BRASS ALLOY CW709R

Free cutting and forging brass in the form of rod. The alloy has very good dezincification resistance and machinability. Hot forgeability is good.

Composition

CW709R	Cu	Zn	Pb	Sn	Fe	Si	Al
Limits	64.8–66.5%	Rem	1.5-2.2%	<0.3%	0.1-0.2%	0.60-0.75%	<0.03%

Ni	As
<0.3%	0.03-0.08%

Standardization

The alloy is, according to international standards, equivalent in composition to

CW709R	CuZn32Pb2AsFeSi

SS-EN 12163, rod for general purposes

Structure type

α-phase together with lead phase. Some β-phase may occur.

Application example

Rod:
Fitting parts in contact with water where there are stringent requirements for dezincification resistance, e.g. certain fittings according to Swedish Building Standards.

Residual stress level

Rod must show no evidence of cracking after testing according to SS-ISO 6957 Copper alloys – "Ammonia test for determining resistance to stress corrosion". High stress according to the standard must be applied.

Heat treatment

Stress-relief annealing. Temperature 330-350°C. Time 2-4 hours. Stress-relief annealing should be carried out after all cold working which gives high residual tensile stresses in the material. It may also be justified after machining. This eliminates the risk of stress corrosion cracking caused by internal stresses.

Soft annealing (Dezincification resistance annealing). Temperature 500-550°C. Time 1-2 hours. The temperature must not be exceeded if the requirements in the sanitary water standard for dezincification resistance shall be met.

Dezincification resistance

The alloy is dezincification resistant, according to ISO 6509 and AS 2345-2006, appendix C.

Copper is a relatively noble metal. Copper and its alloys therefore show little tendency to react with the environment. As a result of this, the copper materials generally have good corrosion resistance. However, corrosion may occur under disadvantageous unfavorable conditions. The type of corrosion which may occur depends on both the environment and the composition of the alloy.

The corrosion resistance of CW709R is

Corrosion types	Corrosion resistance	Comment
Stress Corrosion Cracking, SCC	Satisfactory	This type of corrosion only occurs in the simultaneous presence of high stresses in the material and a corrosive medium containing ammonia and moisture. (*See Heat treatment*.)
Dezincification, DZR	Very good	
Erosion corrosion	Very good	

Physical properties

Property	Value	Unit
Density	8450	kg/m^3
Melting temperature	900-920	°C
Heat capacity at 20°C	0.38	kJ/(kg°C)
Resistivity at 20°C	66	nΩm
Temperature coefficient for resistance at 20°C, 0-100°C	0.0017	°C
Conductivity at 20°C	9 26%	MS/m IACS[1]
Thermal conductivity at 20°C	120	W/m°C
Thermal expansivity, 20-300°C	21*10^{-6}	°C
Modulus of elasticity	109	GPa
Modulus of shearing	39	GPa

1) IACS = International Annealed Copper Standard. 100% IACS is equivalent to a resistivity of 17.241 nΩm and a conductivity of 58 MS/m.

Workability

Hot workability is good. Suitable temperature 775-850°C. Among other things the alloy is intended for hot forging of fittings components for sanitary water fittings and is approved by Swedish National Board of Housing, Building and Planning for this purpose. The approval is based, among other things, on the fact that the temperature indicated is maintained during forging. Slow cooling from the hot working temperature must be applied.

Cold workability in the hot worked and annealed condition is satisfactory. The workability decreases as hardness increases. For stress-relief annealing after cold working see Heat treatment.

Machinability

High surface quality is easy to achieve.
The chips are short.
The alloy is suitable for machining in automated machines.

Tool and cutting data, turning
Material: Tungsten carbide according to ISO-group K 10.High speed steel.

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Cutting data	**Tungsten carbide**	**High speed steel**
Rake angle	2-6°	0-3°
Back rake angle	0°	0°
Clearance angle	4-6°	0-6°
Cutting speed	Approx. 300 m/min or faster	Approx. 150 m/min or faster
Cutting fluid	Dry or cutting oil	Emulsion or cutting oil

Welding and brazing

The high lead content means that in welding the material becomes hot brittle and the weld is porous. The following applies to the different welding methods:

Welding method	**Suitability**	**Comment**
Fuse welding and resistance welding	Poor	Cannot be carried out with good results.
Braze welding	Poor	Cannot be carried out with good results because of the minimal difference between the melting temperature of the base metal and the working temperature of the solder.
Brazing (hard soldering)	Satisfactory, can be carried out with a silver solder and silver-phosphorus-copper solder	Difficult to carry out with a phosphorus-copper solder and cannot be carried out with satisfactory results with a brass solder (see Braze welding).
Soldering	Excellent	Very easy to carry out.

Surface treatment

Mechanical surface treatment such as grinding, brushing, blasting and polishing is carried out by conventional methods.
Pickling (non-oxidizing pickling) is suitably carried out with diluted sulphuric acid at room temperature.
Pickling to a metallically clean surface (oxidizing pickling) is suitably carried out in a pickling bath containing oxidants such as peroxide, nitric acid or dichromate. For pickling to a high gloss, baths containing nitric acid are mainly used.
Chemical and electrolytic polishing is easy to carry out with mixtures of concentrated acids, e.g. phosphoric acid, nitric acid and acetic acid.
Polishing is suitably carried out with commercial cleaning products for copper.
Dark dyeing is easy to carry out by wet chemical methods, dark sulphide or oxide layers being obtained.
Varnishing with clear varnish means that the appearance obtained after cleaning or dyeing, for example, is retained for a long time. Clear varnishes containing a discoloring inhibitor are available for demanding applications.
Metallization (metallic surface coating) is easy to carry out.

Mechanical properties

CW709R from Nordic Brass Gusum meets and exceeds the quality demands defined in the standards. To give an idea of the mechanical properties some empirical values, according to the material grade "M" in the EN standard, are listed below. These values are to be considered as guideline values for the delivered material.

Property	Value	Unit
Rm, Tensile strength	>400	MPa
Rp02, Yield strength	~290	MPa
A5, Fracture elongation	>30	%
Brinell hardness	~115	HB