



TOWERLIFT SYSTEM

**THE WORLD... OUR PASSION
SINCE 1955**

TECHNICAL BROCHURE

The Towerlift system is an extremely heavy duty structural support system for use with centre hole strand jacks. It is specifically designed in modular form for ease of assembly, erection and worldwide transportation. The modular tower sections are assembled on site from two standard components, Tubular Legs and Tubular bracing's.

HISTORY AND EVOLUTION

TOWERLIFT SYSTEM

The original (or first generation) Towerlift was developed by Fagioli in the 1980s and has stood the test of time in that we were still manufacturing new sections as recently as 2004. It was developed as an extremely heavy duty structural support system for use with Strand Jacks. It was specifically designed in modular form for ease of assembly, erection and worldwide transportation. In its basic form it is assembled from only two members – legs and bracings. Bracings are connected to the legs by means of a single pin at each end. Two connection points are provided on all legs so that these members may be assembled in either three-leg triangular or four-leg square format towers. Because of its unrivalled versatility as a temporary structure Towerlift can be used in varying ways to produce the most economical lifting arrangement. Typical lifting arrangements have included:- Two towers with crosshead beams;- Four towers with crosshead beams;- Two towers with cantilever beams;- Independent inclined towers;- Paired luffing towers. In addition most of these arrangements have been used with both triangular and square format towers and in guyed and unguyed configurations. - Heavy duty structural support for use with strand jacks;- Designed in modular form for ease of assembly, erection and transportation; - In its basic form it is assembled from only two members – legs and bracings;- Bracings are connected to the legs by means of a single pin at each end;- Can be assembled in either three-leg triangular or four-leg square format towers.



TOWERLIFT SYSTEM - GENERATION 2

The second generation Towerlift was developed to cope with today's increased lift weights. The new system includes the following features:- 3,000 tonnes lifting capacity using a four tower unguyed system to a height of 120m. Heights in exceeding 120m can be reached but the capacity will reduce. Likewise for short tower height the capacity will increase. - Work and rest platforms at frequent intervals and caged ladders to comply with the latest health and safe requirements. The Generation 2 Towerlift system has the same basic structure – legs and bracings – as the original system and can be used in identical arrangements but with increased capacity.

GENERAL

LIFTING CAPACITY FOR THE FAGIOLI TOWER LIFTING SYSTEM UP TO 3000 T

The tower lifting system is a modular system which can be erected in different configurations to meet the site area requirement and the vessel dimensions and weight. The following parameters can be selected:

- SPAN OF THE CROSSHEAD BEAMS (from 10m to 40m);
- HEIGHT OF TOWERS (from 10m up to 120m);
- Max. STRAND JACKS FOR EACH TOWER (from 1 to 4);
- STRANDS JACKS LIFTING CAPACITY (from L100 to L750);



MAIN COMPONENTS

Fagioli Tower Lift System is basically composed of:

- FOUNDATIONS AND/OR BASE FRAMES;
- LIFTING TOWERS (GUYED OR UNGUYED);
- CROSSHEAD BEAMS;
- STRAND-JACKING SYSTEM;
- RIGGING HARDWARE;
- TAILING SYSTEM

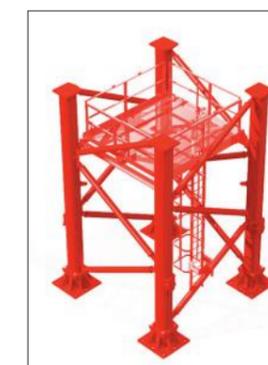
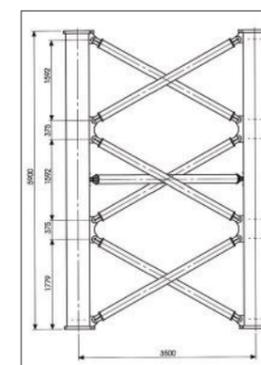


