PRODUCT INFORMATION

PROVISIONAL TECHNICAL DATASHEET
3/15/2016

Introduction

HYPERLAST 153 SERIES
Multi-Component
Elastomer System

HYPERLAST™ 153 is a four component system that can be used to produce a range of polyether based polyurethane elastomers from 55 shore A to 75 shore D hardness. HYPERLAST 153/55A Polyol can be reacted with HYPERLAST LE 5046 Isocyanate to produce an elastomer at 55 shore A, and with increasing quantities of DIPRANE™ E Polyol as a third component to produce elastomers of up to 75 shore D hardness. The cured elastomers offer excellent mechanical properties, and abrasion and hydrolysis resistance.
HYPERLAST™ 153 utilises a catalyst package that is introduced at the mixing head. This allows the user to tailor the reactivity to suit the moulding process.

Component Properties

Polyol Component

Product Reference	HYPERLAST™ 153/55A Polyol
Appearance	White solid at 25°C / colourless, clear liquid at 40°C.
Viscosity	900 – 1500 mPa.s at 40°C
Specific Gravity	0.97 – 1.07 at 40°C

Isocyanate Component

Product Reference	HYPERLAST™ LE 5046 Isocyanate
Appearance	Amber, clear liquid at 25°C
Viscosity	100 – 200 mPa.s at 25°C
Specific Gravity	1.21 – 1.23 at 25°C

Chain Extender Component

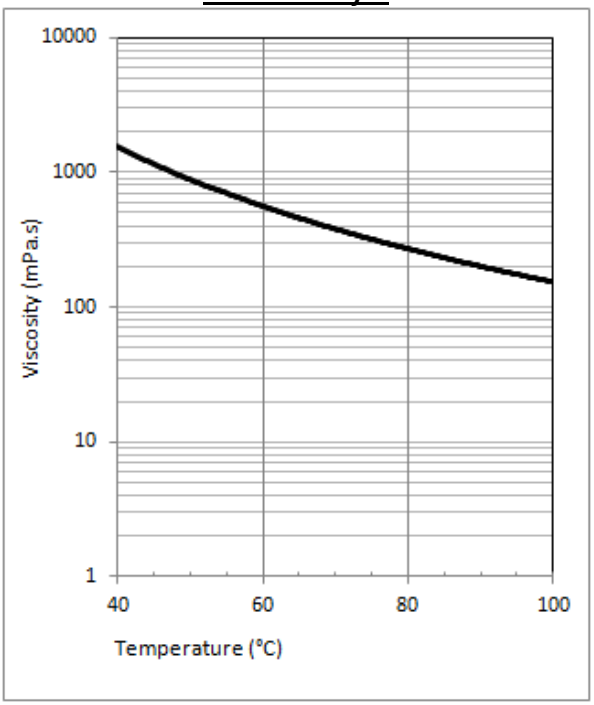
Product Reference	DIPRANE™ E Polyol
Appearance	Colourless, clear liquid at 25°C
Viscosity	50 mPa.s at 20°C
Specific Gravity	1.05 – 1.07 at 20°C

Catalyst Component

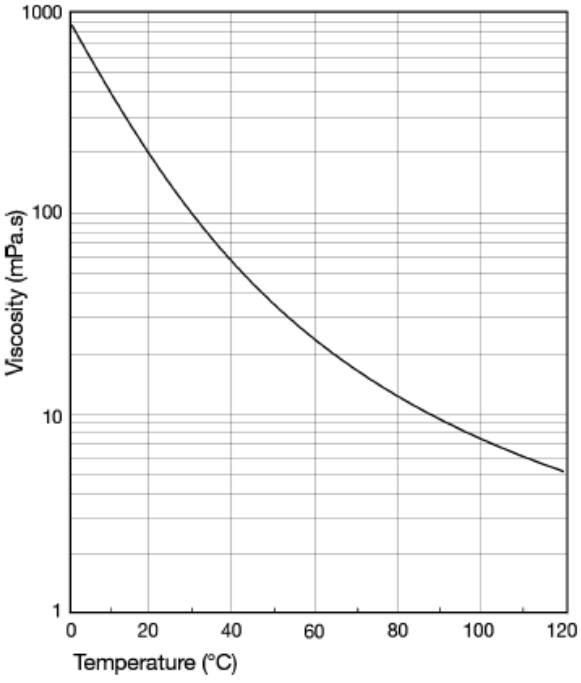
Product Reference	HYPERLAST™ 153 Catalyst
Appearance	Pale amber liquid at 25°C
Viscosity	40 – 80 mPa.s at 25°C
Specific Gravity	1.07 at 20°C

