor tanks in Denmark subsequent.



**Reactor Tanks: 2 x 1,500 m³ for the demonstration plant
Ringkøbing Skjern, built by Assentoft Silo in
June 2012 for ComBigaS.**

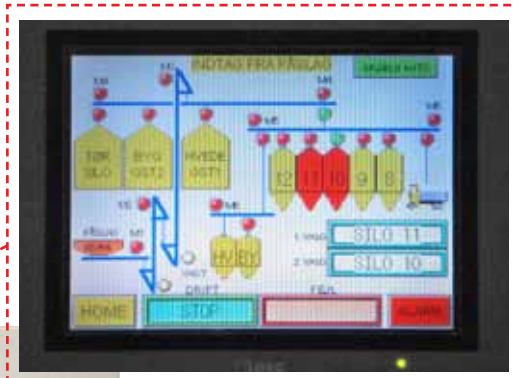
Piping

Pipes, bends, spools etc. of any size can be supplied according to customer requirements Produced, sandblasted and coated at our factory in North Jutland.



Control panels for controlling biogas plants

We have a large production of electric control panels for our silo plants, also for industrial purposes and biogas.



Our electric control panels are made with PLC and touch screen for management and monitoring of the biogas plant. Including connection to analog and digital input signals and perhaps connection to the internet for external monitoring and service. We can also offer GSM based alarm system, calling up to more than one priority-controlled numbers for voice or text message.

Assentoft Silo secures a satisfying result that lasts!

- 500 industrial projects and 4,000 farm silo projects throughout Europe is the proof.

Reactor tanks from Assentoft Silo are designed for 30 years of operation.

Standard operating pressure in a steel tank is 0.03 mbar or 300 mm water column, which moves the gas on in the process without a gas blower.

The tanks are suitable for both thermophilic and mesophilic operation - or switching between the two types.

Tanks, where the diameter and height corresponds to each other, is less expensive to stir, and it is easier to obtain an effective stirring without any dead zones and channeling. This provides higher gas production and more efficient use of the tank.

With bolted tanks a short erection time is required, and there is no hot work on the site.

The 2,000 m³ reactor tank built for ComBigas east of Berlin in 2011 (before insulation).



■ In Denmark and other European countries, Assentoft Silo delivers effective and reliable project management

Assentoft Silo provides complete tank or silo solutions also for storage of grain, maize kernel, cement, sand, bitumen, fish oil etc. In addition we act as subcontractor of tanks and silos for leading Danish suppliers of e.g. concrete plants, asphalt plants and flue gas cleaning filters.



3.300 m³ silo for cement delivered in France, 2009.

Volume in the silo shell m³

(Assentoft Silo standard plate sizes 2.4288 x 1.179)

