Replaces:
RN 860-4:2024-05-03

Delivery conditions for Castings

Copper alloys

Content

Page

Changes

2024-05-24

The following changed in comparison to RN 860-4:2024-05-03:

a) Updated references
b) Chapter 4.2: Information on surface roughness added
c) Chapter 5 a): Correction regarding the authorisation of IACS member societies

1 Scope

This factory standard applies in addition to the standards for raw castings of copper alloys acc. to EN 1982, especially for components made from CuAl10Fe5Ni5, quoted in chapter 2 and has priority over the standards listed below. Components according to this standard are generally intended for underwater applications. The specifications regarding leakage and leak tests refer to this application.

2 References

The following documents, cited in part or in whole, shall apply for the use of this standard. In the case of dated references, only the referenced edition applies; in the case of undated references, the latest edition of the referenced document (including all amendments) applies. The applicable version of the standards listed below shall apply to all contents not covered by this factory standard.

EN 1370	Founding – Examination of surface condition
EN 1559-1	Founding – Technical conditions of delivery – Part 1: General
EN 1593	Non-destructive testing - Leak testing - Bubble emission techniques
EN 1982	Copper and copper alloys - Ingots and castings
EN 10204	Metallic products – Types of inspection documents
EN ISO 2624	Copper and copper alloys - Estimation of average grain size
EN ISO 3452-1	Non-destructive testing - Penetrant testing - Part 1: General principles
EN ISO 6506-1	Metallic materials - Brinell hardness test - Part 1: Test method
EN ISO 6892-1	Metallic materials - Tensile testing - Part 1: Method of test at room temperature
EN ISO 8062-3	Geometrical product specifications (GPS) – Dimensional and geometrical tolerances for moulded parts – Part 3: General dimensional and geometrical tolerances and machining allowances for castings
VDG P 378	Casting of test specimens from copper casting alloys for tensile testing (sand casting and gravity die casting)
RN 72	Packaging and Preservation; Supply parts for production
RN 1936	Labelling; Raw material, parts and gearboxes
0-124-77303	production specification radius design
on request	HB measuring points

3 Designations

Materials for parts of copper alloys are named acc. to EN 1982:

Table 1 Materials and part categories

Part category	EN 1982 designation
A) Housings	CuAl10Fe5Ni5
B) Covers, bearing housing, shaft nuts and small parts	

4 Part-specific requirements

4.1 Chemical composition

Table 2 Mass fractions for CuAl10Fe5Ni5 acc. to EN 1982, Tab. 34

	Al	Cu	Fe	Mn	Ni	Bi	Cr	Mg	Pb	Si	Sn	Zn
min.	8.5	76.0	4.0	-	4.0	-	-	-	-	-	-	-
max.	10.5	83.0	5.5	3.0	6.0	0.01	0.05	0.05	0.03	0.1	0.1	0.5

4.2 Further requirements

mechanical properties:	▪ min. values for **CuAl10Fe5Ni5** acc. to EN 1982 casting method: sand casting (-GS) tensile strength Rm: 600 N/mm^2 0.2 %-yield strength $Rp_{0.2}$: 250 N/mm^2 elongation at break A: 13 % ▪ Brinell hardness: 140 HBW
heat treatment:	▪ residual stresses in the casting must be minimised (controlled cooling in the mould is preferable to stress relief annealing) ▪ casting stress-relieved on delivery
samples:	▪ separately cast test samples acc. to VDG P 378 for test certificate acc. to chapter 5 d)
external and internal condition:	▪ smooth, clean surface without disturbing unevenness, free of cracks, pores, burrs, adhering sand, ceramic residues, oxide skins and streaks ▪ machined on the outside acc. to the reference sample
Surface roughness:	▪ inspection acc. to EN 1370 using BNIF reference samples raw-cast state: 5 S1 to 6 S1 ground surfaces: 1 S2 to 2 S2
leakage:	▪ general: housings must be water- and oil-tight under operating conditions, i.e. leakage rate < 10^{-4}Pa*m^3/s ▪ at the manufacturer: VT for conspicuous porosities and cracks ○ production step: after surface treatment ○ scope: each casting, entire surface ○ description: visually locate conspicuous porosities and cracks and leakage testing acc. to chapter 4.3 ▪ at REINTJES: bubble test acc. to EN 1593 (acc. to test instructions)
hardness measurement	▪ only on special request
general tolerances, machining allowances:	▪ see drawing
Radius design: (only part category A)	▪ acc. to production specification 0-124-77303 (unless specified otherwise in drawing or order)

4.3 Leakage testing (PT)

type	▪ modified dye penetrant testing acc. to EN ISO 3452-1 (red-white test)
preparation	▪ prepared and cleaned acc. to chapter 4.2 and EN ISO 3452-1
processing	▪ apply a suitable penetrant from the inside and developer from the outside (spray, brush) on conspicuous areas ▪ visual testing at the earliest 30 minutes after application of the penetrant, developer must be dry ▪ no indications: passed test existing indications: failed test, treatment of bad spots acc. to chapter 4.4
post-treatment	▪ remove penetrant and developer as far as possible
documentation	▪ logging and test report acc. to EN ISO 3452-1 ▪ in case of failed test additional documentation acc. to chapter 4.4

4.4 Treatment of bad spots by manufacturer

Repair:	▪ repair leaks and larger porosities with production welds by qualified welders after approval by REINTJES ▪ do not fill bad spots, but grind them properly (no visible impurities, shrink holes etc., minimized notch effect)
Documentation:	▪ measure bad spots, write dimensions clearly and legibly on the casting (indicate length, width, depth, residual wall thickness and position) ▪ photograph model number for identification (housings only) ▪ photograph casting so that bad spot(s) can be localized ▪ make close-ups so that dimensions of bad spot(s) are clearly visible
Information, Approval:	▪ Photographs of casting and/or bad spot(s) and ▪ short description of bad spot(s) (type, position, dimensions etc.) must be sent to the purchasing and quality assurance departments of REINTJES for an assessment and the decision for further action

5 Other requirements

a) Steel and forging plant
- certified acc. to: DIN EN ISO 9001 ff.
- approved by at least one member society of IACS

b) Packaging and Preservation
- RN 72

c) Labelling
- RN 1936

d) Documentation (must be digitally available upon delivery)
- inspection certificate 3.1 in accordance with EN 10204 indicating chemical composition, Brinell hardness and tensile strength (for part category A and coupling carriers)
- test certificate 2.2 in accordance with EN 10204 for part category B
- REINTJES quality control plan (geometric dimensions)
- initial sample acceptance drawing (only if requested in the order)
- evidence of radioactivity