SANDIA REPORT
SAND2012-9272
Unlimited Release
Printed October 2012

A NuMAD Model of the Sandia BSDS Blade

Brian R. Resor and Joshua Paquette

Prepared by
Sandia National Laboratories
Albuquerque, New Mexico 87185 and Livermore, California 94550

Sandia National Laboratories is a multi-program laboratory managed and operated by Sandia Corporation, a wholly owned subsidiary of Lockheed Martin Corporation, for the U.S. Department of Energy's National Nuclear Security Administration under contract DE-AC04-94AL85000.

Approved for public release; further dissemination unlimited.

Sandia National Laboratories

Issued by Sandia National Laboratories, operated for the United States Department of Energy by Sandia Corporation.

NOTICE: This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government, nor any agency thereof, nor any of their employees, nor any of their contractors, subcontractors, or their employees, make any warranty, express or implied, or assume any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represent that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government, any agency thereof, or any of their contractors or subcontractors. The views and opinions expressed herein do not necessarily state or reflect those of the United States Government, any agency thereof, or any of their contractors.

Printed in the United States of America. This report has been reproduced directly from the best available copy.

Available to DOE and DOE contractors from
U.S. Department of Energy
Office of Scientific and Technical Information
P.O. Box 62
Oak Ridge, TN 37831

Telephone: (865) 576-8401
Facsimile: (865) 576-5728
E-Mail: reports@adonis.osti.gov
Online ordering: http://www.osti.gov/bridge

Available to the public from
U.S. Department of Commerce
National Technical Information Service
5285 Port Royal Rd.
Springfield, VA 22161

Telephone: (800) 553-6847
Facsimile: (703) 605-6900
E-Mail: orders@ntis.fedworld.gov
Online order: http://www.ntis.gov/help/ordermethods.asp?loc=7-4-0#online

SAND2012-9272
Unlimited Release
Printed October 2012

A NuMAD Model of the Sandia BSDS Blade

Brian R. Resor and Joshua Paquette
Wind Energy Technologies Department
Sandia National Laboratories
P.O. Box 5800
Albuquerque, New Mexico 87185-MS1124

Abstract

This report provides basic documentation of information used to create a BSDS finite element model using NuMAD. The model is intended for use as a structural model. Use of this model for aerodynamic analyses is to be performed with caution. The BSDS project successfully demonstrated the design and manufacturing of a wind turbine blade integrating several innovations including flatback airfoils on inboard blade stations, a carbon fiber spar cap and an iterative blade design process. Refer to the References at the end of this report for full and in-depth information on the BSDS blade project.

ACKNOWLEDGMENTS

The authors thank the DOE Wind and Water Power Program for the support that was required to produce a blade model and blade modeling approach such as is documented in this report.

Acknowledgement of the teams who executed the Sandia blade programs of the early 2000's is needed. These are the experts who were involved in the design, manufacture, test and documentation of the CX-100, TX-100 and BSDS blade programs: Derek Berry and Steve Nolet of TPI Composites; Dayton Griffin of DNV; Mike Zuteck of MDZ Consulting; Case van Dam of UC-Davis; Kevin Jackson of Dynamic Design; Tom Ashwill, Dale Berg, Henry Dodd, Mark Rumsey, Herb Sutherland, Paul Veers, Jose Zayas of Sandia National Laboratories.

The authors thank Tyler Bushnell, Sandia National Laboratories engineering student employee, for his work in pulling together the references and documentation to produce this report.

CONTENTS

Nomenclature 7

Modeling Approach 9
- Blade Geometry 9
- Aerodynamic Center 11
- Normalized X-Offset 11
- Model Images 12

Materials 13
- Measured Material Properties 13
- Material Layup 13
- Blade Root Hardware 13
- Leading Edge Alterations 13
- Sharp Element Alterations 13

Blade Model Archive Files 15
- NuMAD Project Files 15
  - BSDS_v1.0.nmd 15
  - MatDBsi.txt 15
  - shell7.src 15
  - zAirfoil.mac, zFlatback.mac, zSmoothe.mac 15
- 'Airfoils' Folder 15

Example Analyses 17
- Mesh Size 17
- Model Mass 17
- Modal Analysis 17
- Static Analysis 17
- PreComp Analysis 19
- BPE Analysis 20

Additional BSDS Blade Resources 23

Cited References 23

Appendix A: BSDS Layup Drawings – HP/LP Skins 25

Appendix C: BSDS Layup Drawings -- Shear Web 60

Distribution 68

FIGURES

Figure 1: Original Airfoil Sections - Root View (Reference 4, Figure 17) 10
Figure 2: SolidWorks blade model (Reference 4, Figure 30) 11
Figure 3: BSDS model as viewed in NuMAD v2.0. 12
Figure 4: BSDS blade model in ANSYS. 12
Figure 5: A plot of the composite material x-direction strain resulting from a static analysis of the BSDS blade; view of HP surface is shown. 18
Figure 6: Equivalent section properties computed using PreComp; parameters definitions are consistent with FAST blade input file inputs. 20
Figure 7: Chosen edges for elements in the BPE analysis. 20
Figure 8: Equivalent section properties computed using BPE; parameters definitions are consistent with FAST blade input file inputs. 22

TABLES

Table 1: SolidWorks Model Geometry Details with Twist (Reference 4, Figure 23) 10
Table 2: X-offset keypoints 11
Table 3: Summary of Material Properties 13
Table 4: Results from an ANSYS modal analysis. 17

NOMENCLATURE

APDL	Ansys Parametric Dynamic Language
BPE	Beam Property Extraction tool
c	chord length
c_{max}	maximum blade chord
FE	Finite Element
HP	High Pressure
L	blade Length
l/L	fractional spanwise location
LE	Leading Edge
LP	Low Pressure
NuMAD	Numerical Manufacturing and Design tool
TE	Trailing Edge
x/c	distance along airfoil chord

MODELING APPROACH

NuMAD[1] is a MATLAB[2]-based tool developed at Sandia to provide an intuitive interface for defining the outer geometry, shear web locations, materials and stacks, and stack placement in wind turbine blades. The output from NuMAD is a sequence of ANSYS[3] APDL commands used to create the finite element model in ANSYS. Once the model is created, various analyses are used to understand the strength and response of the blade to given loads.

The BSDS project successfully demonstrated the design and manufacturing of a wind turbine blade integrating several innovations including flatback airfoils on inboard blade stations, a carbon fiber spar cap and an iterative blade design process. Refer to References [4,5] for detailed information on the BSDS blade project.

The BSDS model is based primarily on the intended design of the blade. Layup drawings are included as Appendices in this report. Some material locations were obtained more accurately by actual measurements of a manufactured blade. Material properties used in the model are the same that were used in the design process.

This model has not been calibrated to match blade test data. Due to possible small discrepancies in design versus manufacture, the model represents the intended blade design, but not necessarily the manufactured blade. For example, the computed weight of the blade model is lower than the actual blade weights.

The model described by this report is meant as a starting point for a validation project or as a tool that can be used for research and engineering studies of blades.

Blade Geometry

Length of the BSDS blade is 8.325 meters. The blade features a flatback airfoil for half of the blade until developing into a typical airfoil trailing edge. Flatback airfoils differ from truncated airfoils and offer the structural benefits of thicker sections without large aerodynamic losses. See References [6,7,8,9,10] for information on aerodynamics of flatback airfoils.

