

At the Edge of Innovation

KUKDO CHEMICAL PRODUCT GUIDE





MESSAGE FROM CEO

Dear valuable customers,

First of all, I would like to express my deepest gratitude to our valuable customers in the world who have constantly supported Kukdo Chemical Co, Ltd. to become the global leader of Epoxy industry. Since Kukdo set foot in the world of epoxy for the first time in Seoul, Korea, 1972, we have overcome a lot of challenges successfully, thanks to the full support from our customers.

Kukdo currently operates 3 factories in Korea and 1 in China where we produce over 730,000mt of epoxy resins and hardeners yearly. We also set up a logistics center in the heart of Europe where we are able to provide the most efficient and prompt delivery service. It is a huge benefit to our valuable customers that they are able to avoid the risk of time lag and reduce the burden of inventory. We are working hard to finalize our global supply networks in a few years to provide the same excellent service to our customers who are outside of our current network.

Furthermore, Kukdo continuously focuses on our well-organized quality control and environmental management system based on ISO-9000 and 14001 for our customer's confidence. We also increasingly put our efforts toward developing innovative products for our valuable customers who are engaged in a variety of applications including electric & electronic products, automobiles, wet & powder coatings, composites, adhesives and insulation. We are strongly confident that our continuous efforts on R&D benefit our valuable customers enormously, which eventually increase our customer's value.

As Kukdo's core value is "For customer value", we try to provide our valuable customers with a total solution; supplying trend-leading products, innovative materials, cost-efficient packaged delivery service, technology and market information in cooperation with our valuable customers. Our core value will be firmly alive in our daily life in Kukdo.

All members of Kukdo always appreciate the full support from our valuable customers and promise that we will continuously try our best for our customer's success.

Faithfully yours,

Si Chang Lee, President

CONTENTS

| | | | |
|-----------|--|-----------|---|
| 06 | Bisphenol-A Type Epoxy Resin | 19 | Epoxy Resin for P.C.M. |
| 06 | 1. Standard Liquid Type | 19 | Epoxy Modified Polyol |
| 07 | 2. Standard Solid Type | 19 | Filament Winding, Laminating Epoxy Resin |
| 08 | 3. Solution of Solvent Epoxy Resin | 19 | Molding Epoxy Resin |
| 08 | 4. Powder Coating Epoxy Resin | 20 | Special Type Epoxy Resin |
| 12 | 5. Low BPA Type | 20 | 1. High Solid Epoxy Resin |
| 12 | 6. n=0 free, BPA free Type | 21 | 2. High Performance Adhesion Epoxy Resin |
| 13 | 7. High Purity, Low Chlorine Epoxy Resin | 22 | 3. BPA-PO Epoxy Resin |
| 13 | Bisphenol-F Type Epoxy Resin | 22 | 4. Modified Weatherable Epoxy Resin |
| 13 | 1. General Type | 22 | Tri-Functional Epoxy Resin |
| 14 | 2. Low Viscosity Type | 22 | Tetra-Functional Epoxy Resin |
| 14 | 3. Solid Type | 22 | Reactive Diluent |
| 14 | Brominated Epoxy Resin | 23 | Waterborne Resin |
| 15 | Hydrogenated BPA Type Epoxy Resin | 23 | 1. Waterborne Epoxy |
| 15 | Non-Halogen Flame Retardant Epoxy Resin | 23 | 2. Waterborne Curing Agent |
| 15 | Novolac Epoxy Resin | 25 | Polyamide & Amidoamine Type |
| 15 | 1. o-Cresol Novolac Type | 26 | Polyamide Adduct Type |
| 16 | 2. Phenol Novolac Type | 27 | Aliphatic Amine Modified Type |
| 16 | 3. Low Viscosity Phenol Novolac Type | 28 | Cycloaliphatic Amine Modified Type |
| 16 | 4. BPA-Novolac Type | 29 | Aromatic Amine Modified Type |
| 16 | 5. DCPD Type | 29 | Phenalkamine Type |
| 16 | 6. Xylok Type | 31 | Amine & Anhydride Hardener |
| 17 | 7. Multi-Functional Novolac Type | 32 | Polyimide Resin |
| 17 | Multi-Functional Epoxy Resin | 32 | 1. High Soluble Polyimide |
| 17 | Flexible Epoxy Resin | 32 | 2. Thermal Plastic Polyimide |
| 17 | 1. Dimer Acid Modified Epoxy Resin | 32 | 3. Normal Polyimide |
| 17 | 2. Rubber Modified Epoxy Resin | 33 | Polyimide Film |
| 17 | 3. Urethane Modified Epoxy Resin | 33 | 1. Peelable Polyimide Thin Film |
| 18 | UV Curing Type Epoxy Resin | | |
| 18 | Low Temperature Curing Type Epoxy Resin | | |
| 18 | Phenoxy Resin | | |

THE WORLD BEST EPOXY PRODUCER



**GLOBAL
SALES
NETWORKS**



KUKDO HISTORY

1970~80's History

- Feb. 1972 Establishment of KUKDO CHEMICAL Industry CO., LTD.
- Jan. 1973 Completion of Seoul factory for Epoxy resin & Hardener (1st factory in Korea)
- Oct. 1983 Establishment of R&D Center.

1990's History

- Apr. 1994 Completion of Iksan factory for Epoxy resin & Hardener (2nd factory in Korea)
- Mar. 1996 Establishment of KUKDO Fine Chemical in Sihwa(3rd factory in Korea)
- Apr. 1999 Change Company Name to KUKDO CHEMICAL CO., LTD.

2000's History

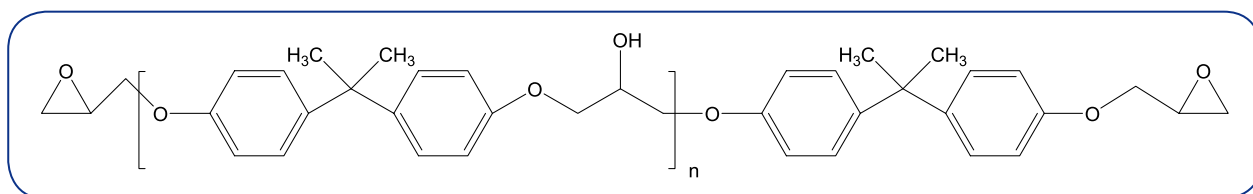
- Apr. 2002 Establishment of KUKDO CHEMICAL (KunShan) CO., LTD. in China
- Nov. 2003 Completion of KunShan factory for Epoxy resin and Polyol in China
- Jul. 2004 Completion of Busan factory for Epoxy resin and System Polyol in Busan
- Mar. 2008 Acquisition of HAJIN CHEM TECH
- Nov. 2008 Completion of 40KT of Liquid Epoxy resin in Iksan
- Dec. 2008 Awarded 200 Million Dollar Export Tower Prize (45th Trade Anniversary)
- Nov. 2010 Awarded 2010 Global Excellent Management by JMAC
- Apr. 2011 Obtained Customs approved registered exporter Certificate by Customs
- Sep. 2011 Obtained AEO(Authorized Economic Operator) Certificate by Customs
- Dec. 2011 Awarded 300 Million Dollar Export Tower Prize (48th Trade Anniversary)
- Dec. 2011 Awarded Korean World-class Product Award 2011 by Knowledge Economy
- Feb. 2013 Establishment of NICHIDO CHEMICAL CO., LTD.
- Dec. 2013 Completion of Plant for Phenol Novolac and Bisphenol-F in Iksan
- Sep. 2014 Completion of Plant for Phenalkamine and Polyamide in Busan
- Mar. 2016 Completion of KUKDO INNOVATION CENTER



KUKDO EPOXY

BISPHENOL-A TYPE EPOXY RESIN

1. Standard Liquid Type



1) Low Viscosity Type

| Grade | EEW (g/eq) | Viscosity (cps@25°C) | Hy-Cl (wt. %) | Specific Gravity* ¹ (20°C) | Color (G,max.) | Characteristics/Use |
|----------|------------|----------------------|---------------|---------------------------------------|----------------|--|
| YD-113 | 175-190 | 500-700 | 0.2max. | 1.14 | 1 | CGE modified type |
| YD-114 | 190-210 | 500-700 | 0.05max. | 1.14 | 0.7 | C ₁₂ -C ₁₄ modified type |
| YD-114E | 190-210 | 700-1,200 | 0.05max. | 1.14 | 0.7 | C ₁₂ -C ₁₄ modified type |
| YD-114F | 185-205 | 450-750 | 0.1max. | 1.14 | 1 | C ₁₂ -C ₁₄ modified type |
| YD-114EF | 180-200 | 700-1,200 | 0.1max. | 1.14 | 1 | C ₁₂ -C ₁₄ modified type |
| YD-115J | 175-195 | 150-500 | 0.6-0.9 | 1.14 | 0.7 | BGE modified type, Low viscosity type |
| YD-115 | 180-194 | 700-1,100 | 0.1max. | 1.14 | 1 | BGE modified type |
| YD-115G | 180-190 | 700-1,100 | 0.2-0.3 | 1.15 | 1 | Non-crystal type |
| YD-115E | 185-205 | 1,100-2,800 | 0.05max. | 1.14 | 0.7 | C ₁₂ -C ₁₄ modified type |
| YD-115CA | 195-215 | 800-1,600 | 1.75-1.95 | 1.15 | 1 | BGE modified type, Non-crystal type |

*¹ Reference data

2) Medium Viscosity Type

| Grade | EEW (g/eq) | Viscosity (cps@25°C) | Hy-Cl (wt. %) | Specific Gravity* ¹ (20°C) | Color (G,max.) | Characteristics/Use |
|----------|------------|----------------------|---------------|---------------------------------------|----------------|----------------------|
| YD-127 | 180-190 | 8,000-11,000 | 0.05max. | 1.17 | 0.5 | Standard type |
| YD-128 | 184-190 | 11,500-13,500 | 0.05max. | 1.17 | 0.5 | Standard type |
| YD-128M | 184-196 | 12,000-14,000 | 0.06-0.07 | 1.17 | 0.5 | Stable reaction type |
| YD-128H | 187-205 | 12,000-18,000 | 0.6-1.0 | 1.17 | 0.5 | Stable reaction type |
| YD-128S | 205-225 | 19,000-24,000 | 1.85-2.20 | 1.17 | 1 | Non-crystal type |
| YD-128SH | 190-205 | 16,000-20,000 | 0.5-1.5 | 1.15 | 1 | Non-crystal type |

*¹ Reference data

3) High Viscosity Type

| Grade | EEW (g/eq) | Solution Viscosity (25°C) | Hy-Cl (wt. %) | Specific Gravity* ² (20°C) | Color (G,max.) | Characteristics/Use |
|--------|------------|---------------------------|---------------|---------------------------------------|----------------|--------------------------|
| YD-134 | 230-270 | P-U* ¹ | 0.1max. | 1.18 | 1 | Semisolid, High adhesion |
| YD-136 | 290-335 | A-C* ³ | 0.1max. | 1.18 | 1 | High adhesion |

*¹ Gardner Holdt Method, Butyl Carbitol NV 70% Solution *² Reference data *³ Gardner Holdt Method, Butyl Carbitol NV 40% Solution

