

Product Guide for Centrex[®] ST4800

Thermoplastic Elastomer/ASA Alloy

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Centrex[®] ST4800

Thermoplastic Elastomer/ASA Alloy

Introduction

Centrex[®] ST4800 material is an alloy of thermoplastic elastomers and weatherable ASA, specifically designed to provide a low gloss look and soft touch feel in applications where it is co-extruded or laminated over a Lustran[®] ABS 752 substrate. Other grades of Lustran ABS may be more suitable, depending on the end-use performance requirements.

The Centrex ST4800 product provides a range of unique properties. In addition to low gloss and soft touch, ST4800 boasts excellent durability, chemical resistance and UV stability as well as improved sound dampening when used as a cap over Lustran ABS. Lustran Polymers strongly recommends a minimum ST4800 cap thickness of 20 mils, after thermoforming, to maintain the proper look and feel as well as UV protection.

Centrex ST4800 alloy is particularly suited for use in exterior applications or those interior parts that will be exposed to direct UV light such as dashboards, panels and trim. This includes marine, recreational vehicles, cars, trucks, heavy trucks, construction vehicles and farm equipment. As with any product, use of Centrex ST4800 resin in a given application must be tested (including but not limited to field testing) in advance by the user to determine suitability.

Providing additional system cost advantages, the Centrex ST4800/Lustran ABS system offers the ability to recycle scrap back into the substrate, up to a specific amount, without significantly affecting the property profile.

This product guide outlines the results of in-house testing on the Centrex ST4800 material and the method and manner to properly utilize it as a cap layer over Lustran ABS.



Key Properties

The key properties of the Centrex® ST4800 material are listed in Table 1 below. These items are approximate values and are provided as general information only, not to be regarded as part of the product specifications. Properties are measured on injection molded ISO specimens, except where noted, and individual samples may vary from the average reported.

Table 1. Key properties of Centrex® ST4800 Thermoplastic Elastomer/ASA Alloy.

Property	Procedure	Unit	Centrex ST4800
MFI	ISO 1133 230°C, 3.8kg	gm/10 min.	15
60° Gloss	ASTM D523 50 mil extr. sheet	%	10
Shore	ASTM D2240 50 mil extr. sheet	D	46
Multiaxial Impact	Internal (E _{max} / E _{fail})	J	6 / 8
Flammability	ISO 3795	mm/min	42

Processing

Drying

Drying prior to processing is recommended in a desiccant dehumidifying hopper dryer. An inlet air dew point of -20°F (-29°C) or below is recommended to achieve a moisture content of ≤ 0.1%. The drying temperature should not exceed 150°F to prevent pellets from fusing in the dryer. Drying at 150°F for 4-6 hours should be adequate.

Co-Extrusion

The soft touch resin can be co-extruded over Lustran ABS, with a minimum suggested cap thickness of 20 mils *in the final part after thermoforming*. A cap thickness above 20 mils after thermoforming will ensure that the soft touch cap layer delivers the optimum look and feel as well as sufficient weatherability protection for applications using the Centrex ST4800 grade. Because the soft touch material is

relatively high flowing, special care should be taken to thoroughly purge the barrel at start-up.

The melt temperature during co-extrusion is critical to the final performance of the soft touch cap layer. The optimum melt temperature range during co-extrusion is 350-375°F (175-190°C) to ensure that the soft touch material maintains its inherent toughness, soft feel, and low gloss. The durability of the cap layer can be correlated to its overall impact toughness and ductility, so these recommendations attempt to provide conditions that maximize the performance of the soft touch resin in the finished part.

For co-extrusion of soft touch over Lustran ABS, sheet can be successfully made using either a feedblock or dual manifold die. The temperatures of the die should be set to the range of 400-425°F (190-220°C). In addition, temperatures for a standard S wrap roll stack are suggested to be set to 160-180°F (70-80°C). However, specific settings are dependent on roll diameter, sheet gauge, and linear speed.

It is important to consider that the performance of the soft touch cap layer in the finished part is dependent on the total heat exposure (time and temperature) during both the extrusion and thermoforming cycles. Following the recommendations set out in both the Extrusion and Thermoforming Guides should ensure that the heat exposure is minimized in order to provide the best look, feel, and durability of the soft touch in the finished part.