These are typical values and should not be construed as specifications.

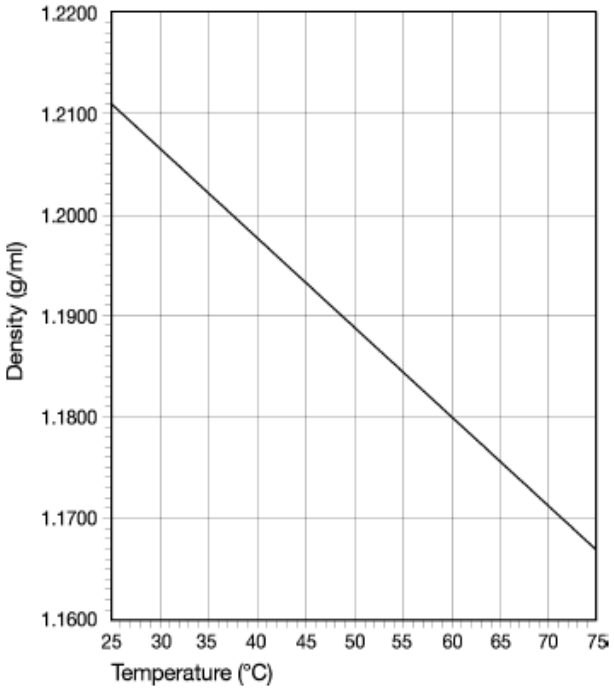
Viscosity Versus Temperature for HYPERLAST™ 153/55A Polyol



Viscosity Versus Temperature for HYPERLAST™ LE 5046 Isocyanate



Density Versus Temperature for HYPERLAST™ LE 5046 Isocyanate



Mixing Ratios

HYPERLAST™ 153 components can be mixed in the following proportions to give a range of hardness from 55°A to 75°D. The mix ratios should be followed to a tolerance of ± 1%.

Shore Hardness	**55A**	**60A**	**65A**	**70A**	**75A**	**80A**	**85A**	**90A**	**92A**	**95A**	**55D**	**60D**	**65D**	**70D**	**75D**
HYPERLAST™ 153/55A Polyol	609	396.0	336.4	276.8	222.2	196.2	166.0	139.9	128.1	94.4	88.9	76.2	62.3	47.5	32.8
DIPRANE™ E Polyol	0	8.1	10.3	12.6	14.7	15.7	16.8	17.8	18.3	19.5	19.7	20.2	20.8	21.3	21.4
HYPERLAST™ LE5046 Isocyanate	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
HYPERLAST™ 153 Catalyst	Loading should be determined by the end user.														

These are typical values and should not be construed as specifications.

HYPERLAST™ 153 Polyols can be supplied ready blended in the aforementioned hardness grades for use as two component systems.

Typical Properties

Tensile properties, tested to ISO 527 – Part 3 using a Type 5 dumbbell at a test speed of 500mm/minute. Testing using this method is better suited to this range of Shore Hardness.