2. Standard Solid Type

| Grade | EEW (g/eq) | Solution Viscosity* ¹ (25°C) | Softening Point* ² (°C) | Specific Gravity* ³ (20°C) | Color (G,max.) | Characteristics/Use |
|----------------------|-------------|---|------------------------------------|---------------------------------------|----------------|----------------------------|
| YD-011* ⁴ | 450-500 | D-F | 60-70 | 1.16-1.20 | 1 | General, Laminate |
| YD-011S | 455-495 | D-F | 60-70 | 1.16-1.20 | 0.5 | General |
| YD-011H | 530-570 | F-J | 70-80 | 1.16-1.20 | 0.3 | General |
| YD-012 | 600-700 | G-J | 75-85 | 1.16-1.20 | 0.5 | General |
| YD-012H | 640-670 | G-K | 75-85 | 1.16-1.20 | 0.5 | General |
| YD-013K | 780-840 | M-O | 88-95 | 1.16-1.20 | 0.5 | General, Non-blocking |
| YD-014ER | 800-950 | P-S | 88-102 | 1.16-1.20 | 1 | High purity, Ester coating |
| YD-014* ⁴ | 900-1,000 | Q-U | 91-102 | 1.16-1.20 | 0.5 | General |
| YD-017* ⁴ | 1,750-1,950 | Y-Z ₁ | 115-125 | 1.16-1.20 | 0.5 | Can coating |
| YD-017R | 1,750-2,100 | Y-Z ₁ | 117-127 | 1.16-1.20 | 1 | High purity, Ester coating |
| YD-017H | 2,100-2,400 | Z ₁ -Z ₆ | 120-135 | 1.16-1.20 | 0.5 | High purity, Can coating |
| YD-019* ⁴ | 2,500-3,100 | Z ₃ -Z ₅ | 125-140 | 1.16-1.20 | 0.5 | Can coating, PCM |
| YD-019K | 2,400-3,800 | Z ₃ -Z ₇ | 120-150 | 1.16-1.20 | 0.7 | Can coating, PCM |
| YD-020 | 4,000-6,000 | Z ₄ -Z ₆ | 140-155 | 1.16-1.20 | 1 | High purity, Can coating |

*¹ Gardner Holdt Method, Butyl Carbitol NV 40% Solution *² Ball & Ring Method *³ Reference data *⁴ Approved by F. D. A



KUKDO INNOVATION CENTER & Head Office



IKSAN Factory

KUKDO EPOXY

3. Solution of Solvent Epoxy Resin

| Grade | EEW (g/eq) | Viscosity (cps@25°C) | Non-Volatile Content (wt. %) | Color (G,max.) | Characteristics/Use |
|-------------|-------------|---|------------------------------|----------------|---------------------------|
| YD-011MS65S | 450-500 | 400-800 | 65±1 | 0.5 | n-Butanol/Xylene/MIBK |
| YD-011BC70 | 450-500 | - | 70±1 | 0.5 | Butyl Cellosolve |
| YD-011X70 | 450-500 | 2,500-4,000 | 70±1 | 0.5 | Xylene |
| YD-011AM70 | 450-500 | K-P* ¹ | 70±1 | 0.7 | Acetone/Methyl Cellosolve |
| YD-011X75 | 450-500 | Z ₃ -Z ₆ * ¹ | 75±1 | 1 | Xylene |
| YD-011T75 | 450-500 | Z-Z ₅ * ¹ | 75±1 | 0.5 | Toluene |
| YD-011BC75 | 450-500 | Z ₃ -Z ₆ * ¹ | 75±1 | 0.5 | Butyl Cellosolve |
| YD-011EC75 | 450-500 | Z ₁ -Z ₆ * ¹ | 75±1 | 0.5 | Ethyl Cellosolve |
| YD-011M75 | 450-500 | - | 75±1 | 0.5 | MIBK |
| YD-011MX75 | 460-485 | Z ₁ -Z ₃ * ¹ | 75±1 | 0.5 | MIBK/Xylene |
| YD-011A80 | 450-500 | X-Z ₄ * ¹ | 80±1 | 0.5 | Acetone |
| YD-012A80 | 600-700 | Z ₃ -Z ₆ * ¹ | 80±1 | 0.5 | Acetone |
| YD-014AM70 | 900-1,000 | Y-Z ₃ * ¹ | 70±1 | 1 | Acetone/Methyl Cellosolve |
| YD-014M75 | 900-1,000 | 30,000-50,000 | 75±1 | 0.5 | MIBK |
| YD-017KT55 | 1,750-2,100 | Z-Z ₄ * ¹ | 55±1 | 1 | MIBK/Toluene |
| YD-128MX75 | 184-190 | - | 75±1 | 0.5 | Xylene/Methanol |
| YD-128X80 | 184-190 | 100-200 | 80±1 | 1 | Xylene |
| YD-128X90 | 184-190 | T-Y* ¹ | 90±1 | 0.5 | Xylene |
| YD-134X80 | 230-270 | S-X | 80±1 | 1 | Xylene |
| YD-134X90 | 230-270 | 10,000-20,000 | 90±1 | 1 | Xylene |
| YD-136X80 | 290-335 | Z-Z ₄ * ¹ | 80±1 | 1 | Xylene |
| KD-211EX75 | 455-485 | Z ₃ -Z ₇ * ¹ | 75±1 | 0.5 | Xylene |
| KD-211GX75 | 500-550 | Z ₃ -Z ₇ * ¹ | 75±1 | 0.7 | Xylene |

*¹ Gardner Holdt Method

4. Powder Coating Epoxy Resin

1) General Grade

| Grade | EEW (g/eq) | Melt Viscosity* ¹ (cps@150°C) | Softening Point* ² (°C) | Color (G,max.) | Characteristics/Use |
|-----------|------------|--|------------------------------------|----------------|-----------------------|
| KD-211E | 455-485 | 300-700 | 65-75 | 0.3 | General |
| KD-211G | 500-550 | 500-1,500 | 70-80 | 0.7 | General |
| KD-242K | 590-640 | 1,000-2,000 | 80-90 | 1 | General |
| KD-242GHF | 625-675 | 1,500-3,500 | 83-93 | 0.7 | Good flow, High gloss |
| KD-242C | 640-700 | 1,500-3,500 | 84-90 | 0.7 | General |
| KD-242G | 650-725 | 2,000-3,500 | 85-95 | 0.7 | General |
| KD-243C | 715-835 | 3,000-8,000 | 88-98 | 0.7 | General, Hybrid |
| KD-213 | 730-840 | 3,500-7,000 | 88-98 | 0.4 | General, Hybrid |
| KD-213K | 780-850 | 4,500-8,000 | 92-102 | 0.5 | General, Hybrid |
| KD-214C | 875-975 | 2,000-4,000* ³ | 95-105 | 0.5 | PCM, Hybrid, General |

*¹ I.C.I Viscometer *² Ball & Ring Method *³ Melt Viscosity at 175°C

2) Low Viscosity, High Flow Grade

| Grade | EEW (g/eq) | Melt Viscosity* ¹ (cps@150°C) | Softening Point** ² (°C) | Color (G,max.) | Characteristics/Use |
|-----------|------------|--|-------------------------------------|----------------|---------------------|
| YD-012 | 600-700 | 800-1,600 | 75-85 | 0.5 | General, Hybrid |
| YD-012H | 640-670 | 1,200-1,700 | 75-85 | 0.5 | General, Hybrid |
| YD-053 | 700-750 | 1,000-3,000 | 85-92 | 0.5 | General, Hybrid |
| YD-013K | 780-840 | 1,500-4,000 | 88-95 | 0.5 | General, Hybrid |
| YD-013K55 | 800-900 | 2,000-5,000 | 90-100 | 0.5 | General, Hybrid |
| YD-014 | 900-1,000 | 3,000-7,000 | 91-102 | 0.5 | General, Hybrid |

*¹ I.C.I Viscometer *² Ball & Ring Method

3) High Molecular Weight Grade

| Grade | EEW (g/eq) | Melt Viscosity* ¹ (cps@175°C) | Softening Point** ² (°C) | Color (G,max.) | Characteristics/Use |
|---------|-------------|---|-------------------------------------|----------------|---------------------|
| KD-214L | 1,050-1,150 | 4,000-8,000 | 100-110 | 1 | Pipe coating |
| KD-214M | 1,150-1,300 | 5,000-10,000 | 107-117 | 0.4 | Pipe coating |
| KD-216 | 1,400-1,600 | 1,400-1,570* ³ | - | 0.5 | General |
| YD-017 | 1,750-1,950 | Y-Z ₁ * ⁴ | 115-125 | 0.5 | General |
| YD-017H | 2,100-2,400 | Z ₁ -Z ₆ * ⁴ | 120-135 | 0.5 | General |
| YD-019 | 2,500-3,100 | Z ₃ -Z ₅ * ⁴ | 125-140 | 0.5 | General |
| YD-019K | 2,400-3,800 | Z ₃ -Z ₇ * ⁴ | 120-150 | 0.7 | Can coating, PCM |
| YD-020 | 4,000-6,000 | Z ₄ -Z ₆ * ⁴ | 140-155 | 1 | Can coating, PCM |

*¹ I.C.I Viscometer *² Ball & Ring Method *³ Brookfield Viscometer at 25°C, Butyl Carbitol NV 40% Solution*⁴ Gardner Holdt Method, Butyl Carbitol NV 40% Solution

4) Special Grade

| Grade | EEW (g/eq) | Melt Viscosity* ¹ (cps@150°C) | Softening Point** ² (°C) | Color (G,max.) | Characteristics/Use |
|---------|-------------|--|-------------------------------------|----------------|-----------------------|
| KD-211D | 500-575 | 1,000-3,500 | 82-92 | 0.7 | Novolac modified type |
| KD-211H | 510-550 | 2,500-3,500 | 90-98 | 0.7 | Novolac modified type |
| KD-213C | 750-850 | 3,000-8,000* ³ | 105-118 | 0.7 | Novolac modified type |
| KD-213H | 750-850 | 23,000-38,000 | 110-120* ⁴ | 0.7 | Novolac modified type |
| KD-242S | 600-700 | 500-2,000 | 77-87 | 0.7 | Good flow |
| KD-242H | 660-720 | 2,200-2,800 | 85-95 | 0.5 | Good flow |
| KD-292 | 660-720 | 1,000-4,000 | 85-95 | 0.4 | Good flow |
| KD-293 | 710-760 | 1,000-3,000 | 85-95 | 0.7 | Good flow |
| KD-294 | 1,000-1,100 | S-V* ⁵ | 100-110 | 0.4 | Good flow |

*¹ I.C.I Viscometer *² Ball & Ring Method *³ Melt Viscosity at 175°C *⁴ Mettler Method*⁵ Gardner Holdt Method, Butyl Carbitol NV 40% Solution

5) Half-capped Epoxy Resin

| Grade | EEW (g/eq) | Ph-OH E.W (g/eq) | Softening Point* ¹ (°C) | Color (G,max.) | Characteristics/Use |
|---------|-------------|------------------|------------------------------------|----------------|-------------------------|
| KD-3013 | 700-1,500 | 700-2,500 | 90-100 | 1 | Self-curing epoxy resin |
| KD-4014 | 1,000-2,000 | 1,000-3,000 | 100-110 | 1 | Self-curing epoxy resin |

*¹ Ball & Ring Method

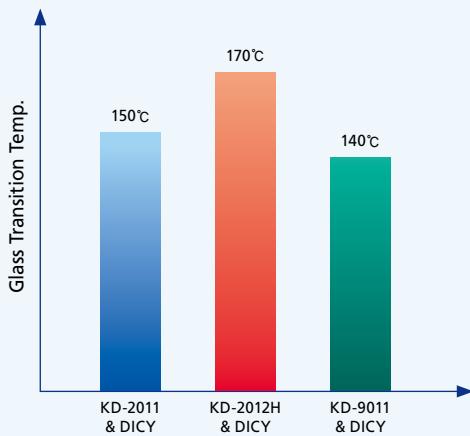
COMPARATIVE PROPERTY DATA

KD-2011 / KD-2012H / KD-9011 HIGH T_g TYPE EPOXY RESINS

KD-2011, KD-2012H and KD-9011 are the solid epoxy resins for high performance and FBE (fusion bonded epoxy) coatings. These Epoxy Resins have modified epoxy functions for high cross-linking and heat resistant systems.

KD-2011, KD-2012H and KD-9011 are designed to endure severe thermic condition and also have excellent chemical and corrosion resistant properties.

