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ENGINEERED POLY SHEETING

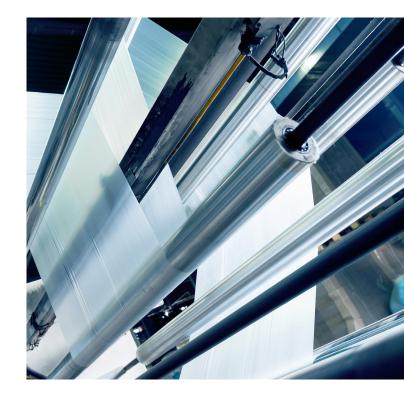
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NU-AGE FILMS WHITE PAPER

ISI Building Products creates cutting edge building products, insulation and accessories for a variety of industries. The majority of our products are created to solve problematic areas surrounding the building envelope, starting from the ground up. By creating diverse vapor barriers and retarders, we are able to counter the hurdles that arise when dealing with underslab moisture and vapor. Under-slab vapor barriers are created to slow or block water vapor from entering the building envelope through the concrete slab. Flooring failures, mold, degradation and damage to moisture sensitive furnishings within a building's interior may occur without the use of an appropriate vapor barrier.



Traditionally, inexpensive polyethylene sheeting (also known as C & A film or Visqueen) has been used to address water vapor issues occurring under a concrete slab. The downside to this approach is these materials often contain high percentages of reprocessed or recycled resin, eventually decreasing the chemical makeup and mechanical performance of the sheeting. This recycling of resin is a positive way to reduce the cost of producing such materials; however, each time resin is broken down, the properties begin to diminish. Introducing re-used or recycled plastic resin to building materials has its place, but not underneath a concrete slab. Vapor barriers and retarders beneath a concrete slab should be manufactured from a first-melt basis. In other words, under-slab vapor barriers and retarders should be manufactured from 100% virgin resin to adequately maintain performance properties for the long term.

In addition to the many benefits of using virgin resin, there are also improvements to the way films are manufactured. Traditional poly sheeting is commonly manufactured in a single-layer, single-resin set up. More advanced performing films, such as Nu-Age Films, are manufactured in a multi-layer or co-extrusion process. This technology uses separate layers to create layers of desired polymer formulations meeting the films performance needs. These layers merge together in their liquid state and are blown into one multi-layer film. Co-extruded films are in high demand because they incorporate the best properties of different resins and link them all together into one film structure. This approach creates a fine-tuned balance of properties performing better than each individual part.

Understanding a film's performance and where to use it can often be more confusing than it needs to be. For instance, polyethylene sheeting is a multi-use product for construction, industrial and agricultural applications. Each application presents its own set of challenges and performance needs, therefore an all encompassing standard, ASTM D 4397 (Standard Specification for Polyethylene Sheeting for Construction, Industrial and

Agricultural Applications), has been established to assign performance guidelines for polyethylene sheeting, 10.0-mils (250 $\mu m)$ or less in thickness. The key properties for polyethylene sheeting are water vapor transmission, puncture resistance, tensile strength and elongation. The following charts are directly from ASTM D 4397 and assign performance values based on the aforementioned properties.

Table 1: The puncture or impact resistance determines energy, in terms of weight, causing the material to fail. With impact resistance, the higher the value, the more resistive the material is to punctures.

	TABLE 2 MECHANICAL PROPERTIES		
	TENSILE STRENGTH	ELONGATION	
Lengthwise	11.7 MPa (1700 psi)	225% LD	
Crosswise	8.3 MPa (1200 psi) 350% CD		
For films nominal thickness <2mil (<50 μ m), min % to be 200 TD and 325 CD			

Table 2: Tensile strength and elongation are used to determine a material's mechanical properties and how much stress can be applied before the material ruptures. As with impact resistance, the higher the tensile and elongation value, the more resistive the material.

