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7. Grain Storage Silos in Steel (Sweden)

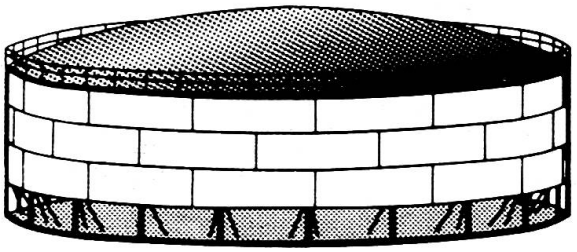
Gränges Hedlund has built a large storage silo plant for Göta Lantmän, Norrköping, Sweden. The silos are used for storage of grain and oil-plants before export. The storage capacity is about 125 000 m^3.

There are two types of storage silos, 10 silos with diameter 25 m and height 25 m and 8 silos with diameter 6 m and height 31 m.

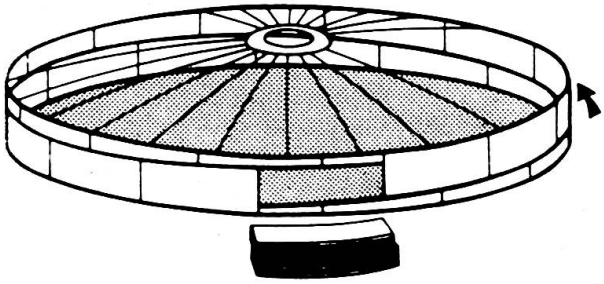
The most common method of erecting steel tanks and silos in Sweden, is to first assemble the roof and the top course and then lift the silo by jacks in steps of about 2 meters, then assemble a new course, lift 2 meters again etc etc until full height.

For the storage silos with diameter 25 m we used in this case a variation of this method called the «spiral method» working as follows:

1 On a bottom – or in this case a foundation ring – a bottom course is welded which during one turn varies in height after a spiral from about 0,3 m to full course height – in this case 2 meters – which gives an angle of about 1,2 degrees.
2 Small hydraulic jacks are put on the top edge of the course and above them the course which is closest to the roof made with the same angle although in the lower edge.
3 The roof is completely finished.
4 The two spirally formed courses are twisted by help of the small jacks in relation to each other one length of the course plate so it will be possible to weld a rectangular course plate to the top course in the hole made. By continuing the twisting and assembling of course plates you can stay on the same spot to store, erect and weld on direct connection with the opening until the silo has reached its full height. This means in this case that the storage silos could be placed very close to each other. Another advantage is that you do not have to wait for the next course edge in order to vary the shell wallthickness. Instead you can successively increase the wall thickness plate by plate, which reduces the total steel weight.



Jacking up method

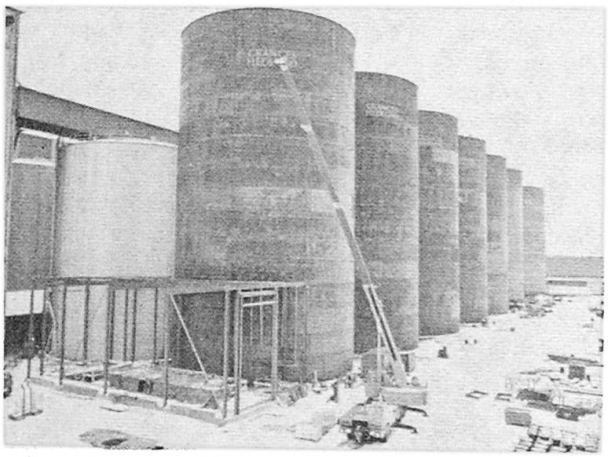


Spiral method

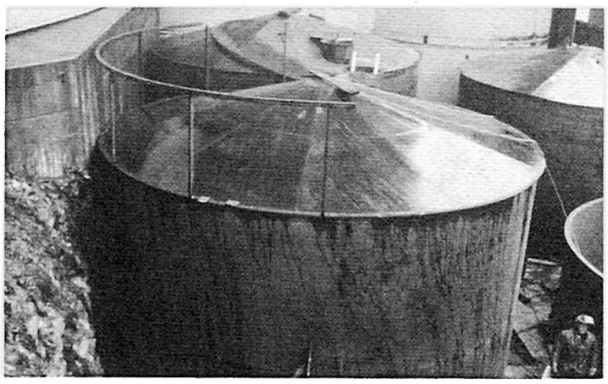
The building of the storage silo plant has been going on in different stages. In January 1984 Gränges Hedlund got the assignment to build further 4 storage silos with diameter 6 m and height 31 m.

