

Construx bv, 8531 Hulste, Belgium

“Top of Mind” in 3D electrical substation moulds

Construx is one of Europe’s leading mould manufacturers and developed over time a vast portfolio of moulds that suit precast manufacturers’ needs. In close collaboration with the customer Construx tries to find the most appropriate mould which is in accordance with all technical specifications, which fits the customers’ budget and which copes with the dimensions and numbers of precast elements the customer wants to cast. For companies supplying precast electrical substations, Construx conceived over the years a full range of state of the art substation moulds.

Either fixed, adjustable or even fully automated, substation moulds are among the most complex 3D-moulds due to the special design and technical specifications of these electrical transformer housings. Being “Top of Mind” in 3D electrical substation moulds, Construx became a leading supplier for many major European precast substation manufacturers.



Precast concrete electrical substation, ready to be dispatched

Germany: PLC controlled fully hydraulically and electrically adjustable mould with 180° turning station

The substations are poured upside-down and turned 180° on a 65 T capacity turning station before they are transported by an overhead crane to the finishing bay. This fully hydraulically and electrically substation mould is conceived to manufacture eight different lengths and three different widths with the following possible dimensions:

- Inside length adjustable from 2,180 mm to 6,380 mm, with 600 mm increments;
- inside width 2,300 mm, 2,500 mm and 3,780 mm;
- inside height from 2,500 mm to 3,600 mm, steplessly adjustable;
- wall thickness adjustable from 100 mm to 200 mm, with 20 mm increments;
- floor thickness from 120 mm to 300 mm, steplessly adjustable.

The outside mould has three hydraulically movable panels, the fourth panel can be opened electrically over a distance



PLC controlled fully hydraulically and electrically adjustable mould



Fully automated 180° turning station with 65 T capacity



Substation sitting on the second tilting station, ready to be transported to the finishing area

of 3,000 mm. Vibrating the elements is done with 30 high frequency vibrators. The inside mould has a fixed part and a movable part with modular intermediate parts of 600 mm, 1,200 mm and 2,400 mm, which can be fit in individually or together. The width of each module and of the complete inside mould can be adjusted with one single movement by means of electric spindles. The intermediate parts can be prepared on beforehand in order to speed up the adjustment of the mould. When demoulding, first the inside corners are pulled down hydraulically after which the wall panels are pulled down hydraulically, this leaves an 8 mm opening on all sides. All hydraulic rams and electric spindles are controlled by means of a PLC with touchpad which also shows the work-flow graphics.

For manipulating the substations, Construx conceived a 180° turning station with a 65 T capacity. This device consists of a set of two combined 90° tilting stations with a 6 m transport system in between, so the customer can either tilt the elements 90° or turn them 180°. It also has a 14 m long transverse movement for transporting the substations to the finishing bay.



Precast Moulds & On-Site Formwork



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Hazebeekstraat 11

Hulste, Belgium

+32 56 72 47 93

info@construx.eu



Belgium: Manually operated substation moulds

A simple way of manufacturing electrical substations is to pour the base first, after which the walls are poured onto the base. Construx made a large number of this type of moulds for the Belgian market.

The first was a simple box type substation with fixed dimensions:

- Length 3,450 mm x width 2,700 mm x height 2,910 mm;
- wall thickness: 70 mm with enlargements inside (to support the intermediate slab) and outside (to support the cladding).

The second substation production unit of this type consisted of two moulds, one for the basement and another for the superstructure. Both moulds have tapered walls.

The basement mould has the following dimensions:

- Length 1,830 mm x width 1,660 mm x height 2,535 mm;
- tapered outside walls: from 152 mm to 68 mm.

The superstructure mould has the following dimensions:

- Length 1,770 mm x width 1,570 mm x height 1,680 mm;
- tapered outside walls: from 82 mm to 68 mm.

Both the base and the superstructure elements are cast upside down and turned 180° the next day using a tilting frame.

The third substation mould was, once again, a simple box type substation with fixed dimensions:

- Length 6,360 mm x width 2,660 mm x height 2,500 mm;
- wall thickness 80 mm.