Thermoforming

Centrex® ST4800 resin is normally used as a cap layer over Lustran® ABS 752. The coextruded sheet can be thermoformed on conventional equipment employing techniques typical for thermoforming ABS. Thermoforming which may include vacuum and pressure forming may be accomplished on male or female tools.



Below are listed some precautions to take when thermoforming Lustran ABS capped with Centrex ST4800 material:

- 1) The ST4800 softens at a much lower temperature compared to Lustran ABS. For this reason, the sheet should be heated only from the substrate side. As long as the substrate reaches a temperature suitable for thermoforming, the soft touch cap layer will also be hot enough to thermoform.

One important consideration is the maximum temperature the cap layer should reach during heating. *The ST4800 cap layer should not be heated to a temperature above 325°F.* The best appearance and performance of the soft touch cap layer has been obtained when the sheet is thermoformed with the temperature of the cap layer at 300°F.

It is extremely important to the performance of the finished part that the cap layer not be overheated. Table 2 below outlines the recommended thermoforming temperatures for Lustran ABS 752 sheet capped with Centrex® ST4800.

Table 2. Thermoforming conditions for soft touch capped sheet.

	Temperature
Centrex® ST4800 cap layer	< 325 °F
Lustran® ABS 752 substrate	325 – 350°F
Mold temperature in contact with soft touch cap layer	< 150 °F

- 2) Particular attention should be paid to the heating of the soft touch side of the sheet and it is important that the top and bottom heaters are on separate controls with the soft touch side much cooler than the ABS side. *The best results are obtained when the heaters on the soft touch side of the sheet are off and all of*

the heating is directed towards the substrate. The heating of the soft touch cap layer in this case is through conductive heat flow through the sheet with no direct heat applied to the cap layer. This will ensure that the soft touch cap layer does not see excessive thermal exposure and can maintain the desired soft feel and low gloss look. As the thermoforming temperature increases, gloss increases, the surface roughens, and the overall quality and durability of the ST4800 cap layer deteriorates.

- 3) Thermoplastic elastomers are more moisture-sensitive than ABS and the coextruded sheet may need to be dried before thermoforming to prevent pitting, blistering, and other surface blemishes.

Thermoforming Heating Rate

One important consideration in thermoforming Centrex® ST4800 capped sheet is the rate at which the sheet is heated to the thermoforming temperature. This heating rate dictates the amount of time the sheet is held in the oven, which is important since prolonged exposure of the cap layer to the high oven temperatures will lead to a decrease in the quality and performance of the soft touch material.

As a general rule, heating rates of 0.5-0.75 sec/mil are the maximum recommended for thermoforming sheet containing Lustran® ABS and/or Centrex. Lustran Polymers' data indicates that when thermoforming sheet composed of Centrex as the cap layer over Lustran ABS 752, the maximum recommended temperature of the thermoformer ovens on the substrate side should be 1000°F with the ovens on the cap layer side turned off.

It should be noted that this is provided only as a general reference and the actual heating rate and times will vary depending on several factors including sheet color, proximity to the heaters, cap to substrate



thickness ratio, and the amount of regrind used in the substrate.

Color Concentrates

Centrex® ST4800 resin is supplied in pellet form as a natural resin. It is imperative that all color concentrates use only the ST4800 virgin material as the carrier resin in order to maintain the proper look, feel, and physical performance of the finished product.

Regrind Usage

In-house evaluations suggest that a minimum Centrex® ST4800 cap thickness of 20 mils in the final part after thermoforming is necessary to achieve the proper soft touch feel and look when co-extruded or laminated over Lustran® ABS 752. A study was conducted to determine how much regrind from this composite system could be used in the substrate without adversely affecting the original property profile of the composite sheet. Evaluations suggest that the toughness and strength of the ABS substrate are affected by its composition and, in particular, the presence of ST4800 cap resin in the regrind.

Lustran Polymers recommends a maximum of 15% content of Centrex ST4800 material in the Lustran ABS substrate. This means, for example, that for systems with 20% cap (of the total sheet thickness), continuous

use of 40% regrind to the substrate is the maximum recommended level. This recommendation is based on an estimation of the equilibrium accumulation of cap material in the substrate with multiple extrusion cycles utilizing regrind. The maximum level of regrind to the substrate for systems with other cap percentages can be determined from the graph in Figure 1.

