



## Slag Pots in Cast Steel

expertise products made in Germany



Slag pots ready for shipment at DILLINGER HÜTTE

DILLINGER HÜTTE is a modern industrial German group specialized in the producing of heavy plates in low-alloyed carbon steel grades. Organised as full integrated works, the major production facilities include cokery plant, blast-furnaces, oxygen steel plant - equipped with BOF-converters, secondary metallurgy, vacuum degassing, continuous and ingots casting - and plate mills.

Complementary to the core business, a "down-stream" manufacturing unit is available as a branch of the Heavy Fabrication: it is mainly focused on the supply of slag-pots made out of cast-steel (GS) everywhere the emphasis is placed on large buckets in capacity up to 45 m<sup>3</sup> (1.575 cu. feet).

The expertise of DILLINGER HÜTTE arises from its privilege to be both user and manufacturer of slag pots. The extensive experience gained in designing and engineering slag-pots is primarily based on the pots operating at the own steel plant and secondly on about 3.000 items produced over the 40 last years also in co-operation with manufacturers of slag pot carriers and service providers to metallurgical industries.

The Dillinger slag pots are operating worldwide wherever reliable tools are required for the disposal of molten or solid slag which arises from metallurgical or chemical processes.



## Product definition

The product covered here is a load-bearing device whose sole purpose is to collect molten or solid slag generated during metallurgical or chemical processes, to retain it during transport and to deposit it at a place of disposal.

Slag pots are crucial items as they are part of a lifting equipment and therefore undergo in terms of mechanical design engineering and handling the national safety regulations of the state where they are supposed to be operated. The design of the Dillinger slag pots intended to be used within the European Community meets the requirements of the European Machinery Directive 2006/42/EC: every slag pots is supplied with the CE conformity marking.

## Material

The pots are made out of the cast-steel DICAST, trade name owned by DILLINGER HÜTTE for castings: this material is similar to the steels A27/A 27M grade 65-35: April 2003, BS 3100 A1/A2: January 1991 or GS 20Mn5 to DIN 17182: May 1992. DICAST is a fully killed steel, vacuum-degassed and processed to a fine grain size structure with improved properties both in toughness and in elongation.

- **Chemical composition** verified on product

Elements	C	Si	Mn	P	S
Required	≤0.23%	≤0.55%	≤1.65%	≤ 0.025%	≤ 0.025%
Typical	0.17%	0.40%	1.45%	0.015%	0.002%

- **Mechanical properties** checked at room temperature in the delivery condition i.e. after completion of the quality heat treatment from cylindrical cast-on test blocks (Ø 60 mm x 250 mm) available on every slag pot: both the sample preparation and the testing comply with ASTM A 370-96.

Properties	R <sub>m</sub>	R <sub>eh</sub>	A	KCV ( average of 3 specimens / individual )
Required	≥ 450 MPa	≥ 240 MPa	≥ 20 %	≥ 55 J / 39 J
Typical	490 MPa	280 MPa	30 %	120 J / 85 J

- **Delivery condition:** normalised

Note regarding the material selection: due to obvious advantages in terms of service life and maintenance cost-efficiency, cast steel has been becoming more significant in the slag pot construction over the last years versus both materials, spheroidal cast-iron and lamellar graphite cast-iron. In contrast to other materials, cast steel offers excellent repair possibilities as it is well-suited to welding.

## Manufacturing

Except the supply of the forgings for trunnions and the engineering of the pattern, all further operations are carried-out at the in-house foundry plant.

- **Moulding**

the castings are manufactured in a workman-like manner as required in the German standard DIN EN 1599-1: August 1997, ruling the delivery conditions of castings. The moulding is individually carried out within a modular flask by using a sand preparation based on resin bonding.

- **Trunnions**

the trunnions - when any - are preferably cast-in: they are as a rule manufactured from the steel material S355 J2G3 to DIN EN 10250-2: December 1999 and forged as per DIN 7527 February 1975. Cast-on or hot-fitted trunnions can be also provided.

- **Melting**

the melting is carried out in the oxygen steel plant ( 2 off 180 t BOF converters ); the ladle capacity allows a continuous bottom pouring process the speed of which is permanently controlled. The metal analysis is checked by using a computer linked spectrograph.



