DILLINGER
We are Pure Steel+

DI-RACK 690

High strength fine grained structural steel for racks and chords of jack-up type rigs and vessels

Material data sheet, edition Juli 2026[1]

DI-RACK 690 is a high strength, quenched and tempered fine grained structural steel with a minimum yield strength of 690 MPa (100 ksi)[2] and special requirements for rack and chord plates for jack-up type legs.

Product description

Designation and range of application

DI-RACK 690 can be delivered in thicknesses from 25 mm to 250 mm (1 in. to 10 in.)[2] according to the dimensional programme. It may be possible to supply other dimensions on request.

Upon request, **DI-RACK 690** can be certified acc. to ABS and DNV steel grades AB-EQ70-R or NV-EO690QT.

Chemical composition

For the ladle analysis, the following limiting values in % are applicable:

For plate thicknesses 25 mm ≤ t ≤ 100 mm:

C max.	Si max.	Mn max.	P max.	S max.	Cu max.	Cr max.	Ni max.	Mo max.	Nb + V + Ti max.	B max.
0.18	0.50	1.50	0.015	0.003	0.30	1.50	1.80	0.60	0.20	0.004

For plate thicknesses 100 mm < t ≤ 250 mm:

C max.	Si max.	Mn max.	P max.	S max.	Cu max.	Cr max.	Ni max.	Mo max.	Nb + V + Ti max.	B max.
0.18	0.50	1.50	0.015	0.003	0.30	1.80	3.50	0.70	0.20	0.004

The steel is fully killed and fine grain treated.

Carbon equivalent CEV (IIW)

Plate thickness t [mm]	max. CEV [a] [%]
t ≤ 120	0.75
120 < t ≤ 178	0.88
178 < t ≤ 250	0.91

[a] CEV = C + Mn/6 + (Cr+Mo+V)/5 + (Cu+Ni)/15

[1] The current version of this material data sheet can be also found on: www.dillinger.de.
[2] The approximately converted values in brackets are for information only.

Delivery condition
Plates are water quenched and tempered according to EN 10025-6. For hot forming purposes, delivery condition might deviate. This means test coupons in the simulated quenched and tempered condition will be tested.

Mechanical properties

Tensile test transverse

	DI-RACK 690
Minimum yield point R_{eH} [a] [MPa]	690
Tensile strength R_m [MPa]	830 - 940
Minimum elongation A_5 [%]	14
$R_{p0.2}/R_m$	max. 0.98

[a] If R_{eH} is not apparent, $R_{p0.2}$ (yield strength) will be measured instead.

Option
Through thickness tensile testing according to EN 10164 can be agreed.

Hardness

Specimen location	Hardness at room temperature [HBW][a]
¼ plate thickness	240 - 310

[a] Average value of three readings.

Impact test on Charpy-V-test specimens

Test temperature [°C]	Plate thickness t [mm]	Location of test pieces [a]	Specimen direction	Min. average impact values A_v [Joule]
- 40	t < 40	Sub-surface [b]	Longitudinal	69
			Transverse	48
	40 ≤ t ≤ 50	¼ plate thickness	Longitudinal	69
			Transverse	48
	t > 50	¼ plate thickness	Longitudinal	69
			Transverse	48
		½ plate thickness	Longitudinal	69
			Transverse	48

[a] If not otherwise agreed or required as per ABS or DNV, test in accordance with EN 10025-6 resp. EN 10025-1

[b] Test pieces are taken from sub-surface position with one face of a specimen located within 2 mm from a rolled surface

The specified minimum value is the average of 3 tests. One individual value may be below the minimum average values specified, provided that it is not less than 70 % of these values.

Sour gas corrosion

On request: HIC test as per NACE TM0284 in solution pH 5, pH_2S = 0.1 bar for information only. One test per order will be performed.

Testing

If not otherwise agreed or required by ABS or DNV:

- Tensile and Impact tests are performed according to EN 10025-6 resp. EN 10025-1.
- Impact tests are carried out on Charpy-V transverse test specimens.
- If ordered, through thickness tensile testing will be performed according to EN 10164.
- Hardness tests according to EN ISO 6506-1 once per heat and thickness.
- Ultrasonic testing is carried out in accordance with EN 10160 S2/E3.
- If test pieces have to be tested in the simulated quenched and tempered condition, mechanical tests will be performed once per heat and thickness.
- Test results are documented in an inspection certificate 3.1 in accordance with EN 10204.