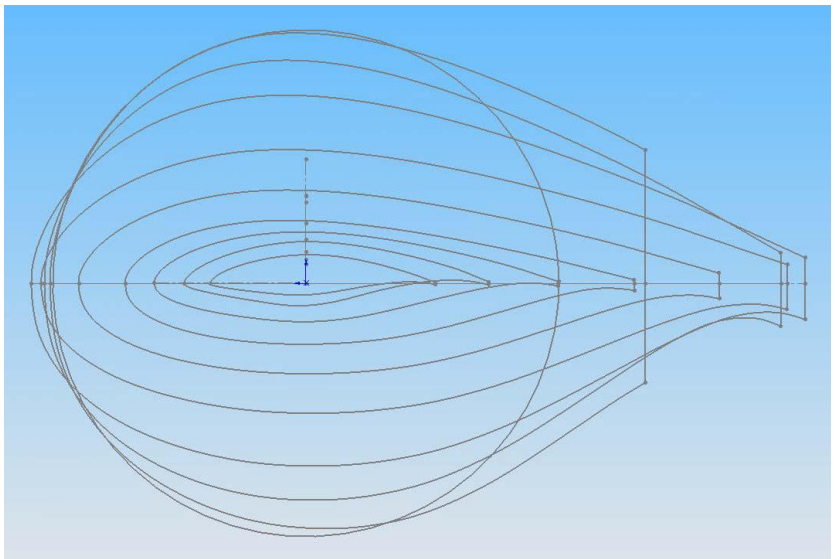


Figure 1: Original Airfoil Sections - Root View (Reference 4, Figure 17)

Table 1: SolidWorks Model Geometry Details with Twist (Reference 4, Figure 23)

BSDS Phase II - Blade Geometry Details - Rev C

Span Length (with Hub):	9,000	mm
Blade Root Location:	7.50%	span
Blade Root Location:	675	mm
Blade Length:	8,325	mm
Root Diameter (7.5% and 10% span):	20.425	inches
Root Diameter (7.5% and 10% span):	518.795	mm

Hub Span (%)	Span Location (mm)	Blade Station (mm)	Chord Length (mm)	Axis Location (% c)	Axis Location (mm LE)	Twist (degrees)	Flatback Thickness (% c)
7.5	675	0	518.795	50.00%	259.4	12.0	N/A
10	900	225	518.795	50.00%	259.4	12.0	N/A
15	1,350	675	609.601	42.98%	262.0	12.0	36.0%
20	1,800	1,125	754.382	35.50%	267.8	12.0	20.0%
25	2,250	1,575	792.482	35.50%	281.3	11.9	12.0%
35	3,150	2,475	764.034	35.50%	271.2	9.0	6.0%
45	4,050	3,375	656.083	35.50%	232.9	6.4	4.0%
55	4,950	4,275	521.463	35.50%	185.1	4.3	2.3%
65	5,850	5,175	414.021	37.50%	155.3	2.6	1.0%
75	6,750	6,075	311.913	40.00%	124.8	1.3	1.0%
85	7,650	6,975	230.124	42.50%	97.8	0.5	1.0%
95	8,550	7,875	146.812	45.00%	66.1	0.1	1.0%
100	9,000	8,325	N/A	N/A	N/A	0.0	1.0%

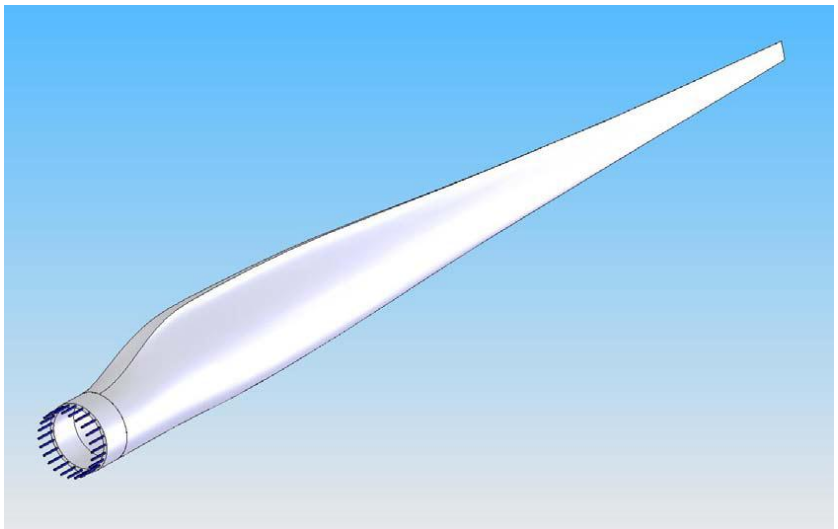


Figure 2: SolidWorks blade model (Reference 4, Figure 30)

Aerodynamic Center

Aerodynamic center at each station is assumed to be located at x/c=0.25 and 0.50 for airfoil shapes and for circular shapes, respectively. These are only assumed values. A more accurate representation for aerodynamic center locations is obtained through an in-depth analysis of the airfoil performance data.

Normalized X-Offset

Normalized x-offset at each station varies depending on span location according to Table 2

Table 2: X-offset keypoints

Span location (m)	x-offset (x/c)
0	0.5
0.238	0.5
1.2	0.355
4.2	0.355
7.875	0.45
8.325	0.45

Model Images

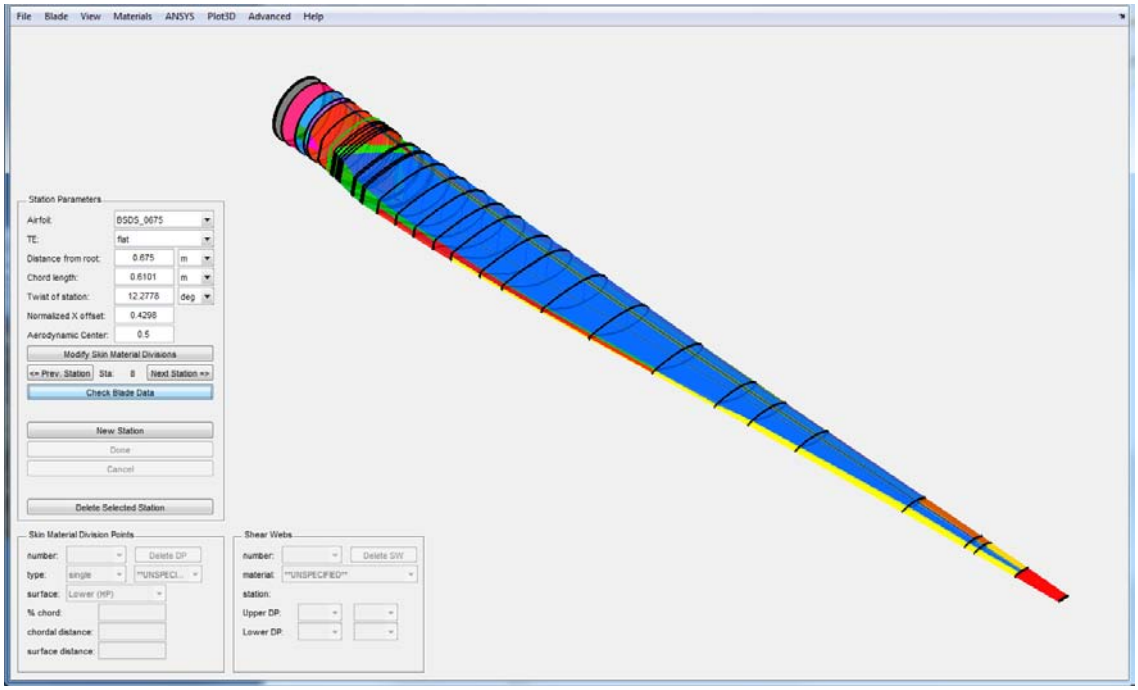


Figure 3: BSDS model as viewed in NuMAD v2.0.

