



## Opaque, Resistant Glass Colours (series H 15)

### 1 General Information

Opaque, resistant glass colours of series H 15 are often used for decoration of drinking glasses and bottles. Because of the release of lead, the lip space should be left undecorated. Sometimes colours of series H 15 are used for a decoration on earthenware and tiles, if a lower firing temperature is preferred.

We deliver our colours in powder form. On request they can be supplied ready for spraying, pasted for screenprinting, thermoplastic or ready for pad printing.

### 2 Firing range

580 (1076) - 630°C (1166°F) 10 to 15 minutes peak-time at 580°C is sufficient for a normal firing. If a shorter peaktime is required, a higher firing temperature is necessary.

### 3 Properties of the colours

The series H 15 colours in comparison with the H 14 colours are more intensive, brighter and opaque.

Colours of series H 15 contain lithium oxide. A reduction of the internal pressure resistance due to the diffusion of the lithium can't be excluded. Before usage of the colours the user has to check according to DIN 52 320 "Innendruckversuch für Hohlglasbehälter, insbesondere Behälterglas" if the containers to be decorated are useful for a filling with beverage containing carbon dioxide.

#### 3.1 Heavy metal content

Colours of series H 15 contain lead and cadmium.

#### 3.2 Miscibility

All colours can be mixed together. Not all mixture results can be foreseen in advance, eg. a mixture between blue and red did not result in a clear violet, but in a dim colour shade.

#### 3.3 Expansion co-efficient

The thermal expansion of the colours lies between 88 to 92 x 10<sup>-7</sup>/°C.

### 4 Achievable properties of finished decorations manufactured with colours from the H15 series.

Besides their colour intensity and brilliance, the important properties of fired colour decorations are, in particular, their dishwasher resistance, the resistance to mechanical and

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#### W. C. Heraeus

Ceramic Colours Division (CCD)  
Heraeusstraße 12-14  
D-63450 Hanau  
Phone: ++49 (6181) 35 3810  
Fax: ++49 (6181) 35 5261  
e-mail: [ccd-m@heraeus.com](mailto:ccd-m@heraeus.com)  
internet: [www.heraeus-ccd.com](http://www.heraeus-ccd.com) / [www.wc-heraeus.com](http://www.wc-heraeus.com)

chemical attack and the release of heavy metals.

The properties of finished decorations are influenced by a number of factors. The high quality of the colour used is an absolute prerequisite for the manufacture of qualitatively high grade decorations. The quality of a fired decoration, however, is derived from the interplay of colour, application, substrate glaze and the firing conditions. A variation in only one factor – for instance, the firing conditions – has an immediate influence in that it leads to altered properties of the fired decoration.

We have processed the colours of our H15 series under defined conditions. Then we determined the properties of the finished decorations. The following gives an indication of achievable quality features for the finished decorations manufactured with the colours of the H15 series. They must, however, always be checked by the user under his own individual conditions.

#### **4.1 Heavy metal release / Resistance according to DIN EN 1388-1-2**

We test the heavy metal release of a decoration according to DIN EN 1388-1-2. This means that the decoration surface to be examined is exposed to the attack of an acetic acid solution with a volume concentration of 4% in darkness for 24 hours at a temperature of  $22 \pm 2^\circ\text{C}$ . Subsequently the mass concentration of lead and cadmium in the extraction solution are determined.

Colours of series H 15 are not resistant according to DIN 1388-1-2, but they show a much better lead and cadmium release in comparison with our series H 32. Moreover they have a good durability against acids and alkalis. Therefore we describe them as resistant.

#### **4.2 Resistance to acids**

We test acid resistance by placing a decorated test substrate in a 4% acetic acid solution at  $22 \pm 2^\circ\text{C}$  for 5 hours. We then examine the stability of brightness and colour brilliance of the colour decoration.

The series H 15 colours have a high durability against acids and alkalis, except of H 15115.

#### **4.3 Dishwasher resistance/- durability**

All details as to whether ceramic decorations are dishwasher resistant or durable are to be regarded as approximate values, as test results vary widely according to the type of dishwasher, washing programme, washing-up detergent, water quality and firing conditions. To avoid defective production the user should test the colours in connection with materials involved in further processing and determine whether the desired dishwasher proof or resistant decorations are achieved.

Heraeus tests whether finished decorations are dishwasher resistant or durable according to a test washing programme of the Special Standards Committee Materials Testing (Fachnormenausschuss Materialprüfung, FNM) in a Miele continuous dishwasher.

If a decoration survives 500 dishwashing cycles essentially without damage, it is designated by us as dishwasher durable. If it survives 1000 washing cycles, we designate it as dishwasher resistant. Decorations on glass generally do not achieve the high resistance of decorations on ceramics. Considering this fact we describe decorations on glass as dishwasher durable, if they withstand 200 dishwashing cycles without essential damage.

Our dishwasher tests showed that many colour of series H 15 are dishwasher durable. Further information is given by our attached product overview.

## **5 Processing Information**

In the following application information, we repeatedly recommend the homogenisation of the mixed colour paste using a triple roll mill. This is a very important recommendation. An insufficiently homogenised paste may lead to a matt or rough colour surface after firing. The use of a triple roll mill prevents this, very common, disturbance of

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Fax: ++49 (6181) 35 5261  
e-mail: [ccd-m@heraeus.com](mailto:ccd-m@heraeus.com)  
internet: [www.heraeus-ccd.com](http://www.heraeus-ccd.com) / [www.wc-heraeus.com](http://www.wc-heraeus.com)

decorations.

## 5.1 Brush Application

Colours of series H 15 can be pasted with an oil or a water based medium.