Manually operated substation mould

France: PLC controlled production unit with turning device

This design involves an automated production unit for electrical substations. The system includes three fixed tables to pour the base plate and the two half sections of the roof, plus a hydraulically shrinkable mould to pour the housing itself. Seen the elements are being poured upside down, Construx also provided a lifting frame with an automated hydraulic turning device. The inside of the housing mould has a fixed tapered divider panel, two hydraulically retractable parts and one hydraulically shrinkable inside corner. The four separate outside panels are hydraulically moveable. A steel base sits around the core and is supported by hydraulic cylinders which push the cabin up whilst demoulding. A PLC controls the sequence of the hydraulic movements and makes the remote controlled demoulding process fully automated and perfectly secured.

Dimensions of the substation:

- Length 2,600 mm x width 2,300 mm x height 2,050 mm;
- tapered outside walls from 75 mm to 50 mm.



PLC controlled production unit with turning device

Germany: Mould for the upright casting of wind turbine control pods

Construx conceived a precast system to manufacture monolithic control pods, including floor slab, walls and roof, without having to turn them 180°. First, the walls and the roof are cast as one single unit. The next day, this unit is taken out and positioned on a table, after which the floor slab is cast. The pod is made straight up, so there is no need to turn the elements and fixing the steel and fitting the accessories is made easy. The inner mould shrinks hydraulically and has a wedge system to sufficiently release the precast element. The bases

feature a discontinuous pattern of openings to let the rebar stick through. These openings are sealed and released in one single movement. The bases also have four box-outs which serve to create concrete spacers whose height is identical to the thickness of the slab. After the first phase, the entire unit (walls and roof) is moved and fit onto the formwork table. The unit is positioned on its four concrete spacers after which the floor slab is cast, thus creating a monolithic 3D element in its upright position, without the need to turn it. Dimensions of the substation:

- Length 4,658 mm x width 2,275 mm x height 2,845 mm;
- wall thickness 150 mm.

Hungary: Electrical substation mould with full hydraulic demoulding

At first sight, these substations have a simple, rectangular geometry. Because they have no inside walls, the upside-down cast should be easy to demould. Nevertheless, the 3 m height of the elements, the absence of shrinkable parts on the inside core and the limited taper on the outside walls make the demoulding a difficult matter. The demoulding is initiated by pushing the bases up and consequently lifting the element out of the mould by means of perfectly synchronized hydraulic rams. The inside of the mould, with the hydraulic unit and a cylindrical flow divider, is accessible through two large door recesses. The four individual outside panels can be opened and closed by means of hydraulic rams. Next to the two door



Mould for the upright casting of wind turbine control pods



Electrical substation mould with full hydraulic demoulding



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openings, there are three more large window openings, all of which have perfectly fitted and sealed recess formers. Vibrating the concrete is done with twelve electrical vibrators, six of which are fixed on the inside mould and the other six are on the outside panels.

Dimensions of the substation:

- Length 4,255 mm x width 2,340 mm x height 3,000 mm;
- tapered outside walls with a step from 160 mm to 65 mm.

Germany: Mould with fixed inside core

These substations are poured upside-down and they have several inside walls and loads of opening in the outside walls. Construx conceived the mould without any shrinkable parts on the inside core. All walls are slightly tapered and all box-outs are conical and self-releasing. The demoulding is initiated by pushing the bases up and consequently lifting the element out of the mould by means of perfectly synchronized hydraulic rams. The inside of the mould, with the hydraulic unit and the cylindrical flow divider, is accessible through two large door recesses. All other movements of the mould parts are manual. The four individual outer panels of the mould are mounted on rollers and can be opened and closed by hand. Securing the outside panels onto each other and against the bases is done with bolts. Each of these outside panels is equipped with a working platform and two of the panels have an access stairs.

Dimensions of the substation:

- Length 3,000 mm x width 2,320 mm x height 2,640 mm;
- tapered outside walls from 100 mm to 140 mm;
- thickness floor: 150 mm.



