

PRIMETM 37 BIO EPOXY INFUSION SYSTEM





PRIME™ 37 is suitable for the moulding of large composite components incorporating advanced fibres such as glass, carbon and aramid.

PRIMETM 37 offers outstanding performance in a variety of liquid infusion processes including SCRIMPTM, RIFT (resin infusion under flexible tooling), VARTM (vacuum assisted resin transfer moulding) and RTM (resin transfer moulding).

PRIME™ 37 resin uses a wide range of hardeners to give a range of working times and cure speeds. This enables the gel time of the resin to be closely matched to the required infusion time for any particular size of moulded part. It achieves excellent mechanical and physical properties, including a high Tg from a moderate (50°C) post cure.

PRIME 37 contains BIO sourced materials as standard with a BIO content range from 15% to 38%.

PRIMETM 37 resin is also available in a high bio-content version. This contains 38% bio-carbon content, certified by EN 16640 carbon dating analysis. The use of sustainable, bio-based matter in the production of Gurit resins allows users to significantly reduce the environmental impact through carbon footprint and global warming potential (GWP) reduction of their components compared to oil-based resins. Gurit achieves this with no change in performance, allowing users to seamlessly substitute from PRIMETM 37 resin.

This system is available with all AmpregTM 3X Hardener speeds, as well as $PRIME^{TM}$ High Tg hardener and in a wide range of formats from small pack sizes to drums and IBCs.

- Uses Ampreg[™] 3X low toxicity hardeners
- Bio content as standard in resin
- Optional high 38% EN 16640 measured bio-content with identical performance
- Fibre wetting technology reduces infusion time & improves laminate quality
- Mixed viscosity remains lower for longer
- Lloyds Register & DNV certified
- Speciality hardener available
- Ampreg[™] 3X Fast, Standard, Slow, Extra-Slow Hardener Mix Ratio by Weight 100:29

DNV



INSTRUCTIONS FOR USE

APPLICATION

The product is optimised for use between 18 - 25°C (64 - 77°F). At lower temperatures the product thickens and may become unworkable. At higher temperatures working times will be significantly reduced. Maximum relative humidity for use is 70%.

MIXING AND HANDLING

Accurate measurement and thorough mixing are essential when using this system, and any deviation from the prescribed mix ratios will seriously degrade the physical properties of the cured system. Ampreg™ 3X Fast and Extra-slow hardeners can be blended in order to achieve intermediate speeds as indicated in the table (right).

HARDENER	FAST	STANDARD	SLOW	EXTRA-SLOW
Ampreg 3X Fast	100%	67%	25%	0%
Ampreg 3X Extra-slow	0%	33%	75%	100%

When blending hardeners, it is recommended that the hardener components are dispensed and mixed together for approximately 2 minutes before the addition to the resin.

The resin and hardener must be stirred well for two minutes or more, with particular attention being paid to the sides and bottom of the container. As soon as the material is mixed the reaction begins. This reaction produces heat (exothermic), which will in turn accelerate the reaction. If this mixed material is left in a confined mixing vessel the heat cannot disperse and the reaction will become uncontrollable. Gurit produces a separate full Safety Data Sheet for each component of this system. Please ensure that you have the correct SDS to hand for the materials you are using before commencing work. A more detailed guide for the safe use of Gurit resin systems is also available from Gurit and can be found on our website at www.gurit.com. Any accidental spillage should be soaked up with sand, sawdust, cotton waste or any other absorbent material. The area should then be washed clean (see appropriate Safety Data Sheet).

APPLICATION

PRIME™ 37 resin used with Ampreg 3X hardeners is intended for use in any established resin infusion process. The information provided in the tables in this data sheet should allow the user to achieve a successful result with this system. However, if further information is required please contact Gurit Technical Support.

CURE SCHEDULE

A post-cure is required to generate optimum mechanical properties for this system. The recommended minimum cure schedule is 7 hours at 65°C (149°F) or 16 hours at 50°C (122°C). Ambient temperature cure of this system will not generate adequate mechanical properties and is therefore not recommended.

Infused parts can be pre-cured on the mould at temperatures just above ambient, eg 30-45°C (86 – 113°F) to give the part sufficient strength and stiffness to allow earlier demoulding. Such parts should still be post cured for the minimum recommended time/temperature indicated above, to obtain adequate inservice mechanical properties. Contact Gurit Technical Support for "pre-cure" time and temperature recommendations.