T_g Comparison



Formulation

| ITEMS | I | II | III | REMARKS |
|-----------------------|-------|-------|-------|---------------------|
| KD-2011 | 291.9 | | | Epoxy |
| KD-2012H | | 291.3 | | Epoxy |
| KD-9011 | | | 291.0 | Epoxy |
| DICY | 8.1 | 8.7 | 9.0 | Hardener |
| MFP-VP | 3 | 3 | 3 | Flow Agent |
| Benzoin | 2 | 2 | 2 | Anti- Pinhole Agent |
| BaSO ₄ | 45 | 45 | 45 | Filler |
| 2-MI | 1.5 | 1.5 | 1.5 | Accelerator |
| TiO ₂ R902 | 150 | 150 | 150 | Pigment |



Test Results

| Testing Items | I | II | III | REMARKS |
|---------------------|------|------|------|-------------|
| Gloss | 98.2 | 97.9 | 99 | 60° |
| Impact Resistance | Pass | Pass | Pass | 500g x 50Cm |
| T _g (°C) | 151 | 170 | 140 | DSC |

KD-2011 / KD-2012H / KD-9011 are designed for application of high heat resistant powder coatings, especially bus bar, bus duct, electrical devices coatings and hot petroleum transporting pipes.

6) High Tg Grade

| Grade | EEW (g/eq) | Melt Viscosity* ¹ (cps@150°C) | Softening Point* ² (°C) | Characteristics/Use |
|----------|------------|--|------------------------------------|---------------------------------------|
| KD-2011 | 400-500 | 1,000-4,000 | 90-100 | High Tg, FBE Powder coating |
| KD-2012H | 350-450 | 3,000-8,000 | 95-105 | High Tg, FBE Powder coating |
| KD-9011 | 350-450 | 500-2,500 | 85-95 | High Tg, FBE Powder coating, BPF type |

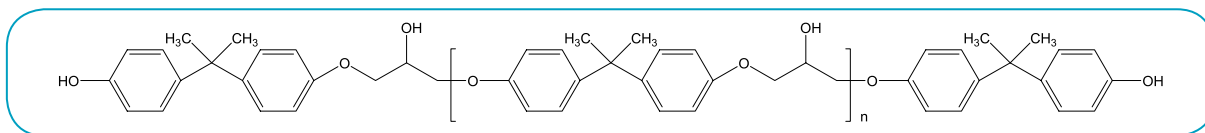
*¹ I.C.I Viscometer *² Ball & Ring Method

7) Rubber Modified Epoxy Resin

| Grade | EEW (g/eq) | Melt Viscosity* ¹ (cps@150°C) | Softening Point* ² (°C) | Color (G,max.) | Characteristics/Use |
|----------|-------------|--|------------------------------------|----------------|-------------------------------------|
| KR-101 | 700-800 | 2,000-10,000 | - | 3 | CTBN modified epoxy resin |
| KR-102 | 1,100-1,300 | 3,000-15,000* ³ | - | 5 | CTBN modified epoxy resin |
| KR-104L | 1,100-1,300 | 3,000-15,000* ³ | 95-105 | 5 | CTBN modified epoxy resin |
| KR-692 | 675-775 | 1,000-7,000 | 82-98 | Milky white | Acrylic rubber modified epoxy resin |
| KR-693 | 800-900 | 3,000-13,000 | 90-105 | Milky white | Acrylic rubber modified epoxy resin |
| KSR-900 | 600-700 | 3,000-5,000 | 82-97 | 2 | Excellent adhesion epoxy resin |
| KSR-1000 | 1,100-1,300 | 1,000-5,000* ³ | - | Milky white | Silicone modified epoxy resin |

*¹ I. C. I Viscometer *² Ball & Ring Method *³ I.C.I Viscometer at 175°C

8) Phenol Excess Type Curing Agent



| Grade | Ph-OH E.W (g/eq) | Softening Point* ¹ (°C) | Gel time* ² (sec) | Color (G,max.) | Characteristics/Use |
|---------|------------------|------------------------------------|------------------------------|-------------------------------------|---|
| KD-401 | 230-260 | 73-85 | 85-150 | Milky White | High adhesion |
| KD-404 | 240-260 | 73-85 | 40-80 | 1 | Fast cure |
| KD-404J | 230-260 | 73-85 | 30-70 | 1 | Fast cure |
| KD-405 | 240-260 | 73-85 | 100-160 | 1 | High adhesion |
| KD-407 | 220-250 | 73-85 | - | 1 | Non-catalyst |
| KD-410 | 230-260 | 73-85 | 40-80 | Milky White | Fast cure |
| KD-410J | 230-260 | 73-85 | 30-70 | Milky White | Fast cure |
| KD-420 | 230-260 | 73-85 | 25-50 | Milky White | Fast cure |
| KD-426 | 360-440 | 90-100 | 25-55* ³ | Milky White | Fast cure, High flexibility |
| KD-438 | 500-580 | 90-110 | - | 1 | Non-catalyst, High flexibility |
| KD-448 | 660-760 | 95-120 | - | 1 | Non-catalyst, High flexibility |
| KD-448J | 660-760 | 95-120 | 30-60* ⁴ | 1 | Fast cure |
| KD-448H | 660-760 | 95-120 | 20-50* ⁴ | 1 | Fast cure |
| KDF-407 | 200-260 | 500-2,500* ⁶ | - | 2 | Non-catalyst, BPF type |
| KDF-438 | 450-550 | 500-4,000* ⁷ | - | - | Non-catalyst, BPF type |
| KDF-448 | 600-700 | 2,000-7,000* ⁷ | - | 2 | Non-catalyst, BPF type |
| KD-407A | 250-280 | 73-85 | - | yellow to brown* ⁸ | Improved adhesion in hot & wet environments |
| KD-410A | 260-290 | 73-85 | 30-70* ⁵ | Milky yellow to brown* ⁸ | Improved adhesion in hot & wet environments |
| KD-420A | 500-600 | 90-100 | - | Yellow* ⁸ | Improved adhesion in hot & wet environments |

*¹ Ball & Ring Method *² 43phr on KD-211D, at 180°C *³ 73phr on KD-211D, at 180°C *⁴ 130phr on KD-211D, at 180°C*⁵ 51phr on KD-211D, at 180°C (Reference data) *⁶ Melt Viscosity : I.C.I Viscometer at 125°C *⁷ Melt Viscosity : I.C.I Viscometer at 150°C*⁸ Reference data

KUKDO EPOXY

9) Master Batch Grade

| Grade | EEW (g/eq) | Melt Viscosity* ¹ (cps@150°C) | Softening Point* ² (°C) | Color (G,max.) | Characteristics/Use |
|-----------|------------|--|------------------------------------|----------------|-------------------------------------|
| YD-012F15 | 730-830 | 1,000-3,000 | 77-87 | Milky White | High flow |
| YD-014DLM | 830-870 | 3,000-7,000 | 93-97 | Milky White | High flow |
| YD-0153F | 820-930 | 4,000-9,000 | 92-102 | Milky White | High flow |
| KD-213F2 | 760-840 | 3,050-7,950 | 92-98 | Milky White | High flow |
| KD-214CR | 900-950 | 5,000-10,000 | 95-105 | Milky White | High flow |
| KD-242GB | 670-770 | 2,000-4,000 | - | Milky White | High flow |
| KD-242GR | 760-875 | 3,000-7,000 | 85-95 | Milky White | High flow |
| KD-264 | 830-940 | 4,000-8,000 | 88-98 | Milky White | Dimer acid modified type, High flow |
| KD-292U | 660-720 | 1,000-4,000 | 85-95 | Milky White | High flow |
| KD-293U | 700-780 | 1,000-4,000 | 85-95 | Milky White | High flow |
| KD-293X | 675-725 | 2,000-3,000 | 83-98 | 0.7 | High flow |

*¹ I.C.I Viscometer *² Ball & Ring Method

5. Low BPA Type

| Grade | EEW (g/eq) | Melt Viscosity* ¹ (cps@150°C) | Softening Point* ⁴ (°C) | Color (G,max.) | BPA Content (ppm,max.) |
|---------|-------------|---|------------------------------------|----------------|------------------------|
| KD-6512 | 600-700 | 1,000-3,000 | 80-90 | 1 | 2 |
| KD-6514 | 900-1,000 | 1,500-4,000 * ² | 95-105 | 1 | 2 |
| KD-6516 | 1,500-1,750 | X-Z ₁ * ³ | 115-130 | 1 | 2 |
| KD-6517 | 1,750-2,100 | Z-Z ₃ * ³ | 120-135 | 1 | 2 |
| KD-6518 | 2,100-2,400 | Z ₁ -Z ₄ * ³ | 120-135 | 1 | 2 |
| KD-6519 | 2,400-2,900 | Z ₃ -Z ₆ * ³ | 130-145 | 1 | 2 |
| KD-6520 | 2,900-3,800 | Z ₄ -Z ₇ * ³ | 135-155 | 1 | 2 |

*¹ I.C.I Viscometer *² Melt Viscosity : I.C.I Viscometer at 175°C *³ Gardner Holdt Method, Butyl Carbitol NV 40% Solution *⁴ Ball & Ring Method

6. n=0 free, BPA free Type

| Grade | EEW (g/eq) | Melt Viscosity* ¹ (cps@150°C) | Softening Point* ² (°C) | Color (G,max.) | BPA Content (ppm,max.) | BADGE Content (ppm,max.) |
|-----------------------|-----------------------|--|------------------------------------|----------------|------------------------|--------------------------|
| KD-452 | 490-570* ³ | 2,000-4,000 | 96-106 | 2 | 400 | - |
| KD-6812 | 600-700 | 800-1,800 | 80-90 | 1 | 1 | 500 |
| KD-6814* ⁴ | 850-950 | 4,000-8,000 | 90-105 | 2 | 1 | 400 |
| KD-6817 | 1,750-2,000 | 1,600-4,500* ⁵ | 115-130 | 2 | 1 | 100 |
| KD-6819 | 2,500-2,900 | 5,000-15,000* ⁵ | 130-150 | 2 | 1 | 100 |

*¹ I. C. I Viscometer *² Ball & Ring Method *³ Ph-OH E.W. *⁴ Approved by F.D.A *⁵ Brookfield Viscometer at 25°C, Butyl Carbitol NV 40% Solution

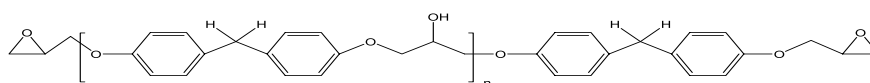
7. High Purity, Low Chlorine Epoxy Resin

| Grade | EEW (g/eq) | Hy-Cl (ppm) | Total-Cl* ¹ (ppm) | Viscosity (cps@25°C) | Purity* ² (n=0,%) | Characteristics/Use |
|-----------|------------|--------------------|------------------------------|--|------------------------------|--|
| YD-128K | 184-196 | <250 | <1000 | 11,000-14,000 | - | Low T-Cl, Low Hy-Cl, Low Phenol-OH, BPA type |
| YDF-170K | 160-180 | <250 | <1200 | 2,000-5,000 | - | Low T-Cl, Low Hy-Cl, Low Phenol-OH, BPF type |
| YDPN-638K | 170-190 | <250 | <1200 | 20,000-50,000 * ³ G-J * ⁴ | - | Low T-Cl, Low Hy-Cl, Low Phenol-OH, Phenol novolac type |
| KDS-8128 | 170-175 | <200 | <700 | 4,000-5,000 | >98 | High purity, Low Cl, BPA type |
| KDS-8170 | 155-160 | <200 | <700 | 1,000-2,000 | >98 | High purity, Low Cl, BPF type |
| KDS-8161 | 160-170 | <200 | <700 | 2,000-3,000 | >98 | High purity, Low Cl, Non crystalline type |
| KDS-8165 | 155-165 | <200 | <700 | 1,000-2,000 | >98 | High purity, Low Cl, Non crystalline type |
| KDS-8128P | 170-175 | <30 | <200 | 3,000-5,000 | >97 | Ultra high purity, Ultra low Cl, BPA type |
| KDS-8011 | 440-500 | <200 | <500 | 70-80* ⁵ | - | High purity, Ultra low Cl, Solid, BPA type |
| KDS-8805 | 92-106 | <0.1* ⁶ | <1.0* ⁶ | 500-850 | >95 | High purity, Low viscosity, High Tg, Heat resistance, TGAP type |
| KDS-8808 | 90-110 | <0.1* ⁶ | <1.0* ⁶ | 1,000-3,500 | >95 | High purity, Low viscosity, High Tg, Heat resistance, TGMAP type |
| KDS-8178 | 230-240 | <150 | <700 | 21,000-30,000 | - | High purity, Low Cl, High adhesion |