The recommendation for a maximum of 15% Centrex ST4800 material in the substrate is based on data generated by a regrind study. All property values were obtained on natural materials extruded and tested side-by-side. Property data from this study are provided in Figures 2-5. They show typical properties of the substrate as a function of the percentage of Centrex ST4800 material in Lustran ABS 752. The maximum loading of 15% ST4800 is marked on each figure. These figures are provided to illustrate trends and the values do not represent the product specifications, which are based on a range of values. All properties were measured at room temperature, unless otherwise specified.

It is the responsibility of the end-user to determine whether the change in properties resulting from the use of regrind is suitable for the application.



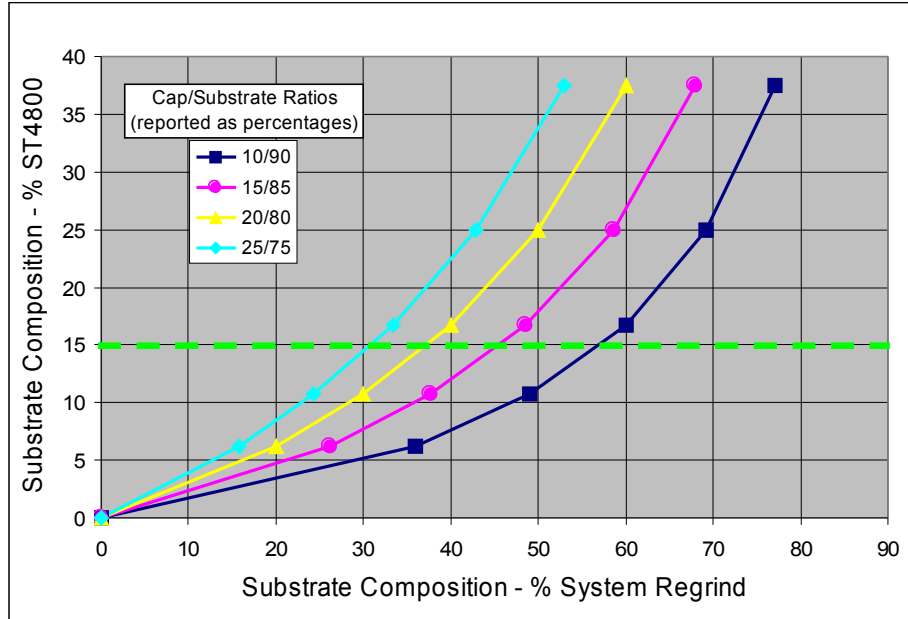


Figure 1. Level of system regrind in the substrate vs. the resulting level of Centrex® ST4800 in the substrate (at equilibrium) for various cap/substrate ratios, reported as percentages.

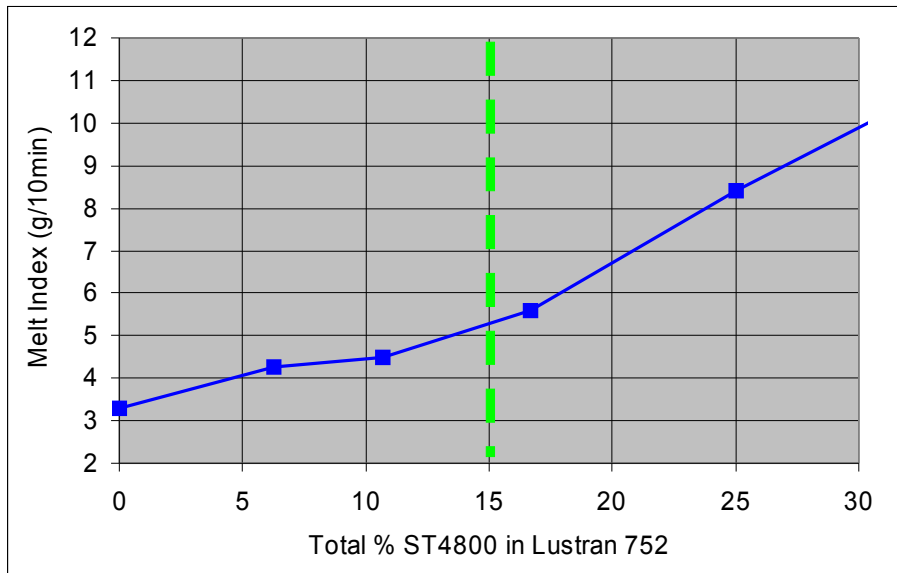


Figure 2. Melt flow index as a function of % ST4800 in Lustran® ABS 752.