- **Heat treatment**

every pot undergoes a combined quality heat treatment (annealing) aiming both to grain refining and to stress relieving i.e.:

- heating to a temperature above AR<sub>3</sub>, austenitising at about 915°C and controlled cooling in furnace
- intermediate holding at 600°C - 630°C and completion of cooling in furnace down to 300°C

- **Fettling and dressing**

The inner surface is processed fit-for-purpose so that the surface discontinuities - which might cause some sticking of the slag - are extensively removed. Additionally, the castings are descaled by shot-blasting and the outside is additionally coated for transportation.

The surface quality results from the comprehensive practice of the manufacturer qualified by the requirements of MSS SP-55-1996 (Visual Method for Evaluation of Surface Irregularities).

## Quality assurance

The fabrication route is governed by the provisions of the implemented Quality System ISO 9001: 2000.

The standard documentation ensures the full traceability of every process step:

- Manufacturer test certificates according to DIN EN 10.204 § 3.1 including chemical composition, mechanical properties and non-destructive examination;
- Dimensional check supported with a “as-built“ sketch;
- Record of the quality heat treatment;
- Documentation required by the Machinery Directive 2006/42/EC (when applicable).

## Design

The slag pots can either be manufactured in accordance with a well-trying and proven concept provided by the commissioner or be customised to the specific requirements resulting from the operational environment. The range of the available design reaches from conventional to most advanced buckets.

Slag pots are wearing products exposed to both mechanical and alternate thermal stresses the extent of them depends on the service conditions. An accurate design aims to minimise the impair of the operative environment on the service life: however, it remains always a compromise taking into consideration both physical and economical aspects, resulting in a variety of shapes tailored to the site operations.

A comprehensive data bank resulting from the previous experiences combined with a proper software implementing the Finite Element Analysis serves the individual design optimisation.

## Service philosophy

The marketing strategy of DILLINGER HÜTTE is to enjoy the direct contact to the slag pot operators and to establish a long-terms relationship for mutual profit.

Slag pots are more than just disposable products: we endeavour to propose options in terms of design engineering in taking advantage of our double experience as manufacturer and user, always targeting the optimisation of their service life.

## Skill with slag pots

Further information on delivery programme as well as useful advises on product, design, material and application are provided by the customer service team of the foundry department: it will support you actively in helping you to elaborate the right solution.

Whenever you need assistance, please contact:

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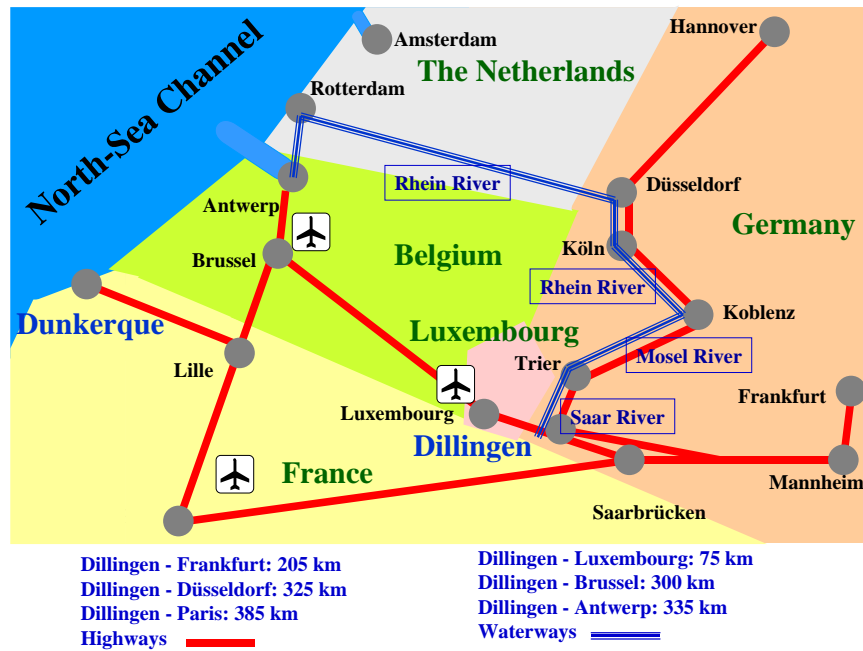


**DILLINGER HÜTTE**  
Heavy Fabrication Division

## How to find us

DILLINGEN is located in the south-western area of Germany near to the French frontier, close to the axis Frankfurt - Paris.

The access to the both North-Sea shipping-ports Antwerp and Rotterdam is available by rail-, road- and waterways and enables the transport of heavy and bulky items like slag pots.



Slag pot (34 m<sup>3</sup> / 63 t) being loaded at the company's pier in DILLINGEN



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