*¹. Total Cl : Potentiometric titration *². Purity : GPC Data *³. Brookfield Viscometer at 52°C (Reference data)

*⁴ Gardner Holdt Method, Butyl Carbitol NV 60% Solution *⁵ Softening Point : Ball & Ring Method, °C *⁶ Unit : wt%

■ BISPHENOL-F TYPE EPOXY RESIN



1. General Type

| Grade | EEW (g/eq) | Viscosity (cps@25°C) | Softening Point* ¹ (°C) | Color (G,max.) | Characteristics/Use |
|----------|------------|----------------------|------------------------------------|----------------|------------------------------|
| YDF-161 | 170-180 | 5,000-7,000 | - | 1 | Bisphenol A/F type |
| YDF-161H | 175-185 | 6,000-8,000 | - | 1 | Bisphenol A/F type |
| YDF-162 | 175-185 | 7,000-10,000 | - | 1 | Bisphenol A/F type |
| YDF-165 | 160-180 | 700-1,100 | - | 3 | Low viscosity |
| YDF-170 | 160-180 | 2,000-5,000 | - | 1 | Standard BPF type |
| YDF-175 | 160-180 | 2,000-5,000 | - | 1 | Less-crystal type |
| YDF-2001 | 450-500 | B-D* ² | 50-60 | 1 | Low viscosity, Flexible type |
| YDF-2004 | 900-1,000 | K-N* ² | - | 1 | High flow, Flexible type |

*¹ Ball & Ring Method *² Gardner Holdt Method, Butyl Carbitol NV 40% Solution

KUKDO EPOXY

2. Low Viscosity Type

| Grade | EEW (g/eq) | Viscosity (cps@25°C) | Color (G,max.) | Characteristics/Use |
|----------|------------|----------------------|----------------|---------------------|
| YDF-1020 | 160-180 | 2,000-3,000 | 3 | Low viscosity |

3. Solid Type

| Grade | EEW (g/eq) | Softening Point* ¹ (°C) | Color (G,max.) | Characteristics/Use |
|---------|-------------|------------------------------------|----------------|--|
| KD-9001 | 450-500 | 50-60 | 1 | Low viscosity, Flexible type |
| KD-9002 | 600-700 | 70-80 | 1 | Low Temp. curing, Low viscosity |
| KD-9003 | 750-850 | 80-90 | 1 | Low Temp. curing, Low viscosity |
| KD-9004 | 900-1,000 | 85-95 | 1 | High flow, Flexible type |
| KD-9005 | 1,000-1,200 | 90-100 | 1 | High flow, Flexible type |
| KD-9006 | 1,400-1,600 | 95-105 | 1 | High flow, Flexible type |
| KD-9007 | 1,750-1,950 | 100-110 | 1 | Can coating, Manufactured with high purity BPF |
| KD-9009 | 2,300-2,900 | 107-122 | 1 | Can coating, Manufactured with high purity BPF |
| KD-9010 | 3,000-4,000 | 120-130 | 1 | Can coating, Manufactured with high purity BPF |

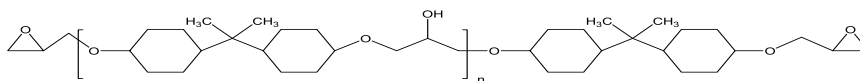
*¹ Ball & Ring Method

BROMINATED EPOXY RESIN

| Grade | EEW (g/eq) | Softening Point* ¹ (°C) | Br. Content (wt.%) | Volatile Content (wt%) | Characteristics/Use |
|-------------|---------------------------|------------------------------------|--------------------|------------------------|---|
| YDB-228 | 210-240 | 10,000-20,000* ² | 16-18 | - | Liquid flame retardant |
| YDB-400 | 380-420 | 64-74 | 46-50 | - | Flame retardant, Artificial marble |
| YDB-400H | 430-460 | 70-80 | 48-51 | - | Flame retardant |
| YDB-400T60 | 390-410 | 9-11* ³ | 46-50 | 39-41 | Toluene solution type, Flame retardant for laminate |
| YDB-400T70 | 390-410 | 30-50* ³ | 46-50 | 29-31 | Toluene solution type, Flame retardant for laminate |
| YDB-400TE70 | 390-410 | - | 48-50 | 29-31 | Toluene / MEK solution type, Flame retardant for laminate |
| YDB-406 | 620-680 | 98-109 | 50-52 | - | Flame retardant for ENPLA |
| YDB-408 | 690-750 | 102-112 | 50-52 | - | Flame retardant for ENPLA |
| YDB-410P | 900-1,000 | 120-130 | 50-52 | - | Flame retardant for ENPLA |
| YDB-423A80 | 420-460 | 1,500-2,500* ³ | 19-21 | 19-21 | Flame retardant for laminate |
| YDB-424A80 | 442-458 | 1,500-2,400* ³ | 19.5-20.5 | 19.5-20.5 | Flame retardant for laminate |
| YDB-500A80 | 475-520 | - | 19-22 | 19.5-20.5 | Narrow molecular distribution type for laminate |
| KB-560 | 800-1,500* ⁴ | 95-105 | 58-60 | - | End capped type for ENPLA |
| KB-562P | 1,700-2,300* ⁴ | 113-120 | 57-59 | - | End capped type for ENPLA |
| KB-563H | 3,000-4,000* ⁴ | 135-145 | 54-57 | - | End capped type for ENPLA |
| KDB-430A80 | 425-440 | 1,700-2,500* ³ | 19-21 | 19-21 | Standard resin for FR-4 laminate |
| KDB-621A80 | 440-460 | 800-1,600* ³ | 19.5-20.5 | 19.5-20.5 | UV-Blocking resin for FR-4 laminate |
| KDB-652A80 | 385-405 | 800-2,000* ³ | 17.5-18.5 | 19.5-20.5 | Middle Tg resin for laminate |

*¹ Ball & Ring Method *² Brookfield Viscometer at 40°C *³ Brookfield Viscometer at 25°C *⁴ Mw (Reference data)

HYDROGENATED BPA TYPE EPOXY RESIN



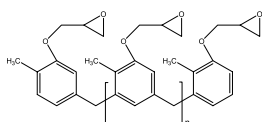
| Grade | EEW (g/eq) | Viscosity (cps@25°C) | Softening Point* ¹ (°C) | Color (G,max.) | Characteristics/Use |
|----------|-------------|----------------------|------------------------------------|----------------|---|
| KST-1101 | 210-230 | 1,800-2,500 | - | 2 | Low viscosity, Fast cure, Weatherability coating |
| ST-3000 | 220-240 | 2,500-4,000 | - | 2 | Good compatibility with acrylic and polyester resin |
| ST-4000D | 600-750 | - | 85-100 | 3 | Good exterior durability, Powder coating |
| ST-4100D | 1,000-1,200 | - | 100-115 | 3 | Good exterior durability, Powder coating |
| ST-5080 | 550-650 | - | 78-88 | 1 | Good exterior durability, Powder coating |
| ST-5100 | 900-1,100 | - | 95-105 | 1 | Good exterior durability, Powder coating |

*¹ Ball & Ring Method

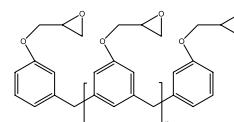
NON-HALOGEN FLAME RETARDANT EPOXY RESIN

| Grade | EEW (g/eq) | Viscosity (cps@25°C) | Volatile Content (wt. %) | Characteristics/Use |
|-------------|------------|----------------------|--------------------------|----------------------------|
| KDP-550MC65 | 555-585 | 2,200-2,800 | 34-36 | High adhesive for laminate |
| KDP-555MC80 | 250-280 | 15,000-20,000 | 19-21 | High Tg for laminate |

NOVOLAC EPOXY RESIN



[o-Cresol Novolac]



[Phenol Novolac]

1. o-Cresol Novolac Type

| Grade | EEW (g/eq) | Softening Point* ¹ (°C) | Hy-Cl (ppm,max.) | Color (G,max.) | Characteristics/Use |
|------------------|------------|------------------------------------|--------------------|----------------|----------------------------------|
| YDCN-500-1P | 190-210 | 50-54 | 350 | 2 | EMC, Laminate, Coating |
| YDCN-500-4P | 200-212 | 60-63 | 350 | 2 | EMC, Laminate, Coating |
| YDCN-500-5P | 200-212 | 63-66 | 350 | 2 | EMC, Laminate, Coating |
| YDCN-500-7P | 200-212 | 66-70 | 350 | 2 | EMC, Laminate, Coating |
| YDCN-500-8P | 200-212 | 68-72 | 350 | 2 | EMC, Laminate, Coating |
| YDCN-500-10P | 200-212 | 70-74 | 350 | 2 | EMC, Laminate, Coating |
| YDCN-500-80P | 190-220 | 75-85 | 350 | 2 | EMC, Laminate, Coating |
| YDCN-500-90P | 190-220 | 85-95 | 350 | 2 | EMC, Laminate, Coating |
| YDCN-500-90PA75 | 200-230 | - | 75±1* ² | 1 | Acetone solution type |
| YDCN-500-80PBC60 | 190-220 | - | 60±1* ² | 8 | Butyl carbitol solution type |
| YDCN-500-80PCA60 | 190-220 | - | 60±1* ² | 8 | Cellosolve acetate solution type |

*¹ Ball & Ring Method *² Non-Volatile Content(wt.%)

KUKDO EPOXY

2. Phenol Novolac Type

| Grade | EEW (g/eq) | Viscosity (cps) | Color (G,max.) | Characteristics/Use |
|-------------|------------|-----------------------------|----------------|--|
| YDPN-631 | 165-185 | A-D* ¹ | 3 | High heat resistance, Molding, Low viscosity |
| YDPN-638 | 170-190 | H-K* ¹ | 3 | High heat resistance, Molding |
| YDPN-641 | 170-190 | 800-1,100* ² | 3 | High heat resistance |
| YDPN-644 | 195-235 | 32,000-52,000* ³ | 3 | High Performance |
| YDPN-638A80 | 170-190 | 80±1* ⁴ | 3 | Acetone solution type |
| YDPN-638X80 | 170-190 | 80±1* ⁴ | 3 | Xylene solution type |

*¹ Gardner Holdt Method, Butyl Carbitol NV 60% Solution *² I.C.I Viscometer at 150°C *³ Brookfield Viscometer at 60°C

*⁴ Non-Volatile Content(wt.%) *⁵ Brookfield Viscometer at 52°C

3. Low Viscosity Phenol Novolac Type

| Grade | EEW (g/eq) | Solution Viscosity* ¹ (25°C) | Color (G,max.) | Characteristics/Use |
|-----------|------------|---|----------------|-------------------------------------|
| KDPN-1020 | 165-185 | D-G | 3 | High heat resistance, Low viscosity |

*¹ Gardner Holdt Method, Butyl Carbitol NV 60% Solution

4. BPA-Novolac Type

| Grade | EEW (g/eq) | Softening Point* ¹ (°C) | Color (G,max.) | Characteristics/Use |
|--------------|------------|------------------------------------|----------------|--|
| KBPN-110 | 190-230 | 60-70 | 3 | High heat resistance, High performance |
| KBPN-115 | 200-230 | 70-80 | 3 | High heat resistance, High performance |
| KBPN-120 | 200-230 | 80-90 | 3 | High heat resistance, High performance |
| KBPN-110EK80 | 196-210 | 3000max* ² | 3 | High heat resistance for laminate |

