



DILLINGER

GIANTS IN A CLASS OF THEIR OWN

DILLIMAX for XXXL lifting equipment

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Dillinger, Europe's leading producer of heavy plate, has again expanded its format range for plates of unparalleled thicknesses and quality. Thermo-mechanically rolled (TM) plates in DI-MC branded grades S355 and S460 are now also available in thicknesses of up to 150 millimetres. DILLIMAX ultra-high-strength branded steels can now be supplied in greater thicknesses and with even further enhanced properties. With effect immediately, the DILLIMAX 965 strength level, for example, can be ordered in the form of 120 millimetres thick plate. In the case of DILLIMAX 690 T, the producer guarantees Charpy V-notch toughness significantly higher than those specified in the EN 10025, Part 6 and ASTM A514 standards. Starting immediately, Dillinger is also making an important commitment in its quality standards for the entire DILLIMAX product family, by guaranteeing excellent internal cleanness on the basis of in-works ultrasonic inspection (UT). In the case of extremely thick plates, this extra safety can additionally be assured by means of optional agreement of stringent ultrasonic-inspection requirements and guaranteeing of properties in the plate-thickness direction (Z grade in accordance with EN 10164). All DILLIMAX steels possess CEV/CET carbon equivalents significantly below the levels specified in the standard, and therefore permit the use of welding processes which can be reliably calculated on the basis of widely applied standards, such as EN 1011. These low CEV/CET values also reduce preheat temperatures and thus again boost cost-efficiency. ALE, an internationally leading specialist in the transportation and lifting of heavy loads, uses these Dillinger grades in the grand style. DILLIMAX makes critical contributions to feasibility and safety both in the AL.SK350, the world's largest capacity land-based heavylift crane, and in the Mega Jack modular jacking system.

The enhanced performance spectrum of DILLIMAX steels opens up new potentials in thick, heavily stressed designs, for which maximum mechanical strength, extreme toughness and reliable welding are of elementary importance for safety. The manufacturers of heavy-lift cranes and other lifting equipment with extreme loading and safety requirements, inter alia, also therefore put their trust in these grades. Showpiece examples of this are the lifting systems operated by super-heavy-load and crane firm ALE. This company is one of the world's largest heavy transportation and lifting service providers, and also develops and builds gigantic land-based heavy-lift cranes and a jacking system that can lift complete oil rigs to heights of up to 50 metres. No other heavy-lift system anywhere in the world possesses lifting capacities even approaching those of the AL.SK190 and AL.SK350, or of the Mega Jack. ALE puts its faith in high-performance steels from Dillinger for all models of these XXXL lifters.

Dillinger range of dimensions for high, higher and ultra-high strength steels

Grade*	Characterisation	Yield strength	Charpy impact toughness	Thickness	Width
DI-MC 355	TM grade with extremely low carbon content and excellent weldability; in accordance with EN 10025-4	Constant yield strength of 355 MPa up to 150 mm plate thickness available	Grades B/T with guaranteed values at -20 °C/-50 °C	up to 150 mm	Maximum depending on thickness/grade: 4.400 mm – 4.600 mm
DI-MC 460		Constant yield strength of 460 MPa up to 120 mm plate thickness available			
DILLIMAX 690	Quenched and tempered high strength structural steel; in accordance with EN 10025-6	690 MPa (nominal)	Grades B/T/E with guaranteed values at -20 °C/-40 °C/-60 °C	up to 255 mm	Maximum depending on thickness/grade: 3.300 mm – 4.500 mm
DILLIMAX 890		890 MPa (nominal)		up to 100 mm	
DILLIMAX 965		960 MPa (nominal)		up to 120 mm	
DILLIMAX 1100	Quenched and tempered high strength structural steel	1100 MPa	Guaranteed values at -40 °C; at -60 °C on request	up to 40 mm	Depending on thickness up to 3.300 mm

*Selection, for yield strength between 460 MPa and 690 MPa more grades both TM and quenched and tempered are available

World's largest land-based crane

ALE was founded in Stafford, UK, in 1983, now has more than thirty base depots, and has evolved into a leading global player in the lifting, transportation and installation of heavy, non-divisible loads. These gigantic cranes and jacking systems are tailor-designed for customers' projects that are as spectacular as they are exacting. The company regularly sets new records with the load-bearing performance of its heavy-lift machines. These colossi are used wherever extreme loads need to be lifted for the construction of industrial plants, oil and gas production facilities, and infrastructural projects. The tasks involved extend to offshore rigs, port infrastructure projects, the mining, chemicals and energy industry, and even architecture. In 2008, ALE set its first world record, using the AL.SK190: this machine, with its 141.3 metres main boom, maximum load of 4,300 tonnes and a load moment of 196,000 tonne-metres, became the world's heaviest-lift land-based crane. The crane's ballast