If using Slow or Extra Slow Hardener the part requires a post-cure before de-moulding. When sanding or machining a component made from PRIME™ 37, which has seen no heat, there will be very low degree of cure, and the sanding dust will be more irritating than dust from a laminate, which has seen heat to effect more thorough cross-linking.

TRANSPORT & STORAGE

The resin and hardener should be kept in securely closed containers during transport and storage. Any accidental spillage should be soaked up with sand, sawdust, cotton waste or any other absorbent material. The area should then be washed clean (see appropriate Safety Data Sheet). Adequate long term storage conditions will result in a shelf life, as per table, from the date of manufacture for both the resin and hardeners, see product container label for expiry date.

COMPONENT	UNITS	10 – 25°C (50 – 77°F)
Prime 37 Resin	months	36
Ampreg 3X Fast, Std. Slow, Ex Slow Hardeners	months	36
Prime 37 High Tg Hardener	months	24

Storage should be in a warm dry place out of direct sunlight and protected from frost. The storage temperature should be kept constant between 10°C and 25°C (50°F and 77°F), cyclic fluctuations in temperature can cause crystallization. Containers should be firmly closed. Hardener, in particular, will suffer serious degradation if left exposed to air. Hardeners may darken over time, however the physical properties are not affected. Be aware of a possible mixed system colour change if very old and new hardeners are used on the same project.

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PRIME™ 37 RESIN & AMPREG 3X FAST HARDENER

This product summary is intended for use in conjunction with further advice provided under the Instructions for Use section. All data has been generated from typical production material and does not constitute a product specification.

PROPERTY	UNITS	PRIME™ 37 RESIN	FAST HARDENER	MIXED SYSTEM	TEST METHOD
Mix Ratio by Weight	Parts by weight	100	29	-	-
Mix Ratio by Volume	Parts by volume	100	34	-	-
Density at 21°C (ISO 1183-1B)	g/cm3	1.13	1.02 ± 0.05	1.10	ISO 1183-1B

COMPONENT & MIXED SYSTEM PROPERTIES

PROPERTY	UNITS	15°C	20°C	25°C	30°C	TEST METHOD
PRIME™ 37 Resin Viscosity	cP	956 - 1130	675 - 731	415 - 515	270 - 395	-
PRIME™ Fast Hardener Viscosity	cР	900 - 1000	500 - 600	300 - 500	150 - 250	-
Initial Mixed System Viscosity	cP	-	771	510	375	-
Geltime (150 g, mixed in water)*	hrs:min	-	-	00:30	-	Tecam Gel Time
Latest flow under vacuum	hrs:min	02:32	02:12	01:41	01:16	Theoretical, thin film
Earliest vacuum off time	hrs:min	04:47	03:53	02:26	02:00	Theoretical, thin film
Earliest demould time	hrs:min	07:13	05:34	04:01	02:56	Theoretical, thin film

CURED RESIN PROPERTIES

PROPERTY	SYMBOL	UNITS	16 Hours @ 50°C**	TEST METHOD
Glass Transition Temp.	Tg ₁	°C	72	ISO 6721 (DMA)
Glass Transition Temp	Tg ₂	°C	76	DSC
Ultimate Glass Transition Temp	Tg ₂	°C	84	DSC
Cured Density	pcured	g/cm3	1.17	ISO 1183-1A
Barcol Hardness	-	mg	31.9	ISO 62
Tensile Strength	στ	MPa	72.4	ISO 527-2
Tensile Modulus	Ε _T	GPa	3.26	ISO 527-2
Flexural Strength	σF	MPa	116	ISO 178
Flexural Modulus	E _F	GPa	3.21	ISO 178

CURED LAMINATE MECHANICAL PROPERTIES

Laminate: 4 plies of XE600 biaxial e-glass.