*¹ Ball & Ring Method *² Brookfield Viscometer at 25°C

5. DCPD Type

| Grade | EEW (g/eq) | Softening Point* ¹ (°C) | Characteristics/Use |
|--------------|------------|------------------------------------|---|
| KDCP-130 | 240-260 | 65-75 | Low melt viscosity, Low moisture absorption, EMC, PCB, etc. |
| KDCP-130EK80 | 245-255 | 79-81* ² | Low melt viscosity, Low moisture absorption, EMC, PCB, etc. |

*¹ Ball & Ring Method *² Non-Volatile Content(wt%)

6. Xylok Type

| Grade | EEW (g/eq) | Softening Point* ¹ (°C) | Characteristics/Use |
|-----------|------------|------------------------------------|---|
| KDXN-1055 | 225-255 | 50-60 | Flame retardance, Low moisture absorption, Electronic application |

*¹ Ball & Ring Method

7. Multi-functional Novolac Type

| Grade | EEW (g/eq) | Softening Point* ¹ (°C) | Characteristics/Use |
|-----------|------------|------------------------------------|-------------------------------------|
| KDMN-1065 | 162-176 | 65-75 | High heat resistance, EMC, PCB, etc |

*¹ Ball & Ring Method

MULTI-FUNCTIONAL EPOXY RESIN

| Grade | EEW (g/eq) | Softening Point* ¹ (°C) | Hy-Cl (wt, %) | Color (G,max.) | Characteristics/Use |
|---------|------------|------------------------------------|---------------|----------------|--|
| KD-1011 | 270-300 | 50-58 | 0.2 max | 2 | Low temp. curing coating, High heat resistance |
| KD-1012 | 300-360 | 65-80 | 0.2 max | 2 | Low temp. curing coating, High heat resistance |
| KD-1014 | 320-370 | 75-90 | 0.2 max | 1 | Low temp. curing coating, High heat resistance |
| KD-1024 | 340-400 | 85-95 | 0.2 max | 3 | Low temp. curing coating, High heat resistance |

*¹ Ball & Ring Method

FLEXIBLE EPOXY RESIN

1. Dimer Acid Modified Epoxy Resin

| Grade | EEW (g/eq) | Viscosity (cps@25°C) | Color (G,max.) | Characteristics/Use |
|-----------|------------|----------------------------|----------------|---------------------------------|
| YD-171 | 390-470 | 400-900 | 12 | Dimer acid modified epoxy resin |
| YD-172 | 600-700 | Semisolid | 6 | Dimer acid modified epoxy resin |
| YD-172X75 | 600-700 | X-Z* ¹ | 6 | Xylene solution type |
| YD-173 | 600-700 | Semisolid | 6 | Dimer acid modified epoxy resin |
| KD-176A | 280-380 | 5,000-15,000* ² | - | Dimer acid modified epoxy resin |

*¹ Gardner Holdt Method *² Brookfield Viscometer at 50°C

2. Rubber Modified Epoxy Resin

| Grade | EEW (g/eq) | Viscosity (cps@25°C) | Color (G,max.) | Characteristics/Use |
|---------|------------|------------------------------|----------------|---|
| KR-170 | 200-235 | 30,000-60,000 | 8 | CTBN modified epoxy resin |
| KR-202C | 350-400 | 600-1,000 | 9 | NBR modified epoxy resin. Mixed solvent |
| KR-207 | 175-205 | 2,000-3,000 | 10 | CTBN modified epoxy resin |
| KR-208 | 270-330 | 8,000-12,000 | 5 | NBR modified epoxy resin |
| KR-309 | 280-320 | 25,000-40,000 | 11 | NBR modified epoxy resin |
| KR-415 | 375-425 | 50,000-100,000* ¹ | 10 | NBR modified epoxy resin |
| KR-450 | 400-500 | Semisolid | 12 | CTBN modified epoxy resin |
| KR-818 | 370-430 | Semisolid | 8 | CTBN modified epoxy resin |
| KR-909 | 350-400 | 15,000-40,000 | 11 | NBR modified epoxy resin |
| KR-627 | 190-210 | 10,000-30,000 | Milky white | Acrylic rubber modified epoxy resin |
| KR-628 | 220-240 | 40,000-60,000 | Milky white | Acrylic rubber modified epoxy resin |

*¹ Brookfield Viscometer at 50°C

KUKDO EPOXY

3. Urethane Modified Epoxy Resin

| Grade | EEW (g/eq) | Viscosity (cps@25°C) | Color (G,max.) | Characteristics/Use |
|---------|------------|-----------------------------|----------------|---------------------------|
| UME-305 | 230-270 | 5,000-12,000 | 3 | High flexibility, Molding |
| UME-330 | 265-280 | 10,000-40,000* ¹ | 5 | Elasticity, Molding |

*¹ Brookfield Viscometer at 40°C

UV CURING TYPE EPOXY RESIN

| Grade | Acid Value (mgKOH/g) | Solution Viscosity* ¹ (25°C) | Volatile Content (wt.%) | Color (G,max.) | Characteristics/Use |
|-------------|----------------------|---|-------------------------|----------------|---------------------|
| KDU-651 | 3max. | Semisolid | - | 1 | NV 100% |
| KDU-651TP75 | 1max. | Z ₃ -Z ₅ | 25±1 | 1 | TPGDA |
| KDU-653 | 3max. | Semisolid | - | 5 | NV 100% |

*¹ Gardner Holdt Method

LOW TEMPERATURE CURING TYPE EPOXY RESIN

| Grade | EEW (g/eq) | Solution Viscosity* ¹ (25°C) | Non-Volatile Content (wt.%) | Color (G,max.) | Characteristics/Use |
|---------|------------|---|-----------------------------|----------------|------------------------------------|
| KDN-253 | 300-340 | W-Z | 70±1 | 1 | Low temp. curing coating, Adhesive |
| KDN-255 | 450-500 | S-W | 60±1 | 1 | Low temp. curing coating, Adhesive |

*¹ Gardner Holdt Method

PHENOXY RESIN

| Grade | Solution Viscosity (25°C) | Non-Volatile Content (wt.%) | Color (G,max.) | Characteristics/Use |
|-----------|---|-----------------------------|----------------|---------------------|
| YP-50 | Z ₁ -Z ₅ * ¹ | 100 | 3 | Coating, Adhesive |
| YP-50EK35 | W-Z ₂ | 35±1.5 | - | Coating, Adhesive |
| YP-55 | 50,000-60,000* ² | 84* ³ | - | BPA type |
| YP-70 | 50,000-60,000* ² | 74* ³ | - | BPA/BPF type |

*¹ Gardner Holdt Method, MEK NV 40% solution *² Mw(Reference data) *³ Tg(°C), DSC(Reference data)

EPOXY RESIN FOR P.C.M.

| Grade | Mw | Viscosity (cps@25°C) | Non-Volatile Content (wt.%) | Characteristics/Use |
|------------|-----------------------------|----------------------|-----------------------------|-----------------------------|
| KU-400T40 | 20,000-30,000 | 3,000-4,800 | 40±1 | Mixed solvent, Coil coating |
| KU-420K40 | 15,000-30,000* ³ | X-Z* ¹ | 40.5±1 | Mixed solvent, Coil coating |
| KU-450B40 | 5,000-15,000* ³ | T-Y* ¹ | 40±2 | Mixed solvent, Coil coating |
| YD-017CW50 | 2,000-2,200* ² | 700-1,300 | 51±1 | Mixed solvent, Coil coating |
| YD-017KC50 | 2,000-2,200* ² | T-Z* ¹ | 50±1 | Mixed solvent, Coil coating |

*¹ Gardner Holdt Method *² EEW(g/eq) *³ Reference data

EPOXY MODIFIED POLYOL (ISOCYANATE CURING TYPE)

| Grade | OH Value (mgKOH/g) | Solution Viscosity (25°C) | Non-Volatile Content (wt.%) | Characteristics/Use |
|--------|--------------------|---------------------------|-----------------------------|--|
| YU-300 | 100-130 | Z-Z ₄ | 60±1 | Tar-urethane coating, MIBK/Toluene=1/1 |

FILAMENT WINDING, LAMINATING EPOXY RESIN

| Grade | EEW (g/eq) | Viscosity (cps@25°C) | Color (G,max.) | Characteristics/Use |
|----------|------------|----------------------|----------------|-----------------------|
| KBR-1722 | 190-200 | 3,000-7,000 | 2 | F/W, Laminate |
| KBR-1726 | 187-197 | 4,500-6,500 | 1 | F/W, Paint |
| KBR-1728 | 175-190 | 6,500-9,500 | 1 | F/W, Non-crystal type |
| KBR-1729 | 170-190 | 3,000-7,000 | 1 | F/W, Laminate |
| KBR-1753 | 190-205 | 800-1,000 | 1 | F/W, Laminate, Paint |

MOLDING EPOXY RESIN

| Grade | EEW (g/eq) | Viscosity (cps@25°C) | Color (G,max.) | Characteristics/Use |
|---------|------------|-----------------------|----------------|---|
| YC-195 | 360-400 | 500-700* ¹ | 1 | Large scale electrical molding, Hardener YC-195H |
| YC-195B | 370-420 | 380-550* ¹ | 1 | Large scale electrical molding, Hardener YC-195H |
| YC-230 | 185-200 | 10,000-15,000 | 1 | Electrical parts, Hardener YC-230H |
| KC-305 | 183-192 | 9,500-13,000 | 0.5 | Large scale electrical casting, Transformer, Hardener KC-305H |
| KC-335 | 188-196 | 8,500-15,000 | - | Electrical casting, Molding, Hardener KC-335H |

*¹ Brookfield Viscometer at 120°C

KUKDO EPOXY

SPECIAL TYPE EPOXY RESIN

1. High Solid Epoxy Resin

| Grade | EEW(g/eq) | Viscosity(cps@25°C) | Characteristics/Use |
|------------|-----------|---------------------|------------------------|
| KD-174X90 | 230-270 | 1,000-3,000 | High solid epoxy resin |
| KD-175LX90 | 240-300 | 2,000-8,000 | High solid epoxy resin |
| KD-175X90 | 240-275 | 2,000-4,000 | High solid epoxy resin |
| KD-176EX80 | 290-330 | 1,000-2,000 | High solid epoxy resin |
| KD-176X80 | 290-330 | 1,000-2,000 | High solid epoxy resin |

COMPARATIVE PROPERTY DATA

High Solid Type Epoxy Resin

EPOKUKDO KD-17X series is a high solid epoxy resin which is derived from Bisphenol-A, Epichlorohydrin and special modification to improve mechanical properties such as adhesion, impact resistance and flexibility. It is recommended for low VOCs coating system needed flexibility and corrosion protection.