If you prefer an oil-based medium, we recommend the use of oil Nr.221, in a mixing ratio of 100 parts by weight of colour powder to 60 to 80 parts by weight of oil. The mixed paste should be homogenised on a triple roll mill before it is thinned with turpentine oil Nr. 62 ready to use.

Alternatively the colour powder can be pasted with our water-based medium Nr.46. We recommend a mixing ratio 100 parts by weight of colour to 50 to 60 parts by weight of medium. The mixed paste should be homogenised on a triple roll mill before it is thinned with 30 to 40 parts by weight of water ready for use.

## 5.2 Direct screen printing and decal production

The colour powder needs to be pasted with screen printing oil Nr. 221, in a mixing ratio of 100 parts by weight of colour powder to 50 to 65 parts by weight of oil. The mixed paste has to be homogenised on a triple roll mill.

The thickness of a printed colour layer is not only determined by the screen size, but also by the film solution thickness, the angle, sharpness and hardness of the squeegee, as well as the squeegee pressure and the speed of printing. This makes the recommendation of a "best" screen very difficult.

We have obtained good printing results with 68-55 to 90-50 (180 to 220 mesh) polyester screens or respectively 220 to 300 mesh steel screens.

Hint: If a very opaque colour layer is required, we recommend printing first, a white underlay and then the colour on top. Our white H 15007 is suitable for this process.

For use on decals, we recommend our covercoat L 406, printed using a 24-140 to 32-120 (60 to 80 mesh) polyester screen or the corresponding steel screen.

The series H 15 is not suitable for printing with UV-Media.

## 5.3 Thermoplastic Screenprinting

Normally we dispatch our colours pasted with Medium Nr. 234. The processing temperature is 80°C. If the viscosity is too high, we recommend to add 1-3% of the above mentioned thermoplastic medium Nr. 234. The colour will be applied melted on the screen. For detailed information, please look in our Technical Information Nr. 4.40.

For printing we normally use a screen made of electric conducting material, e.g. 220-350 VA iron-steel-screen or a metallized polyester screen (heated by current).

The use of this colour series in thermoplastic screen printing should be thoroughly tested because of high opacity of the colours.

## 5.4 Spraying (air brushing)

For spray application the colour powder can be pasted with an oil based or a water based medium.

If you prefer an oil-based medium, the colour powder can be pasted with either oil Nr. 230 or Nr. 21. Depending on the individual spraying conditions, we recommend a mixing ratio of 100 parts by weight of colour powder to 70 to 150 parts by weight of oil.

Alternatively, the colour powder can also be pasted with water based medium Nr. 231 in a mixing ratio of 100 parts by weight of colour powder to 100 to 150 parts by weight of medium. For additional thinning, water or ethanol can be used.

The use of this colour series in spraying should be thoroughly tested because of high opacity of the colours.

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## 5.5 Pad printing

We differentiate between cold pad printing and pad printing with a semi-thermoplastic medium.

For cold pad printing, 100 parts by weight of colour powder needs to be pasted with 40 to 50 parts by weight of medium Nr. 232. The colour paste should be homogenised on a triple roll mill.

For semi-thermoplastic pad printing, the colours need to be pasted with medium Nr. 040695. Normally we deliver the colours already pasted in the semi-thermoplastic medium, ready to use. The semi-thermoplastic colour paste can be used for pad printing via steel or polymer clichés as well as for total transfer. The paste has to be processed at approx. 80°C. If necessary the processing characteristics of the colour paste can be adjusted by the addition of medium Nr. 040695 (further information can be found in the technical information sheet Nr. 3.34 "Semi-thermoplastic colour for total transfer").

## 6 Firing

The decorated article should be fired with a slowly increasing temperature. An efficient removal of the organic fumes in the firing phase up to 350°C and a high oxidising atmosphere are important for an excellent fired result of the colours.

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## 7 Opaque, resistant glass colours of series H 15

Name of Colour	Number of Colour	Pantone No.	precious metal content	lead free	cadmium free	resistant	dishwasher durable	dishwasher resistant	mixable	Notes)
<b>Basisfarben</b>										
Flux	H 15000	-				●	●	●		
White	H 15007	-				●	●	●		
Pink	H 15072	169C				●	●	●		
Sky blue	H 15110	299C				●	●	●		
Light blue	H 15112	284C				●	●	●		
Blue	H 15114	285C				●	●	●		
Royal blue	H 15115	2718C				●	●	●		
Green	H 15143	319C				●	●	●		
Red brown	H 15226	1685C				●	●	●		
Dark brown	H 15228	175C				●	●	●		
Ocher	H 15234	143C				●	●	●		
Cream yellow	H 15330	-				●	●	●		
Yellow	H 15332	120C				●	●	●		
Sun yellow	H 15335	116C				●	●	●		
Petrol green	H 15417	322C				●	●	●		
Moss green	H 15436	377C				●	●	●		
Green	H 15446	339C				●	●	●		
Dark green	H 15449	349C				●	●	●		
Salmon	H 15503	1565C				●	●	●		
Orange	H 15535	1585C				●	●	●		
Tangerine	H 15575	172C				●	●	●		
Cherry	H 15773	485C				●	●	●		
Red	H 15777	1797C				●	●	●		
Grey	H 15884	429C				●	●	●		
Black	H 15886	426C				●	●	●		
<b>4-colour-process colours</b>										
Cyan	H 15104	285C				●	●	●		
Yellow	H 15304	116C				●	●	●		
Red	H 15704	1797C				●	●	●		
Black	H 15804	426C				●	●	●		

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