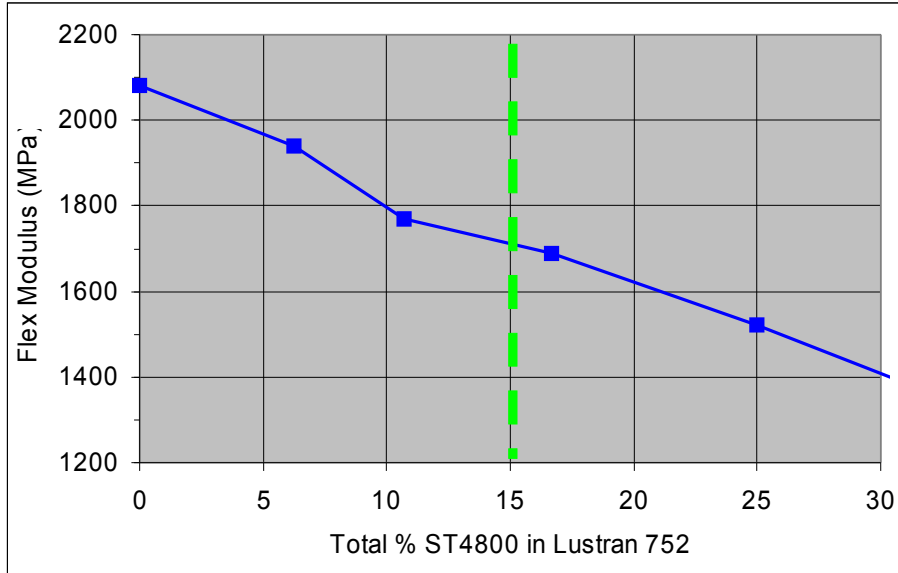


Figure 3. Flex Modulus as a function of % ST4800 in Lustran[®] ABS 752.

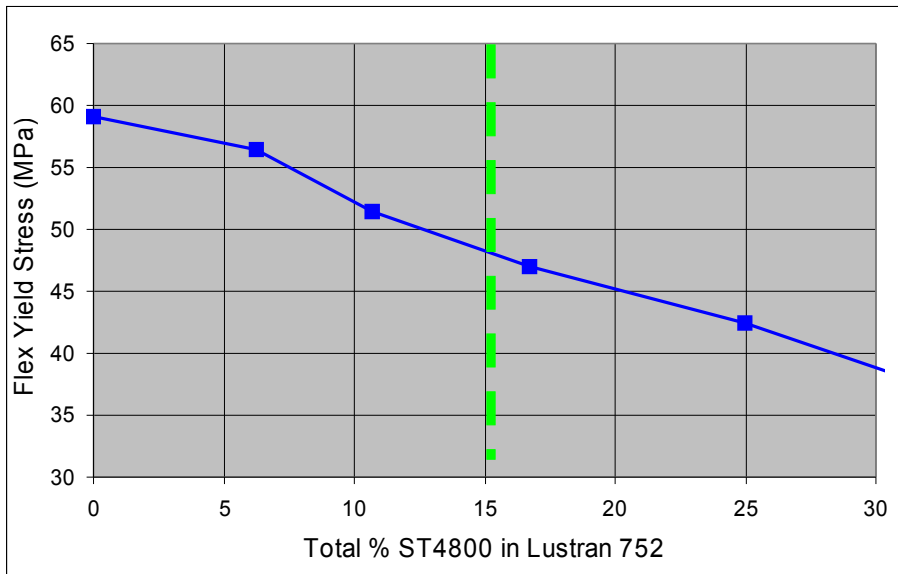


Figure 4. Flex Yield Stress as a function of % ST4800 in Lustran[®] ABS 752.