Identification

Unless otherwise agreed, the marking is carried out with low stress steel stamps with at least the following information:

- Steel grade (DI-RACK 690)
- Heat number
- Rolled plate number and single plate number
- The manufacturer's symbol
- Authorized inspection representative's sign

Processing

Due to its high yield strength and elevated hardenability, DI-RACK 690 requires special care during plate processing. The following hints and recommendations are based on best knowledge and experience of Dillinger. They shall help the fabricator to develop his own fabrication procedures, appropriate for the material and adapted to his particular conditions. The responsibility for the final choice of the processing conditions therefore remains with the fabricator. The recommendations of CEN/TR 10347 and EN 1011 (= ISO/TR 17671) should be considered.

Cold forming

Cold forming means forming below the maximum stress relief temperature of 560 °C. DI-RACK 690 can be cold formed with regard to its high yield strength. Flame cut or sheared edges should be ground before cold forming. Cold forming is always related to a hardening of the steel and to a decrease in toughness. This change in the mechanical properties can, as a rule, be partially recovered through a subsequent stress relief heat treatment. For larger cold forming amounts or if prescribed by regulations, a new quenching and tempering treatment may be necessary to restore the initial mechanical properties. In this case we recommend consulting us prior to ordering.

Hot forming

Hot forming means: Forming at temperatures above the maximum allowable stress relief temperature of 560 °C. Hot forming can alter the initial properties of the material and therefore requires a subsequent quenching and tempering. If hot forming is required, please contact us prior to ordering.

Flame cutting and welding

Prior to cutting the surface of the plate must be free of scale and impurities that might disturb the cutting process and cause heavy drag lines and blow wholes. For flame cutting, a minimum preheating temperature of 150 °C – 200 °C is recommended. It is beneficial to preheat the complete plate and not only the area to be cut.
The temperature shall not fall below 150 °C and not exceed 400 °C during the entire cutting process.

For general welding instructions, please consult EN 1011. Preliminary tests under actual shop conditions are recommended to prove the suitability of the intended processing conditions and consumables.

In order to avoid hydrogen-induced cold cracking, only welding conditions and filler materials which add very low hydrogen to the base material shall be used. Shielded arc welding introduces very low hydrogen provided that the gas protection is correct. For manual arc welding, electrodes with basic coating (type HD < 5 ml/100 g in accordance with ISO 3690) which are dried according to the manufacturer's instructions should be used.
If the tensile strength of the weld metal has to fulfil the requirements of the base material, this also must be taken into account when choosing the filler materials.

It should be considered that increased heat input leads to lower tensile properties in the weld metal. Experience has shown that the welding conditions should be chosen so that $t_{8/5}$ does not exceed 15 s. Heat input and interpass temperatures have to be restricted to approximately 2 kJ/mm and 200 °C to keep $t_{8/5}$ below this limit. If materials with undermatching strength properties should be joined (e.g. for welded joints between racks and chords of lower strength), welding consumables corresponding to the softer steel may be applied and higher heat input can be tolerated.

Minimum preheat and interpass temperature shall be 120 °C for GSAW and 150 °C for SMAW. For SAW the higher deposition rates will usually result in somewhat higher residual hydrogen content after welding.

To avoid cracks a hydrogen effusion treatment shall be carried out immediately after weld completion and for weld interruptions before the weld area has cooled below 80 °C. Hydrogen removal shall be performed at 250 - 300 °C for 3 - 6 h (increasing time and temperature with increasing weld thickness). Under well controlled and beneficial conditions (low hydrogen clearly below 5 ml, moderate restraint, shallow weld layers) a retarded cooling by insulating the weld may be good enough to reach a sufficiently low residual hydrogen level.

For more comprehensive information about flame cutting and welding, please consult us.

Heat treatment

If a thermal stress relieving has to be considered because of constructional regulations, constructive reasons or because it is necessary for plate processing, please consult us. The properties of the material may be altered by a stress relief heat treatment.

General technical delivery requirements

Unless otherwise agreed, the general technical delivery requirements in accordance with EN 10021 apply.

Surface Quality

Unless otherwise agreed, the provisions in accordance with class B2 of EN 10163-2 are applicable.

Tolerances

Unless otherwise agreed, the tolerances are in accordance with EN 10029, with class B for thickness.

General note

If special requirements, which are not covered in this material data sheet, are to be met by the steel due to its intended use or processing, these requirements are to be agreed before placing the order.
The information in this data sheet is a product description. This data sheet is updated at irregular intervals. The current version is relevant. The latest version is available from the mill or as download at www.dillinger.de.

Contact

AG der Dillinger Hüttenwerke
Tel.: +49 6831 47 3452
e-mail: info@dillinger.biz
Werkstraße 1
66763 Dillingen / Saar
Germany

You can find your contact person on www.dillinger.de