TABLE 1 DART DROP IMPACT RESISTANCE			
NOMINAL THICKNESS	IMPACT RESISTANCE		
25 µm (1.0 mils)	40 grams		
38 µm (1.5 mils)	65 grams		
50 μm (2.0 mils)	85 grams		
75 µm (3.0 mils)	125 grams		
100 μm (4.0 mils)	165 grams		
125 µm (5.0 mils)	205 grams		
150 µm (6.0 mils)	260 grams		
175 µm (7.0 mils)	315 grams		
200 µm (8.0 mils)	370 grams		
225 µm (9.0 mils)	420 grams		
250 µm (10.0 mils)	475 grams		
Values for nominal thickness other than those listed shall be determined by arithmetical interpolation			

TABLE 3 WATER VAPOR TRANSMISSION RATE			
THICKNESS WVTR metric		WVTR imperial	
25 µm (1.0 mils)	22.0 g/24·h·m²	1.40 g/24·h·100·in²	
50 µm (2.0 mils)	11.0 g/24·h·m²	0.70 g/24·h·100·in²	
75 µm (3.0 mils)	7.3 g/24·h·m²	0.47 g/24·h·100·in²	
100 µm (4.0 mils)	5.5 g/24·h·m²	0.35 g/24·h·100·in²	
125 µm (5.0 mils)	4.4 g/24·h·m²	0.28 g/24·h·100·in²	
150 µm (6.0 mils)	3.7 g/24·h·m²	0.23 g/24·h·100·in ²	
175 µm (7.0 mils)	3.1 g/24·h·m²	0.20 g/24·h·100·in²	
200 µm (8.0 mils)	2.8 g/24·h·m²	0.18 g/24·h·100·in²	
225 µm (9.0 mils)	2.4 g/24·h·m²	0.16g/24·h·100·in²	
250 μm (10.0 mils) 2.2 g/24·h·m²		0.14 g/24·h·100·in²	
Values for nominal thickness other than those listed			

shall be determined by arithmetical interpolation

TABLE 4 PERMEANCE			
THICKNESS PERMS metric PERMS imperial			
25 µm (1.0 mils)	0.500 perms	0.760 perms	
50 µm (2.0 mils)	0.250 perms	0.380 perms	
75 µm (3.0 mils)	0.170 perms	0.250 perms	
100 µm (4.0 mils)	0.120 perms	0.190 perms	
125 µm (5.0 mils)	0.100 perms	0.150 perms	
150 µm (6.0 mils)	0.084 perms	0.130 perms	
175 µm (7.0 mils)	ls) 0.070 perms 0.110 perms		
200 µm (8.0 mils)	0.063 perms 0.096 perms		
225 µm (9.0 mils)	0.054 perms 0.082 perm		
250 µm (10.0 mils)	s) 0.050 perms 0.076 perms		
Values for nominal thickness other than those listed			

shall be determined by arithmetical interpolation

NU-AGE FILMS WHITE PAPER

Table 3 & 4: The water vapor transmission rate (or permeance) determines how much water vapor will pass through a material. With this property, the lower the value, the more resistive the material is to water vapor migration.

All of these physical properties are created naturally in the production of polyethylene sheeting to some degree. Again, the value of each property revolves around the ingredients and technology used in the manufacturing process.

Determining what film or sheeting should be used for a given application generally falls under the responsibility of the International Building Code (IBC) or the International Residential Code (IRC) as written by the International Code Council (ICC). Building construction and design professionals, such as architects and engineers, will also establish appropriate guidelines for specific applications from the IBC, IRC and/or respective American Society for Testing and Materials (ASTM) standards. Under-slab vapor retarding applications are a very common place for plastic sheeting type products. The most recognized application specific standard is ASTM E 1745 (Standard Specification for Plastic Water Vapor Retarders Used in Contact with

Soil or Granular Fill under Concrete Slabs). ASTM E 1745 is geared specifically towards under-slab vapor retarding applications, whereas ASTM D 4397 is more generalized as previously discussed. ASTM E 1745 is predominately a high performance product driven standard creating a good, better, best approach to protecting high dollar flooring systems applied with water based adhesives. ASTM E 1745 standardizes materials in a classification system of Class A, B or C (Class A being the highest rating, Class C the lowest). The classifications are also directly related to a materials puncture resistance, water vapor transmission and tensile strength. With ASTM E 1745, the performance values or requirements are set much higher and, in most cases, can only be achieved from co-extrusion films manufactured from virgin resin blends. Our Viper under-slab vapor barriers and retarders offer a complete line of products conforming to and exceeding all ASTM E 1745 requirements.