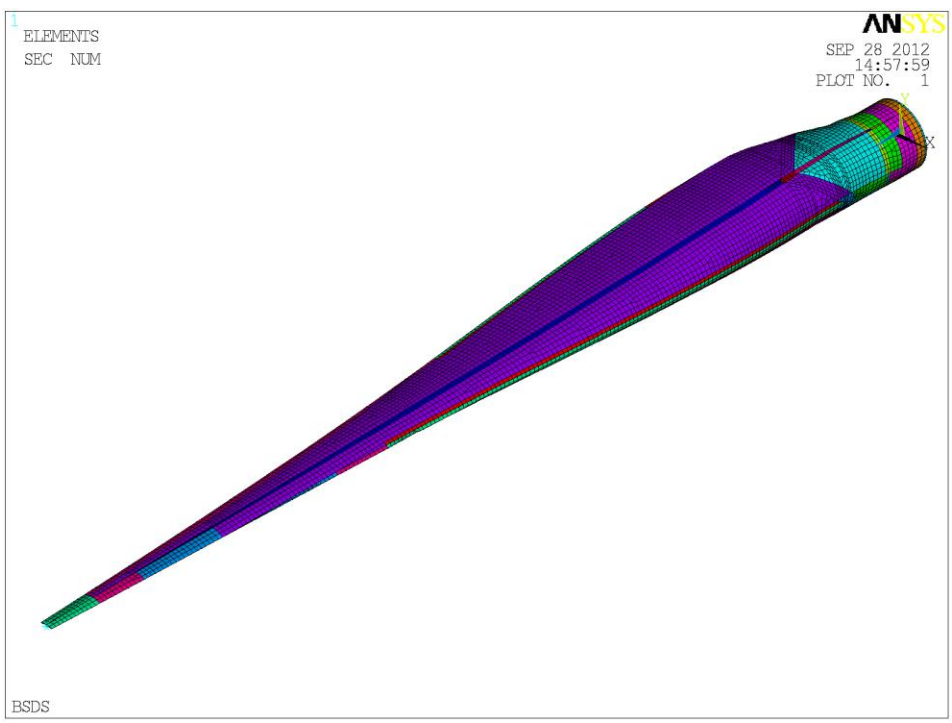


Figure 4: BSDS blade model in ANSYS.

MATERIALS

Table 2 lists the properties of common materials used in the BSDS model.

Table 3: Summary of Material Properties

Property	C260	Seartax_ Carbon_ triax	DBM 1208	DBM 1708	Balsa	Gel Coat	075oz_ Mat	6oz_ Woven_ Rug
Ex (GPa)	37.30	73.85	9.58	9.58	0.120	3.44	7.58	9.58
Ey (GPa)	7.60	6.82	9.58	9.58	0.120	3.44	7.58	9.58
Gxy (GPa)	6.890	3.320	6.89	6.89	0.020	1.38	4.00	6.89
ν_{xy}	0.31	0.25	0.39	0.39	0.3	0.3	0.3	0.39
ρ(g/cm3)	1.874	1.685	1.814	1.814	0.23	1.23	1.687	1.814
Layer thickness (mm)	2.4 or 1.4	3.4	0.620	0.737	6.4	0.508	0.305	1.1

Measured Material Properties

Mechanical tests were performed in order to determine the as-built mechanical material properties for the blade materials. The test-derived values have not been included in the model here, but the results of those tests are included in the TX-100 report[11] as Appendix A.

Material Layup

Drawings for manufacture of this blade are included in the Appendices of this report.

The model is based primarily on these drawings but is supplemented with actual measurements of a manufactured blade.

Blade Root Hardware

Blade root hardware is not included in this model of the BSDS blade. Steel is included in the base of the root to help account for the weight of the hardware.

Leading Edge Alterations

The leading edge has some alterations to the material to avoid shell element errors in ANSYS while using 8-noded shells (i.e. SHELL281). Leading edge material composites were renamed with a modifying tag: "_x10". The modification indicates that a material in composite was made ten times as strong, stiff, and dense, and one-tenth the thickness. This modification has been performed in small areas along leading edge.

Sharp Element Alterations

Because of errors in ANSYS due to excessively sharp elements, some of the material layup has been slightly modified to have blunt edges. This creates a solvable ANSYS model at the price of minor inaccuracies. These changes have been deemed negligible because of their extremely small size, and because of the inherit imperfections of the built blade due to manufacturing.

BLADE MODEL ARCHIVE FILES

NuMAD Project Files

The following files are located in the BSDS blade model folder, *BSDS_v1.0:*

BSDS_v1.0.nmd
The NuMAD blade model data file. This file is for use with NuMAD v2.0.

MatDBsi.txt
The NuMAD material data file.

shell7.src
Output from NuMAD. This file contains the APDL commands that are used directly in ANSYS to create the BSDS shell element model using the command string "/INPUT,shell7,src" at the ANSYS command input.

zAirfoil.mac, zFlatback.mac, zSmoothe.mac
These are ANSYS macro files that are required to execute the commands found in the *shell7.src* file. These macros must remain in the same folder as the shell7 file when the ANSYS input execution is performed.

'Airfoils' Folder

Following is a list of the airfoil shape files found in the BSDS *airfoils* folder:

BSDS_0000.txt	BSDS_1370.txt
BSDS_0089.txt	BSDS_1575.txt
BSDS_0238.txt	BSDS_1775.txt
BSDS_0350.txt	BSDS_1985.txt
BSDS_0394.txt	BSDS_2175.txt
BSDS_0550.txt	BSDS_2475.txt
BSDS_0550f.txt	BSDS_2700.txt
BSDS_0675.txt	BSDS_3100.txt
BSDS_0675f.txt	BSDS_3575.txt
BSDS_0730.txt	BSDS_4200.txt
BSDS_0760.txt	BSDS_4815s.txt
BSDS_0800.txt	BSDS_5150s.txt
BSDS_0830.txt	BSDS_5625.txt
BSDS_0860.txt	BSDS_6715.txt
BSDS_1055.txt	BSDS_7350.txt
BSDS_1075.txt	BSDS_7455.txt
BSDS_1178.txt	BSDS_7875.txt
BSDS_1200.txt	BSDS_8325.txt

EXAMPLE ANALYSES

Following are results from basic analyses. These results can be used as a baseline for comparison if the user needs to check the validity of their model against the original archive files.

Mesh Size

The global element size (AESIZE setting in ANSYS) is set to 0.04 meters.

Model Mass

The overall model mass is 101.626 kg, as calculated by ANSYS. The spanwise location of the blade center of mass is at 1.9726 meters.

Based on measurements of the production blades[4], the weight of the average as-built CX-100 blade is 131.0 kg and the spanwise location of the blade center of mass is at 2.201 meters.

Modal Analysis

A cantilevered modal analysis of the BSDS ANSYS model is performed. The Block Lanczos solver is used to find six modes.

Table 4: Results from an ANSYS modal analysis.

Mode	Frequency (Hz)	Shape
1	4.0692	1st flapwise bending
2	6.8840	1st edgewise bending
3	9.0599	2nd flapwise bending
4	17.273	3rd flapwise bending
5	18.835	2nd edgewise bending
6	29.142	4th flapwise bending

Static Analysis

A cantilevered static analysis was performed on the BSDS ANSYS model, using a flapwise (t-direction) 1000 N pull on the tip of the blade. Results were processed using the material coordinate system (RSYS,SOLU) and mid-thickness results (SHELL, MIDDLE). Shown is the elastic strain in the material x-direction, or blade spanwise direction. Maximum tip displacement computed with this analysis is 1.77076 meters.

