STEEL IS THE VITAL INGREDIENT

Solutions in Steel for Offshore Wind Energy Installations

DILLINGER

OFFSHORE WINDPOWER – THE ENERGY OF THE FUTURE

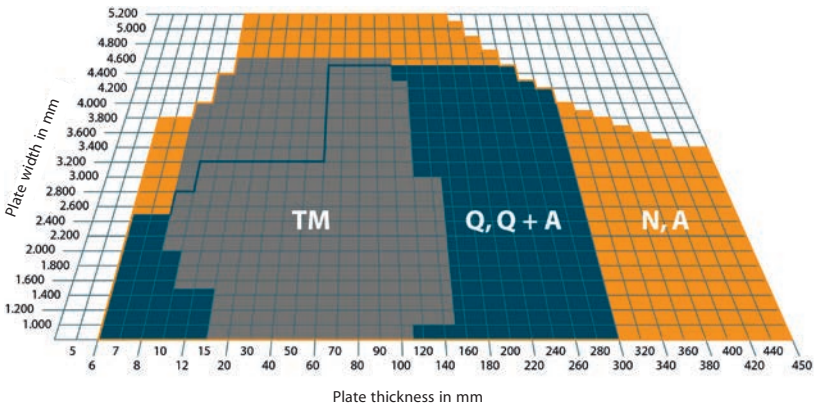
High waves, turbulent weather. The world's oceans are brim full with energy. The high wind velocities constantly prevailing there, in particular, contain a highly promising energy potential. For numerous European countries, the expansion of the offshore wind energy generation is therefore the most important element in future energy concepts. The success of this energy source is dependent to a very large extent on stable and highly durable offshore wind tower foundations that are able to defy the hostile conditions encountered far out to sea.

Heavy plate: The backbone of the regenerative energy

Steel's high specific load bearing capability and durability, combined with its versatility, make it the material of choice for these offshore foundations. Its role in the generation of renewable energy achieves dual sustainable use of resources, since steel, with its excellent recyclability, is in itself a resources conserving material.

Dillinger: The industry's partner for dependable solutions

Wind energy installations need stable foundations to withstand the conditions found in deeper waters. Equally, dependable partners are needed to assure trouble free completion of major projects. Dillinger, with its broad range of tailor-made products, is precisely this reliable partner: even high tonnages can be supplied in extremely short times. It is therefore no coincidence that the majority of the offshore wind energy projects completed up to now have been based, irrespective of the type of steel foundation, on plate supplied by Dillinger.



Tailor-made ultra high quality plate solutions

Plate thicknesses ranging from 6 to over 510 mm, widths of up to 5,200 mm and lengths of up to 28 m, with item weights exceeding 42 t – these are the sizes in which Dillinger can produce and supply its world leading grades of steel. But it is not only these unique dimensions, but also, and above all, the "inner" values and good working properties which give Dillinger heavy plate its outstanding reputation. Excellent weldability, assurance of maximum strength and toughness performance at low temperatures may be mentioned here only as examples of the special, tailor-made customer requirements that Dillinger plate makes possible.

World record for Dillinger TM plates

Thermomechanically rolled plate (TM) has become particularly well established in offshore applications since, in addition to an optimum combination of the mechanical properties of strength and toughness, it also assures, thanks to its low carbon equivalent, significantly superior conditions for welding (e.g. the reduction of preheating temperatures or even the elimination of preheating). Here Dillinger sets again new standards, with available plate thicknesses up to 150 mm and item weights exceeding 42 t.

World record for Dillinger TM plates

Convincing customer support

Technical and commercial boundary conditions can be fixed jointly with the customer and the project participants at the early stages of a project, assuring availability of the necessary capacities, maximum logistical support and thus trouble free implementation. Top solutions in steel, achieved equitably with the customer – this is the proud record of Dillinger.

Pure dependability

Maximum quality and safety specifications that our customers can rely on: this is the challenge we set ourselves every day. Dillinger has proven its capability for meeting these maximum dependability standards throughout its many years of experience in sensitive offshore oil and gas projects.

Reliability

Multiple investments like chamfering milling machines, extension of the flame cutting capacity and especially the project of superlatives, the new vertical continuous caster (CC6), have conditioned Dillinger to the future. This consistent orientation around the production of thick heavy plates in both rolling mills gives Dillinger the ability to supply large quantities of plate on time and within narrow time windows. Maximum delivery reliability and logistical support for the customer are our constant top priority. The successful completion of many extremely diverse major projects provides the definitive proof.

Service Plus: Edge preparation

An additional service provided by Dillinger is individual weld preparation by means of milling, assuring extra cost effectiveness of welding for the customer. Edge machining is possible both on rectangular format plates and on radius and conical plates. The most diverse range of edge geometries, even including tapers in the dimension range up to 160 mm thickness, 5,000 mm width and 25 m length, can be milled with ultra high accuracy. Tolerances of ±1 mm are achieved in length and width, ±0.5 mm for edge position and ±0.5° for the milled angle. The sandwich configuration of the milling tools, in combination with an automated tool changing system, assures the necessary flexibility for individual edge geometries. The plates are shipped with an individual marking including barcode. Just-in-time delivery of edge machined plates is also possible on agreement.