Shore Hardness	ISO 868	**Unit**	**55A**	**60A**	**65A**	**70A**	**75A**	**80A**	**85A**	**90A**	**92A**	**95A**	**55D**	**60D**
Tensile Strength	ISO 527 – Part 3 Type 5, 2mm; 500 mm/min	MPa	7	17	17	26	28	29	34	37	40	41	38	35
100% Modulus	ISO 527 – Part 3 Type 5, 2mm; 500 mm/min	MPa	1.1	1.7	2.3	3.0	3.5	4.8	6.1	9.1	10.1	15.6	17.3	19.0
300% Modulus	ISO 527 – Part 3 Type 5, 2mm; 500 mm/min	MPa	1.3	3.1	5.0	7.5	8.6	11.5	14.4	18.9	18.9	27.4	27.3	27.1
Elongation at Break	ISO 527 – Part 3 Type 5, 2mm; 500 mm/min	%	590	540	465	450	450	430	420	440	440	430	430	450

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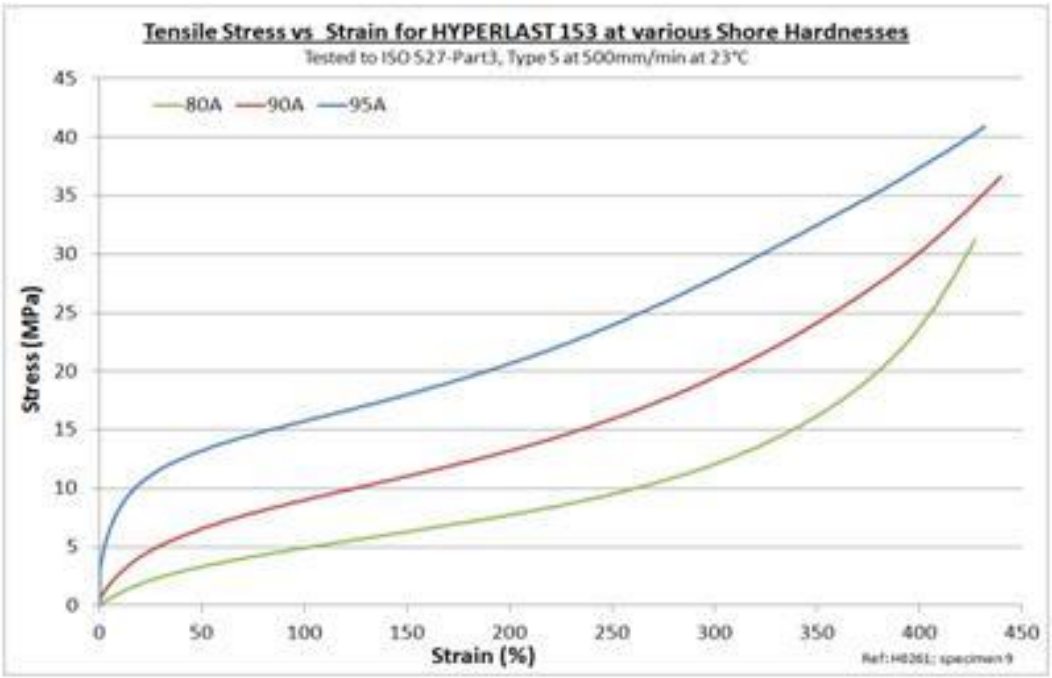

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Tensile properties, tested to ISO 527 using a Type 1B dumbbell at a test speed of 100mm/minute. Testing using this method is better suited to this range of Shore Hardness and rigidity.

Shore Hardness	ISO 868	**Unit**	**55D**	**60D**	**65D**	**70D**	**75D**
Tensile Strength	ISO 527 – Type 1B, 4mm; 100 mm/min	MPa	45	38	38	40	33
3% Secant modulus	ISO 527 – Type 1B, 4mm; 100 mm/min	MPa	140	210	320	570	990
6% Secant modulus	ISO 527 – Type 1B, 4mm; 100 mm/min	MPa	105	150	210	350	520
10% Secant modulus	ISO 527 – Type 1B, 4mm; 100 mm/min	MPa	77	107	145	225	313
Young's Modulus	ISO 527 – Type 1B, 4mm; 100 mm/min	MPa	220	230	485	815	1350
100% Modulus	ISO 527 – Type 1B, 4mm; 100 mm/min	MPa	15.2	18	21.7	26.2	31.2
300% Modulus	ISO 527 – Type 1B, 4mm; 100 mm/min	MPa	35.4	37.8	40	n/a	n/a
Elongation at Break	ISO 527 – Type 1B, 4mm; 100 mm/min	%	335	295	280	255	150

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Additional typical properties are given below. The amount of compression that was applied when measuring compression set was dependent on the requirements of the test standard and the Shore Hardness.