PROPERTY	SYMBOL	UNITS	16 HOURS AT 50°C**	TEST METHOD
Fibre Volume Fraction	V _{FVF}	%	52	ASTM D 3171 Method II
Tensile Strength***	στ	MPa	579	ISO 527-4
Tensile Modulus***	ET	GPa	28.0	ISO 527-4
Compressive Strength***	σc	MPa	528	SACMA SRM1-94
Compressive Modulus***	Ec	GPa	29.0	SACMA SRM1-94
Flexural Strength	σF	MPa	646	ISO 14125
Flexural Modulus	E _F	GPa	15.1	ISO 14125
ILSS	X _{ILSS}	MPa	44.3	ISO 14130

^{*}working time properties are highly subjective to ambient conditions and should be used as an approximate guideline for all PRIMETM 37 systems
initial cure of 24 hours at 21°C *normalised to 55% fibre volume fraction

^{**}initial cure of 24 hours at 21°C

PRIME™ 37 RESIN & AMPREG 3X STANDARD HARDENER

This product summary is intended for use in conjunction with further advice provided under the Instructions for Use section. All data has been generated from typical production material and does not constitute a product specification.

PROPERTY	UNITS	PRIME™ 37 RESIN	STANDARD HARDENER	MIXED SYSTEM	TEST METHOD
Mix Ratio by Weight	Parts by weight	100	29	-	-
Mix Ratio by Volume	Parts by volume	100	34	-	-
Density at 21°C (ISO 1183-1B)	g/cm3	1.13	0.97 ± 0.05	1.11	ISO 1183-1B

COMPONENT & MIXED SYSTEM PROPERTIES

PROPERTY	UNITS	15°C	20°C	25°C	30°C	TEST METHOD
PRIME™ 37 Resin Viscosity	cР	956 - 1130	675 - 731	415 - 515	270 - 395	-
PRIME™ Standard Hardener Viscosity	cР	200 - 300	150 - 200	100 – 150	50 – 100	-
Initial Mixed System Viscosity	cР	-	569	345	267	-
Geltime (150 g, mixed in water)*	hrs:min	-	-	0:53	-	Tecam Gel Time
Latest flow under vacuum	hrs:min	5:20	4:07	3:10	2:18	Theoretical, thin film
Earliest vacuum off time	hrs:min	7:38	5:33	4:28	3:00	Theoretical, thin film
Earliest demould time	hrs:min	10:00	8:08	6:10	4:21	Theoretical, thin film

CURED RESIN PROPERTIES

PROPERTY	SYMBOL	UNITS	16 Hours @ 50°C**	TEST METHOD
Glass Transition Temp.	Tg ₁	°C	72	ISO 6721 (DMA)
Glass Transition Temp	Tg ₂	°C	73	DSC
Ultimate Glass Transition Temp	Tg ₂	°C	80	DSC
Cured Density	PCURED	g/cm3	1.17	ISO 1183-1A
Barcol Hardness	-	mg	34	ISO 62
Tensile Strength	σ_{T}	MPa	70.1	ISO 527-2
Tensile Modulus	Ε _T	GPa	3.16	ISO 527-2
Flexural Strength	σF	MPa	112	ISO 178
Flexural Modulus	E _F	GPa	3.11	ISO 178

CURED LAMINATE MECHANICAL PROPERTIES

Laminate: 4 plies of XE600 biaxial e-glass.

PROPERTY	SYMBOL	UNITS	16 HOURS AT 50°C**	TEST METHOD
Fibre Volume Fraction	V _{FV} F	%	53	ASTM D 3171 Method II
Tensile Strength***	στ	MPa	552	ISO 527-4
Tensile Modulus***	Ε _T	GPa	28.7	ISO 527-4
Compressive Strength***	σc	MPa	540	SACMA SRM1-94
Compressive Modulus***	Ec	GPa	29.2	SACMA SRM1-94
Flexural Strength	σF	MPa	820	ISO 14125
Flexural Modulus	E _F	GPa	22.7	ISO 14125
ILSS	X _{ILSS}	MPa	42.2	ISO 14130

^{*}working time properties are highly subjective to ambient conditions and should be used as an approximate guideline for all PRIMETM 37 systems

**initial cure of 24 hours at 21°C

***normalised to 55% fibre volume fraction

PRIME™ 37 RESIN & AMPREG 3X SLOW HARDENER

This product summary is intended for use in conjunction with further advice provided under the Instructions for Use section. All data has been generated from typical production material and does not constitute a product specification.