DILLINGER: THE STANDARD IN OFFSHORE WIND FARMS

Gemini

With the offshore wind farm Gemini, which went into operation in 2017, one of the largest offshore wind farms in the world has its foundations on steel from Dillinger. Gemini (twins) stands for two sea areas in which the wind farm was erected in water depths up to 36 m. With its site around 85 km north of the coast of the province of Groningen, it is located in one of the windiest areas off the Dutch coast. The Gemini wind farm stretches over 68 km² and comprises a total of 150 wind turbines with an overall output of 600 MW. It is therefore currently among the most powerful wind farms in the world and can supply over 400,000 households in the Netherlands with electricity. The turbines are based on monopiles that are up to 73 m in length and up to 7 m in diameter. Dillinger supplied around 94,500 t of TM plates in thicknesses up to 95 mm for these steel foundations. With individual plate weights up to 32 t, this gigantic project made full use of Dillinger's huge production possibilities for TM plates, going to the limits of what was feasible at that time. Meanwhile, Dillinger can even supply these steels with individual plate weights exceeding 42 t and is thus at the leading edge of this technology worldwide.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Baltic 2

The offshore wind farm, officially inaugurated in September 2015, is able to generate 1.2 TWh of electricity a year, sufficient to supply approximately 200,000 German households with eco friendly electricity. So it makes a decisive contribution to save over 400,000 t of CO_2 every year. With its 80 Siemens SWT-3.6-120 turbines erected in the waves of the Baltic Sea, the wind farm covers an area of almost 27 km^2, making it the largest offshore wind farm in the Baltic Sea area. The wind turbines rising 138 m above the surface of the water are almost as tall as the Cheops Pyramid in Giza. Its location in the German Exclusive Economic Zone (EEZ), 32 km north of the island Rügen, with variing water depths between 23 and 44 m and difficult soil conditions presented a new challenge for the wind farm developers. Finally, depending on the water depth, the wind turbines have been erected on different foundations. Monopiles have been used for water depths up to 35 m, while three legged jackets have been utilized at depths over 35 m. For the monopile and jacket foundations Dillinger supplied around 37,700 t of TM plates (S355ML, S420ML, S355G10+M) in thicknesses from 20 to 85 mm.

DanTysk

The farm's close proximity to the Danish border gave rise to the facility name; it consists of the Danish words "Dan" for Danmark and "Tysk" for Tyskland ("Germany" in Danish) and thus underlines the unifying and crossborder nature of this project. Its giant wind turbines are erected on steel foundations in water depths from 21 to 25 m, about 70 km west of the island of Sylt, in the EEZ. Covering an area of 70 km^2 (approximately 7,000 football pitches), it's one of the first large scale offshore wind farms ever built in the German North Sea. DanTysk consists of 80 wind towers, each carrying a Siemens SWT 3.6 MW turbine, for a total output of 288 MW. The energy generated is sufficient to provide up to 200,000 homes with environment friendly electricity and to save some 400,000 t of CO_2, an amount equivalent to a 2.7 billion reduction in car kilometers – a distance that is nearly 70 times the equator's circumference. Thus, the wind farm contributes significantly to the reduction of CO_2 emissions and thereby to the German "Energiewende".

Steel giants

"Almost the size of the Cologne Cathedral (150 m over the North Sea), rotor blades (diameter of 120 m) of "the size of one-and-a-half soccer fields", foundation piles diameter "only half a meter less than the tunnel diameter of the new underground railway line U4 in Hamburg",… these mostly used comparisons reveal a lot about the magnitude of these facilities. The dimensions of the monopile foundations are really gigantic: diameter up to 6 m, length up to 65 m and weigth up to 950 t. For these monopile foundations Dillinger supplied around 65,000 t of TM plates in thicknesses from 60 to 126 mm.

Transformer substation: Dillinger steel converts

Heavy plates from Dillinger have also been used for the construction of the transformer substation (1,350 t TM plates in thicknesses from 8 to 65 mm). Set up in a water depth of 25 m, this substation with a total weight of 3,200 t collects the energy from the 80 wind farm turbines, converts it to a higher voltage and sends it to a power transfer station. From there a 205 km long underwater cable carries the electricity to the consumers.

London Array

London Array is located in the outer Thames Estuary, around 20 km off the coasts of Kent and Essex. London Array consists of 175 wind towers, each carrying a 3.6 MW turbine, for a total output of 630 MW. The energy generated is sufficient to supply up to 500,000 private households with electricity from wind power. According to the operator, this wind farm will contribute significantly to the attainment of Britain's ambitious climate targets, enabling the United Kingdom to take a great step forward in reducing CO_2 emissions. London Array should help reduce harmful CO_2 emissions by more than 900,000 t a year, equivalent to taking nearly 300,000 cars off the road each year. The dimensions of the wind turbines are gigantic. The total height up to the blade tip is nearly 150 m, the rotor diameter is 120 m. The wind turbines are mounted on monopile foundations of diameters from 4.7 to 5.7 m in water depths of up to 25 m. These foundations, which have a total length up to 85 m and a weight up to 650 t, are among the largest ever built. Dillinger supplied for these monopile foundations around 54,000 t of, essentially TM plates in thicknesses up to 100 mm.

Alpha Ventus, the world's first high seas wind farm

The Alpha Ventus pilot project is the world's first offshore wind farm to advance into waters of depths of 30 m and more. Since completion, it has supplied important knowledge needed for the further expansion of offshore wind energy. The farm features 12 wind turbines of the 5 MW class. The southern group of Areva Wind M5000 turbines stands each on three legged foundations (tripods) with edge lengths of nearly 25 m. Some 1,000 t of steel were used for the tripod, feet, tower and nacelle of each turbine. The other six REpower 5M wind turbines were installed to the north, on jacket foundations. The jacket foundation is around 57 m in height, with a mass of some 320 t. This wind farm consumed 12,800 t of steel supplied by Dillinger (S355G8+N/M and S355K2+N in thicknesses up to 110 mm).

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