Mould with fixed inside core

Belgium: Fully automated and hydraulically operated substation mould

Because the main walls of the substations are straight and only the basement walls, both inside and outside, are tapered, the demoulding needs to be done hydraulically. The mould has two hydraulically shrinkable inner cores and four hydraulically movable outside panels. Not only shrinking and moving are hydraulic, but also securing the outside panels is done with a hydraulic wedge system. Before the outside panels can be opened completely, they are slightly pushed backwards by means of a hydraulically operated eccentric device. The actual demoulding of the element is initiated by pushing the bases up and consequently lifting the element out of the mould by means of six perfectly synchronized hydraulic rams and six air vents. Construx provided the complete mould with electronic valves, sensors and a control panel, thus controlling all movements and securing the right sequence of movements, which resulted in a fool-proof system.

List of sensors:

- On every corner joint: check wedge open or wedge closed;
- on every wall: check wall open or not;
- on every corner of the shrinking core: check core completely out or core completely in;
- on the push-up system: check system out or system in/ bottom in or bottom out.

Sequence of demoulding operations:

- Pulling wedges on the outside corners;
- pushing walls slightly open;
- opening walls completely;
- shrinking of inner core;



Fully automated and hydraulically operated substation mould

- pushing up the concrete element.

Sequence of closing operations:

- Expansion of inner core;
- closing outside panels (pushers retracted);
- securing the outside panels by closing the wedge connections.

An audio signal and a flashing light indicate when the mould is in operation.

The elements are poured upside-down with self-compacting concrete. To facilitate the turning of the element, Construx supplied a special frame connecting the mould onto the customers' turning device. All the outside panels have working platforms, one of which is equipped with stairs and the three others have access ladders. Construx also supplied a roof mould.

Dimensions of the substation:

- Length 3,525 mm x width 2,380 mm x height 2,780 mm;
- upper part wall thickness 80 mm;
- inside and outside basement walls with various tapers.

Germany: Hydraulically operated mould

For the monolithic manufacturing of a large series of small substation cabins, Construx designed a mould with a hydraulically retractable inside core, two hydraulically movable L-shaped outside panels and two interchangeable bases. By means of an eccentric hydraulic movement, both outside panels can first be lowered and then be rolled backwards. By doing so, the sill can easily be demoulded without damaging its drip profile. The substations can be made with two



Hydraulically operated mould

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different wall thicknesses by changing the bases. The outside mould has external vibrators. The inside core is equipped to accommodate the connections for the various components.

Dimensions of the substation:

- Length 2,670 mm x width 1,500 mm x height 2,530 mm;
- adjustable wall thickness: 70 mm and 100 mm.

The Netherlands: Adjustable substation with complex geometry and architectural outside pattern

This mould stands out by the special feature on the outside panels. The continuous recesses with a wavy pattern and the large bottom rebate, surrounding the top of the mould, create an extra difficulty for demoulding the elements. Construx designed the mould suitable for two different element lengths, to allow for this adjustability, one of the outside panels can be set at two different locations and one of the inside cores can be larger or smaller by adding or removing a large insert. The mould has one inner core that is pulled down hydraulically, two hydraulically shrinkable inner cores and four hydraulically movable outside panels. Before the outside panels can be opened completely, they are slightly pushed backwards by means of a hydraulically operated eccentric device. The actual demoulding of the element is initiated by pushing the bases up and consequently lifting the element out of the mould by means of several perfectly synchronized hydraulic rams and air vents. All the outside panels have working platforms, two of which are equipped

with an access ladder. The elements are poured upside-down with self-compacting concrete. To facilitate the turning of the element, Construx supplied a hydraulic turning device which is adjustable, not only for the two actual substation types, but also for future elements with other dimensions. Construx also supplied adjustable basement and roof moulds.

Dimensions of the substations:

- Length 2,449 mm and 3,449 mm x width 1,324 mm x height 2,190 mm;
- inside and outside walls with various taper.

FURTHER INFORMATION



Construx
Hazebeekstraat 11
8531 Hulste, Belgium
T +32 56724793
info@construx.eu
www.construx.eu



Adjustable substation with complex geometry and architectural outside pattern



Demoulding of the substation