Shore Hardness	ISO 868	**Unit**	**55A**	**60A**	**65A**	**70A**	**75A**	**80A**	**85A**	**90A**	**92A**	**95A**	**55D**	**60D**	**65D**	**70D**	**75D**
Angle Tear Strength	ISO 34-Pt B, Proc A (2mm)	N/mm	24	36	45	56	64	70	75	93	108	117	140	133	195	200	110
DIN Abrasion	ISO 4649	mm^3 loss	130	130	<75	<50	<30	<30	30	30	<50	<55	<60	<60	60	<80	<80
Rebound Resilience	ISO 4662	%	70	70	70	67	63	56	51	37	32	33	37	42	41	40	40
Compression Set - 25% (22Hr/70°C)	ISO815-1 (Part 1)	%	20	25	30	20	20	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Compression Set - 15% (22Hr/70°C)	ISO815-1 (Part 1)	%	n/a	n/a	n/a	n/a	n/a	25	30	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Compression Set - 10% (22Hr/70°C)	ISO815-1 (Part 1)	%	n/a	n/a	n/a	n/a	n/a	n/a	n/a	25	27	27	35	40	40	n/a	n/a
Compressive Modulus at 5% strain	ISO 7743, at 5mm/min.	MPa	-	-	-	-	0.6	-	-	2.3	-	-	8.2	10.3	16.2	16.3	17.1
Compressive Modulus at 10% strain	ISO 7743, at 5mm/min.	MPa	-	-	-	-	1.1	-	-	3.9	-	-	13	16.9	23.4	30.6	34.9
Compressive Modulus at 15% strain	ISO 7743, at 5mm/min.	MPa	-	-	-	-	1.8	-	-	5.7	-	-	16.3	20.6	27.5	35.8	-
Compressive Modulus at 20% strain	ISO 7743, at 5mm/min.	MPa	-	-	-	-	2.5	-	-	7.3	-	-	19.3	24	31.4	37.4	-
Compressive Modulus at 25% strain	ISO 7743, at 5mm/min.	MPa	-	-	-	-	3.4	-	-	9.3	-	-	22.5	27.6	35.7	-	-
Compressive Modulus at 50% strain	ISO 7743, at 5mm/min.	MPa	-	-	-	-	10.2	-	-	23.6	-	-	-	-	-	-	-

