



Opaque Universal Glass Colours (Series H 32)

1 General information

Opaque universal colours of series H 32 are often used for the decoration of bottles, cosmetic containers and drinking glasses. Due to the lead release the lip rim should stay undecorated. Fired at glass firing temperature, the colours of range H 32 can also be used for the decoration of earthenware and tiles.

We supply the colours in powder form. On request they can be offered ready for spraying, pasted for screenprinting, thermoplastic or ready for pad printing.

2 Firing range

490-580°C/914-1076°F

3 Properties of the colours

3.1 Heavy metal content

All colours of the series H 32 contain lead and cadmium.

3.2 Miscibility

All colours of the series can be mixed in all proportions.

3.3 Expansion co-efficient

The expansion co-efficient of the colours lies between 90 to 100 x 10⁻⁷/°C

4 Achievable properties of finished decorations manufactured with colours from the series H 32

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

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properties of the fired decoration.

We have processed the colours of range H 32 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 H 32 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 32 are not resistant according to DIN EN 1388-1-2.

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 32 colours are not resistant against acids.

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.

Heraeus colours of the series H 32 are neither dishwasher resistant nor dishwasher durable.

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 decorations.

5.1 Brush application

Colours of series H 32 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 50 to 60 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.

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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 60 to 80 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 32007 is suitable for this process.

For use on decals, we recommend our covercoat L 406, printed using a 24-160 to 32-120 (60 to 80 mesh) polyester screen or the corresponding steel screen.

5.3 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.

5.4 Pad printing

We differ 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. 260600. 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. 260600 (further information can be found in the technical information sheet Nr. 3.34 "Semi-thermoplastic colour for total transfer").

6 Firing

Articles decorated by direct screenprinting with fairly thin colour layer can be fired right after the application of the colour. Articles decorated by decals need to dry 2 to 3 hours before they are fired.

The decorated object has to be fired at a slowly increasing temperature. Please take care to maintain good ventilation particularly in the first firing phase up to approx. 400°C (752°F). This is important for the quality of the final result.

Too much water vapour or a reducing atmosphere in a gas kiln can lead to a matt colour surface after firing.

7 Opaque glass colours of series H 32

Name of Colour	Number of Colour	Pantone No. 2)	precious metal content	lead free	cadmium free	resistant	dishwasher durable	dishwasher resistant	mixable	Notes 1)
Basic colours										
Flux	H 32000	-							●	
Pink	H 32070	692C							●	
Pink	H 32071	486C							●	
Blue	H 32107	632C							●	
Blue	H 32112	542C							●	
Blue	H 32113	2727C							●	
Medium blue	H 32116	293C							●	
Gentian blue	H 32117	286C							●	
Dark blue	H 32118	2758C							●	
Turquoise	H 32141	549C							●	
Turquoise	H 32143	631C							●	
Blue green	H 32148	3305C							●	
Brown	H 32226	175C							●	
Brown	H 32228	4625C							●	
Yellow brown	H 32234	145C							●	
Cream	H 32320	316C							●	
Cream	H 32330	616C							●	
Light yellow	H 32332	611C							●	
Yellow	H 32335	116C							●	
Yellow	H 32339	110C							●	
Turquoise green	H 32412	3282C							●	
Yellow green	H 32433	367C							●	
Yellow green	H 32445	364C							●	
Green	H 32446	3435C							●	
Dark green	H 32449	349C							●	
Yellow pink	H 32535	717C							●	
Yellow orange	H 32575	1525C							●	
Carmin	H 32672	688C	●						●	
Purple	H 32676	511C	●						●	
Red	H 32773	179C							●	
Red	H 32777	186C							●	
Red	H 32778	704C							●	
Grey	H 32884	430C							●	
Black	H 32886	BlackC							●	
Violet	H 32965	2622C	●						●	
4-colour-process										
White	H 32007	-	*)						●	
Medium blue	H 32104	293C	*)						●	
Yellow	H 32304	605C	*)						●	
Red	H 32704	180C	*)						●	
Black	H 32804	BlackC	*)						●	

1) Thermal expansion: 90 to 100 x 10⁻⁷ / °C

2) screen: steel VA 220 *) polyester 150 SX

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