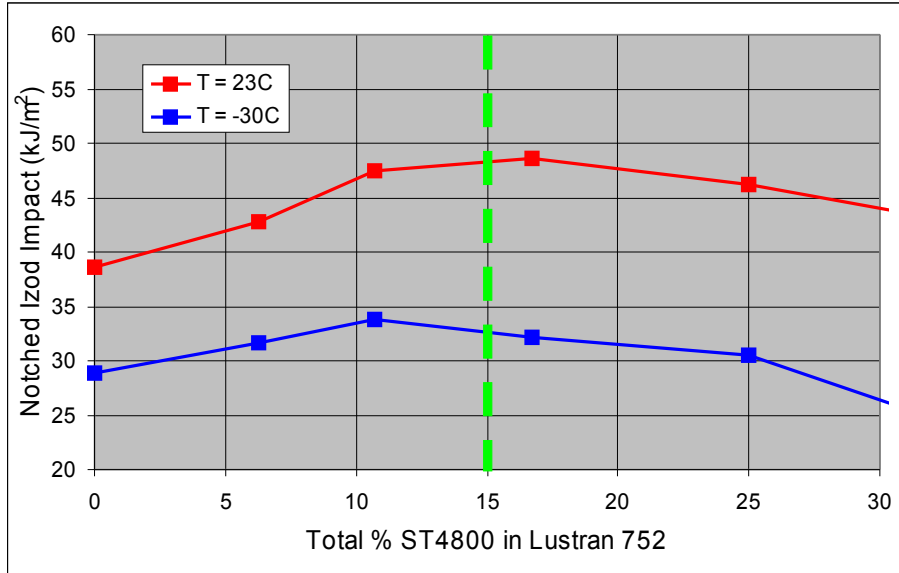


Figure 5. Izod Impact as a function of % ST4800 in Lustran® ABS 752.

Weatherability

Centrex® weatherable polymers exhibit good resistance to weather aging in outdoor applications. Centrex 825 ASA and 833 ASA/AES have been used as a co-extruded cap over ABS in various outdoor applications in the extrusion market for more than 15 years. Used as a co-extruded cap over Lustran® ABS, the Centrex ST4800 material provides the same outstanding physical property protection of the ABS substrate.

Since weatherability is dependent on variables such as resin color, end-use environment, and length of exposure, users need to determine whether color appearance and property changes are

acceptable for their intended applications. As with any product, use of Centrex polymers in a given application must be evaluated for performance by the end user to determine suitability of the resin.

For effective protection of the ABS substrate, Lustran Polymers recommends that the Centrex ST4800 cap layer should be a minimum of 20 mils in the final part, after thermoforming.

Centrex ST4800 alloy has been tested for color and gloss retention under accelerated weathering conditions using ASTM D2565 Xenon Arc exposure. The results are given in Figures 6-8.



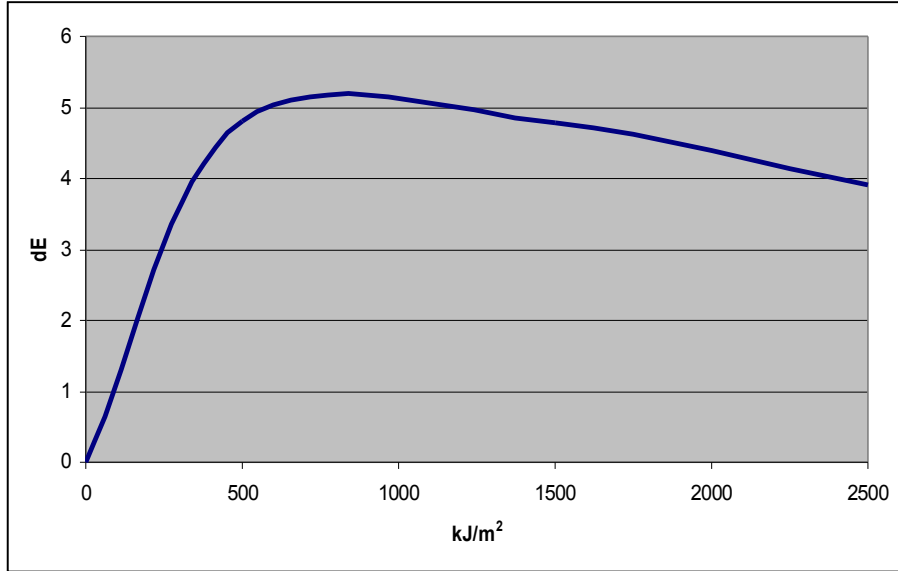


Figure 6. Color change (dE) for Centrex® ST4800 natural color.