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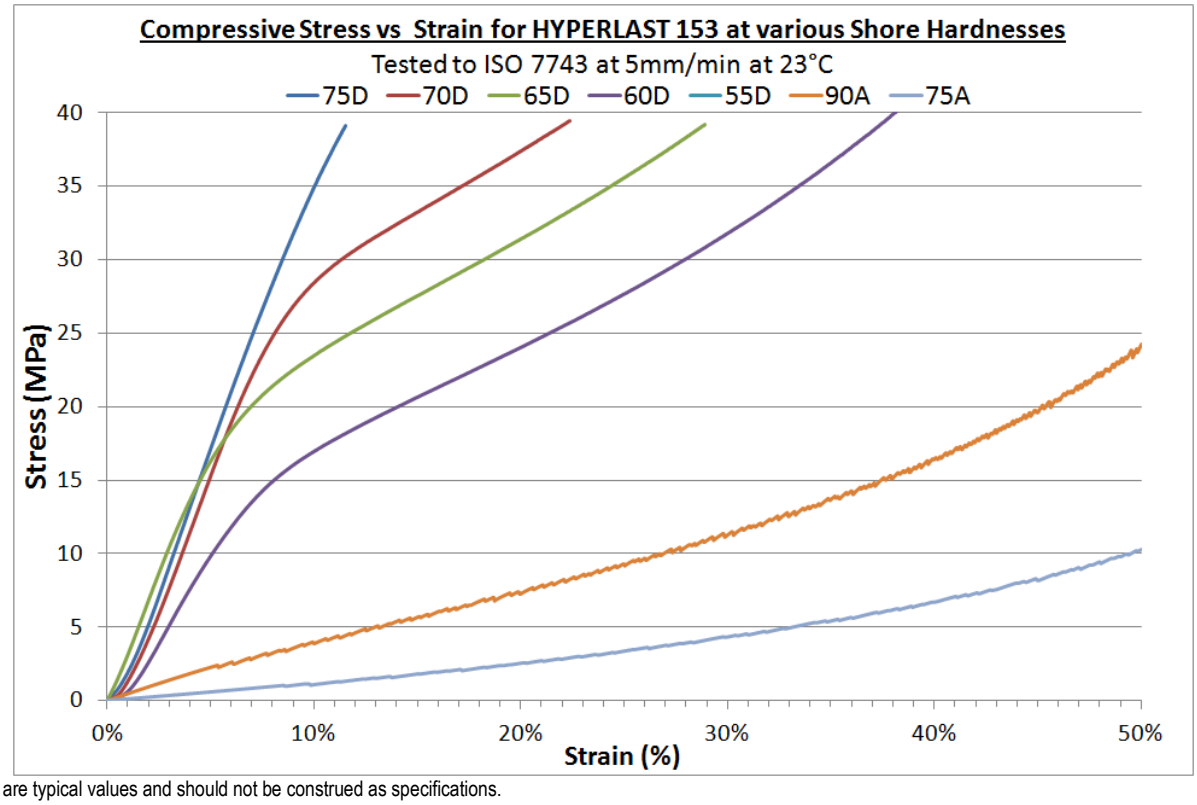

These are typical values and should not be construed as specifications.

Processing Details

The following information is given as a guide to processing this product. It is recommended that optimum conditions for a specific application are determined experimentally. Our Technical Service Department can offer more detailed advice.

Recommended Processing Conditions

HYPERLAST™ 153/55A Polyol Temperature:	40°C
DIPRANE™ E Polyol Temperature:	25°C
HYPERLAST™ LE 5046 Isocyanate Temperature:	25°C
HYPERLAST™ 153 Catalyst Temperature:	20 – 30°C
Mould Temperature:	90 – 100°C
Pot-life:	Dependent on catalyst loading %, controlled by the user
Typical Demould Time:	Dependent on catalyst loading %, controlled by the user. Mould temperature should be maintained at the required temperature until demould is achieved.
Recommended Cure Cycle:	A post-cure is recommended to help ensure full mechanical properties are achieved 16 hours at 100 – 110°C, followed by 1 week at room temperature

These are typical values and should not be construed as specifications.

Material Preparation

Polyol component

HYPERLAST™ 153/55A Polyol component is a viscous liquid, and, depending on the storage temperature, it may freeze or crystallise. The polyol component forms a waxy solid at the recommended storage temperature of 0 – 30°C. Heat is required to liquefy the polyol and / or to condition the polyol to the processing temperature. It is recommended that the polyol be warmed slowly either:

- in an air circulating oven (preferred) or a hot box,
- with a drum blanket,
- or with band heaters.

Temperatures up to 70°C are recommended.

CAUTION: Exposure to temperatures above 70°C should be avoided because this will lead to degradation of the product.

It is recommended that the warming/melting process should be carefully controlled, taking care to avoid overheating or heating for extended periods of time. Hot spots can cause degradation and should, therefore, be avoided.
In general, warming for a longer time period at a lower temperature (50°C) is preferred compared to a short time period at a higher temperature (70°C).

