April 2021

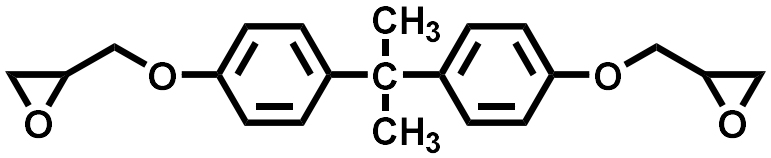
jER ™
Epoxy resins

Epoxy Unit
Sustainable Polymers Sector
Mitsubishi Chemical Corporation

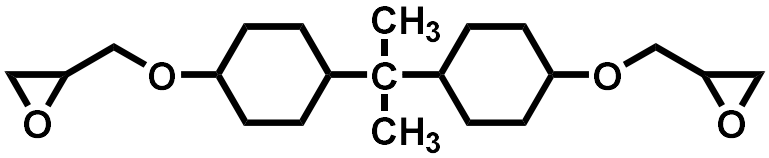
Specialty (i)

KAITEKI Value for Tomorrow
Mitsubishi Chemical Holdings Group

Bisphenol A (BisA) and Hydrogenated



828/YL980



YX8000/YX8000D

Grade	WPE (g/eq)	Viscosity (P)	Total-Cl (ppm)	Comments
828	186	135	3,100	Standard BisA
YL980	186	135	300	Low-Cl
YX8000	201	19	1,500	Hydrogenated BisA
YX8000D	185	8	900	Hydrogenated BisA, Low viscosity, Low-Cl
YX8040	1,000	3 *	500	Hydrogenated BisA, Solid, Low-Cl

* at 150℃

■YL980 is suitable for electronic application

■Hydrogenation of aromatic rings can improve photocurability

<Possible Applications>

◆YL980: Liquid underfill/adhesive for semiconductor package

◆YX8000s: LED/OLED encapsulant, LED reflector, adhesive for optical devices

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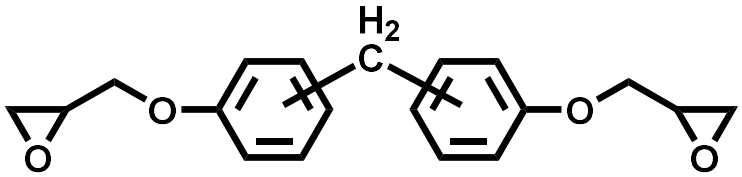
Specialty (ii)

KAITEKI Value for Tomorrow
Mitsubishi Chemical Holdings Group

Bisphenol F (BisF)



807/YL983U

Grade	WPE (g/eq)	Viscosity (P)	Total-Cl (ppm)	Comments
807	169	36	2,100	Standard BisF
YL983U	169	35	300	Low-Cl
1750	157	13	800	Lower viscosity

■YL983/1750 are suitable for electronic application where low viscosity needed

<Possible Applications>

◆YL983U/1750: Liquid underfill/adhesive for semiconductor package especially low viscosity is needed

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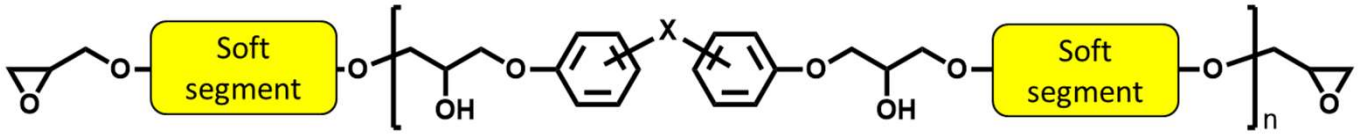
Specialty (iii)

KAITEKI Value for Tomorrow
Mitsubishi Chemical Holdings Group

Flexible and Rubbery

YX7105/YX7110



YX7400N

Grade	WPE (g/eq)	Viscosity (P)	Total-Cl (ppm)	Comments
YX7105	485	62 at 50℃	500ppm	Standard
YX7110	1,100	2,670 at 50℃	500ppm	More flexible and stretchable
YX7400N	440	1.9 at 25℃	1,000ppm	Rubbery elastic

■Keep flexibility even after full-curing
■YX7100s are tough & stretchable, YX7400N features rebound resilience

<Possible Applications>
◆Additives for stress relaxation (to avoid cracking, warpage)
◆Impact modifier for brittle materials
◆Base film/sheet for wearable devices