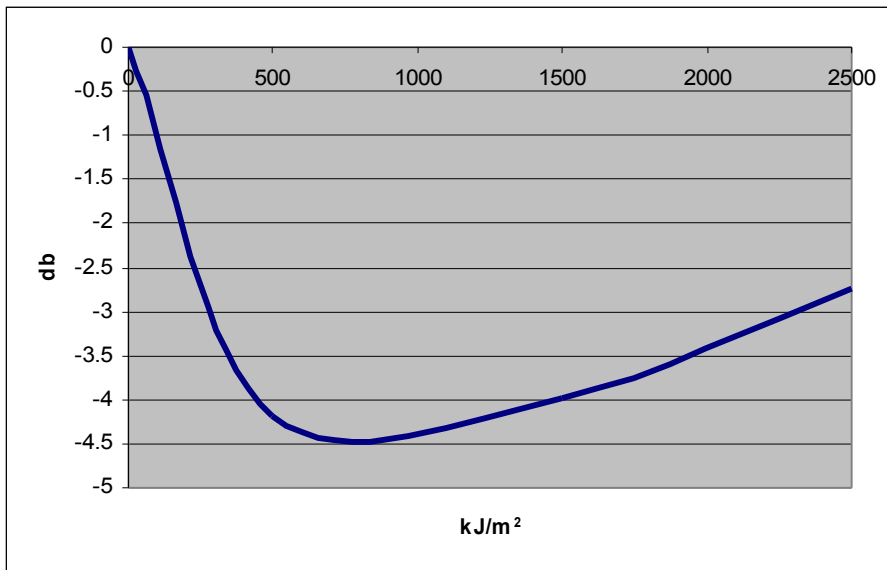


Figure 7. Observed shift to negative db illustrates a bleaching process that typically occurs in Centrex® products. This is not indicative of degradation, but is the main contributor to the dE in Figure 6.



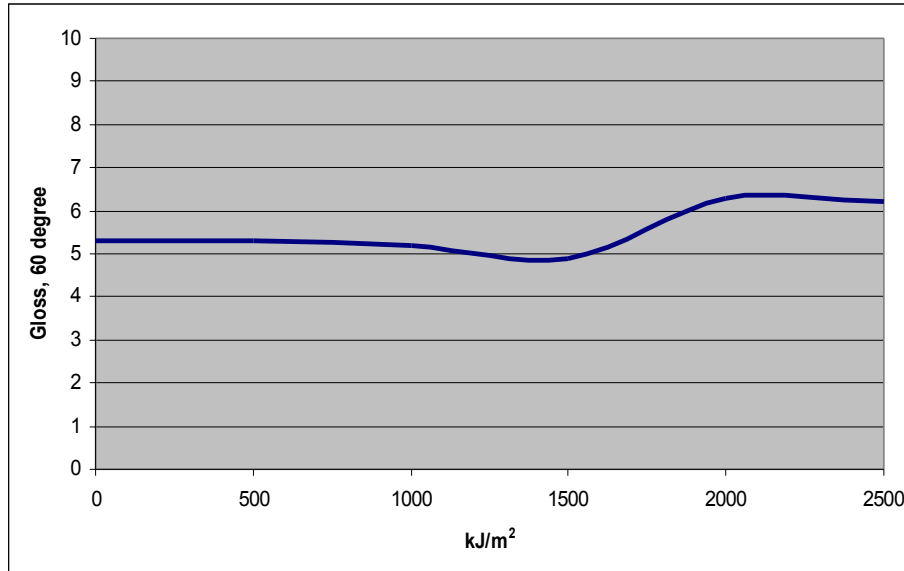


Figure 8. Centrex® ST4800 product retains desirable low gloss look after prolonged weathering.

