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## Proposed ASTM Standard for UV-Cured GRP Jacketing: A Technical Approach



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# UV-Cured Jacketing

## Proposed ASTM Standard for UV-Cured GRP Jacketing

A Technical Approach

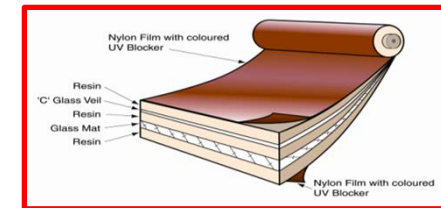
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# UV-Cured Jacketing

## What is UV-Cured GRP?

- Is a Composite product based upon an Polyester Resin reinforced with chopped glass fibers and surfacing tissue.
- Typically delivered in thickness of between 1mm and 2.5mm (1/32" up to 3/32") on rolls 24" wide or 39"
- The product cures with U/V light in the wavelength 280 – 420nm at ambient temperatures.
- Product cures in UV A, UV B, or visible types of light.
- Cure times between 5 min up to 1 hr. Many factors influence cure time
  - Type of light (natural vs. lamp)
  - Distance from light if using lamp
  - Product formulation





# UV-Cured Jacketing

## Benefits of UV-Cured GRP:

- Cures under ambient temperatures and pressures makes it easily fabricated into 90's, tees, tank heads and complicated shapes
  - Cures to a hardness that can be walked on and can withstand mechanical abuse (ideal for walk down areas)
  - Highly chemical resistant
  - Can withstand cryogenic temperatures and direct contact with cryogen
  - Product is a vapor barrier (though not recommended as primary vapor barrier)
  - High emittance (0.8) could allow for thinner insulation design
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# UV-Cured Jacketing

## Why the need for an ASTM now?

- UV-Cured GRP has been used in Asian and European markets successfully for over 15 years over all types of insulation.
  - O&G owners and specifiers are pushing non-metallics into certain areas of their upstream and midstream processes
  - Already listed in CINI Specifications
  - Need to convert European standards to US standards
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# UV-Cured Jacketing

What are key elements of the UV-Cured GRP ASTM Standard?

- **Smoke and Flame properties including toxicity and dripping. Product should meet ASTM E-84 25/50 Smoke and flame and be non-dripping and should not support flames.**
  - **UV degradation – For any outdoor use it is highly recommended that UV-Cured GRP products pass accelerate weathering to ASTM G-154 Standards**
  - **Fittings and Straights should comply with ASTM C450 and C585**
  - **Material should be free from defects (air pockets, holes, etc) and be meet dimensional tolerances.**
  - **Temperature Resistance – UV-GRP products are thermoset resins and as such do not melt but char. It is important to get good temperature resistant data and testing from your supplier.**
    - **Polymers + Heat + Time = ??????**
    - **ASTM- D-746 - Brittleness test**
    - **ASTM D-648 – Heat Deflection Temperature**
  - **ASTM – E-96 Water Vapor Permeability**
    - **Most GRP products are classified as vapor barriers, but we do not recommend them to be the primary vapor barrier. We should protect the vapor barrier from being damaged/compromised.**
  - **Product should be labelled properly and traceable**
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## Proposed Properties of UV-GRP

### At 1.8 mm Thickness

		GRP Values
Water Vapor Permeability	ASTM E-96 Ng/(Pa-s-m <sup>2</sup> )	<15
Density	lbs/SF	0.75 lbs/ft <sup>2</sup>
Smoke and Flame	ASTM E-84	25/50
Barcol Hardness	Barcol	61
Tensile Modulus	ASTM D638	17,200 psi
Compressive Strength	ASTM D695	16000 psi
Izod Impact	Ft-lb/in	13
Flexural Stress	ASTM D790	18000 psi
Manuf. Max Temp		300 F
Meet CINI Stds		Yes

Providing solutions to the insulation industry

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# Thermal Advantages to GRP in hot applications

UV-GRP has an emissivity of 0.8 versus 0.1 for Aluminum

The image displays two side-by-side screenshots of the 3E Plus v4.1 software interface, showing the 'Personnel Protection Report' for a horizontal pipe system. The left screenshot compares Aluminum (oxidized, in service) and the right screenshot compares FibreClad. Both reports show a table of results for variable insulation thicknesses from 0.5 to 5.5 inches.