No. of rings		4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
Height		4,78	5,96	7,14	8,32	9,50	10,68	11,86	13,04	14,22	15,40	16,58	17,76	18,94	20,11	21,29	22,47	23,65	24,83
Diam.	Sheets																		
3,87	5	56	70	84	98	112	125	139	153	167	181	195	208	222	236	250	264	278	291
4,64	6	81	101	121	141	161	181	200	220	240	260	280	300	320	340	360	380	400	420
5,41	7	110	137	164	191	219	246	273	300	327	354	381	408	436	463	490	517	544	571
6,18	8	144	179	215	250	285	321	356	392	427	463	498	533	569	604	640	675	711	746
6,96	9	182	227	272	316	361	406	451	496	541	585	630	675	720	765	810	855	899	944
7,73	10	225	280	335	391	446	501	557	612	667	723	778	834	889	944	1.000	1.055	1.110	1.166
8,50	11	272	339	406	473	540	607	674	741	808	875	942	1.009	1.076	1.143	1.210	1.276	1.343	1.410
9,28	12	323	403	483	563	642	722	802	881	961	1.041	1.121	1.200	1.280	1.360	1.439	1.519	1.599	1.679
10,05	13	380	473	567	660	754	847	941	1.034	1.128	1.222	1.315	1.409	1.502	1.596	1.689	1.783	1.876	1.970
10,82	14	440	549	657	766	874	983	1.091	1.200	1.308	1.417	1.525	1.634	1.742	1.851	1.959	2.068	2.176	2.285
11,60	15	505	630	754	879	1.004	1.128	1.253	1.377	1.502	1.626	1.751	1.875	2.000	2.125	2.249	2.374	2.498	2.623
12,37	16	575	717	858	1.000	1.142	1.284	1.425	1.567	1.709	1.850	1.992	2.134	2.276	2.417	2.559	2.701	2.842	2.984
13,14	17	649	809	969	1.129	1.289	1.449	1.609	1.769	1.929	2.089	2.249	2.409	2.569	2.729	2.889	3.049	3.209	3.369
13,92	18	728	907	1.086	1.266	1.445	1.625	1.804	1.983	2.163	2.342	2.521	2.701	2.880	3.059	3.239	3.418	3.597	3.777
14,69	19	811	1.011	1.211	1.410	1.610	1.810	2.010	2.210	2.410	2.609	2.809	3.009	3.209	3.409	3.609	3.808	4.008	4.208
15,46	20	898	1.120	1.341	1.563	1.784	2.006	2.227	2.448	2.670	2.891	3.113	3.334	3.556	3.777	3.998	4.220	4.441	4.663
16,24	21	991	1.235	1.479	1.723	1.967	2.211	2.455	2.699	2.943	3.188	3.432	3.676	3.920	4.164	4.408	4.652	4.896	5.141
17,01	22	1.087	1.355	1.623	1.891	2.159	2.427	2.695	2.963	3.230	3.498	3.766	4.034	4.302	4.570	4.838	5.106	5.374	5.642
17,78	23	1.188	1.481	1.774	2.067	2.360	2.652	2.945	3.238	3.531	3.824	4.117	4.409	4.702	4.995	5.288	5.581	5.874	6.166
18,55	24	1.294	1.613	1.931	2.250	2.569	2.888	3.207	3.526	3.845	4.163	4.482	4.801	5.120	5.439	5.758	6.076	6.395	6.714
19,33	25	1.404	1.750	2.096	2.442	2.788	3.134	3.480	3.826	4.172	4.518	4.864	5.210	5.556	5.901	6.247	6.593	6.939	7.285
20,10	26	1.518	1.893	2.267	2.641	3.015	3.389	3.764	4.138	4.512	4.886	5.260	5.635	6.009	6.383	6.757	7.131	7.506	7.880
20,87	27	1.637	2.041	2.445	2.848	3.252	3.655	4.059	4.462	4.866	5.269	5.673	6.076	6.480	6.883	7.287	7.691	8.094	8.498
21,65	28	1.761	2.195	2.629	3.063	3.497	3.931	4.365	4.799	5.233	5.667	6.101	6.535	6.969	7.403	7.837	8.271	8.705	9.139
22,42	29	1.889	2.355	2.820	3.286	3.751	4.217	4.682	5.148	5.613	6.079	6.544	7.010	7.475	7.941	8.407	8.872	9.338	
23,19	30	2.022	2.520	3.018	3.516	4.014	4.513	5.011	5.509	6.007	6.505	7.004	7.502	8.000	8.498	8.996	9.495	9.993	
24,74	32	2.300	2.867	3.434	4.001	4.567	5.134	5.701	6.268	6.835	7.402	7.968	8.535	9.102	9.669	10.236	10.803	11.370	
26,29	34	2.597	3.236	3.876	4.516	5.156	5.796	6.436	7.076	7.716	8.356	8.996	9.636	10.275	10.915	11.555	12.195		
27,83	36	2.911	3.628	4.346	5.063	5.781	6.498	7.215	7.933	8.650	9.368	10.085	10.802	11.520	12.237	12.955	13.672		
29,38	38	3.243	4.043	4.842	5.641	6.441	7.240	8.039	8.839	9.638	10.437	11.237	12.036	12.835	13.635	14.434			
30,92	40	3.594	4.480	5.365	6.251	7.137	8.022	8.908	9.794	10.679	11.565	12.451	13.336	14.222					
34,02	44	4.349	5.420	6.492	7.564	8.635	9.707	10.779	11.850	12.922	13.994	15.065							
37,11	48	5.175	6.451	7.726	9.001	10.277	11.552	12.827	14.103	15.378	16.654								
40,20	52	6.074	7.570	9.067	10.564	12.061	13.558	15.054	16.551										
46,39	60	8.086	10.079	12.072	14.065	16.057	18.050												