Typical melt times for HYPERLAST™ 153/55A Polyol are:,

- a 25kg drum (pail) requires 16 hours at 45 – 50°C, or 12 – 16 hours at 60 – 70°C;
- a 200kg drum requires 24 – 48 hours at 45 – 50°C, or at least 24 hours at 60 – 70°C,

although this will depend on the initial temperature of the material and the heat distribution efficiency of the heating method. **It is recommended that the optimum conditions for a particular application are determined experimentally by the user.**

HYPERLAST 153/55A Polyol can be stored at 40 – 60°C for up to 4 weeks without any detrimental effect on product quality, provided that the container is unopened and tightly sealed. If storing containers for extended periods of time such as this, then care must be taken to vent any pressure before opening.

Please Note: HYPERLAST™ 153/55A Polyol has been specially formulated using compatible chemicals, meaning that there should be no need to mix the polyol before use, provided that the preparation guidelines detailed above have been followed. If in doubt, please consult Dow Technical Service Department.

Isocyanate component
HYPERLAST™ LE 5046 isocyanate is a clear, amber, low viscosity, stable liquid at the recommended storage temperature of 25 – 30°C, however below this temperature range it does crystallise. The crystalline portion of the solidified product is 4,4'- diphenylmethane diisocyanate and, in this solid form, it exhibits the same dimerisation characteristics as pure diphenylmethane diisocyanate. Unless proper action is taken to reform the original solution, subsequent dimerisation will proceed quickly and deteriorate the clarity and assay of the product.

The recommended technique for melting crystallised material is drum rolling (5 - 10 RPM) in atmospheric steam. This method provides for efficient heat transfer while the solid block of frozen diphenylmethane diisocyanate cools the liquefied portion, so that the product temperature does not reach a high enough level (>60 °C) to cause excessive dimerisation.

CAUTION: Exposure to temperatures above 60°C should be avoided because this will lead to degradation of the product.

A second, but slower technique for melting crystallised material, involves warming in a hot air-circulating fan oven at up to 60°C, ideally including slow drum rolling (5 – 10 RPM) inside such an oven. Static melting in hot air ovens (i.e. with no air circulation) is not recommended because this can lead to hot spots.

Another satisfactory method for melting crystallised material is static melting in a steam chest.

As can be seen, agitation and subsequent but even heating is the key to maintaining HYPERLAST™ LE 5046 Isocyanate quality during melting, and this should be for as short a time period as possible in order to achieve its typical appearance.

Further information can be found in Dow's information sheet 'Safe Handling – Pure, Modified and Polymeric MDI' Form No. 109-01224X-1009P&M.

In the case of isocyanate that is already a colourless liquid (i.e. already melted), further heating may be necessary to condition the material to the recommended processing temperature.

The recommended technique should be to warm the isocyanate slowly

- in an air circulating oven (preferred) or a hot box, either:
- with a drum blanket,
- with band heaters.

Temperatures up to 60°C are recommended.

CAUTION: Exposure to temperatures above 60°C should be avoided because this will lead to degradation of the product.

It is recommended that the warming/melting process should be carefully controlled, taking care to avoid overheating or heating for extended periods of time. Hot spots can cause degradation and should, therefore, be avoided. In general, warming for a longer time period at a lower temperature (40 – 50°C) is preferred compared to a short time period at a higher temperature, although the exact time/temperature combination will depend on the initial temperature of the material and the heat distribution efficiency of the heating method. **It is recommended that the optimum conditions for a particular application are determined experimentally by the user.**

It is recommended that the isocyanate component is NOT stored:

- at 40 – 45°C for greater than 2 weeks;
- at 45 – 50°C for greater than 7 days;
- at 50 – 60°C for greater than 2 days.

In each case this assumes unopened, tightly sealed containers.

Chain extender component and Catalyst component

The chain extender component and catalyst component will remain liquid at the recommended storage temperature of 0 – 30°C. These should be conditioned to the processing temperature. It is recommended that the chain extender component or catalyst component be warmed slowly either:

- in an air circulating oven (preferred) or a hot box,
- with a drum blanket,
- or with band heater.