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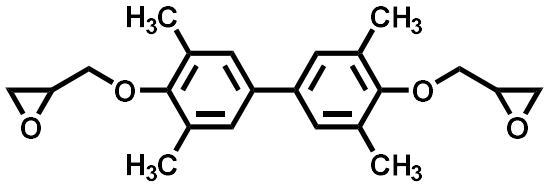
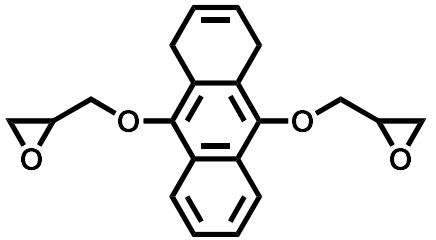
Specialty (iv)

KAITEKI Value for Tomorrow
Mitsubishi Chemical Holdings Group

Crystalline



YX4000



YX8800

Grade	WPE (g/eq)	m.p. (℃)	Total-Cl (ppm)	Comments
YX4000	185	105	1,000	Standard for EMC
YX8800	180	109	1,000	High Tg, Low CTE, Flame Retardant

■YX4000 is widely used for thin-package EMC as de-facto standard
■YX4000H(low-Cl type; 400ppm) also available
■YX8800 features higher Tg, lower CTE, better flame retardant than YX4000
☐Both suitable for solid compounding, but not stable in varnish

<Possible Applications>
◆Electronic application (EMC, solder resist, PCB, etc.)
◆Powder paint/coating (taking advantage of crystallinity)

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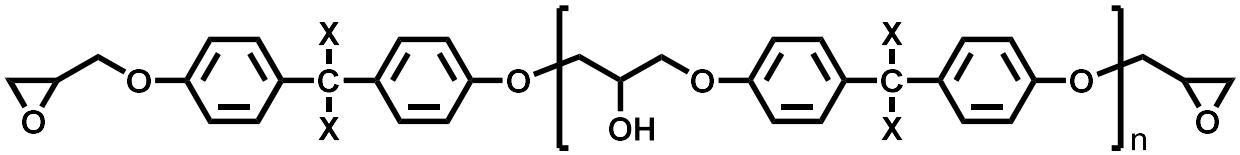
Specialty (v)

KAITEKI Value for Tomorrow
Mitsubishi Chemical Holdings Group

Polymer type



BisA-type: X=CH_3 BisF-type: X=H

Grade	Structure	WPE (g/eq)	Mw	Appearance	Comments
1256	BisA	7,800	51,000	Pellet	Standard
4250	BisA : BisF = 50 : 50	8,200	59,000	Pellet	Flexible

■Fully cured epoxy resins are generally very hard but brittle
■Addition of polymer epoxy resin gives toughness and film/sheet formability

<Possible Applications>
◆Paint & Coating: Additives to improve paintability/coatability
◆CFRP: Additives to give toughness/flexibility
◆Modifier for thermoplastics (Hydrolysis resistance, adhesive etc.)

MITSUBISHI CHEMICAL

General (Liquid Type)

KAITEKI Value for Tomorrow
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Grade	Sales specification			Remarks
	WPE (g/eq)	Color / Gardner (-)	Viscosity at 25℃ (P)	
827	180 ～ 190	0.6 max	90 ～ 110	Bisphenol A (BisA)
828	184 ～ 194	0.6 max	120 ～ 150	BisA
828EL	184 ～ 194	0.6 max	120 ～ 150	BisA, Low chlorine content (Sap. Cl: 240ppm*)
828US	184 ～ 194	0.4 max	120 ～ 150	BisA, Low chlorine content (Sap. Cl: 50ppm*)
834	230 ～ 270	0.6 max (1)	P ～ U (2)	BisA, Semi-solid
806	160 ～ 170	3 max	15 ～ 25	Bisphenol F (BisF)
807	160 ～ 175	3 max	30 ～ 45	BisF

* Typical value
(1) 40% butyl carbitol solution
(2) 40% butyl carbitol solution, Gardner-Holdt

MITSUBISHI CHEMICAL

General (Solid Type-1)

