DILLINAL 460/630

High strength fine grained steel

Material data sheet, edition February 2024[1]

DILLINAL 460/630 is a weldable normalized fine grained steel, which is characterised by a minimum yield strength of 460 MPa and a minimum tensile strength of 630 MPa.
DILLINAL 460/630 is mainly applied for the construction of tanks for the transport of liquefied gas with road and rail vehicles where a low vessel weight is of the essence.

Product description

Designation and range of application

DIILLINAL can be supplied in two qualities:

- DILLINAL 460/630 N and
- DILLINAL 460/630 NL.

Both steels are type of the P460 according to EN 10028-3. They fulfil the enhanced requirement acc. option 5 of the EN 10028-3 as well as the VdTÜV material data sheet 531 "Hochfester, legierter Feinkornbaustahl 460/630 für Einsatztemperaturen bis -40 °C" (high strength alloyed fine grained steel 460/630 for service temperatures down to -40 °C). A further approval by a notified body in accordance with PED (2014/68/EU) is available. This material data sheet applies to heavy plates with thicknesses from 7 to 20 mm.

Chemical composition

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

C	Si	Mn	P	S	N	Ni	V	Cr[a)]	Cu	Mo[a)]	Al[b)]
0.20	0.10-0.60	1.00-1.70	0.020	0.005	0.025	0.40	0.10-0.20	0.30	0.20	0.10	0.020

[a)] Cr + Mo ≤ 0,30 %
[b)] Minimum requirement for ladle and piece analysis

Delivery condition

The plates are generally supplied in a normalized condition. In accordance with EN 10028-3, additional tempering can be carried out at the manufacturer's discretion.
Verification of the mechanical-technological properties on simulated post weld heat-treated specimens can be agreed. This optional test must be specified when ordering and is carried out instead of the test in the reference condition.

[1] The current version of this material data sheet can be also found on: www.dillinger.de.

Mechanical properties

The mechanical properties are verified on specimens in the normalized condition (N) or in the normalized and tempered condition (N+T).

Tensile test at ambient temperature – transverse test specimens –

Plate thickness [mm]	Minimum tensile strength R_m [MPa]	Minimum yield strength R_{eH}[a)] [MPa]	Minimum elongation A_5 [%]
≤ 20	630 - 725	460	17

[a)] In case of indefinite yield strength, $R_{p0.2}$ is to be determined in accordance with the provisions shown in EN 10028-1.

Impact test on Charpy-V – transverse test specimens

	Test temperature [°C]	Impact energy KV_2 [J]	Impact energy KV_2 [J][b)]
DILLINAL 460/630 N	-20	≥ 27	≥ 45
DILLINAL 460/630 NL	-40	≥ 27	≥ 45

[b)] On separate request

The specified minimum values are the average of 3 specimens. No individual value is to be less than 70 % of the specified minimum. For plate thickness ≤ 12 mm the test can be carried out on Charpy-V specimens or Charpy-V-type specimens with reduced width. The minimum impact value will be reduced proportionally to the reduction of the specimen's cross section.

Testing

Sampling, testing method and tests are in accordance with EN 10028-1, unless otherwise stipulated or agreed. The plates can be delivered with inspection certificate 3.1 or 3.2 in accordance with EN 10204. The kind of the inspection certificate must be specified on the order.

Identification

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

- steel grade (DILLINAL 460/630 N or DILLINAL 460/630 NL)
- heat number
- rolled plate number and single plate number
- the manufacturer's symbol
- inspector's mark

Processing

The recommendations in accordance with EN 1011 and CEN-TR 10347 should be observed. The entire processing and application techniques are of fundamental importance to the reliability of the products made from this steel. The user should ensure that his design, construction, and processing methods are aligned with the material, correspond to the state-of-the-art that the fabricator must comply with and are suitable for the intended use. The customer is responsible for the selection of the material.

Welding and thermal cutting
The suitability of DILLINAL 460/630 for flame cutting and welding has been proven. The verification of the toughness properties is performed on welding specimens with basic filler metal and a cooling time $t_{8/5}$ in the range between 8 and 33 seconds. In case of high toughness requirements, it may be necessary to reduce the heat input so that the $t_{8/5}$ time is below 20 seconds. In any case welding shall be performed in multi pass technique with flat welding passes and good grain refinement.

Forming
The plates can be hot or cold formed. Even in case of appropriate hot forming an additional tempering can be necessary particularly for thin plates due to the accelerated cooling within the forming tool.

Heat treatment
If stress-relieving treatment is necessary, this is usually performed on the finished welded vessel. The stress-relieving treatment should be performed at temperature under 560 °C, as higher temperatures lead to reduced toughness properties in the weld. The time-temperature-parameter P in accordance with EN 10028-3 must not exceed the value 16.7 for DILLINAL 460/630 N and 16.3 for DILLINAL 460/630 NL.
The stress-relieving treatment can be omitted if no corrosive media will be transported in the vessels and if allowed by the applicable regulations.

General technical delivery requirements

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

Tolerances

Unless otherwise agreed, tolerances are in accordance with EN 10029. For the thickness Class B will be applied, for the flatness table 4, steel group L of the EN 10029. Smaller flatness tolerances may be agreed upon request.

Surface quality

Unless otherwise agreed, the indications in accordance with EN 10163-2, class B3, apply.

General note

If 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 material data sheet is a product description. This material data sheet is updated at irregular intervals. The current version is available from the mill or as download at https://www.dillinger.de/products/.

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