Chemical Resistance

A sample of Centrex® ST4800 monolayer sheet was immersed in a variety of solvents and liquids to determine its resistance to staining and chemical attack. The samples were immersed for 24 hours at 73°F and measurements were made of sample dimensions and mass along with visual observation of staining or discoloration. The liquids listed below showed no effect on sample dimensions and no visible staining:

- Cola
- Coffee
- Armor-All®¹ Cleaner
- Formula 409®² Citrus Cleaner
- Windex®³ Cleaner
- Windshield Washer Fluid
- Green Cleaner
- Gasoline
- Salt Water
- Banana Boat®⁴ Suntan Lotion*

Particular note should be made that gasoline and citrus-containing cleaners did show evidence of chemical attack towards the Centrex ST4800 product. Gasoline resulted in significant swelling of the ST4800 and Formula 409® Citrus showed moderate swelling along with some

discoloration. In general, citrus-containing cleaners are not recommended for Lustran® or Centrex products.

Test results for the above materials apply only to the Centrex ST4800 layer; some of these materials may penetrate the ST4800 and cause crazes in the Lustran® ABS substrate. As is the case with any compatibility test, the results are dependent on such variables as concentration, time, temperature, part design, and residual stresses and should serve only as a guideline. *It is imperative that production parts be evaluated under actual application conditions to verify performance prior to commercial use.*

1. ARMOR ALL is a registered trademark of The Armor All/STP Products Company.
 2. FORMULA 409 is a registered trademark of The Clorox Company.
 3. WINDEX is a registered trademark of S.C. Johnson & Son, Inc.
 4. BANANA BOAT is a registered trademark of Wells Fargo Bank Minnesota, National Association.
- * Banana Boat Sport, UVA & UVB Sunblock, SPF15, Ultra Sweatproof, Waterproof.

Flammability (FMVSS302 / ISO 3795)

The Federal Motor Vehicle Safety Standard (FMVSS) 302 applies to automotive components and not materials. Lustran



Polymers does not certify against this specification since it is a component test. Test results are dependent on the part geometry as well as upon the material. Recognizing this dilemma, automotive OEM's and standardization organizations have written procedures that are based on the FMVSS 302 procedure but which use a standardized test specimen. Among these are; GM 9070P, Ford BN-24-2, and ISO 3795. These standards require the identical apparatus as FMVSS 302 and also measure burn rate identically. Even these procedures, however, state that sample thickness should be the same minimum thickness as the component into which the

material will be made. This tends to further complicate the difficulty of making a material compliance statement that will be universal for all potential components.

In general terms, to meet FMVSS burn requirements an actual plastic part must not burn faster than 4 in/min (101.6 mm/min) in a horizontal test. Testing has been carried out on a 50 mil monolayer of Centrex[®] ST4800 material according to ISO 3795, giving a burn rate of 1.65 in/min (42 mm/min). Flammability testing should be run on actual parts manufactured using Lustran Polymers materials to determine compliance with FMVSS302.

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Health and Safety Information

Appropriate literature has been assembled which provides information concerning health and safety precautions that must be observed when handling the Lustran Polymers resins described in this bulletin. Before working with these products, you must read and become familiar with the available information on their hazards, proper use, and handling. This cannot be overemphasized. Information is available in several forms, e.g. material safety sheets and product labels. Consult your local Lustran Polymers representative or contact Lustran Polymers' Product Safety and Regulatory Affairs Department in Pittsburgh, PA.

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The manner in which you use and the purpose to which you put and utilize our products, technical assistance and information (whether verbal, written or by way of production evaluations), including any suggested formulations and recommendations are beyond our control. Therefore, it is imperative that you test our products, technical assistance and information to determine to your own satisfaction whether they are suitable for your intended uses and applications. This application-specific analysis must at least include testing to determine suitability from a technical as well as health, safety, and environmental standpoint. Such testing has not necessarily been done by us. Unless we otherwise agree in writing, all products are sold strictly pursuant to the terms of our standard conditions of sale. All information and technical assistance is given without warranty or guarantee and is subject to change without notice. It is expressly understood and agreed that you assume and hereby expressly release us from all liability, in tort, contract or otherwise, incurred in connection with the use of our products, technical assistance, and information. Any statement or recommendation not contained herein is unauthorized and shall not bind us. Nothing herein shall be construed as a recommendation to use any product in conflict with patents covering any material or its use. No license is implied or in fact granted under the claims of any patent.