PROPERTY	UNITS	PRIME™ 37 RESIN	SLOW HARDENER	MIXED SYSTEM	TEST METHOD
Mix Ratio by Weight	Parts by weight	100	29	-	-
Mix Ratio by Volume	Parts by volume	100	35	-	-
Density at 21°C (ISO 1183-1B)	g/cm3	1.13	0.95 ± 0.05	1.10	ISO 1183-1B

COMPONENT & MIXED SYSTEM PROPERTIES

PROPERTY	UNITS	15°C	20°C	25°C	30°C	TEST METHOD
PRIME™ 37 Resin Viscosity	cР	956 - 1130	675 - 731	415 - 515	270 - 395	-
PRIME™ Slow Hardener Viscosity	cР	34 - 42	24 - 34	20 - 30	14 - 20	-
Initial Mixed System Viscosity	cР	-	-	245	-	-
Geltime (150 g, mixed in water)*	hrs:min	-	-	04:00	-	Tecam Gel Time
Latest flow under vacuum	hrs:min	08:45	06:43	05:07	03:47	Theoretical, thin film
Earliest vacuum off time	hrs:min	14:43	10:52	08:10	05:47	Theoretical, thin film
Earliest demould time	hrs:min	21:50	15:51	11:52	08:40	Theoretical, thin film

CURED RESIN PROPERTIES

PROPERTY	SYMBOL	UNITS	16 Hours @ 50°C**	TEST METHOD
Ultimate Glass Transition Temp.	Tg ₁	°C	74	ISO 6721 (DMA)
Glass Transition Temp	Tg ₂	°C	68	DSC
Ultimate Glass Transition Temp	Tg ₂	°C	80	DSC
Cured Density	ρcured	g/cm3	1.16	ISO 1183-1A
Barcol Hardness	-	mg	25.5	ISO 62
Tensile Strength	στ	MPa	72.5	ISO 527-2
Tensile Modulus	E _T	GPa	3.21	ISO 527-2
Flexural Strength	σF	MPa	113	ISO 178
Flexural Modulus	E _F	GPa	3.01	ISO 178

CURED LAMINATE MECHANICAL PROPERTIES

Laminate: 4 plies of XE600 biaxial e-glass

PROPERTY	SYMBOL	UNITS	16 HOURS AT 50°C**	TEST METHOD
Fibre Volume Fraction	V _{FVF}	%	51	ASTM D 3171 Method II
Tensile Strength***	στ	MPa	537	ISO 527-4
Tensile Modulus***	ET	GPa	28.4	ISO 527-4
Compressive Strength***	σс	MPa	547	SACMA SRM1-94
Compressive Modulus***	Ec	GPa	28.4	SACMA SRM1-94
Flexural Strength	σF	MPa	664	ISO 14125
Flexural Modulus	E _F	GPa	16.2	ISO 14125
ILSS	X _{ILSS}	MPa	44.9	ISO 14130

^{*}working time properties are highly subjective to ambient conditions and should be used as an approximate guideline for all PRIMETM 37 systems

**initial cure of 24 hours at 21°C

***normalised to 55% fibre volume fraction

PRIME™ 37 RESIN & AMPREG 3X EXTRA-SLOW HARDENER

This product summary is intended for use in conjunction with further advice provided under the Instructions for Use section. All data has been generated from typical production material and does not constitute a product specification.

PROPERTY	UNITS	PRIME™ 37 RESIN	EXTRA-SLOW HARDENER	MIXED SYSTEM	TEST METHOD	
Mix Ratio by Weight	Parts by weight	100	29	-	-	
Mix Ratio by Volume	Parts by volume	100	35	-	-	
Density at 21°C (ISO 1183-1B)	g/cm3	1.13	0.93 ± 0.05	1.09	ISO 1183-1B	

COMPONENT & MIXED SYSTEM PROPERTIES

PROPERTY	UNITS	15°C	20°C	25°C	30°C	TEST METHOD
PRIME™ 37 Resin Viscosity	cР	956 - 1130	675 - 731	415 - 515	270 - 395	-
PRIME™ Extra-Slow Hardener Viscosity	cР	17	14	12	-	-
Initial Mixed System Viscosity	cP	-	217	150	97	-
Geltime (150 g, mixed in water)*	hrs:min	-	-	10:30	-	Tecam Gel Time
Latest flow under vacuum	hrs:min	13:02	11:07	07:59	06:34	Theoretical, thin film
Earliest vacuum off time	hrs:min	21:35	17:47	12:26	09:43	Theoretical, thin film
Earliest demould time	This hardener requires an elevated temperature cure – demould times at temperatures of 15-30°C are not recommended.					Theoretical, thin film

