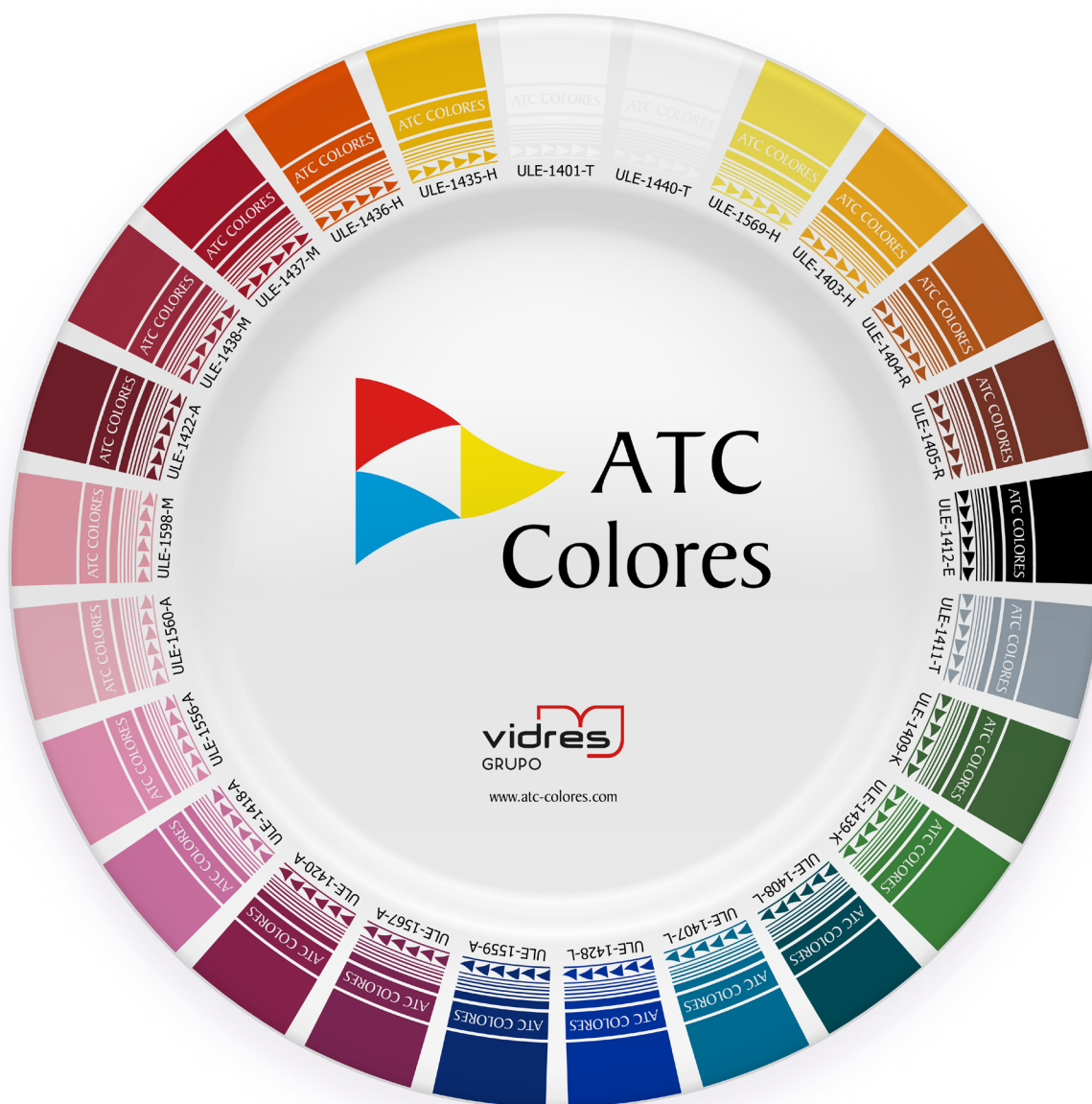


**ULE SERIES - LEAD FREE ONGLAZE ENAMEL
COLOURS FOR TABLEWARE, EARTHENWARE,
STONEWARE, PORCELAIN, BONE CHINA & TILE**

The Colour Chart shows an approximate impression of the basic colours for a first selection of colours. For exact reproduction of a colour tone it is absolutely necessary to test a sample under original conditions.