This time the space was even more narrow and the erection time was very limited.

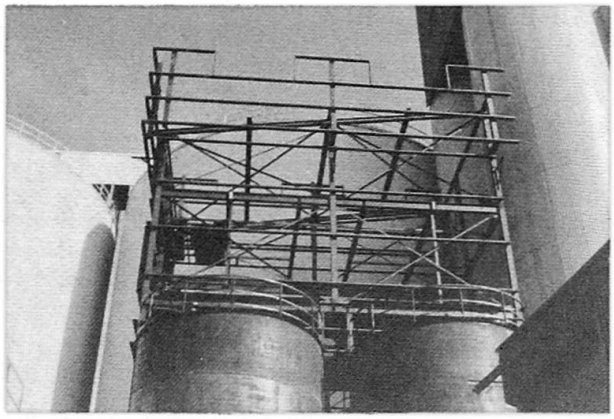
First we built the roof and the top course on an erection foundation beside the definite foundation and then we lifted the silos in position, assembled the jacks and lifted the silos course by course in such a way that we could stand on the foundation and weld from the inside, which was necessary in order not to damage already existing silos and buildings. It was also an advantage with regard to the weather. The erection started at the end of January in full winter with a lot of snow.



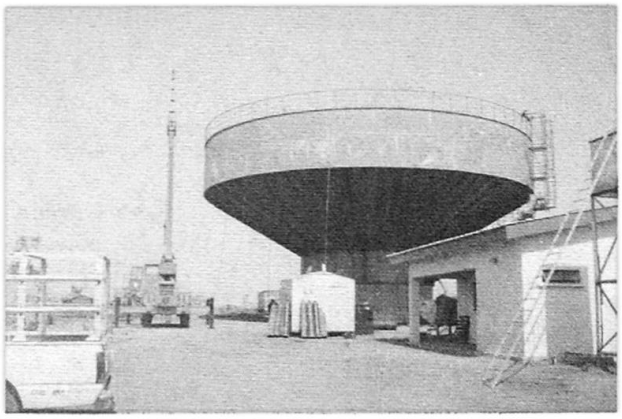
Grain storage silos ∅25 m, h 25 m, erected with spiral method



Grain storage silos ∅6 m, h 31 m, erected with jacking up method



Wind stabilizing by letting a steelstructure follow during the erection



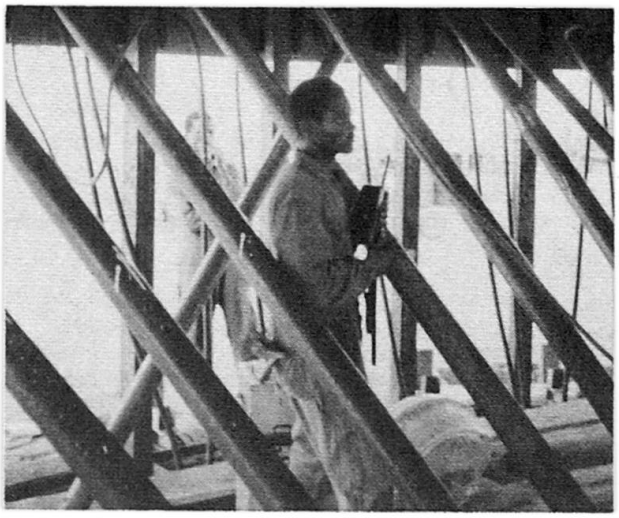
Water tower reservoir ready. The shaft is erected by jacking up method

There were some problems. You cannot erect a storage silo with the base 6 m and the height 31 m without anchoring against the wind. It was impossible to anchor with stay wires. We chose to let a permanent steelstructure follow during the jacking up period. The steelstructure was reinforced so that we could count the 4 silos as one unit. In this way we got a base of 12,5 m, which was enough including the stabilized weight, but under the condition that the cladding of the steelstructure was erected afterwards.

An advantage was that the steelstructure could be manufactured parallel to the storage silo and that we could avoid erection on high level.

Another interesting steel project is the delivery of a water tower for State Water Board in Kaduna, Nigeria, of 2500 m^3. We have built the water reservoir first and then lifted the reservoir with jacks and erected the shaft course by course.

(Kjell Andersson)



Jacking ups