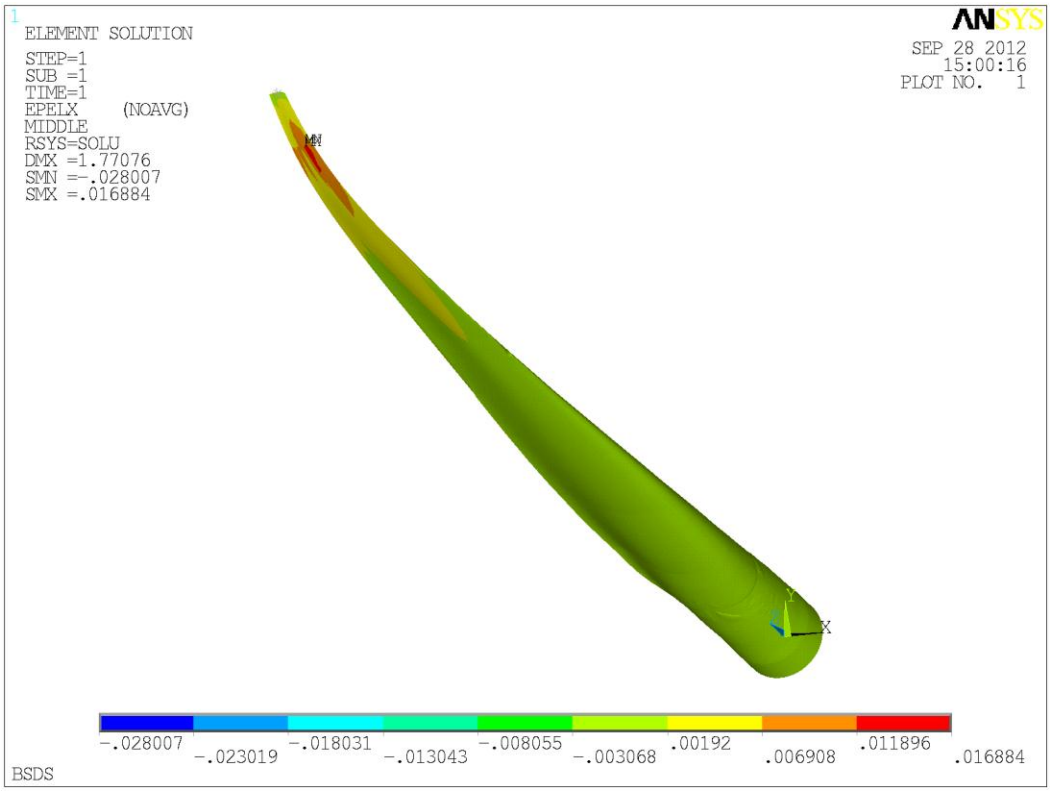
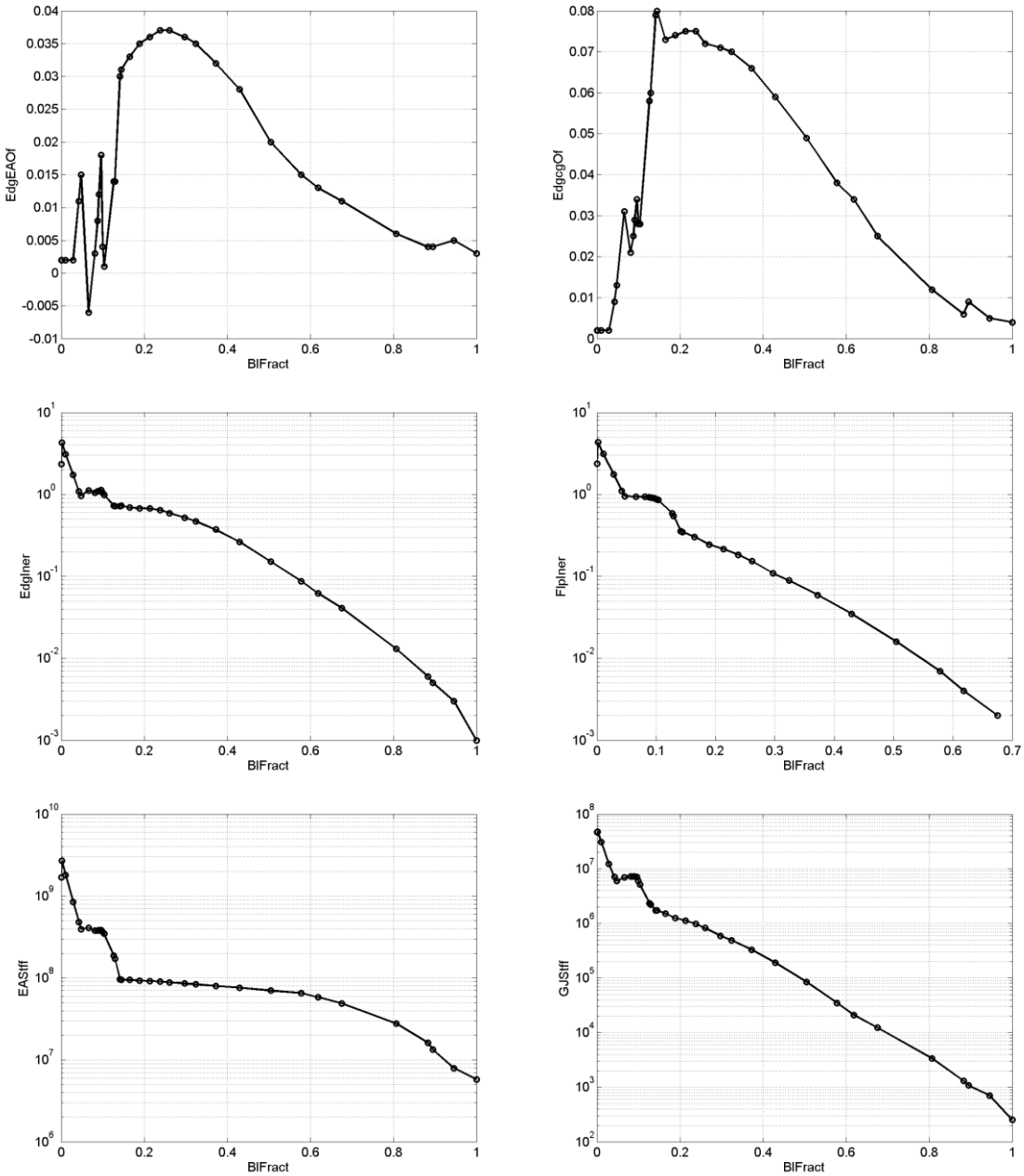


Figure 5: A plot of the composite material x-direction strain resulting from a static analysis of the BSDS blade; view of HP surface is shown.

PreComp Analysis

NuMAD v2.0 provides the capability to use PreComp[12] to compute sectional properties of the blade based on the information contained in the NuMAD blade model. Following are the results of those analyses:



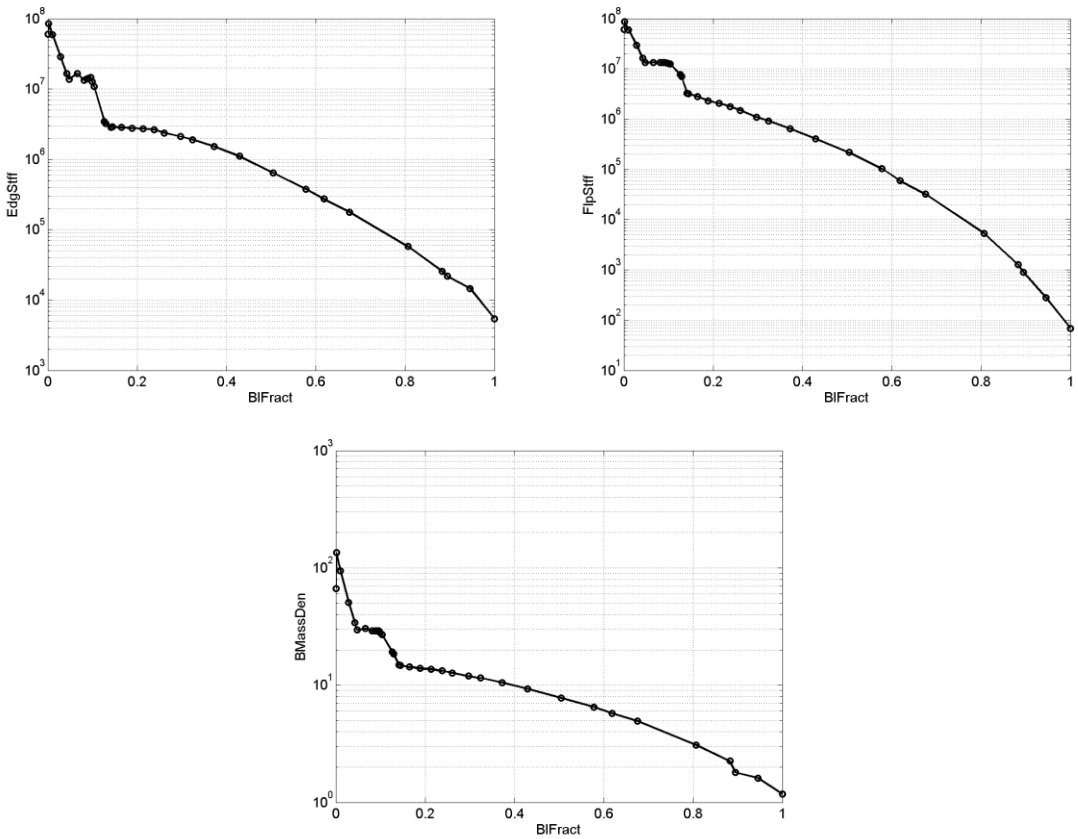


Figure 6: Equivalent section properties computed using PreComp; parameters definitions are consistent with FAST blade input file inputs.

BPE Analysis

BPE is an approach used to compute equivalent section properties of the three-dimensional blade model using an inverse approach[13]. This blade can be analyzed using BPE, however, there are some caveats discussed below. Following are the blade cross section property distributions computed using BPE.

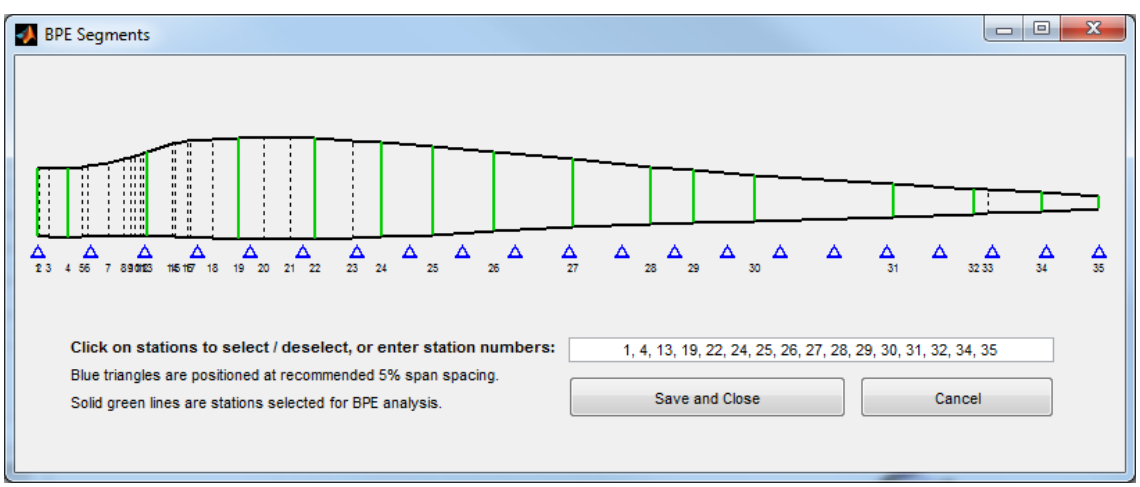
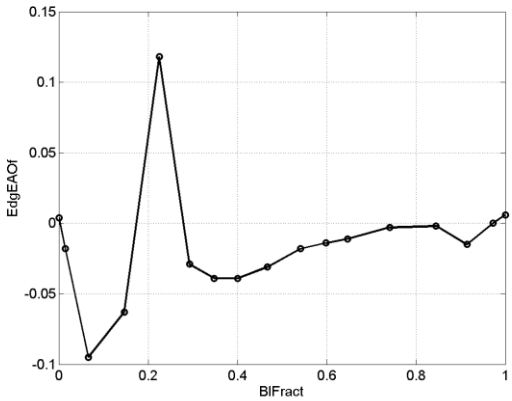
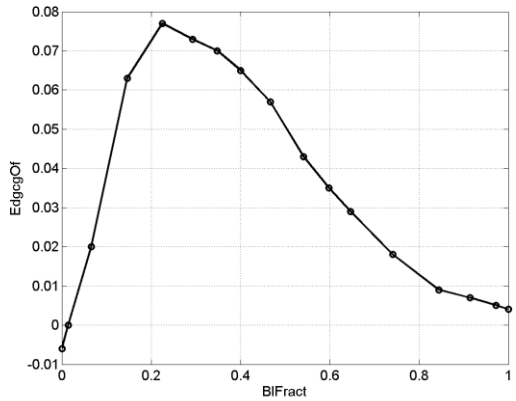
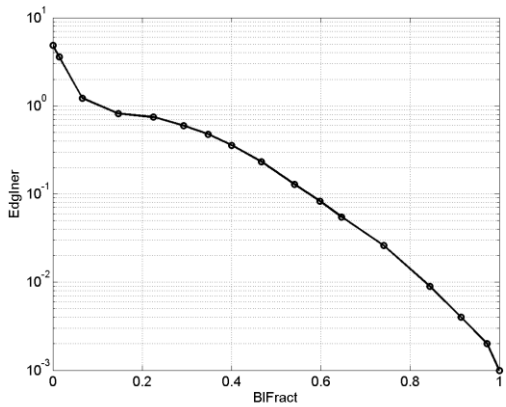
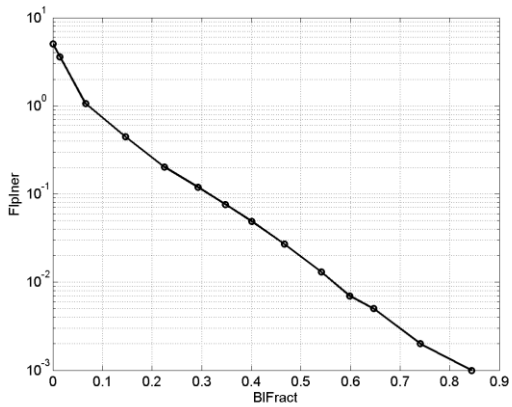


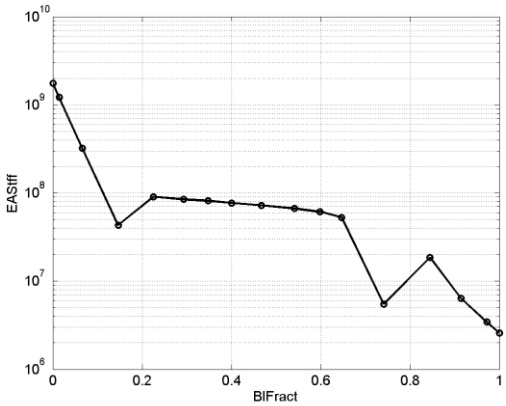
Figure 7: Chosen edges for elements in the BPE analysis.