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TECHNICAL DATA SHEET AND USAGE

The ULE colours are Onglaze colours, lead free for low temperature decoration. They can be used on a variety of substrates and glazes providing a comprehensive range of colours designed for maximum miscibility and optimal metal release.

MAIN PROPERTIES

High color intensity

The highest intensity is obtained by printing the colors without flux addition. Gloss and intensity can be fine-tuned by adding a higher or lower amount of fluxes.

Excellent particle size powder distribution

The particle size of the colors will vary depending on the composition, in this series the Typical Diameter particle D50=3-5 microns and D90=15-20 microns with trace residue on a 120 s sieve.

Very good resistance

Mechanical durability is widely resistant showing good resistance in contact with food products, however, it is necessary for users to determine metal release and durability, according to their own production conditions.

Low thermal expansion coefficient

The Coefficient of thermal expansion is $70-80 \times 10^{-7} \cdot 1/K$ (20 to 400°C) and it is suitable for different surfaces.

MISCIBILITY AND COMPATIBILITY

All colours are designed for maximum intermixing. The Main Group & Gold Group can be intermixed together and the use of different Mixing Flux is suitable to create pleasing pastel shades with the exception of Cadmium Group.

For dilution of colours, in order from highest to lowest opacity, we can use the fluxes below:

ULE-1440-T Mixing White	
ULE-1441-C Hard Mixing Flux	
ULE-1417-C Soft Mixing Flux	(Suitable for dilution of colours up to 10-20% maximum)

Cadmium Group are intermixable fully each other and can be mixed with the other colours with limitations up to a maximum of 5% . For dilution of colours we recommend the flux:

ULE-1427-C Cd. Mixing & Cover Flux (Suitable for overprinting decal schemes to reduce Cadmium metal release and improve mechanical and chemical resistance)

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APPLICATION

DIRECT SCREEN PRINTING AND DECALS

For direct screen printing or decal transfers, 120T - 90T polyester mesh can be used for most colors, 120T can be used to achieve halftone effect, however, we recommend 90T mesh or 230/200/300 GP stainless steel mesh, especially for cadmium-based colors.

The colors require optimal deposition to ensure stability and we recommend customers test them under their specific processing conditions.

On substrates such as hard and soft-paste porcelain, the recommended allowable layer thickness should not exceed 20 to 30 microns to avoid cracking or peeling of enamels and should be observed when applying multiple layers or one thick layer, we recommend assess suitability including re-fired pieces.

ULE colours can be used on low-solubility or leaded glazes but this dynamic could increase metal release, so customers need to determine the outcome on their own conditions.

As a guide, recommended mixing ratios and mediums below:

Reference	Description	Parts medium per 10 parts of colour	Water Media	Oil-based Media
L427	WATER MISCIBLE MEDIUM	5	✓	
W172	WATERBASED PRINT MEDIUM	3,5	✓	
M286D	SEMI-THIXO S/PRINT MEDIUM	7		✓
M286T	THIXOTROPIC S/P MEDIUM	8		✓
M51D	SCREEN TRANSFER MEDIUM	6		✓
M6	DIRECT PRINT MEDIUM	3,5		✓

HANDPAINTING-MACHINE BANDING AND LINING & SPRAYING OR AEROGRAPHING

The colors can supplied as dry powder for painting directly onto glazed ware and also in the following mediums:

Reference	Description	Parts medium per 10 parts of colour	Water Media	Oil-based Media
W108	WATERBASED HAND PAINT MEDIUM	5	✓	
M162N	GELLED BANDING MEDIUM	6		✓
M9	HAND PAINTING MEDIUM	5		✓

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FIRING RECOMMENDATIONS

For cycles of 4 hours or more the following temperatures are recommended:

Hard Paste Porcelain	840 - 880 degrees
Soft Paste Porcelain	840 - 870 degrees
Vitreous Tableware	840 - 870 degrees
Bone China	820 - 850 degrees
Earthenware/Tiles	850 - 900 degrees

Fast firing and shorter cycles are possible:

860-900 degrees/60-90 min

Firing affect metal release and durability so it is best determined depending on cycle profile.