FOUNDATIONS AND / OR BASE FRAMES



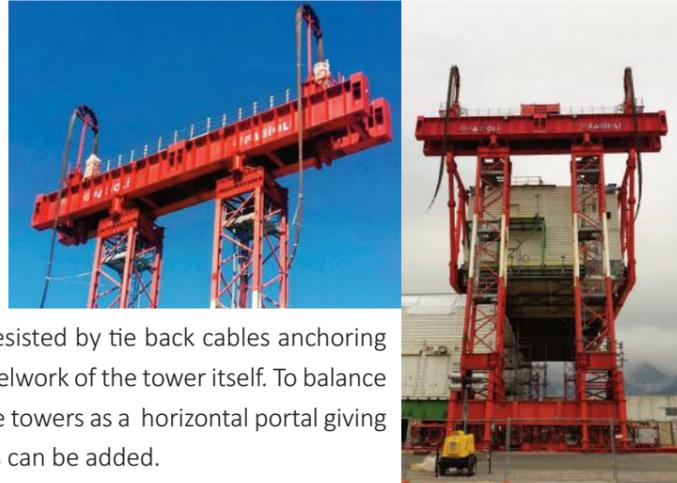
LIFTING TOWERS

The typical Fagioli tower lifting sections have the following dimensions: HEIGHT 5.9 m / LENGTH - WIDTH: 3.5 m



(TOP) CROSS HEAD AND CANTILEVER BEAMS

A pair of crosshead beams are used to span between the tower tops. These beams are provided with rails to allow the jack support beams mounted on the transverse crosshead beams to be traversed across the span. The alternative Cantilever Beams are used limit the height of the Towerlift system. The towers' height is normally just above the component's lifting trunnion level. The lifting jacks are cantilevered beyond the inside of the face of the towers. The balancing reaction from the lifting jacks is resisted by tie back cables anchoring the rear end of the cantilever beams down to the base steelwork of the tower itself. To balance the guy forces at the tower top a stability frame joining the towers as a horizontal portal giving adequate clearance for the vessel to lift inside the towers can be added.



(TOP) STRAND JACKS



Fagioli operate a range of Jacks from 15 to 750 tonnes capacity each based upon lift cables of 1 to 50 strands of 18mm diameter, 7 wire die -compacted, prestressing strand of guaranteed minimum breaking load of 38 tonnes per strand. Jacks may be used singularly, in pairs, or in groups to give any lifting capacity required. Jacks may be used singly, in pairs, or in groups to give any lifting capacity required. The Strand Jacks are capable to move structures in a series of increments roughly equivalent to the stroke of the hydraulic jack. For the purposes of lifting or pulling operations the jack piston is simply extended and retracted in sequence.