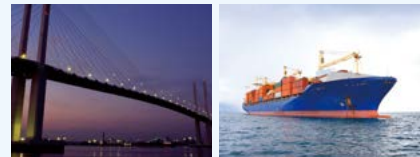
Features of High Solid Type Epoxy Resin

- Low solution viscosity
- Improved compatibility with polyamide and hydrocarbon resins
- Better flexibility than standard resin

- Longer pot life than standard resin
- Improved salt fog and water resistance than standard resin

Suggested uses

- Marine and Protective Coatings
- Industrial Maintenance
- Epoxy Top Coat Applications
- Railcar Coatings



Formulation

| | EEW(g/eq) | G-5022X70* ¹ | GX-475B70* ² | KMH-101X80* ³ |
|-------------|-----------|-------------------------|-------------------------|--------------------------|
| AHEW (g/eq) | - | 250 | 190 | 163 |
| YD-134X90 | 278 | 90 phr | 68 phr | 59 phr |
| KD-174X90 | 272 | 92 phr | 70 phr | 60 phr |
| KD-175LX90 | 282.5 | 89 phr | 67 phr | 58 phr |
| KD-175X90 | 282.5 | 89 phr | 67 phr | 58 phr |

* Curing Condition : Room Temperature x 14 days

* Plate : Cold Rolled Steel (0.7T)

* EEW : Epoxy Equivalent Weight (solution base)

* AHEW : Active Hydroxyl Equivalent Weight (solution base)

*¹ : Polyamide Hardener

*² : Polyamide Adduct Type Hardener

*³ : Phenalkamine Hardener

Test Results

| Classification | G-5022X70 | | | GX-475B70 | | | KMH-101X80 | | |
|----------------|-----------------|----------------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| | A* ¹ | B* ² | C* ³ | A* ¹ | B* ² | C* ³ | A* ¹ | B* ² | C* ³ |
| Test Item | | | | | | | | | |
| YD-134X90 | 100 / 100 | 50/50F* ⁴ | 8.7 | 64 / 100 | 50F/40F | 7.6 | 5 / 100 | 30F/10F | 8.2 |
| KD-174X90 | 100 / 100 | 50/50 | 9.1 | 100 / 100 | 50F/50F | 7.7 | 12 / 100 | 30F/20F | 8.9 |
| KD-175LX90 | 100 / 100 | 50/50 | 9.0 | 100 / 100 | 40F/40F | 7.9 | 48 / 100 | 50F/30F | 8.8 |
| KD-175X90 | 100 / 100 | 50/50 | 9.0 | 100 / 100 | 50F/50F | 7.8 | 63 / 100 | 50F/40F | 8.9 |

*¹ A : Adhesion test (cross-hatch) *² B : Dupont test (Impact Test, D/R), condition : 1/2 inch x high(cm) x 1,000 g *³ C : Erichsen Test(mm) *⁴ F : Failed

2. High Performance Adhesion Epoxy Resin

| Grade | EEW(g/eq) | Viscosity (cps@25°C) | Characteristics/Use |
|--------------|-----------|----------------------|---|
| KSR-176X90 | 240-270 | 2,000-5,000 | Excellent adhesion for non-ferrous metal and glass |
| KSR-177 | 190-220 | 9,000-15,000 | Excellent adhesion for non-ferrous metal and glass |
| KSR-276M70 | 450-500 | 500-2,500 | Excellent adhesion for non-ferrous metal and glass |
| KSR-276EK70 | 450-500 | 100-600 | Excellent adhesion for non-ferrous metal and glass |
| KSR-277EK70 | 450-500 | 500-2,500 | Excellent adhesion for non-ferrous metal and glass |
| KSR-277HMC70 | 450-500 | 2,000-7,000 | Excellent adhesion for non-ferrous metal and glass, Low T-CI type |

*1 Softening Point(°C) : Ball & Ring Method

COMPARATIVE PROPERTY DATA

High Performance Adhesion Epoxy Resin

EPOKUKDO KSR series is a High Performance Epoxy Resin, which provides excellent adhesion to wide range of substrates such as glass and nonferrous metals. It shows excellent wettability, leveling and high gloss as well. KSR Series follows the trends of lightweight using light materials.

Features

1. Excellent adhesion to nonferrous metals
2. Good wettability and leveling on nonferrous metals
3. Good compatibility with polyamide and hydrocarbon resins
4. High gloss type

Applicable Substrates

- Aluminum
- Titanium
- Stainless steel
- Copper
- Steel
- Glass
- Magnesium
- Bronze
- Nickel
- Nickel Chrome plating
- Tin
- Nonferrous alloy

Adhesion Measurement

| Substrate | | KSR-276M70 | YD-011X70 | KSR-177 | YD-128 |
|-----------------------------|-----------------|------------|-----------|---------|--------|
| Cross Hatch (% Retained) | Glass | 100 | 30 | 100 | 20 |
| | Aluminum | 100 | 40 | 100 | 37 |
| | Steel | - | - | 100 | 100 |
| | Stainless steel | 100 | 15 | - | - |
| | Tin | 100 | 18 | - | - |
| | Copper | 100 | 12 | - | - |

* Test Method : ASTM D 3359B

* Mixing ratio : KSR-276M70/G-640=16p/hr,
YD-011X70 / G-640=16p/hr

* Curing condition : 3days at RT × 80°C for 1hr

* Curing agent : Kukdo Domide G-640

* Film thickness: 20μm

* Substrate condition : No sanding treatment

* Mixing ratio : KSR-177/G-640=100/53,
YD-128 / G-640=100/59

* Curing condition : 80°C for 2hr

Unit: kg/cm²

| Item | KSR-177 | YD-128 |
|-------------------------|---------|--------|
| Shear adhesion strength | 80.8 | 34.1 |

* Substrate condition : No sanding treatment on Aluminum

* Mixing ratio : KSR-177/G-640=100/53
YD-128 / G-640=100/59

* Curing condition : 80°C for 2hr

KUKDO EPOXY

3. BPA-PO Epoxy Resin

| Grade | EEW(g/eq) | Viscosity (cps@25°C) | Characteristics/Use |
|----------|-----------|----------------------|------------------------------|
| KDSF-180 | 300-350 | 3,000-6,000 | High adhesive, Low viscosity |

4. Modified Weatherable Epoxy Resin

| Grade | EEW(g/eq) | Viscosity (cps@25°C) | Characteristics/Use |
|------------|-----------|----------------------|---------------------------------------|
| KT-3100X70 | 360-400 | 200-400 | Advanced weather resistance |
| KT-3200X70 | 450-500 | 300-1,300 | Advanced weather resistance |
| KT-4004X80 | 350-450 | 4,000-8,000 | Advanced weather resistance, Top coat |

TRI-FUNCTIONAL EPOXY RESIN

| Grade | EEW(g/eq) | Viscosity (cps@25°C) | Hy-Cl (wt.%) | Specific Gravity* ¹ (20°C) | Color (G,max.) | Characteristics/Use |
|--------|-----------|----------------------|--------------|---------------------------------------|----------------|---------------------|
| YH-300 | 135-150 | 100-300 | 0.1max | 1.14 | 1 | TMPTGE type |
| YH-325 | 175-190 | 4,000-6,000 | 0.1max | 1.16 | 1 | High adhesion |

*¹ Reference data

TETRA-FUNCTIONAL EPOXY RESIN

| Grade | EEW(g/eq) | Viscosity (cps@25°C) | Volatile Content (wt.%) | Hy-Cl (ppm) | Characteristics/Use |
|-------------|-----------|----------------------|-------------------------|-------------|--|
| KDT-4400 | 210-240 | 80-90* ¹ | - | 3,000max. | High heat resistance, UV-Blocking |
| KDT-4400A70 | 210-240 | 100-200 | 29-31 | 1,400-1,600 | High heat resistance, UV-Blocking Acetone solution type |
| KDT-4400M70 | 210-240 | 150-350 | 29-31 | 1,400-1,600 | High heat resistance, UV-Blocking MEK solution type |

*¹ Softening Point (°C) : Ball & Ring Method

REACTIVE DILUENT

| Grade | EEW(g/eq) | Viscosity (cps@25°C) | Color (G,max.) | Characteristics/Use |
|------------|-----------|----------------------|------------------|---|
| PG-202 | 135-165 | 15-30 | 1 | NPGDGE type |
| PP-101 | 220-240 | 10-20 | 5 | SBPMGE type |
| PG-207 | 310-330 | 55-75 | 60* ¹ | PPGDGE type |
| PG-207P | 300-330 | 40-100 | 0.2 | PPGDGE type |
| Neokukdo-E | 240-265 | 5-20 | 2 | Coating, Carboxylic acid glycidyl ester |
| LGE | 275-300 | 5-20 | 30* ¹ | Aliphatic glycidyl ether |
| BGE | 145-155 | 1-5 | 30* ¹ | Butyl glycidyl ether |
| 1,6HDGE | 135-165 | 10-30 | 50* ¹ | 1,6 Hexanediol diglycidyl ether |
| 1,4BDGE | 120-140 | 15-30 | 50* ¹ | 1,4 Butanediol diglycidyl ether |

*¹ APHA Color

WATERBORNE RESIN

1. Waterborne Epoxy

| Grade | EEW(g/eq) | Viscosity (cps@25°C) | Non-Volatile Content(wt.%) | Characteristics/Use |
|-------------|---------------------------|----------------------|----------------------------|---|
| KEM-128M | 200-220 | 7,000-15,000 | 100 | YD-128 based self-emulsifiable epoxy resin |
| KEM-128R | 195-215 | 2,000-8,000 | 100 | YD-128 based self-emulsifiable epoxy resin |
| KEM-128-70 | 190-210* ¹ | 1,000-10,000 | 70±2 | Liquid based epoxy emulsion resin Waterborne paint, Adhesive, Cement mortar, Sizing |
| KEM-134-60 | 260-300* ¹ | 500-7,000 | 60±2 | Semisolid based epoxy emulsion resin Waterborne paint, Adhesive, Cement mortar, Sizing |
| KEM-101-50 | 450-550* ¹ | 1,000-10,000 | 47±2 | Solid based epoxy emulsion resin Waterborne paint, Adhesive, Cement mortar, Sizing |
| KEM-012F-50 | 700-1,000* ¹ | 200-1,000 | 50±2 | Solid based epoxy emulsion resin Waterborne paint, Sizing |
| KEM-474F-55 | 1,100-1,500* ¹ | 500-5,000 | 55±2 | Solid based epoxy emulsion resin Waterborne paint, Sizing |
| KEM-1020-55 | 190-210* ¹ | 500-5,000 | 55±2 | Phenol novolac based emulsion resin Waterborne paint, Sizing |

*¹ Basis of solid content

2. Waterborne Curing Agent

| Grade | TAV* ¹ (mgKOH/g) | Viscosity (cps@25°C) | A.H.E.W. (g/eq) | Description |
|--------|-----------------------------|----------------------|-----------------|---|
| KH-700 | 190-250 | 3,000-10,000 | 145-185 | Polyamine base Waterborne coatings and primers |
| KH-701 | 350-420 | 14,000-22,000 | 60-70 | Polyamide base Primer/sealer for concrete Adhesives for wood and steel Waterborne coatings and primers |
| KH-720 | 200-250 | 30-150 | 280-320 | Polyamine base. Emulsion type Waterborne coatings and primers |
| KH-721 | 190-240 | 10,000-20,000 | 140-160 | Polyamine base Waterborne coatings and primers |
| KH-723 | 260-300 | 20,000-40,000 | 130 | Polyamide base Waterborne coatings and primers |
| KH-748 | 190-250 | 5,000-15,000 | 160-180 | Polyamine base Waterborne coatings and primers |

*¹ TAV : Total Amine Value (0.1N-HCl Method)

KUKDO HARDENER

SUMMARY OF HARDENER PRODUCT GROUP

| PRODUCT GROUP | PRODUCT PROPERTIES | PRODUCT TYPE |
|--------------------------|---|--------------|
| POLYAMIDES | Ambient cure, low toxicity, good flexibility and toughness, high viscosity, long pot-life and good water resistance. Polyamide-Adducts provide good compatibility and faster dry under severe conditions than standard polyamides. | G-series |
| AMIDOAMINES | Low viscosity. Exhibit very good adhesion, particularly to concrete. Modified Amidoamine can offer faster cure speed, lower viscosity and good chemical resistance. | G-A series |
| ALIPHATIC AMINES | Wide range of products has a different properties. High reactivity and fast cure at room or low temperature. Relatively moisture sensitivity. Good chemical resistance, particularly to solvents. For heat-cure applications, very good chemical resistance and electrical and mechanical properties. | KH-5 series |
| CYCLOALIPHATIC AMINES | Good film properties such as excellent gloss. Resistance to amine blush and water-spotting. For heat-cure applications, good elevated-temperature performance and very good chemical resistance. | KH-8 series |
| AROMATIC AMINES | For heat-cure applications, low viscosity. Lower exothermic and higher heat resistance. Very good chemical resistance and electrical properties. | TH-series |
| PHENALKAMINES | Good cure at low temperature condition. Good chemical resistance and anti-corrosive. High-solid and solvent free system are available for marine coating. | KMH-series |
| WATERBORNE CURING AGENTS | Water is a diluent, instead of solvents in waterborne-epoxy system. This system with Zero-VOC may not affect on environmental conditions. | KH-7 series |
| ACCELERATOR & CATALYST | This includes tertiary amines, imidazoles substituted urea (e.g., thiourea.). Tertiary amines and imidazoles are excellent accelerators for other curing agents such as dicyandiamide and anhydrides. | KH-30 |