Colossi made of Dillinger steel are used, for example, in and around harbours, wherever lifting of extreme loads is necessary.

radius of 32.1 metres makes it possible to perform all lifts from a single position, eliminating cost-intensive dismantling and repositioning. The AL.SK cranes lift up to 4,000 tonnes with winches. For loads up to 600 tonnes an additional quick winch system is installed and for loads above 4,000 tonnes a strand jack system is used. This crane's big brother, the AL.SK350, followed in 2011, and has since then held the world size

record for land-based cranes. The AL.SK350, with its 141.2 metres main boom can handle a maximum carry load of 5,000 tonnes. The crane has a reach of twelve metres at maximum load, giving it a load moment of 354,000 tonne-metres. Its ballast radius of more than 49.2 metres also makes it unique in the world up to now. This crane is also equipped not only with its strand jacking system, but also with a high-speed rope winch which, on the AL.SK350, can tackle lifts of up to 4,000 tonnes. The AL.SK350, weighing in at 3,000 tonnes, is itself a real heavyweight. Both heavy-lift cranes can be modularly be expanded with a fixed jib to extend the boom. With a maximum length of 100 metres, the jib can lift loads up to 3,400 tonnes. Fabricated from ultra-high-strength steel, it is enabling this colossus to lift even heavier loads to even greater heights within a further expanded radius. As Ronald Hoefmans, Technical Director at the heavy-load specialists, notes, the length of the individual parts is an additional challenge in the design and construction of such cranes. They



The fixed jib consisting of ultra-high-strength DILLIMAX steel serves as an extension of the boom and can, with its length of up to 120 m, lift a maximum of 3,400 tonnes.

Jacking system for mega loads

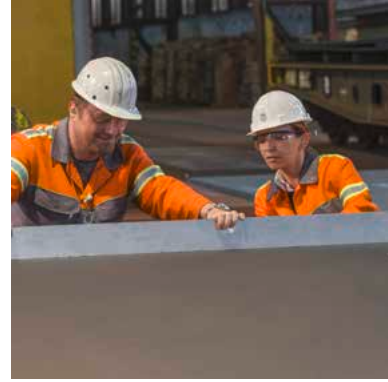
must not be longer than 12 metres, to permit containerised transportation. The designs must also permit quick and easy setting-up. This is why, in Hoefmans' view, ultra-high-strength DILLIMAX steel is indispensable in bearing the forces generated by the cranes' dimensions. The plate-length and plate-thickness formats available only from Dillinger also give him decisive design and cost-efficiency benefits during fabrication, however. One example of this is provided by the AL.SK350's tie rods, which were fabricated from 10 metres long plates consisting of ultra-high-strength DILLIMAX 1100. ALE uses 11.4 metres long DILLIMAX 690 and DILLIMAX 890 elements for the main boom and the backmast. Ronald Hoefmans also trusts in the DILLIMAX 690 and DILLIMAX 890 grades of steel for the topping system and crossbeam structures. DILLIMAX 690 components of 5.7 metres are used for the baseframe. The necessary durability of these giant cranes during deployments at Arctic temperatures of -40 °C is assured by the specified high toughness of the DILLIMAX grades used.

ALE developed the Mega Jack as a special system for the installation or repositioning of offshore rigs with weights up to 60,000 tonnes on 12 towers. Such rigs stand 25 metres above the water, in order that even high waves cannot reach them. "Clients prefer to build rigs in one piece on ground level and at a later stage the Mega Jack system jacks it up to the required height. After jacking a loadout frame is being positioned under the rig and is being loaded out onto a barge by an ALE skidding system. After load out the rig goes offshore and by float over operation the topside will be installed on top of the jacket", Ronald Hoefmans explains. For example, a Mega Jack lifted the Malikai rig located 100 kilometres off the coast of Malaysia 40 metres high and transported it

90 metres horizontally. It's a modular system with 5,200 tonnes jacking capacity per tower. When installing more towers loads up to 100,000 tonnes or more are achievable. This system's gigantic lifting capacity gives the oil industry the otherwise impossible capability of constructing modules of this magnitude and moving them in a single day without the use of other tackle. Since 2014, ALE has possessed a medium size jacking system, in the form of the Mega Jack 800. Dillinger ultra-high-strength DILLIMAX steels are also used in many of the components of this colossal jacking system: the necessary strength and stability of the jacking beams is assured, for example, by plates consisting of the DILLIMAX 690 grades in thicknesses of up to 240 millimetres.

The Mega Jack 800 modular jacking system consists of up to twelve individual lifting towers fabricated from DILLIMAX steels, each of which can lift 5,000 tonnes to a height of up to 50 m. Total lifting capacity can be expanded to up to 60,000 tonnes.