**Left Screenshot (Aluminum):**

System Application: Pipe - Horizontal  
 Dimensional Standard: ASTM C 555 Rigid  
 Calculation Type: Personnel Protection  
 Process Temp: 550 °F  
 Ambient Temp: 75.0 °F  
 Wind Speed: 0.0 mph  
 Max Surface Temp: 140.0 °F  
 NPS Pipe Size: 4 in  
 Jacket Material: Aluminum, oxidized, in service

Variable Insulation Thickness	Surface Temp (°F)	Heat Loss (BTU/hr/ft)	Efficiency (%)
Bare	548.6	2322.00	
0.5	268.7	376.66	83.69
1.0	193.5	239.50	89.69
1.5	161.8	184.10	92.07
2.0	143.5	153.00	93.41
2.5	131.6	132.90	94.28
3.0	122.2	117.30	94.95
3.5	116.2	107.20	95.38
4.0	111.5	99.34	95.72
4.5	107.0	91.64	96.05
5.0	104.1	86.68	96.27
5.5	101.7	82.49	96.45

**Right Screenshot (FibreClad):**

System Application: Pipe - Horizontal  
 Dimensional Standard: ASTM C 555 Rigid  
 Calculation Type: Personnel Protection  
 Process Temp: 550 °F  
 Ambient Temp: 75.0 °F  
 Wind Speed: 0.0 mph  
 Max Surface Temp: 140.0 °F  
 NPS Pipe Size: 4 in  
 Jacket Material: FibreClad

Variable Insulation Thickness	Surface Temp (°F)	Heat Loss (BTU/hr/ft)	Efficiency (%)
Bare	548.6	2322.00	
0.5	206.3	433.20	81.35
1.0	151.1	256.60	88.95
1.5	129.0	193.20	91.68
2.0	116.6	158.80	93.16
2.5	108.6	137.00	94.10
3.0	102.4	120.40	94.82
3.5	98.5	109.70	95.28
4.0	95.5	101.40	95.63
4.5	92.7	93.29	95.98
5.0	90.8	88.11	96.21
5.5	89.3	83.75	96.39





# Thermal Advantages to GRP in cold applications

UV-GRP has an emissivity of 0.8 versus 0.1 for Aluminum

The image displays two side-by-side screenshots of the 3E Plus v4.1 software interface, showing the 'Condensation Control Report' for different jacket materials. Both reports use the same input parameters: Dimensional Standard: ASTM C 585 Rigid; Calculation Type: Condensation Control; Process Temp: -200; Ambient Temp: 75.0; Wind Speed: 0.0; NPS Pipe Size: 4; Rel. Hum: 50.0; Dew Point: 55.1. The left report is for 'Aluminum, oxidized, in service' and the right report is for 'FibraClad'. Both reports include a table with columns for Variable Insulation Thickness, Surface Temp (°F), Heat Gain (BTU/hr/ft), and Efficiency (%).

Variable Insulation Thickness	Surface Temp (°F)	Heat Gain (BTU/hr/ft)	Efficiency (%)
Bare	-199.7	670.00	
0.5	14.0	90.17	86.56
1.0	38.2	55.32	91.75
1.5	48.1	42.36	93.68
2.0	53.7	35.19	94.75
2.5	57.4	30.59	95.44
3.0	60.3	27.02	95.97
3.5	62.2	24.71	96.32
4.0	63.6	22.92	96.58
4.5	65.0	21.15	96.85
5.0	65.9	20.02	97.02
5.5	66.7	19.06	97.16

Variable Insulation Thickness	Surface Temp (°F)	Heat Gain (BTU/hr/ft)	Efficiency (%)
Bare	-199.7	670.00	
0.5	31.7	99.11	85.22
1.0	51.6	59.09	91.19
1.5	58.9	44.63	93.35
2.0	62.9	36.75	94.62
2.5	65.4	31.75	95.27
3.0	67.2	27.90	95.84
3.5	68.4	25.44	96.21
4.0	69.3	23.52	96.49
4.5	70.1	21.65	96.77
5.0	70.7	20.45	96.95
5.5	71.1	19.45	97.10



# UV-Cured Jacketing

## Where are we with the ASTM Standard?

- **Work Item 41433 is the UV-Cured GRP standard.**
  - **We have submitted to subcommittee ballot in January 2017.**
  - **Received 2 persuasive negatives when we went to ballot in 2016 (both concerned the use of C411 for determining temperature resistance).**
  - **Expect approval in 2017 for this standard.**
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# Examples





# UV-Cured Jacketing

Questions?

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