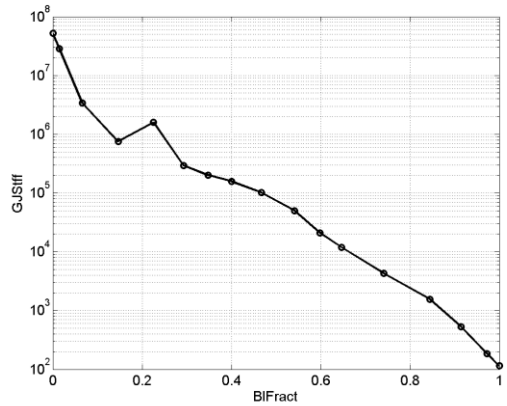

EdgEAOf
BlFract


EdgcgOf
BlFract


EdgInr
BlFract


FlpInr
BlFract


EAStff
BlFract


GJStff
BlFract

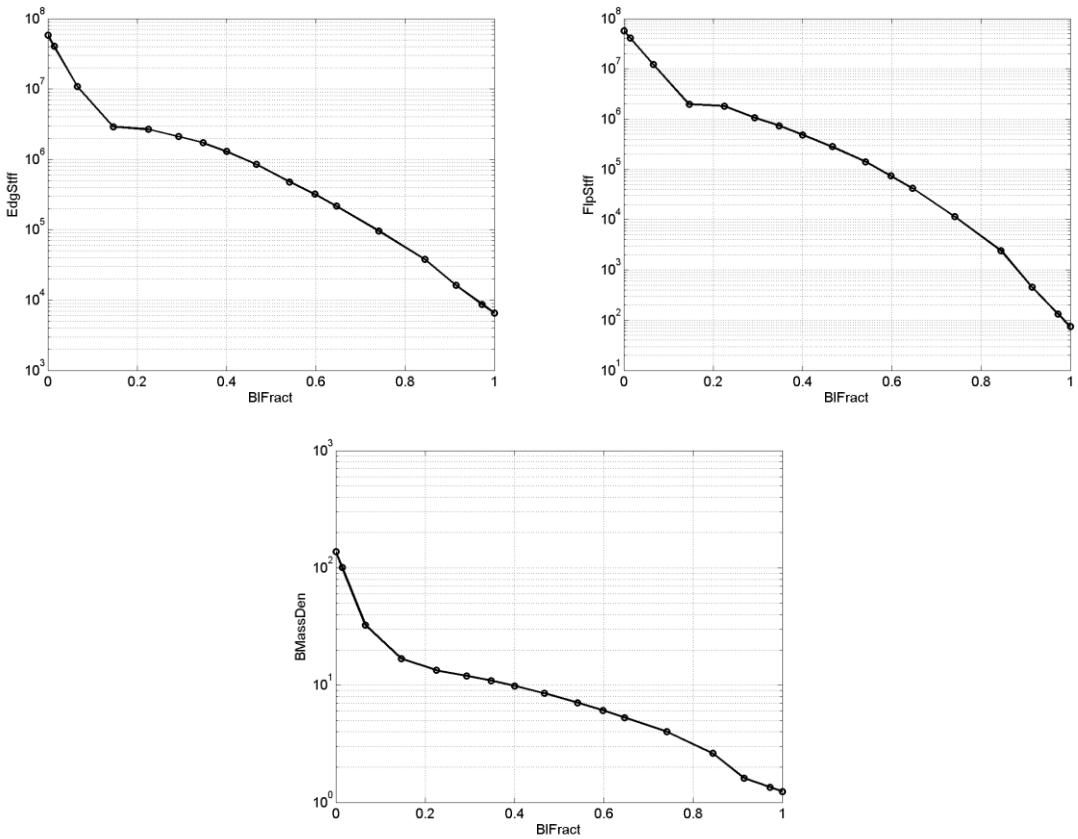


Figure 8: Equivalent section properties computed using BPE; parameters definitions are consistent with FAST blade input file inputs.

The inboard region of this blade is quite stiff. The stiffness causes numerical issues when the inverse approach for finding effective blade properties is used. Current capabilities of the BPE algorithm require that the BPE elements for the inboard portion of the blade be much longer than what would be ideal. See Figure 7 for the BPE element edge indications. Even with this selection of segments, segment #3 is a singular element. BPE attempts to deal with singular elements by automatically expanding the length of the element. This approach is not ideal in that it may contaminate the accuracy of the equivalent properties for adjacent elements, i.e. element #4. Additionally, in this blade model we see issues with computation of certain parameters, especially *EAStff*, in the vicinity of 75% span.

The development of the BPE algorithm is still an area of active research and development. Future work will seek to improve our understanding of these blade property computation issues.

ADDITIONAL BSDS BLADE RESOURCES

Paquette, J. A. and P. S. Veers. "Increased Strength in Wind Turbine Blades Through Innovative Structural Design." AWEA Windpower Conference, 2008.
http://windpower.sandia.gov/other/AWEA2008-Paquette.pdf

Paquette, J. A., Jeroen van Dam, and Scott Hughes. "Structural Testing of 9m Carbon Fiber Wind Turbine Research Blades." AIAA Aerosciences Meeting, 2007.
http://windpower.sandia.gov/asme/AIAA-2007-Testing9m.pdf

D.D. Chao, C.P. van Dam, D.E. Berg "CFD Analysis of Rotating Two-Bladed Flatback Wind Turbine Rotor" Sandia National Laboratories Report, SAND08-1688, 2008.
http://windpower.sandia.gov/other/084648.pdf

CITED REFERENCES

[1] Jonathan C. Berg and Brian R. Resor, "Numerical Manufacturing And Design Tool (NuMAD v2.0) for Wind Turbine Blades: User's Guide." Sandia National Laboratories SAND Report SAND2012-7028. http://energy.sandia.gov/?page_id=2238

[2] Mathworks Matlab. Natick, Massachusetts. https://www.mathworks.com/

[3] ANSYS Inc., Canonsburg, PA 15317, http://www.ansys.com

[4] D.S. Berry, D.E. Berg "Blade System Design Studies Phase II: Final Project Report." SAND08-4648 . Printed July 2008. http://windpower.sandia.gov/other/084648.pdf

[5] D. Griffin, T.D. Ashwill "System Design Studies Phase II: Final Project Report (GEC)." SAND09-0686. Printed May 2009. http://windpower.sandia.gov/other/090686.pdf

[6] C.P. van Dam, D.L. Kahn, D.E. Berg "Trailing Edge Modifications for Flatback Airfoils" SAND08-1781. http://prod.sandia.gov/techlib/access-control.cgi/2008/081781.pdf

[7] C.P. van Dam, E.A. Mayda, D.D. Chao, D.E. Berg "Computational Design and Analysis of Flatback Airfoil Wind Tunnel Experiment" SAND08-1782. http://prod.sandia.gov/techlib/access-control.cgi/2008/081782.pdf

[8] J.P. Baker, C.P. van Dam, B.L. Gilbert, and D.E. Berg "Flatback Airfoil Wind Tunnel Experiment." SAND08-2008. http://prod.sandia.gov/techlib/access-control.cgi/2008/082008.pdf

[9] D.E. Berg, M. Barone "Aerodynamic and Aeroacoustic Properties of a Flatback Airfoil (Will it Rumble or Whisper?)" Windpower 2008, Houston, TX, June 2008. http://windpower.sandia.gov/other/AWEA-06-08-Berg.pdf

[10] D.E. Berg, J.R. Zayas "Aerodynamic and Aeroacoustic Properties of Flatback Airfoils" 46th AIAA Aerospace Sciences Meeting and Exhibit (27th ASME Wind Energy Symposium), Reno, Nevada, January 2008. http://windpower.sandia.gov/asme/AIAA-2008-1455.pdf

[11] B. Resor and J. Paquette. "A NuMAD Model of the Sandia TX-100 Blade." Sandia National Laboratories Report SAND2012-9274.

[12] NWTC Design Codes (PreComp by Rick Damiani). http://wind.nrel.gov/designcodes/preprocessors/precomp/. Last modified 28-June-2012; accessed 28-June-2012.