All-welded silos and tanks

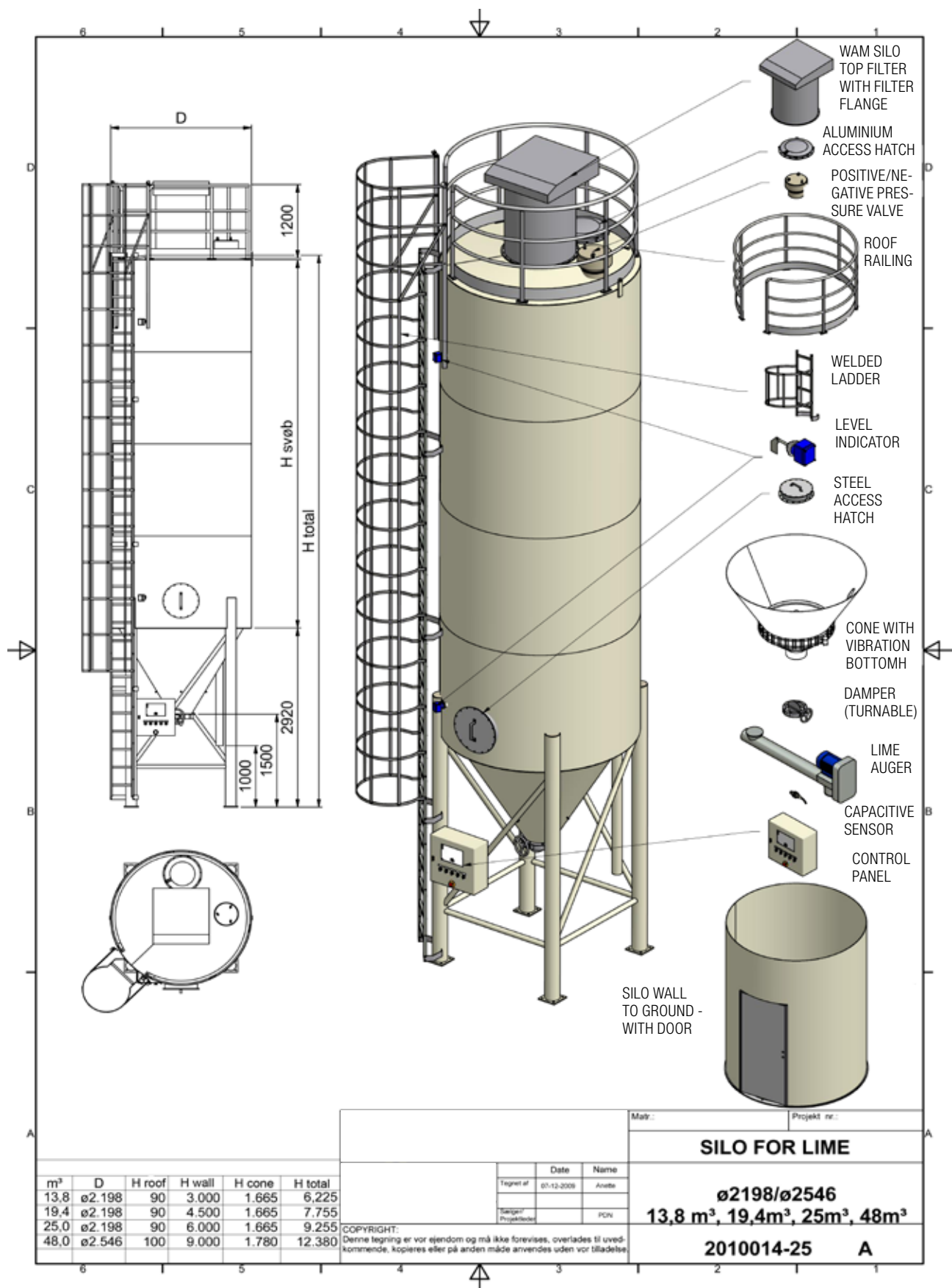
Rational storage and handling of dry products/residues and liquid raw materials for biogas production. Welded tanks and silos from 10 m³ and up to 150 m³, designed, produced and supplied on site.

On our own factory in North Jutland 15 certified welders produce tanks, silos and piping systems. The tanks are sandblasted and epoxy treated in our own paint shop and insulated, if required by customer.

The tanks are made as standard products – with the possibility of equipping after customer demand. Diameters from 2546 to 4500 mm.



Example of equipment on an all-welded silo





assentoft silo

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