POLYAMIDE & AMIDOAMINE TYPE

| Grade | TAV* ¹ (mgKOH/g) | Viscosity (cps@25°C) | Color (Gardner) | A.H.E.W. (g/eq) | Description |
|-----------|--------------------------------|-----------------------------|--------------------|-----------------------|--|
| G-700 | 90-100 | Semi-Solid | 12max. | 450-500 | High M.W Type Coatings, Adhesives |
| G-5022 | 200-240 | 50,000-70,000* ² | 12max. | 165-185 | Standard high-viscosity polyamide Flexibility, Long pot-life and good properties with solid epoxy resin |
| G-0930 | 280-320 | 8,000-12,000* ² | 12max. | 120-140 | Standard medium-viscosity polyamide 1:1 volume ratio with standard liquid epoxy resin |
| G-640 | 370-400* ³ | 8,000-12,000 | 12max. | 100-120 | Standard high-imidazoline content polyamide High solid coatings, Adhesives, Sealer and putties |
| G-0430 | 270-330 | 4,500-8,500 | 16max. | 100-120 | Medium-viscosity polyamide Adhesive, Civil works Competitive price |
| G-0331 | 280-340 | 2,500-4,500 | 12max. | 100-120 | Medium-viscosity polyamide Adhesives, Civil works |
| G-650 | 370-400* ³ | 2,000-4,000 | 10max. | 100 | Medium-viscosity polyamide High solid coatings, Adhesives, Sealer and putties |
| G-0240 | 370-430 | 1,500-3,000 | 12max. | 60-80 | Standard type polyamide for adhesives, Coatings |
| G-A0533 | 310-350 | 500-1,000 | 14max. | 95-115 | Grouts, Mortar and floorings, Low-viscosity adhesives |
| G-A0432 | 320-380 | 200-600 | 10max. | 70-80 | High-imidazoline content amidoamine Grouts, Mortar and adhesives |
| G-A0635 | 325-375* ³ | 500-850 | 10max. | 93 | Grouts, Mortar and adhesives Good chemical resistance |
| G-5022X70 | 140-170 | T-W* ⁴ | 9max. | 235-265* ⁵ | DOMIDE G-5022X70 is a 70% solid solution of DOMIDE G-5022 cut in xylene Solventborne primer coating Long pot-life |

*¹ TAV : Total Amine Value(0.1N-HCl Method) *² Viscosity : cps at 40°C *³ TAV : Total Amine Value(0.1N-HClO₄ Method)

*⁴ Viscosity : Gardner Holdt Method *⁵ A.H.E.W. : Solution base

POLYAMIDE ADDUCT TYPE

| Grade | TAV* ¹ (mgKOH/g) | Viscosity (cps@25°C) | NV* ² (wt.%) | Solvents | A.H.E.W.* ⁵ (g/eq) | Description |
|------------|--------------------------------|---------------------------------|----------------------------|--------------------------|----------------------------------|--|
| GX-328B75 | 230-260* ³ | 4,000-8,000 | 74-76 | n-Butanol | 160-180 | Polyamide adduct High solid, Anti-corrosive coatings for marine & industrial use |
| GX-328K | 210-250 | 1,500-4,500 | 75-77 | Xylene | 110-130 | Polyamide adduct High solid, Anti-corrosive coatings for marine & industrial use |
| GX-422 | 110-150 | Z-Z ₃ * ⁴ | 59-61 | Xylene/ iso-Butanol | 350-390 | Polyamide adduct Solventborne coatings Fast dry |
| GX-430 | 170-220* ³ | 2,000-6,000 | 73-77 | n-Butanol | 180-190 | Polyamide adduct High solid, Anti-corrosive coatings for marine & industrial use |
| GX-450TI60 | 120-140 | 800-1,500 | 58.5-61.5 | Toluene/ iso-propanol | 316 | Polyamide adduct Coal tar Epoxy curing agent |
| GX-450XB70 | 145-165* ³ | 4,500-8,500 | 68.5-71.5 | Xylene/ n-Butanol | 330 | Polyamide adduct Fast dry and fast cure Anti-corrosive coatings for marine & industrial use |
| GX-455X75 | 120-160 | 3,000-7,000 | 73-77 | Xylene | 260-280 | Polyamide adduct High solid, Anti-corrosive coatings for marine & industrial use |
| GX-460 | 230-270* ³ | 3,000-6,000 | 88-92 | Ethanol | 190 | Polyamidoamine adduct High solid, Anti-corrosive coatings for marine & industrial use |
| GX-475B70 | 135-175 | 1,500-3,500 | 68.5-71.5 | n-Butanol | 190 | Polyamide adduct Fast dry and fast cure Anti-corrosive coatings for marine & industrial use |
| GX-483 | 180-219* ³ | 2,700-6,400 | 100 | - | 133 | Polyamidoamine adduct High solid coatings for marine & industrial use |
| GX-533 | 260-320 | 800-2,000 | 100 | - | 100 | Polyamidoamine adduct |
| GX-540 | 250-290* ³ | 1,200-2,500 | 100 | - | 115 | Polyamidoamine adduct High solid coatings for marine & industrial use |

*¹ TAV : Total Amine Value(0.1N-HCl Method) *² N.V : Non-Volatile Content(wt.%) *³ TAV : Total Amine Value(0.1N-HClO₄ Method)

*⁴ Viscosity : Gardner Holdt Method *⁵ A.H.E.W. : Solution base

ALIPHATIC AMINE MODIFIED TYPE

| Grade | TAV* ¹ (mgKOH/g) | Viscosity (cps@25°C) | Color (Gardner) | A.H.E.W. (g/eq) | Description |
|---------|--------------------------------|-------------------------|--------------------|--------------------|---|
| KH-240 | 280-360 | 2,000-4,000 | 15max. | 80-90 | Adhesives, Sealants and putties Concrete repair |
| KH-252 | 420-500 | 50-800 | 12max. | 75 | Fast cure Accelerator for other curing agent |
| KH-406 | 600-660 | 300-900 | 5 max. | 47 | Good chemical resistance and mechanical properties |
| KH-417 | 420-480 | 500-3,000 | 8 max. | 75 | Fast cure Accelerator for other curing agent |
| KH-500 | 450-500 | 500-4,000 | 7max. | 70 | Mannich product Curable at low temperature and damp conditions |
| KH-500F | 450-500 | 500-4,000 | 7max. | 70 | Mannich product curable at low temperature and damp conditions Reduced free amine and phenol comparing with KH-500 |
| KH-505 | 300-370 | 500-2,500 | 10max. | 90-105 | Curable under damp condition |
| KH-506 | 340-400 | 500-2,000 | 9max. | 70 | Fast curing under cold and damp conditions Good water-spot resistance |
| KH-530N | 450-500 | 20-50 | 6max. | 90-100 | Laminating, Floorings, Grouts |
| KH-531N | 290-350 | 30-150 | 3max. | 80-90 | Self-leveling, Floorings, Grouts, Mortar |
| KH-550N | 360-420 | 100-200 | 8max. | 90-100 | Fast cure Accelerator for other curing agent |
| KH-602 | 670-730 | 50-250 | 5max. | 47 | Good flexibility and mechanical properties Resin mortar, Grouts |
| KH-620 | 550-610 | 2,000-5,000 | 6max. | 38 | Fast cure Good resistance to alcohol, solvents, acids |

*¹ TAV : Total Amine Value(0.1N-HCl Method)

CYCLOALIPHATIC AMINE MODIFIED TYPE

| Grade | TAV* ¹ (mgKOH/g) | Viscosity (cps@25°C) | Color (Gardner) | A.H.E.W. (g/eq) | Description |
|---------|--------------------------------|-------------------------|--------------------|--------------------|---|
| KH-808 | 310-370 | 200-500 | 7 max. | 75 | Self-leveling floorings High-solid coatings |
| KH-809 | 345-385 | 400-900 | 5 max. | 95 | Self-leveling floorings High-solid coatings |
| KH-811 | 370-430 | 2,000-6,000 | 3max. | 65 | Good chemical resistance Floorings, High gloss coatings |
| KH-812 | 290-350 | 30-150 | 3max. | 85 | Low viscosity High solid, Solvent-free floorings |
| KH-813 | 300-350 | 80-200 | 8max. | 85-90 | Low viscosity Solvent-free and high solid coatings Tank linings |
| KH-814 | 300-360 | 30-100 | 3max. | 95 | Low viscosity Good color retention, High gloss Solvent-free and high solid coatings |
| KH-815N | 245-305 | 100-1,000 | 3max. | 105-110 | Resin mortar Solvent-free and high solid coatings |
| KH-816 | 220-320 | 300-500 | 3max. | 110 | Good color retention, High gloss Solvent-free and high solid coatings |
| KH-818B | 250-320 | 100-300 | 3max. | 110 | Low viscosity Good color retention, High gloss Solvent-free and high solid coatings |
| KH-819 | 340-390 | 50-150 | 5max. | 85 | Low viscosity Solvent-free and high solid coatings |
| KH-820 | 235-275* ² | 350-700 | 10max. | 110 | Excellent chemical resistance High solid, Solvent free floorings |
| KH-825N | 270-300 | 80-350 | 5max. | 95-100 | Low viscosity, High gloss Resin mortar, Floorings |
| KH-831 | 330-400 | 400-1,000 | 3max. | 85 | Self-leveling floorings Solvent-free and high solid coatings |
| KH-835 | 305-335 | 20-40 | 2max. | 78 | Self-leveling floorings Low viscosity Good color retention, High gloss |
| KH-836 | 340-380 | 250-450 | 5max. | 78 | Self-leveling floorings Low temperature cure |
| KH-839 | 310-360 | 500-3,000 | 10max. | 75 | Self-leveling floorings Solvent-free and high solid coatings |
| KH-852 | 350-450 | 200-500 | 7max. | 75 | Self-leveling floorings Solvent-free and high solid coatings |
| KH-891 | 290-350* ² | 7,000-13,000 | 3max. | 179 | Adhesives, Sealer and putties Fast cure |
| KH-892 | 420-460* ² | 500-2,000 | 3max. | 120 | Floorings, Resin mortar Fast cure |

*¹ TAV : Total Amine Value(0.1N-HCl Method) *² TAV : Total Amine Value(0.1N-HClO₄ Method)

AROMATIC AMINE MODIFIED TYPE

| Grade | Viscosity (cps@25°C) | Appearance | A.H.E.W. (g/eq) | Description |
|---------|----------------------|-------------------|-----------------|--------------------------|
| TH-430 | 4,000-8,000 | Dark brown liquid | 110 | Good chemical resistance |
| TH-431 | 3,200-6,300 | Dark brown liquid | 110 | Good chemical resistance |
| TH-432 | 300-1,000 | Dark brown liquid | 110 | Good chemical resistance |
| TH-437 | 600-2,000 | Dark brown liquid | 75 | Good chemical resistance |
| TH-438 | 14,000-23,000 | Dark brown liquid | 110 | Good chemical resistance |
| TH-451 | 14,000-23,000 | Dark brown liquid | 110 | Good chemical resistance |
| TH-452N | 1,500-2,500 | Dark brown liquid | 110 | Good chemical resistance |