KAITEKI Value for Tomorrow
Mitsubishi Chemical Holdings Group

Grade	Sales specification			Typical value		Remarks
	WPE (g/eq)	Color / Gardner (1) (-)	Viscosity at 25℃ / Gardner-Holdt (1) (-)	Softening Point /(2) (℃)	Mn	
1001	450 ～ 500	0.6 max	D ～ F	64	900	Bisphenol A (BisA)
1002	600 ～ 700	0.6 max	G ～ K	78	1,200	BisA
1003	670 ～ 770	0.6 max	J ～ N	89	1,300	BisA
1055	800 ～ 900	0.6 max	4 ～ 6 P (3)	93	1,600	BisA
1004	875 ～ 975	0.6 max	Q ～ U	97	1,650	BisA
1004AF	875 ～ 975	0.6 max	Q ～ U	97	1,650	BisA, Alcaline free
1007	1,750 ～ 2,200	0.6 max	Y ～ Z1	128	2,900	BisA
1007H	1,750 ～ 2,200	0.6 max	Y ～ Z1	-	-	BisA, BisA content controlled (3ppm max. *)
1009	2,400 ～ 3,300	1 max	Z3 ～ Z5	144	3,800	BisA
1009T	2,700 ～ 3,100	1 max	Z3 ～ Z5	-	-	BisA, BisA content controlled (1ppm max. *)
1010	3,000 ～ 5,000	1 max	Z5 ～ Z7	-	5,500	BisA

* It is an actual value.
(1) 40% butyl carbitol solution
(2) Ring-and-Ball Method
(3) 40% butyl carbitol solution, Capillary viscometer

MITSUBISHI CHEMICAL

General (Solid Type-2)

KAITEKI Value for Tomorrow
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Grade	Sales specification			Typical value	Remarks
	WPE (g/eq)	Color / Gardner (1) (-)	Viscosity at 25℃ / Gardner-Holdt (1) (-)	Softening Point /(2) (℃)	
1003F	700 ～ 800	0.6 max	P ～ T	96	Bisphenol A (BisA)
1004F	875 ～ 975	0.6 max	T ～ W	103	BisA
1005F	950 ～ 1,050	0.6 max	U ～ X	—	BisA
1009F	1,750 ～ 2,250	1 max	Z3 ～ Z5	144	BisA
1004FS	770 ～ 850	0.6 max	Q ～ V	100	BisA
1006FS	900 ～ 1,100	0.6 max	U ～ X	112	BisA
1007FS	1,200 ～ 1,400	0.6 max	X ～ Z1	124	BisA
4005P	950 ～ 1,200	1 max	O ～ U	87	Bisphenol F (BisF)
4007P	2,000 ～ 2,500	1 max	X ～ Z2	108	BisF
4010P	3,800 ～ 4,600	1 max	Z4 ～ Z6-	135	BisF

(1) 40% butyl carbitol solution
(2) Ring-and-Ball Method

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General (Multi Functional Type)

KAITEKI Value for Tomorrow
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Grade	Sales specification			Typical value	Remarks
	WPE (g/eq)	Color / Gardner (-)	Viscosity / Capillary viscometer	Softening Point /(1) (℃)	
152	172 ～ 178	1 max	14 ～ 18 P (2)	—	Phenol Novolac
154	176 ～ 180	1 max	350 ～ 650 P (2)	—	Phenol Novolac
157S70	200 ～ 220	5 max (3)	65 ～ 85 cSt (3)	70	Bisphenol A novolac, Solid
1031S	180 ～ 220	—	B ～ F (4)	90	Tetrakis(hydroxyphenyl) ethane type, Solid
1032H60	163 ～ 175	10 max (5)	34 ～ 40 cSt (3)	62	Tris(hydroxyphenyl)methane type, Solid
604	110 ～ 130	15 max	50 ～ 100 P (6)	—	Diaminodiphenylmethane type, Semi-solid
630	90 ～ 106	5 max	5 ～ 10 P (7)	—	p-Aminophenol type

(1) Ring-and-Ball Method
(2) Brookfield viscometer, at 52℃
(3) 50% 1,4-dioxane solution, at 25℃
(4) 40% butyl carbitol solution, Gardner-Holdt, at 25℃
(5) 40% MEK solution
(6) At 50℃
(7) At 25℃

MITSUBISHI CHEMICAL

Safety and Handling

These products and the auxiliary materials normally combined with them are capable of producing adverse health effects ranging from minor skin irritation to serious effects. Exposure to these materials should be minimized and avoided if feasible through the observance of proper precautions, use of appropriate engineering controls and proper personal protective clothing and equipment, and adherence to proper handling procedures. **Each of these preventive measures depends upon responsible action by adequately informed persons. None of these materials should be used, stored or transported until the handling precautions and recommendations as stated in the Material Safety Data Sheet (MSDS) for these and all other products being used are understood by all persons who will word with them.** Questions and requests for information on Mitsubishi Chemical Corporation (MCC) products should be directed to MCC. Information and MSDSs on non-MCC products should be obtained from the respective manufacturer or vender.

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