When dealing with smaller footprints, such as residential slabs, the International Building Code is generally followed. Section 1907.4, as displayed below, is an excerpt from the International Building Code outlining vapor retarders under-slabs-on-ground.

SECTION 1907 MINIMUM SLAB PROVISIONS Section 1907.4 Vapor Retarder. A 6-mil (0.006 inch; 0.15 mm) polyethylene vapor retarder with joints lapped not less than 6 inches (152 mm) shall be placed between the base course or subgrade and the concrete floor slab, or other approved equivalent methods or materials shall be used to retard vapor transmission through the floor slab.

The highlighted text allows for other approved equivalent methods or materials. For this example, Nu-Age Films 6+ meets and exceeds the performance properties of 6-mil polyethylene sheeting, as ruled by ASTM D 4397, and would be considered an equivalent method or material used to retard vapor transmission through a floor slab. The majority of state building codes conform to the same codes as written by the International Building Code. For example, the minimum slab provisions found in section 1907 of the Florida Building Code are adapted and taken directly from the same section as referenced in the above International Building Code.

To reinforce the fact that performance of a material does not just come from its thickness, Nu-Age Films were independently tested by nationally accredited, third party laboratories. Nu-Age Films 6+ and Nu-Age Films 10+ have also received building product listings (ESL-1009 and ESL-1033 respectively) from the International Code Council Evaluation Service (ICC-ES). The listings provide evidence that the engineered vapor retarders meet consensus standards requirements in the I-Codes. Building officials, architects, contractors, specifiers and designers utilize

these ICC-ES Building Product Listings to provide a basis for using or approving Nu-Age Films 6+ and 10+ in construction projects under the International Building Code. The ICC-ES examined ISI Building Products product information, test reports, calculations, quality control methods and other factors to ensure the product is compliant with the specific consensus standards. The charts below summarize results for Nu-Age Films 6+ and 10+ when compared to the properties listed in ASTM D 4397 for 6-mil and 10-mil polyethylene sheeting.

PROPERTIES	STANDARD	NU-AGE FILMS 6+	6-MIL POLY
Drop Dart Impact Resistance	ASTM D 1709 Method A	299 grams	260 grams
Tensile Strength	ASTM D 882 Method A	4,860 psi / 4,650 psi	1,700 psi / 1,200 psi
Elongation	ASTM D 882 Method A	910% / 850%	225% / 350%
Water Vapor Permeance	ASTM E 96 Method E	0.028 perms	0.13 perms

PROPERTIES	STANDARD	NU-AGE FILMS 10+	10-MIL POLY
Drop Dart Impact Resistance	ASTM D 1709 Method A	598 grams	475 grams
Tensile Strength	ASTM D 882 Method A	5,030 psi / 4,870 psi	1,700 psi / 1,200 psi
Elongation	ASTM D 882 Method A	920% / 1,000%	225% / 350%
Water Vapor Permeance	ASTM E 96 Method E	0.047 perms	0.076 perms

There are endless options in film engineering through the use of prime-grade virgin resin and co-extrusion manufacturing technology. This manufacturing approach has greatly influenced the success of Viper Under-Slab Vapor Barriers. The same expectations position Nu-Age Films in high regard. By creating superior value without forfeiting quality, Nu-Age Films are changing the face of polyethylene sheeting for construction applications.



FREQUENTLY ASKED QUESTIONS

THE **FUTURE** OF PLASTIC SHEETING



WHAT IS THE DIFFERENCE BETWEEN NU-AGE AND STANDARD POLY?