CURED RESIN PROPERTIES

PROPERTY	SYMBOL	UNITS	16 Hours @ 50°C**	TEST METHOD
Glass Transition Temp.	Tg ₁	°C	64	ISO 6721 (DMA)
Glass Transition Temp	Tg ₂	°C	69	DSC
Ultimate Glass Transition Temp	Tg ₂	°C	80	DSC
Cured Density	PCURED	g/cm3	1.15	ISO 1183-1A
Barcol Hardness	-	mg	22.5	ISO 62
Tensile Strength	στ	MPa	64.7	ISO 527-2
Tensile Modulus	E _T	GPa	3.21	ISO 527-2
Flexural Strength	σF	MPa	112	ISO 178
Flexural Modulus	E _F	GPa	3.03	ISO 178

CURED LAMINATE MECHANICAL PROPERTIES

Laminate: 4 plies of XE600 biaxial e-glass

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PROPERTY	SYMBOL	UNITS	16 HOURS AT 50°C**	TEST METHOD
Fibre Volume Fraction	V _{FVF}	%	52	ASTM D 3171 Method II
Tensile Strength***	στ	MPa	492	ISO 527-4
Tensile Modulus***	E _T	GPa	27.9	ISO 527-4
Compressive Strength***	σc	MPa	516	SACMA SRM1-94
Compressive Modulus***	Ec	GPa	28.6	SACMA SRM1-94
Flexural Strength	σF	MPa	738	ISO 14125
Flexural Modulus	E _F	GPa	20.7	ISO 14125
ILSS	XILSS	MPa	49	ISO 14130

^{*}working time properties are highly subjective to ambient conditions and should be used as an approximate guideline for all PRIMETM 37 systems
initial cure of 24 hours at 21°C *normalised to 55% fibre volume fraction

**initial cure of 24 hours at 21°C

PRIME™ 37 RESIN & PRIME™ HIGH TG HARDENER

SPECIALITY HARDENER

This hardener does not fall within our low toxicity and common mix ratio range of the standard 3X range of hardeners, see MSDS for details. This product summary is intended for use in conjunction with further advice provided under the Instructions for Use section. All data has been generated from typical production material and does not constitute a product specification.

PROPERTY	UNITS	PRIME™ 37 RESIN	HIGH TG HARDENER	MIXED SYSTEM	TEST METHOD
Mix Ratio by Weight	Parts by weight	100	25	-	-
Mix Ratio by Volume	Parts by volume	100	31	-	-
Density at 21°C (ISO 1183-1B)	g/cm3	1.13	0.92	1.08	ISO 1183-1B

COMPONENT & MIXED SYSTEM PROPERTIES

PROPERTY	UNITS	TEMPERATURE 25°C	TEST METHOD		
PRIME™ 37 Resin Viscosity	cP	415 - 515	-		
PRIME™ High Tg Hardener Viscosity	cP	25 - 27	-		
Initial Mixed System Viscosity	cP	245	-		
Geltime (150 g, mixed in water)*	hrs:min	320 - 340	Tecam Gel Time		
Latest flow under vacuum	hrs:min		Theoretical, thin film		
Earliest vacuum off time	hrs:min		Theoretical, thin film		
Earliest demould time	This hardener requires a	This hardener requires an elevated temperature cure – demould times at temperatures of 15-30°C are not recommended.			

THERMAL PROPERTIES CURE PROGRESSION

PROPERTIES	UNITS	16 HOURS AT 50°C	16HRS 50 + 5HRS 70	12 HOURS AT 85°C	16 HRS 50 + 5HRS 90°C		16HRS 50 + 5 HRS 100°C	1 HOUR AT 150°C	TEST METHOD
Tg1 by DMA	°C	75	93	109	108	120	114	120	ISO 6721 (DMA)
Tg2 by DSC	°C	74	83	105	101	110	108	117	ISO 11357 (DSC)

CURED RESIN PROPERTIES

PROPERTY	SYMBOL	UNITS	16 Hours @ 50°C*	TEST METHOD
Heat Distortion Temperature	T_{HDT}	°C	75	ISO 75
Glass Transition Temp.	Tg ₁	°C	75	ISO 6721 (DMA)
Cured Density	pcured	g/cm3	1.1	ISO 1183-1A
Linear Shrinkage	-	%	1.8	ISO 1183-1A
Barcol Hardness	-	mg	34	ISO 62
Tensile Strength	στ	MPa	70.4	ISO 527-2
Tensile Modulus	Eτ	GPa	3.5	ISO 527-2
Flexural Strength	σF	MPa	105.3	ISO 178
Flexural Modulus	E _F	GPa	3.6	ISO 178

CURED LAMINATE MECHANICAL PROPERTIES

Laminate: 4 plies of XE600 biaxial e-glass.