CAUTION: Exposure to temperatures above 60°C should be avoided as this will lead to degradation of the product.

The warming process should be carefully controlled, taking care to avoid overheating or heating for extended periods of time. Hot spots can cause degradation and should, therefore, be avoided.

It is recommended that the chain extender component is NOT stored at 40 – 45 °C for greater than 2 weeks, assuming the containers are unopened and tightly sealed. Storage at temperatures greater than 45°C is not recommended.

The catalyst component can be stored at 0 – 30°C for up to 6 months, assuming the containers are unopened and tightly sealed. Storage at temperatures greater than 30°C is not recommended.

Hot air circulating oven requirements

A recommended warming method for all components is in an air circulating fan oven, capable of rapid air circulation from top to bottom of the oven. The oven must be capable of achieving and maintaining the recommended material temperature. The oven type should be sufficient to ensure that the required temperature is reached quickly. An even temperature distribution throughout the oven is extremely important to achieve product consistency. The material containers should be raised off the floor of the oven (for example, on pallets) to allow good air circulation under and around them.

One of the most effective warming methods to ensure even temperature distribution throughout the material is by slow rolling (5 -10 RPM) inside such an air circulating oven.

Please Note: Depending on the heat distribution efficiency of the oven, the oven set point may not correspond to the internal air temperature or the material temperature. It is recommended that the optimum conditions for a particular application are determined experimentally by the user.

Our Technical Service Department can offer advice on oven design.

Degassing

It is recommended that all components are degassed before use, either by machine or in a vacuum chamber. It is the responsibility of the customer to ensure that the product is degassed sufficiently for use. Please consult the Dow Technical Service Department if you are unsure of the recommended methods for degassing the materials.

Moisture

Some of the components in the HYPERLAST™ 153 Series are hygroscopic. Care should be taken to avoid moisture contamination. If containers are vented during the warming period, a drying tube or dry nitrogen should be used. If the components are to be opened and then resealed, a blanket of dry nitrogen should always be used (**dry air is unsuitable because it can result in oxidation of the components**).

To help ensure satisfactory results – PROTECT FROM MOISTURE.

Mould Preparation

Aluminium, steel, alloy, brass GRP, polyurethane or silicone RTV moulds can be used, of which metal moulds are the recommended choice. Aluminium is considered to be the best material for large mouldings because it has good heat transfer characteristics and is lightweight.

Ensure the mould is cleaned thoroughly and is well sealed to prevent material from escaping. The mould should then be treated with a recommended mould release agent.

Pre-heat the mould to the recommended mould temperature before casting; this helps to ensure a uniform cure cycle, offering the best operating procedure for producing uniform castings. An even temperature distribution throughout the mould is extremely important to help achieve product consistency.

Demoulding

HYPERLAST™ 153 elastomers can be demoulded hot. Removal from the mould should not be a problem, providing the correct release agent has been employed. Care should be taken when demoulding large or complicated mouldings to avoid causing damage or distortion whilst hot.

Curing

The recommended curing temperatures are given earlier in this document. Curing at other temperatures is possible, although the cure time should be adjusted accordingly.

The recommended curing method is in an air circulating fan oven, capable of rapid air circulation from top to bottom of the oven. The oven must be capable of achieving and maintaining the recommended curing temperature. The oven type should be sufficient to ensure that the curing temperature is reached quickly. An even temperature distribution throughout the oven is extremely important to achieve product consistency. It is important that moulds be heated and maintained at the recommended temperature to help achieve satisfactory demould times and subsequent curing of the elastomer.

It is recommended that optimum conditions for a particular application are determined experimentally by the user.

Our Technical Service Department can offer advice on oven design.

Additional Processing Details

Machine Mixing

Our Technical Service Department can offer advice on suitable two, three or four component polyurethane dispensing equipment for processing HYPERLAST™ elastomers.
Agitation should be maintained on the polyol tank to ensure the polyol is homogeneous in use.