RIGGING HARDWARE



TAILING WITH SPMTs - CRAWLER CRANES - SKID SHOES AND TAILING FRAME

SPMTs / STRAND JACKS



CRAWLER CRANE



SKIDDING SYSTEM



ENGINEERING

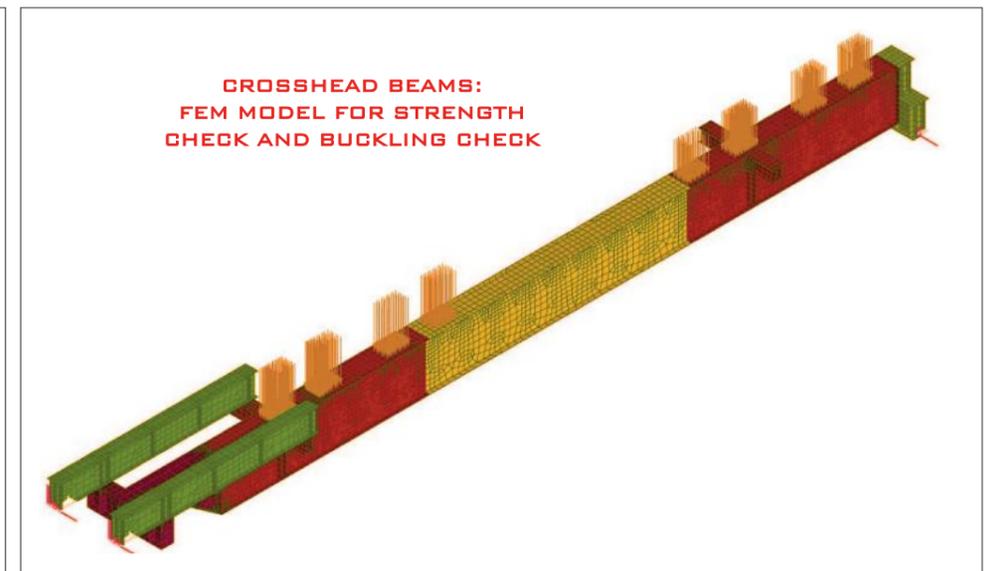
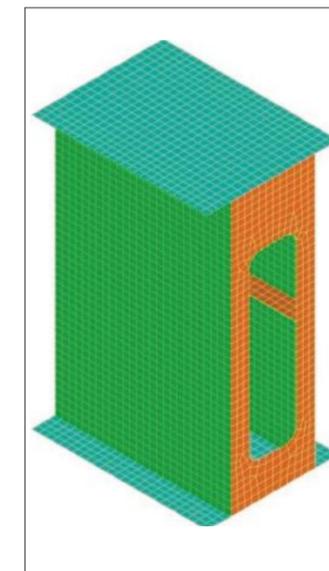
The tower lifting system is designed and checked considering the followings loads and effects.

- Item weight to be lifted (with contingency and cog envelope);
- Rigging weight (spreader beams, strand weight, etc...);
- Dynamic lifting effects while lifting;
- Design stand by wind speed (depending on the site basic windspeed):
wind velocity up to =40m/sec (3 sec GUST, 10m height);
- Design operational wind speed (maximum allowable wind speed for the lifting operation – restricted operation):
wind velocity up to = 16m/sec (3 sec GUST, 10m height);
- Notional horizontal load (applied on the top tower);

THE TOWER LIFTING SYSTEM IS DESIGNED AND CHECKED ACCORDING TO THE INTERNATIONAL STANDARD AND GUIDELINE AND TO THE REGIONAL STANDARD.

FEM MODEL

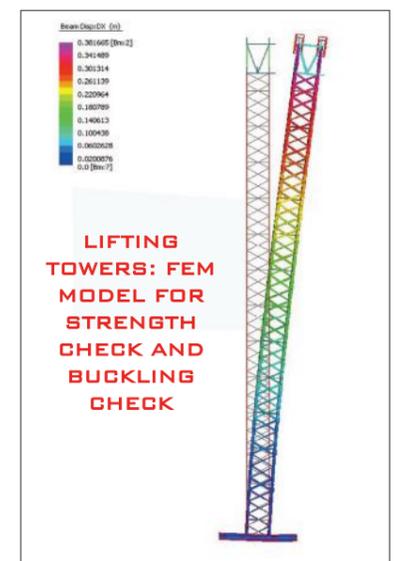
THE TOWER LIFTING SYSTEM IS DESIGNED AND CHECKED WITH FEM MODELS



All documents issued by engineering department are reviewed also in cooperation with the HSE department. Engineering documents are the base for developing the Safety manual, Hazid, Risk Assessment, Job Safety analysis.

The main engineering output are :

- Calculation reports;
- Fabrication specifications;
- Fabrication drawings;
- Tower system erection drawings;
- Lifting sequence drawings;
- Tower erection procedure;
- Load and functional test procedures;
- Operational lifting procedures.