PROPERTY	SYMBOL	UNITS	16 HOURS AT 50°C**	TEST METHOD
Fibre Volume Fraction	V_{FVF}	%	51 – 53	ASTM D 3171 Method II
Tensile Strength***	στ	MPa	607.7	ISO 527-4
Tensile Modulus***	ET	GPa	30.0	ISO 527-4
Compressive Strength***	σc	MPa	592.0	SACMA SRM1-94
Compressive Modulus***	Ec	GPa	29.8	SACMA SRM1-94
Flexural Strength	σF	MPa	692.2	ISO 14125
Flexural Modulus	E _F	GPa	17.9	ISO 14125
ILSS	XILSS	MPa	-	ISO 14130

^{*}working time properties are highly subjective to ambient conditions and should be used as an approximate guideline for all PRIMETM 37 systems



HEALTH AND SAFETY

The following points must be considered:

- 1. Skin contact must be avoided by wearing protective gloves. Gurit recommends the use of disposable nitrile gloves for most applications. The use of barrier creams is not recommended, but to preserve skin condition a moisturising cream should be used after washing.
- 2. Protective clothing should be worn when mixing, laminating or sanding. Contaminated work clothes should be thoroughly cleaned before re-use.
- 3. Eye protection should be worn if there is a risk of resin, hardener, solvent or dust entering the eyes. If this occurs flush the eye with water for 15 minutes, holding the eyelid open, and seek medical attention.
- 4. Ensure adequate ventilation in work areas. Respiratory protection should be worn if there is insufficient ventilation. Solvent vapours should not be inhaled as they can cause dizziness, headaches, loss of consciousness and can have long term health effects.
- 5. If the skin becomes contaminated, then the area must be immediately cleansed. The use of resin-removing cleansers is recommended. To finish, wash with soap and warm water. The use of solvents on the skin to remove resins etc must be avoided.

Washing should be part of routine practice:

- before eating or drinking
- before smoking & vaping
- before using the lavatory
- after finishing work
- 6. The inhalation of sanding dust should be avoided and if it settles on the skin then it should be washed off. After more extensive sanding operations a shower/bath and hair wash is advised.

Gurit produces a separate full Safety Data Sheet for all hazardous products. Please ensure that you have the correct SDS to hand for the materials you are using before commencing work.

NOTICE

All advice, instruction or recommendation is given in good faith but the selling Gurit entity (the Company) only warrants that advice in writing is given with reasonable skill and care. No further duty or responsibility is accepted by the Company. All advice is given subject to the terms and conditions of sale (the Conditions) which are available on request from the Company or may be viewed at Gurit's Website: www.gurit.com/terms-and-conditions.aspx

The Company strongly recommends that Customers make test panels in the final process conditions and conduct appropriate testing of any goods or materials supplied by the Company prior to final use to ensure that they are suitable for the Customer's planned application. Such testing should include testing under conditions as close as possible to those to which the final component may be subjected. The Company specifically excludes any warranty of fitness for purpose of the goods other than as set out in writing by the Company. Due to the varied nature of end-use applications, the Company does, in particular, not warrant that the test panels in the final process conditions and/or the final component pass any fire standards.

The Company reserves the right to change specifications and prices without notice and Customers should satisfy themselves that information relied on by the Customer is that which is currently published by the Company on its website. Any queries may be addressed to the Technical Services Department.

Gurit is continuously reviewing and updating literature. Please ensure that you have the current version by contacting your sales contact and quoting the revision number in the bottom left-hand corner of this page.

CONTACT INFORMATION

Please see local contact information at www.gurit.com

24-HOUR CHEMICAL EMERGENCY NUMBER

For advice on chemical emergencies, spillages, fires or exposures:

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