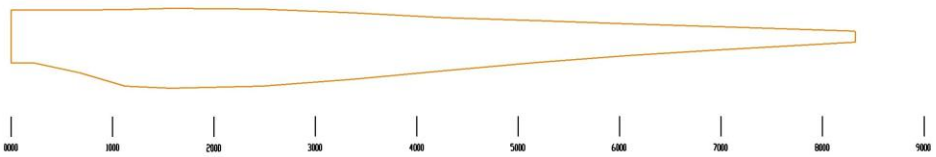
[13] Malcolm, D. J. & Laird, D. L. Extraction of Equivalent Beam Properties from Blade Models. *Wind Energy*, 2007, 10, 135-137.

APPENDIX A: BSDS LAYUP DRAWINGS – HP/LP SKINS

DWG NO. SNL-009M-01-BSDS-L0

REVISIONS				
REV	DESCRIPTION	BY	APPR.	DATE
A	DETAIL DESIGN LAMINATE	DSB		2/4/05
B	PRODUCTION LAMINATE	DSB		9/12/05

BSDS PHASE II
8.325 METER WINDBLADE



LAMINATE SCHEDULE
HIGH PRESSURE (HP) AND LOW PRESSURE (LP) SKIN
REV B

NOTE: ALL DIMENSIONS HAVE A TOLERANCE OF ±10MM

NO.	PART NO.	DESCRIPTION	QTY

PARTS LIST

tpi COMPOSITES INC.
RT. 136 MARKET ST. WARREN, R.I. 02885-0328
TEL. (401) 245-1200 FAX (401) 245-3160

.X	.XX	.XXX	ANGLES
±10	±10	±10	±5°

UNLESS OTHERWISE SPECIFIED:
MACHINED SURFACE FINISHES 125√
MACHINED FILLET RADII .015-.030

ALL DIMENSIONS IN mm

THIRD ANGLE

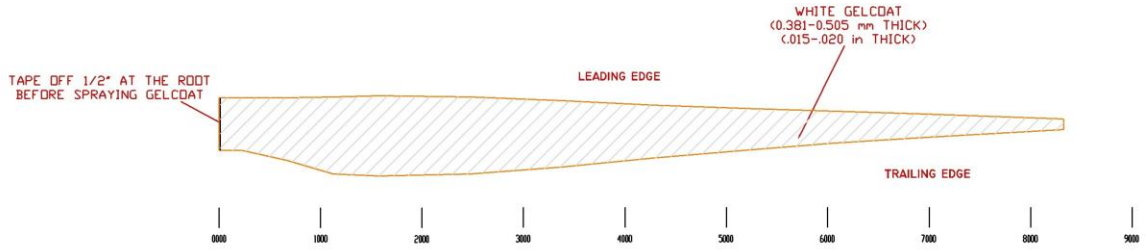
THIS DOCUMENT IS THE PROPERTY OF T.P.I. AND IS NOT TO BE USED OR REPRODUCED IN WHOLE OR IN PART WITHOUT WRITTEN PERMISSION.

PROJECT: BSDS PHASE II
TITLE: HP SKIN LAMINATE SCHEDULE
SIZE: A
DWG NO.: SNL-009M-01-BSDS-L0
REV: B
TPI PART #: BSDS II
DR BY: DSB
CHK'D BY:
APP'D BY:
FILE: Lam_BSDSII_HP
DATE: 2/4/05
SCALE: NONE
SHT: 1 OF 1

DWG NO. SNL-009M-01-BSDS-L0

DWG NO. SNL-009M-01-BSDS-L0

REVISIONS				
REV	DESCRIPTION	BY	APPR.	DATE
A	DETAIL DESIGN LAMINATE	DSB		2/4/05
B	PRODUCTION LAMINATE	DSB		9/12/05



LAYER I:

- MASK THE FLANGES OF THE MOLD TO AVOIS OVERSPRAY
- TAPE OFF 1/2" AT THE ROOT
- SPRAY WHITE GELCOAT OVER ENTIRE SURFACE AS SHOWN
- THICKNESS AFTER SPRAYING SHOULD BE 0.381-0.508 MM (0.015"-0.020")
- ALLOW GEL COAT TO AIR DRY

NO.	PART NO.	DESCRIPTION		QTY
1	46508	GELCOAT, SPORT WHITE, 953-WA411	(LB)	10.0

PARTS LIST

tpi COMPOSITES INC.
RT. 136 MARKET ST. WARREN, R.I. 02885-0328
TEL. (401) 245-1200 FAX (401) 245-3160

.X	.XX	.XXX	ANGLES
±10	±10	±10	±5°

UNLESS OTHERWISE SPECIFIED:
MACHINED SURFACE FINISHES 125
MACHINED FILLET RADII .015-.030

ALL DIMENSIONS IN mm

THIRD ANGLE

THIS DOCUMENT IS THE PROPERTY OF T.P.I. AND IS NOT TO BE USED OR REPRODUCED IN WHOLE OR IN PART WITHOUT WRITTEN PERMISSION.

PROJECT: BSDS PHASE II

TITLE: HP SKIN LAMINATE SCHEDULE

SIZE: A | DWG NO.: SNL-009M-01-BSDS-L0 | REV: B

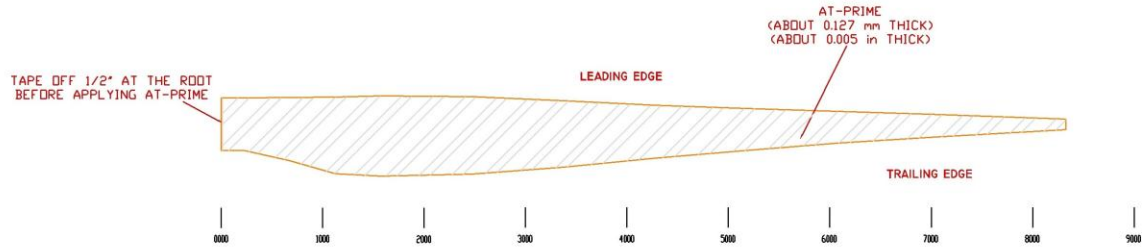
TPI PART #: BSDS II | DR BY: DSB | CHK'D BY: | APP'D BY:

FILE: Lam_BSDSII_HP | DATE: 2/4/05 | SCALE: NONE | SHT: 1 OF 1

DWG NO. SNL-009M-01-BSDS-L0

DWG NO. SNL-009M-01-BSDS-L0

REVISIONS				
REV	DESCRIPTION	BY	APPR.	DATE
A	DETAIL DESIGN LAMINATE	DSB		2/4/05
B	PRODUCTION LAMINATE	DSB		9/12/05



LAYER 2:

- ROLL AT-PRIME OVER ENTIRE SURFACE AS SHOWN
- THICKNESS AFTER ROLLING SHOULD BE 0.381-0.508 MM (0.015"-0.020")
- ALLOW AT-PRIME TO AIR DRY

NO.	PART NO.	DESCRIPTION	QTY
1	46110	AT-PRIME ADHESION, PARTS A AND B (LB)	10.0

PARTS LIST

TPI COMPOSITES INC.
RT. 136 MARKET ST. WARREN, R.I. 02885-0328
TEL. (401) 245-1200 FAX (401) 245-3160

.X	.XX	.XXX	ANGLES
±10	±10	±10	±5°

UNLESS OTHERWISE SPECIFIED:
MACHINED SURFACE FINISHES 125√
MACHINED FILLET RADII .015-.030

ALL DIMENSIONS IN mm

THIRD ANGLE

THIS DOCUMENT IS THE PROPERTY OF T.P.I. AND IS NOT TO BE USED OR REPRODUCED IN WHOLE OR IN PART WITHOUT WRITTEN PERMISSION.