FABRICATION

Tower lifting structural new components are fabricated according to fabrication specifications and fabrication inspection plan. Lifting tower structural components are certified by third party (DNV, Noble Denton GL, Lloyd Register, Bureau Veritas, IIS..). New fabrication is executed according to EN 1090. Existing components are checked with "Non-destructive Testing" on welds and additional mechanical tests on samples are carried out if required.

IN-HOUSE LOAD TEST : TOWER AND STRAND JACKS MAINTENANCE

Load test on the tower components is executed in the Fagioli workshop to validate engineering and fabrication

- 1) Compression Load Tests on a single Tower Leg;
- 2) Compression Load Tests on a single Tower section;
- 3) Compression Load Tests on a whole Lifting Tower System (with different heights);



Strand jacks load test are executed up to 120% load capacity before shipment to site. For further details on strand jacking system, please refer to "FAGIOLI TECHNICAL DATA STRAND JACKING SYSTEM" document.



SITE ACTIVITY

Site activities are executed according to the operational procedures. Tool box meeting is executed before starting any operational activity.

TOWER SYSTEM ERECTION

Erection of Tower Lift system at site is executed by mobile or crawler cranes. Once the installation is completed, check list document is fulfilled by Heavy Lift Superintendent in order to be sure that all operation has been successfully and safely completed.



NOTE : A DEDICATED CHECK LIST SHALL BE FULFILLED FOR EACH TOWER

ITEM: TOWER SECTION	NUMBER OF SECTIONS INSPECTED:	
Tower Legs Flanges (6th (M40-10 ft) Nut/Washer)	<input type="checkbox"/> OK <input type="checkbox"/> NO <input type="checkbox"/> N/A	
Diagonal Brace Pin-R-clips	<input type="checkbox"/> OK <input type="checkbox"/> NO <input type="checkbox"/> N/A	
Plan Brace Pin-R-clips	<input type="checkbox"/> OK <input type="checkbox"/> NO <input type="checkbox"/> N/A	
Platform Visual Examination	<input type="checkbox"/> OK <input type="checkbox"/> NO <input type="checkbox"/> N/A	
Platform Hinged Access Door	<input type="checkbox"/> OK <input type="checkbox"/> NO <input type="checkbox"/> N/A	
Ladder Visual Examination	<input type="checkbox"/> OK <input type="checkbox"/> NO <input type="checkbox"/> N/A	
Ladder connection top/bottom	<input type="checkbox"/> OK <input type="checkbox"/> NO <input type="checkbox"/> N/A	
Tower sections types erected as per sequence shown in ref. drawing	<input type="checkbox"/> OK <input type="checkbox"/> NO <input type="checkbox"/> N/A	245-HEB-SK-510 rev.0
Extended platform on last section erected as per ref. drawing	<input type="checkbox"/> OK <input type="checkbox"/> NO <input type="checkbox"/> N/A	245-HEB-SK-510 rev.0
Extended platform on last section protrude towards external side of towers	<input type="checkbox"/> OK <input type="checkbox"/> NO <input type="checkbox"/> N/A	245-HEB-SK-510 rev.0
Tower out of verticality within tolerance: - INNER SIDE: NOT ALLOWED - OUTER SIDE: MIN: 10 mm / MAX: 30 mm (survey required)	<input type="checkbox"/> OK <input type="checkbox"/> NO <input type="checkbox"/> N/A	245-HEB-SK-510 rev.0

SITE LOAD TEST

After the tower lifting system erection a load and functional test is carried out. After test completion, the tower lifting system is ready to execute the hoisting operation



LIFTING OPERATION



TOWER LIFT SYSTEM

The Towerlift system is a safe and reliable system for the heavy lifting and hoisting operations with capacity up to 3,000 ton. Fagioli Towerlift system is mainly used in Oil & Gas, Offshore, Power, Civil industries. Picture below shows the lifting and final installation of a 2,000 ton reactor, 56 m high with a diameter of 5,4 m executed in Italy, by means of No. 2 unguyed 80 m high towers and No. 4 x 600 ton capacity strand jacks mounted on top.



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