Nu-Age Films are engineered films manufactured from state of the art tri-layer extruders. The manufacturing equipment has a high degree of versatility allowing for several types of plastic or polymers to be combined into one film structure. Furthermore, Nu-Age Films are manufactured from 100% virgin resin blends allowing for longevity and better performance. Simply put, Nu-Age Films are produced using advances in equipment technology along with quality ingredients.



IF IT IS LIGHTER WEIGHT THEN HOW IS IT BETTER?

Standard poly contains high percentages of reprocessed and reground resin and is blown through single layer extruders. The more polyethylene is reprocessed and recycled, the greater the reduction in performance and stability. Additionally, single layer extrusion machines limit the products ingredients and polymer formulation.



UNDERSTANDING THE STANDARD: WHAT IS ASTM D 4397?

ASTM D 4397 is the Standard Specification for Polyethylene Sheeting for Construction, Industrial, and Agricultural Applications. ASTM D 4397 outlines the required performance properties of polyethylene sheeting materials ranging from 1-mil up to 10-mil. Puncture resistance, tensile strength, elongation and water vapor transmission rate/permeance are the key performance properties as specified per ASTM D 4397.



DO NU-AGE FILMS MEET CURRENT INTERNATIONAL BUILDING CODES?

Yes, the minimum slab provisions (section 1907) per the International Building Code calls for a 6-mil polyethylene vapor retarder to be placed between the base course or subgrade and the concrete floor slab, or other approved equivalent methods or materials used to retard vapor transmission through the floor slab. Nu-Age Films 6+ meets and exceeds the performance properties of 6-mil polyethylene sheeting as outlined in ASTM D 4397 and would be considered an equivalent method.







WHAT DO THE ICC ES LISTINGS MEAN FOR NU-AGE FILMS?

ICC ESL-1009 and ICC ESL-1033 are product certification listings that include testing samples taken from the market, supplier's stock, or a combination of both, to verify compliance with applicable codes and standards. The ICC ESL-1009 listing confirms that Nu-Age Films 6+ meets or exceeds performance properties of 6-mil poly sheeting per ASTM D 4397. The ICC ESL-1033 listing confirms that Nu-Age Films 10+ meets or exceeds performance properties of 10-mil poly sheeting per ASTM D 4397 Standard Specification for Polyethylene Sheeting for Construction, Industrial and Agricultural Applications.



DOES NU-AGE CONTAIN ANY RECYCLED MATERIAL?

Nu-Age Films are manufactured using 100% virgin resin. There is no recycled or reprocessed resin used.



WHAT APPLICATIONS CAN NU-AGE BE USED FOR?

Nu-Age Films are used in a wide variety of construction, industrial and agricultural applications. The use of Nu-Age Films 4+, 6+ or 10+ is determined by the degree of performance needed for the respective application.



WHY IS IN-HOUSE ANALYSIS AND TESTING IMPORTANT?

For quality control purposes, samples of Nu-Age Films are pulled at random and put through a series of 5 tests, 8 to 10 different times to ensure the highest quality material.



WHY SHOULD I CHOOSE NU-AGE OVER OTHER POLY SHEETING?

Nu-Age Films are lighter, stronger and a better overall quality compared to other polyethylene sheeting products available today.

ENGINEERED POLY SHEETING

Nu-Age Films 10+



WEIGHTS & MEASURES

Roll Sizes from 8 ft x 100 ft to 20 ft x 100 ft Weight Approximately 21.3 lbs / 1,000 ft²

Thickess .00445 inches (113 μ)

Special roll lengths are available upon request

DATA HIGHLIGHT

Where To Use

MODERATE-DUTY APPLICATIONS

Nu-Age Films 10+ exceeds properties outlined in ASTM D 4397 and performs as a Class C vapor retarder per ASTM E 1745 requirements. It is ideal for residential and light commercial under-slab vapor retarding applications.