Hand Mixing

When hand mixing, the following procedures should be adhered to:

1) Precondition the components to the recommended temperature.
2) HYPERLAST™ 153/55A Polyol should be mixed by rolling the drum before use.
3) Weigh out the required quantities of HYPERLAST™ 153/55A Polyol, DIPRANE™ E and HYPERLAST 153 Catalyst into the mixing vessel and mix together.
4) Weigh the required amount of HYPERLAST™ LE 5046 isocyanate into the vessel and mix thoroughly for approximately one minute.
5) Put the mixture under vacuum (5 Torr min) for 1 - 2 minutes or until bubbling ceases.
6) Pour the reaction mixture into heated moulds, which have been treated with mould release agent.

Storage and Handling

		Shelf life
Polyol Component	Store in tightly sealed containers at a temperature of 0 - 30°C. Condition to the processing temperature and mix well before use. Avoid contact with moisture. HYPERLAST™ 153/55A Polyol forms into a waxy solid at normal warehouse temperatures. Heat is required to liquefy the polyol. For best results, warm the polyol slowly in an air circulating oven (preferred) or a hot box, with a drum blanket, or with band heater. Temperatures up to 80°C are recommended. **Exposure to temperatures above 70°C should be avoided because this will lead to degradation of the product.**	12 months
Isocyanate Component	Store in tightly sealed containers at a temperature of 25 - 35°C. Avoid contact with moisture. Storage below the recommended minimum temperature may result in crystallisation of the Isocyanate. The crystalline portion of the solidified product is 4,4'- diphenylmethane diisocyanate and, in this solid form, it exhibits the same dimerisation characteristics as pure diphenylmethane diisocyanate. Unless proper action is taken to reform the original solution, subsequent dimerisation will proceed quickly and deteriorate the clarity and assay of the product. Guidelines for melting crystallised HYPERLAST™ LE 5046 isocyanate can be found in the MATERIALS PREPARATION section of this document.	12 months
Chain Extender Component	Store in tightly sealed containers at a temperature of 0 – 30°C. Condition to the processing temperature and mix well before use. Avoid contact with moisture.	12 months
Catalyst Component	Store in tightly sealed containers at a temperature of 0 – 30°C. Condition to the processing temperature and mix well before use. Avoid contact with moisture. **Exposure to temperatures above 60°C should be avoided because this will lead to degradation of the product.**	6 months

More detailed information on the storage and handling of polyurethane components can be obtained by contacting Dow Technical Service Department.

Packaging

Polyol Component	25 kg, 200 kg
Isocyanate Component	25 kg, 225 kg
Chain Extender Component	25 kg, 200 kg
Catalyst Component	25 kg

Product Stewardship

The Dow Chemical Company and its subsidiaries ("Dow") has a fundamental concern for all who make, distribute, and use its products, and for the environment in which we live. This concern is the basis for our Product Stewardship philosophy by which we assess the safety, health, and environmental information on our products and then take appropriate steps to protect employee and public health and our environment. The success of our Product Stewardship program rests with each and every individual involved with Dow products — from the initial concept and research, to manufacture, use, sale, disposal, and recycle of each product.

Safety Considerations

Safety Data Sheets (SDS) are available from The Dow Chemical Company (Dow). SDS are provided to help customers satisfy their own handling, safety and disposal needs, and those that may be required by locally applicable health and safety regulations. SDS sheets are updated regularly. Therefore, please request and review the most current SDS before handling or using any product. Copies of the SDS are available on request through the nearest Dow Sales office.

Customer Notice

Dow strongly encourages its customers to review both their manufacturing processes and their applications of Dow products from the standpoint of human health and environmental quality to help ensure that Dow products are not used in ways for which they were not intended or tested. Dow personnel are available to answer your questions and to provide reasonable technical support. Dow product literature, including safety data sheets, should be consulted prior to use of Dow products.

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