Be aware that Cadmium Colours ULE-1437-M and ULE-1438-M are more susceptible to higher temperatures.

ACID AND ALKALI RESISTANCE

The chemical resistance of the fired color layers is influenced by the color deposit, the firing conditions and the glaze. The colors don't show a visible attack with 4%acetic acid solution ($22\pm 2^{\circ}\text{C}$, 24h) as well as with 5% sodium carbonate solution ($60\pm 2^{\circ}\text{C}$, 32h).

METAL RELEASE CHARACTERISTICS

Every effort is made to make these colors technically lead-free, however, lead residues may be analytically detectable due to production processes, but are on the order of less than 0.2% lead and 0.05% cadmium, respectively, under normal application conditions and optimal cooking, that this is well below the limits currently permitted for tableware.

Metal release conditions can be influenced by deposit weight, substrate glaze, firing cycle, etc. and, in general, the higher the cycle temperatures, the better metal release and greater durability will be obtained. Under some conditions, note that the lining of kilns previously used to fire Low-Solubility or Lead products is known to release volatile metals detectable in the test.

The solubility of some particular colors can affect the mechanical strength and metal release in the case of cobalt and cadmium colors, in particular ULE-1428-L, or Cadmium Group Colours.



























It is possible to improve mechanical resistance and metal release using Cover Flux ULE-1427-C or by firing and applying in optimal conditions.

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REFERENCES

	Colour	Reference		Colour Composition	Pantone
Main Group:		ULE-1401-T	White	Ce	-
		ULE-1440-T	Mixing White	Ce	-
		ULE-1403-H	Orange	Cr-Sb-Ti	130 C
		ULE-1404-R	Golden Brown	Cr-Fe-Zn-Al	2429 C
		ULE-1405-R	Reddish Brown	Cr-Fe-Zn	7594 C
		ULE-1407-L	Cyan	Cr-Co-Al-Zn	7705 C
		ULE-1408-L	Greenish Blue	Cr-Co-Al	3165 C
		ULE-1409-K	Chrome Green	Cr	7743 C
		ULE-1411-T	Grey	Sn-Sb	7543 C
		ULE-1412-E	Black	Cr-Fe-Co	Black C
		ULE-1428-L	Blue	Co-Si-Zn	286 C
		ULE-1569-H	Yellow	Cd-S-Zr-Si	106 C
		ULE-1598-M	Pink	Cr-Ca-Sn-Si	494 C
		ULE-1417-C	Soft Flux for Mixing	-	-
		ULE-1441-C	Hard Mixing Flux	-	-
Gold Group:		ULE-1418-A	Gold Pink	Sn-Al-Ag-Au	3582 C
		ULE-1420-A	Magenta	Sn-Al-Ag-Au	7435 C
		ULE-1422-A	Maroon	Sn-Al-Ag-Au	188 C
		ULE-1556-A	Light Pink	Sn-Al-Ag-Au	2044 C
		ULE-1559-A	Royal Blue	Sn-Al-Ag-Au-Co-Si-Zn-Cr-Fe	288 C
		ULE-1560-A	Rose Pink	Sn-Al-Ag-Au-Cd-S-Se	509 C
		ULE-1567-A	Purple	Sn-Al-Ag-Au-Co-Si-Zn	683 C
		ULE-1000-C	Special Cover Flux for Gold Colours	-	-
Cadmium Group:		ULE-1435-H	Cd. Yellow	Cd-S-Zn	7408 C
		ULE-1436-H	Cd. Orange	Cd-S-Se	166 C
		ULE-1437-M	Cd. Bright Red	Cd-S-Se	187 C
		ULE-1438-M	Cd. Dark Red	Cd-S-Se	7427 C
		ULE-1439-K	Cd. Green	Cd-S-Zn-Cr-Co-Al	7741 C
		ULE-1427-C	Cd. Mixing & Cover Flux	-	-

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