PROPERTIES	10-MIL PE SHEETING	NU-AGE FILMS 10+
PUNCTURE RESISTANCE ASTM D 1709 METHOD A	475 grams	598 grams
TENSILE STRENGTH (LD/CD) ASTM D 882	1,700 PSI / 1,200 PSI	5,030 PSI / 4,870 PSI
ELONGATION (LD/CD) ASTM D 882	225% / 350%	920% / 1,000%
WATER VAPOR PERMEANCE ASTM D 96 METHOD E	0.076 perms	0.047 perms



ISI certifies that Nu-Age Films 10+ is manufactured in the U.S.A. and meets performance properties outlined in ASTM D 4397 (Standard Specification for Polyethylene Sheeting for Construction, Industrial, and Agricultural Applications) and ASTM D 2103-10 (Standard Specification for Polyethylene Film and Sheeting).

ASTM D 4397 MINIMUM PERFORMANCE CHARACTERISTICS

THICKNESS	DROP DART IMPACT	TENSILE STRENGTH	ELONGATION	WVTR	PERMEANCE
ASTM D 6988	ASTM D 1709	ASTM D 882	ASTM D 882	ASTM D 96	ASTM D 96
10 MIL	475 grams	1,700 LD / 1,200 CD	225 % LD / 350 % CD	0.14 g/24·h·100·in²	0.076 perms

ENGINEERED POLY SHEETING

Nu-Age Films 6+

OUTPERFORMS 6-MIL POLY

WEIGHTS & MEASURES

Roll Sizes from 8 ft x 100 ft to 20 ft x 100 ft Weight Approximately 13.2 lbs / 1,000 ft²

Thickess .00275 inches (69.9 μ)

Special roll lengths are available upon request

DATA HIGHLIGHT

Where To Use

LIGHT-DUTY APPLICATIONS

Nu-Age Films 6+ meets and exceeds 6-mil poly sheeting properties outlined in ASTM D 4397. Applications include: residential light-duty under-slab vapor retarder, wall assemblies, surface protection and abatement.









PROPERTIES	6-MIL PE SHEETING	NU-AGE FILMS 6+
PUNCTURE RESISTANCE ASTM D 1709 METHOD A	260 grams	299 grams
TENSILE STRENGTH (LD/CD) ASTM D 882	1,700 PSI / 1,200 PSI	4,860 PSI / 4,650 PSI
ELONGATION (LD/CD) ASTM D 882	225% / 350%	910% / 850%
WATER VAPOR PERMEANCE ASTM D 96 METHOD E	0.13 perms	0.028 perms



ISI certifies that Nu-Age Films 6+ is manufactured in the U.S.A. and meets performance properties outlined in ASTM D 4397 (Standard Specification for Polyethylene Sheeting for Construction, Industrial, and Agricultural Applications) and ASTM D 2103-10 (Standard Specification for Polyethylene Film and Sheeting).

ASTM D 4397 MINIMUM PERFORMANCE CHARACTERISTICS

THICKNESS	DROP DART IMPACT	TENSILE STRENGTH	ELONGATION	WVTR	PERMEANCE
ASTM D 6988	ASTM D 1709	ASTM D 882	ASTM D 882	ASTM D 96	ASTM D 96
6 MIL	260 grams	1,700 ld / 1,200 cd	225% LD / 350% CD	0.23 g/24·h·100·in²	0.13 perms

ENGINEERED POLY SHEETING

Nu-Age Films 4+



WEIGHTS & MEASURES

Roll Sizes from 8 ft x 100 ft to 20 ft x 100 ft Weight Approximately 7.51 lbs $/ 1,000 \text{ ft}^2$

Thickess .00155 inches (39.4 μ)