PHENALKAMINE TYPE

| Grade | TAV* ¹ (mgKOH/g) | Viscosity (cps@25°C) | Non-Volatile Content (wt%) | Solvent | A.H.E.W.* ² (g/eq) | Description |
|-------------|-----------------------------|----------------------|----------------------------|----------------------|-------------------------------|---|
| KMH-100 | 490-550 | 1,000-4,000 | 100 | - | 81 | Phenalkamine type Low viscosity Coatings for marine & industrial use |
| KMH-101 | 300-335 | 20,000-45,000 | 100 | - | 130 | Phenalkamine type Coatings for marine & industrial use |
| KMH-101X90 | 250-290 | 2,500-4,500 | 88-92 | Xylene | 144 | Phenalkamine solution type Coatings for marine & industrial use |
| KMH-121X80 | 170-210 | 4,000-8,000 | 78-82 | Xylene | 225 | Phenalkamine modified type High solid anti-corrosive coatings for marine & industrial use High flexibility |
| KMH-151XB70 | 170-210 | 1,000-3,000 | 68-72 | Xylene/ n-Butanol | 170 | Phenalkamine modified type Coatings for marine & industrial use |
| KMH-153XB80 | 220-265 | 1,000-4,000 | 78-82 | Xylene/ n-Butanol | 164 | Phenalkamine modified type High solid anti-corrosive coatings for marine & industrial use |
| KMH-154XB70 | 160-210 | 1,000-3,000 | 68-72 | Xylene/ n-Butanol | 169 | Phenalkamine modified type Coatings for marine & industrial use |
| KMH-350X80 | 155-175 | 2,500-5,000 | 78-82 | Xylene | 180 | Phenalkamine modified type High solid anti-corrosive coatings for marine & industrial use |
| KMH-553XI80 | 170-190 | 1,000-4,000 | 68-72 | Xylene/ IPA | 255 | Phenalkamine modified type Coatings for marine & industrial use |
| KMH-591X70 | 145-175 | 1,000-3,000 | 68-72 | Xylene | 250 | Phenalkamine & Polyamide modified type |

*¹ TAV : Total Amine Value (0.1N-HClO₄ Method) *² A.H.E.W : Solution base

COMPARISON OF CURED PROPERTIES OF PHENALKAMINES FOR EPOXY APPLICATIONS

| Grade | KMH-100 | KMH-101 | KMH-121X80 | KMH-151XB70 | KMH-153XB80 | KMH-154XB70 | KMH-350X80 | KMH-591X70 |
|---------------------------------|---------|---------|------------|-------------|-------------|-------------|------------|------------|
| Low Temperature Cure | △ | △ | ○ | ◎ | ○ | ◎ | ○ | △ |
| Price competition | ◎ | ◎ | △ | ◎ | ◎ | ◎ | x | ○ |
| Appearance | x | x | ◎ | x | x | x | ○ | △ |
| Chemical Resistance | △ | △ | △ | ○ | ○ | ○ | △ | ○ |
| Flexibility | x | x | ◎ | △ | △ | △ | ◎ | ○ |
| Adhesion | x | x | ◎ | △ | △ | △ | ◎ | ○ |
| High solid | ○ | ○ | ○ | △ | ○ | △ | ○ | △ |
| Compatibility with Liquid epoxy | x | x | ◎ | △ | △ | △ | ◎ | △ |
| Workability | x | x | ○ | ◎ | ◎ | ◎ | ○ | ◎ |

Epoxy resin: YD-128(Standard liquid epoxy resin)

◎: Very good, ○: Good, △: Normal, x: Bad



AMINE & ANHYDRIDE HARDENER

| Grade | | A.H.E.W. (g/eq) | H.D.T (°C) | Description |
|----------------------|---------|--------------------|---------------|---|
| Aliphatic Amines | DETA | 19-23 | 90-120 | Civil works, Construction |
| | TETA | 23-27 | 90-120 | |
| Tertiary Amines | KH-30 | 10-20 | 90 | 1 Accelerator for anhydride, polyamide and other amines |
| | BDMA | 10-20 | 100 | |
| Aliphatic Amine | MXDA | 32-36 | 130-150 | Heat and chemical resistance |
| Cycloaliphatic Amine | IPDA | 40-46 | 100-120 | Good weatherability Civil works, Construction |
| Aromatic Amine | DDM | 50-55 | 140 | Heat and chemical resistance |
| Anhydrides | Me-THPA | 165-175 | 130 | Electrical fields, Laminating, Filament winding, FRP |
| | MNA | 170-180 | 135 | |
| Jeffamine | D-230 | 56-60 | 60 | Coating, Molding |
| | D-400 | 98-102 | 50 | |
| | A-399 | 10-30 | 60 | Accelerator for Jeffamine |



SIHWA Factory



BUSAN Factory



CHINA Factory

POLYIMIDE RESIN

1. High Soluble Polyimide

| Grade | Solid Content (wt%) | Viscosity (cps@25°C) | Tg* ¹ (°C) | Modulus (GPa) | CTE* ² (x10 ⁻⁶ /°C) | Color | Solvent | Characteristics |
|------------|---------------------|----------------------|-----------------------|---------------|---|-------------|---------|-------------------|
| KDPI-1101 | 20 | 3,000-6,000 | 250 | 2.5 | 60 | Brown | NMP | General purpose |
| KDPI-1102 | 20 | 3,000-6,000 | 220 | 2.2 | 50 | Brown | NMP | High adhesion |
| KDPI-1103 | 20 | 3,000-6,000 | 180 | 2.1 | 50 | Brown | NMP | Li-Battery binder |
| KDPI-1104 | 30 | 500-3,000 | 150 | 2.1 | 60 | Brown | NMP | Low viscosity |
| KDPI-1015 | 20 | 10,000-20,000 | 200 | 2.5 | 50 | Transparent | NMP | Crystal clear |
| KDPI-1101B | 20 | 3,000-6,000 | 250 | 2.5 | 60 | Black | NMP | General purpose |
| KDPI-1102B | 20 | 3,000-6,000 | 250 | 2.2 | 50 | Black | NMP | High adhesion |

*¹ DSC Method *² TMA Method

2. Thermal Plastic Polyimide

| Grade | Solid Content (wt%) | Viscosity (cps@25°C) | Tg* ¹ (°C) | Modulus (GPa) | CTE* ² (x10 ⁻⁶ /°C) | Color | Solvent | Characteristics |
|-----------|---------------------|----------------------|-----------------------|---------------|---|--------|---------|-----------------|
| KDPI-1201 | 18 | 10,000-20,000 | 270 | 2.5 | 60 | Yellow | NMP | High Adhesion |
| KDPI-1202 | 18 | 10,000-20,000 | 220 | 3.8 | 40 | Yellow | NMP | High Modulus |
| KDPI-1203 | 18 | 10,000-20,000 | 250 | 2.0 | 60 | Yellow | NMP | Low Dk |

*¹ DSC Method *² TMA Method

3. Normal Polyimide

| Grade | Solid Content (wt%) | Viscosity (cps@25°C) | Tg* ¹ (°C) | Modulus (GPa) | CTE* ² (x10 ⁻⁶ /°C) | Color | Solvent | Characteristics |
|------------|---------------------|----------------------|-----------------------|---------------|---|-------------|---------|-----------------|
| KDPI-1301 | 18 | 20,000-30,000 | 350 | 3.5 | 16 | Yellow | NMP | General purpose |
| KDPI-1302 | 18 | 20,000-30,000 | 350 | 5.0 | 5 | Yellow | NMP | Low CTE |
| KDPI-1303 | 18 | 10,000-30,000 | 250 | 2.0 | 5 | Yellow | NMP | Low Dk (2.0) |
| KDPI-1304 | 18 | 10,000-30,000 | 250 | 2.0 | 5 | Transparent | NMP | Crystal Clear |
| KDPI-1301B | 18 | 20,000-30,000 | 350 | 3.5 | 16 | Black | NMP | General purpose |
| KDPI-1302B | 18 | 20,000-30,000 | 350 | 5.0 | 5 | Black | NMP | Low CTE |

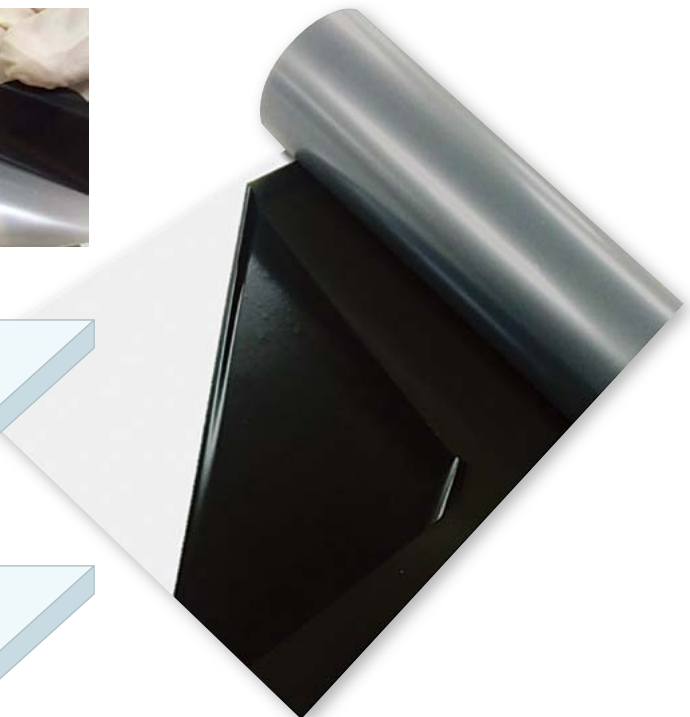
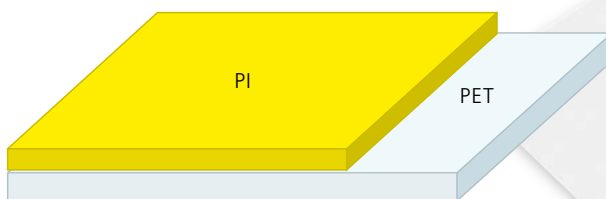
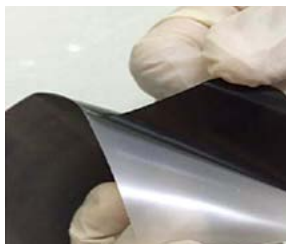
*¹ DSC Method *² TMA Method

POLYIMIDE FILM

1. Peelable Polyimide Thin Film

| Grade | Thickness (μm) | | Gloss (%) | Tg* ¹ (°C) | Modulus (GPa) | CTE* ² (x10 ⁻⁶ °C) | Color | Characteristics |
|------------|----------------|-----|-----------|-----------------------|---------------|--|-----------|------------------|
| | PI | PET | | | | | | |
| KDPI-2101B | 3, 5, 7 | 50 | 1 | 230 | 2.0 | 65 | Black | High Flexibility |
| KDPI-2102B | 3, 5, 7 | 60 | 11 | 250 | 2.8 | 60 | Black | Normal |
| KDPI-2103B | 3, 5, 7 | 50 | 11 | >280 | 3.8 | 50 | Black | High Modulus |
| KDPI-1104 | 3, 5, 7 | 50 | 1 | 220 | 2.0 | 65 | Yellow | High Flexibility |
| KDPI-1015 | 3, 5, 7 | 60 | 11 | 250 | 2.8 | 60 | Yellow | Normal |
| KDPI-1101B | 3, 5, 7 | 60 | 11 | >280 | 3.8 | 50 | Yellow | High Modulus |
| KDPI-1102B | 5, 10, 15 | 60 | - | 250 | 3.5 | 45 | Colorless | Crystal Clear |

*¹ DSC Method *² TMA Method





61, Gasandigital 2-ro,
Geumcheon-Gu, Seoul
153-802, Korea

Global Business

Tel +82-2-3282-1540

Fax +82-2-869-4409

Domestic sales

Tel +82-2-3282-1500

Fax +82-2-869-4944

R&D Center

Tel +82-2-3282-1560

Fax +82-2-3282-1586

**E-mail : trade@kukdo.com
www.kukdo.com**