Concentrated lifting power

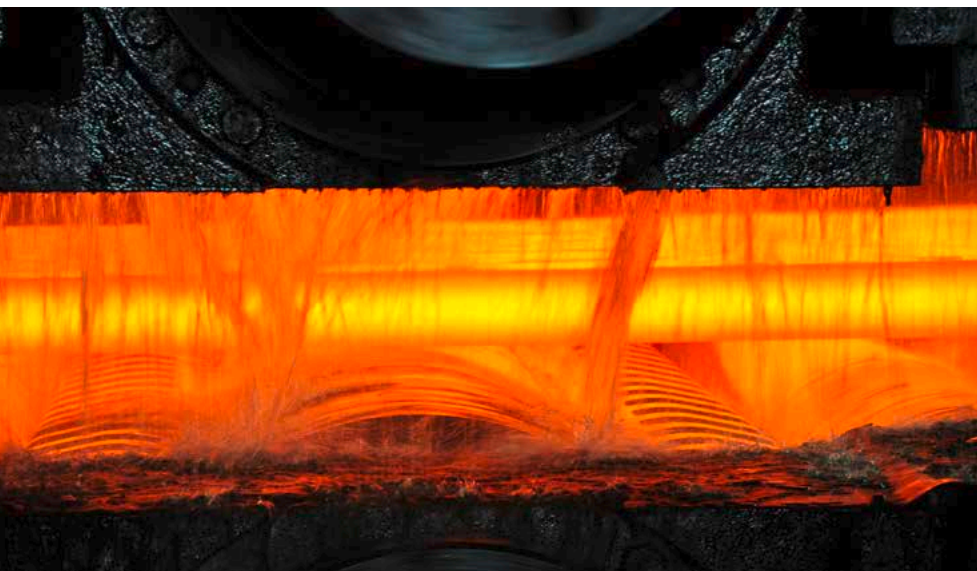
Whether for big cranes or for gigantic jacking systems: Ronald Hoefmans knew he could rely on Dillinger capabilities and quality for all three of these colossi. The extreme plate formats and out-of-the-ordinary properties of DILLIMAX steels all argue in favour of their use for these lifting systems, which leave every other machine of their type standing. The unparalleled size of the plates used permitted cost-efficient dimensions for production, for example. For Ronald Hoefmans, „These steel’s extremely high mechanical strength and Charpy V-notch toughness are absolutely essential for our designs“. In addition, their excellent working and welding properties contribute decisively in achieving cost-saving fabrication and use of these huge machines, because they mean lower labour and welding costs, shorter installation times and reduced transportation needs. „Dillinger gives us the safety we need, with tried and proven grades and quality“, Ronald Hoefmans

affirms, adding „Another important factor is that we have a highly capable and acclaimed partner for supply and fabrication, in the form of AncoferWaldram Steelplates, a Dutch subsidiary of Dillinger. They supply us with finished flame-cut parts and complete modules which integrate perfectly into our fabrication processes“. Ultra-clean steel, cast at Dillinger into the world’s thickest slabs and ingots, form the basis for DILLIMAX-brand high-strength fine-grained structural steels. Subsequent rolling under a rolling force of 11,000 tonnes homogenises the plates down into their centres.

Their exceptional mechanical strength is the result of water-quenching, followed by tempering. This gives the DILLIMAX grades, including those used for ALE’s plates, the necessary property profile for designs that could not be implemented without plates of these thicknesses and featuring these properties.

Even thicker TM plates arrive

Dillinger can now boast a further addition to its thickness range in high and higher-strength grades: DI-MC-brand thermo-mechanically rolled (TM) plates are now available in even greater thicknesses in Grades S355 and S460. Thicknesses of 150 millimetres are now suppliable in these steels, thus anticipating the planned inclusion of these thicknesses in the upcoming new edition of the EN 10025, Part 4, standard. TM plates are notable for their exceptionally cost-efficient working and welding properties, the result of their significantly lower CET/CEV carbon equivalents compared to normalised steels of the same strength class. Despite their thickness, they are significantly easier to weld, and preheating can be omitted if the appropriate parameters are selected. Constant yield strengths of 355 MPa in the 150 millimetres thickness range, and 460 MPa at a thickness of 120 millimetres, make an important additional contribution to the cost-effectiveness and safety of demanding steel structures. The cost-efficiency of their use is underlined, in particular, by the availability of item weights of up to 32.5 tonnes and widths of well over 4,000 millimetres, which permit optimum plate sizes ideally tailored to each specific project.



The application of rolling forces of 11,000 tonnes during rolling homogenises DILLIMAX plates down to their centre.

Figure top-left:
The Millau freeway viaduct in the South of France, designed by Norman Foster and higher than the Eiffel Tower, incorporates an amazing 43,000 tons of Dillinger steel, including DI-MC.

Figure top-right:
Starting right now, Dillinger can supply its ultra-high-strength DILLIMAX-brand steels in even greater thicknesses and with further enhanced properties.

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