Special roll lengths are available upon request

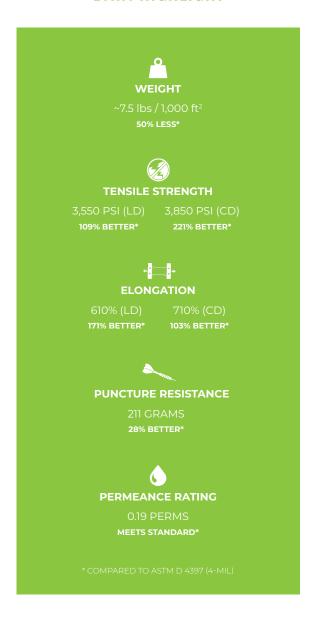
DATA HIGHLIGHT

Where To Use

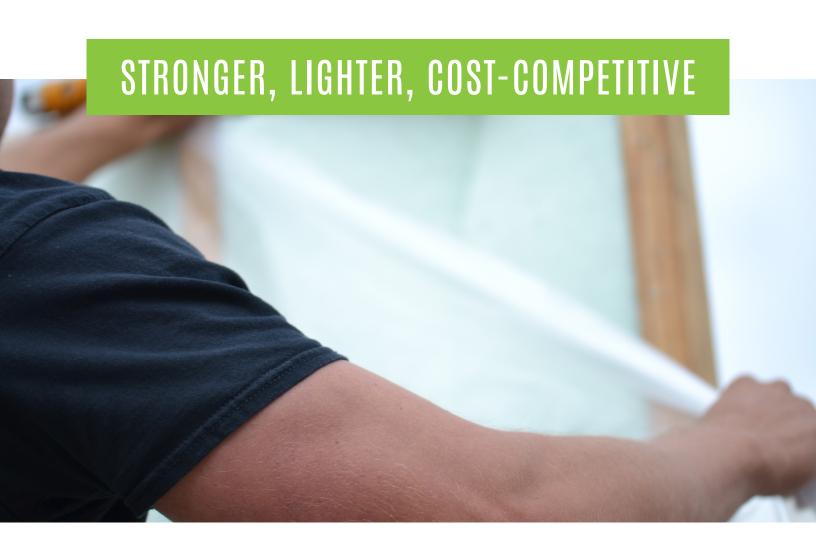
LIGHT-DUTY APPLICATIONS

Nu-Age Films 4+ meets ASTM D 4397 performance specifications for 4-mil polyethylene sheeting. Nu-Age Films 4+ is commonly used as a vapor retarder for wall assemblies, surface protection, and light-duty abatement applications.









PROPERTIES	4-MIL PE SHEETING	NU-AGE FILMS 4+
PUNCTURE RESISTANCE ASTM D 1709 METHOD A	165 grams	211 grams
TENSILE STRENGTH (LD/CD) ASTM D 882	1,700 PSI / 1,200 PSI	3,550 PSI / 3,850 PSI
ELONGATION (LD/CD) ASTM D 882	225% / 350%	610% / 710%
WATER VAPOR PERMEANCE ASTM D 96 METHOD E	0.19 perms	0.19 perms

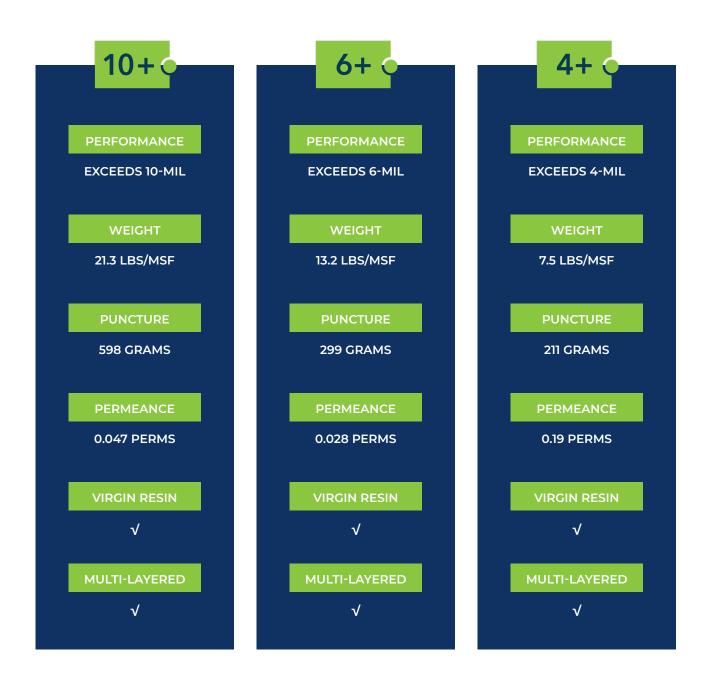


ISI certifies that Nu-Age Films 4+ is manufactured in the U.S.A. and meets performance properties outlined in ASTM D 4397 (Standard Specification for Polyethylene Sheeting for Construction, Industrial, and Agricultural Applications) and ASTM D 2103-10 (Standard Specification for Polyethylene Film and Sheeting).

