

*Case study:*

## **Alimak Hek sets new records at Europe's tallest residential tower**



*Turning Torso, Malmö, Sweden*



***Other prestigious projects  
where Alimak construction  
hoists have been used***

- *Dokaae (Al-Kala Project),  
Mecca, Saudi Arabia*
- *Eiffel Tower, Paris, France*
- *Statue of Liberty,  
New York, USA*
- *Taipei 101, Taipei, Taiwan*
- *Petronas Towers,  
Kuala Lumpur, Malaysia*
- *CN Tower, Toronto, Canada*
- *Emirates Towers,  
United Arab Emirates*
- *Burj Al Arab, Dubai*
- *Viaduc de Millau, France*
- *Channel Tunnel,  
England-France*
- *Troll production platform,  
North Sea*
- *Oresund Bridge,  
Sweden-Denmark*

# Turning Torso, Malmö, Sweden

## 190 m and a unique building design are no problem for the Alimak construction hoists

**When one of Europe's largest residential towers, the 190 m high Turning Torso, advanced above its 15th-story in Malmo, Sweden, the contractor changed the configuration of its dual Alimak construction hoists to high speed – the first in Sweden – to keep up with the pace of construction.**

Two Alimak Scando 10/32 FC units had been installed by completion of the third floor for transportation of people and materials. By the 15th story, the hoists were reconfigured for high speed operation. Reconfiguring the hoists enabled a speed of 60 m/min – for the first time in Sweden – reducing travel time for passengers and materials by up to 50 percent.

This type of hoist will become more common as buildings become taller and time schedules shorten.

The ground breaking for the 54-story Turning Torso project was in February 2001 with construction commencing four months later. The 190 m tall tower 'topped-out' by mid-October 2004, and was completed in 2005.

The Turning Torso breaks new ground in architectural terms. It consists of nine cubes with five stories each. The cubes twist from top to bottom, producing an astonishing effect. The building twists 90-degrees from the bottom to the top, thus the name "Turning Torso."

### Building for the future

The tower is situated in Malmo's former western docks and is part of a massive regeneration project. This area had become a 'backwater' in southern Sweden, particularly following the closure of its docks.

This all changed with the opening of the Oresund Bridge linking to the Danish capital, Copenhagen. Today, with traffic movement and train passengers exceeding projected targets between the two cities, the area has seen a property boom.

### On completion

In total, 152 apartments will be located between cubes three and nine. Each floor will feature approximately 400 m<sup>2</sup> of living area comprising an almost square area around the centre core plus a triangular section reinforced by an external steel support.

In addition to the residential floors, the 'torso' will also provide more than 4,000 m<sup>2</sup> of office space in the two lower cubes.

### Superstructure

At the heart of the tower, a central core shaft is being poured using an automatic climbing system weighing 140 tons.

Progressing three levels above the slab construction, the system completes the shaft walls to a thickness of 2.5 m at the base reducing to 40 cm by the 54th story.

Completion of each floor slab was originally anticipated to take seven days, but the projected completion cycle was reassessed as a result of the excessive reinforcement necessary for such a structure.

There is no other building like this, claims the project director. At 250 kg/m<sup>2</sup>, it has the same reinforcement as a nuclear power plant. This extreme level of reinforcement is necessary to withstand the tower's forces through the core and slabs.

As a direct consequence, the contractors were able to achieve an eight-day cycle for standard slabs and nine days for each conical slab. The lower and upper slabs of each cube incorporate a higher degree of reinforcement and met 12- and 10-day cycles respectively.

Throughout construction of the lower levels, a Swedish standard K60 concrete strength was specified, changing to K45 for the upper levels.

When it was completed, the project used more than 64,000 tons of steel reinforcement and concrete at a pour rate of up to 150 tons of concrete/h. The tower also established a new Swedish record for pumping concrete to a height of 190 m.



## Case study:

**Although the tower's unique, twisting design presented challenges for tie-in and landing placement, Alimak engineers provided a solution that allowed the Alimak Scando hoist to successfully follow the curvature of the tower's face and transport workplace personnel and construction materials safely and efficiently.**

Both hoists have 1.5 m wide cages. One is 3.2 m deep, while the other has been extended to 3.9 m.

Extending the cage allowed two facade panels to be transported in the hoist, each weighing up to 400 kg – further improving the efficiency of material movement on-site.

With the unique shape requiring a 1.6-degree rotation of each level in order to provide a full 90-degree turn at the top of the tower, positioning of the Alimak hoists was critical to the successful transportation of the workforce and materials.

The optimum position was determined so as not to interfere with the 'turning' slabs. Nevertheless, the tower's slight curvature presented tie-in and landing challenges.

The solution was provided by tying the mast system to the tower every 20 m at the bottom slab of each cube and erection of scaffolding in front of the hoist cage for access to the other slabs.

Throughout construction of the upper cubes, ties were installed every 6 m to offer additional resistance against the prevailing high winds.

Following the slight curvature on the face of the tower meant that landings vary floor to floor – from 1.2 - 2.5 m across to the scaffolding. During progressive construction of the top two cubes, landings were made for each floor level to ease movement of materials. As the cubes progressed, in order to improve transportation efficiency, landings were made only on the top floor of the lower cubes.

With the reconfiguration of the two Alimak hoists, travel time from the ground to the 52nd story was 2 min 45 sec. By the time the tower 'topped-out' the mast had been extended to a height of 190 m.



### DETAILS

Location	Turning Torso, Malmö, Sweden
Hoist type	Alimak Scando FC 10/32 FC II
Number of cages	2
Capacity	1,000 kg/cage
Cage size, internal	1.5 x 3.2/3.9 x 2.55 m (W x L x H)
Speed	0–60 m/min
Lifting height	180 m

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