ASTM D 4397 MINIMUM PERFORMANCE CHARACTERISTICS

THICKNESS	DROP DART IMPACT	TENSILE STRENGTH	ELONGATION	WVTR	PERMEANCE
ASTM D 6988	ASTM D 1709	ASTM D 882	ASTM D 882	ASTM D 96	ASTM D 96
4 MIL	165 grams	1,700 LD / 1,200 CD	225 % ld / 350% CD	0.35 g/24·h·100·in²	0.19 perms

ENGINEERED POLY SHEETING







LIGHTWEIGHT



MULTI-PURPOSE



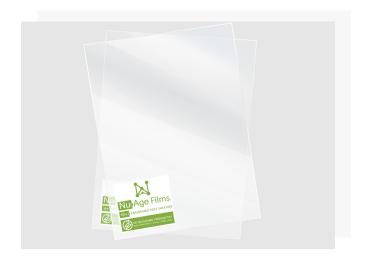
ECONOMICAL



LOW CARBON FOOTPRINT



RESOURCES



Sample Request



Scan to request Nu-Age Films samples or visit www.isibp.com/sample-request.

Product Catalog



Browse our full product catalog to discover what other solutions can work for you.



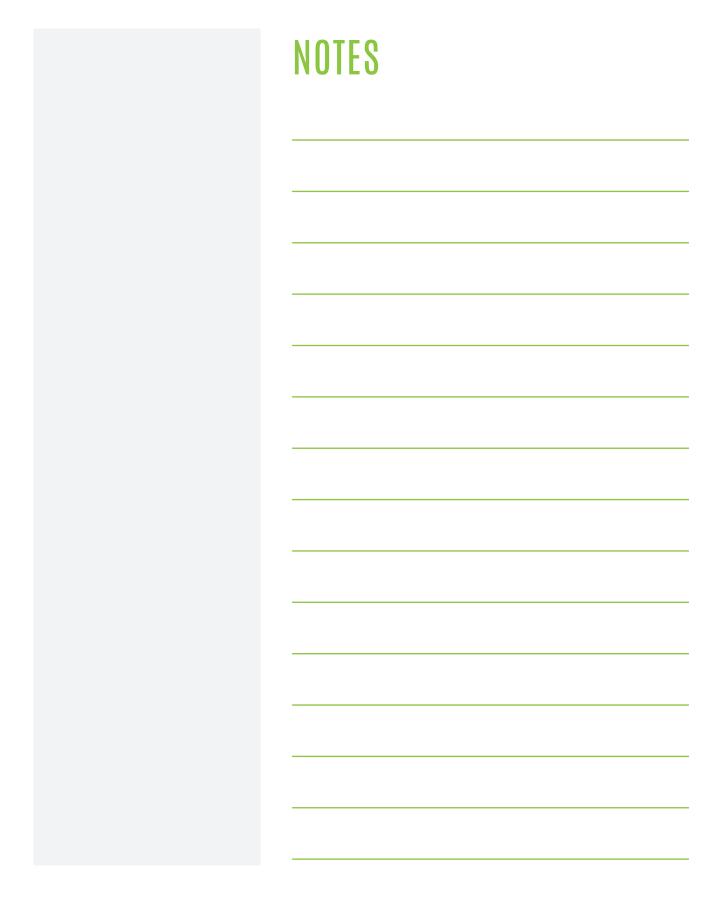
ISI BUILDING PRODUCTS Product Canada Description Test and State T

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