PROJECT: BSDS PHASE II

TITLE: HP SKIN LAMINATE SCHEDULE

SIZE: A | DWG NO.: SNL-009M-01-BSDS-L0 | REV: B

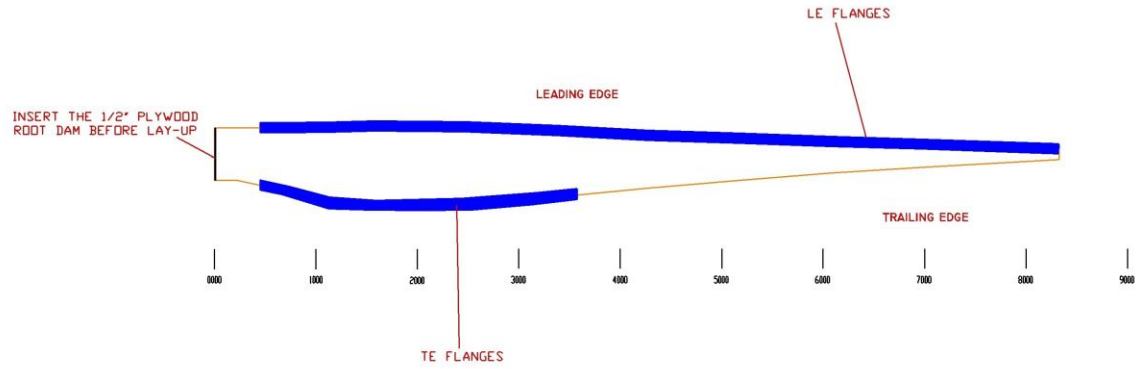
TPI PART #: BSDS II | DR BY: DSB | CHK'D BY: | APP'D BY:

FILE: Lam_BSDSII_HP | DATE: 2/4/05 | SCALE: NONE | SHT: 1 OF 1

DWG NO. SNL-009M-01-BSDS-L0

DWG NO. SNL-009M-01-BSDS-L0

REVISIONS				
REV	DESCRIPTION	BY	APPR.	DATE
A	DETAIL DESIGN LAMINATE	DSB		2/4/05
B	PRODUCTION LAMINATE	DSB		9/12/05



INSTALL RETURN FLANGES / INSERT ROOT DAM:

- INSTALL THE RETURN FLANGES ON THE MOLD
- ENSURE ALL FLANGES ARE IN THE CORRECT LOCATION BY MATCHING THE FLANGE NOTATION TO THE MOLD NOTATION
- WAX THE FLANGES TO ALLOW FOR PROPER RELEASE
- ENSURE ALL FASTENERS ARE HAND TIGHT
- (NOTE: IT MAY BE NECESSARY TO LEAVE SOME OF THE FLANGES LOOSE TO FIT FABRIC UNDER - THIGHTEN THE FLANGES BEFORE APPLYING THE VACUUM BAG)
- INSERT THE 1/2" PLYWOOD DAM AT THE ROOT

NO.	PART NO.	DESCRIPTION	QTY

PARTS LIST

TPI COMPOSITES INC.
RT. 136 MARKET ST. WARREN, R.I. 02885-0328
TEL. (401) 245-1200 FAX (401) 245-3160

.X	.XX	.XXX	ANGLES
±10	±10	±10	±5°

UNLESS OTHERWISE SPECIFIED:
MACHINED SURFACE FINISHES 125√
MACHINED FILLET RADII .015-.030

ALL DIMENSIONS IN mm

THIRD ANGLE

THIS DOCUMENT IS THE PROPERTY OF T.P.I. AND IS NOT TO BE USED OR REPRODUCED IN WHOLE OR IN PART WITHOUT WRITTEN PERMISSION.

PROJECT: BSDS PHASE II

TITLE: HP SKIN LAMINATE SCHEDULE

SIZE: A | DWG NO.: SNL-009M-01-BSDS-L0 | REV: B

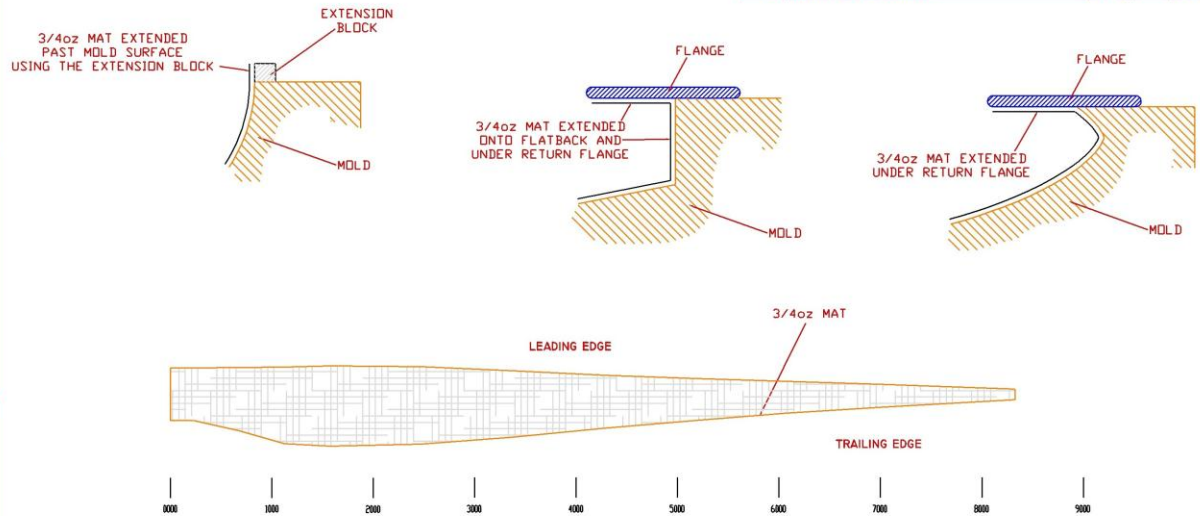
TPI PART #: BSDS II | DR BY: DSB | CHK'D BY: | APP'D BY:

FILE: Lam_BSDSII_HP | DATE: 2/4/05 | SCALE: NONE | SHT: 1 OF 1

DWG NO. SNL-009M-01-BSDS-L0

DWG NO. SNL-009M-01-BSDS-L0

REVISIONS				
REV	DESCRIPTION	BY	APPR.	DATE
A	DETAIL DESIGN LAMINATE	DSB		2/4/05
B	PRODUCTION LAMINATE	DSB		9/12/05



LAYER 3:

- APPLY 3/4oz MAT TO THE ENTIRE SURFACE OF THE MOLD
- BRING THE MAT UP UNDER THE RETURN FLANGES IN ALL LOCATIONS
- BRING MAT ABOUT 25MM PAST THE MOLD SURFACE IN THE ROOT AREA - USE THE MOLD EXTENSION BLOCKS
- BRING MAT UP ONTO THE FLATBACK AND UP UNDER THE RETURN FLANGE AT THE TRAILING EDGE

NO.	PART NO.	DESCRIPTION		QTY
1	46051	3/4oz MAT	(LB)	3

PARTS LIST

TPI COMPOSITES INC.
RT. 136 MARKET ST. WARREN, R.I. 02885-0328
TEL. (401) 245-1200 FAX (401) 245-3160

.X	.XX	.XXX	ANGLES
±10	±10	±10	±5°

UNLESS OTHERWISE SPECIFIED:
MACHINED SURFACE FINISHES 125√
MACHINED FILLET RADII .015-.030

ALL DIMENSIONS IN mm

THIRD ANGLE

THIS DOCUMENT IS THE PROPERTY OF T.P.I. AND IS NOT TO BE USED OR REPRODUCED IN WHOLE OR IN PART WITHOUT WRITTEN PERMISSION.

PROJECT: BSDS PHASE II

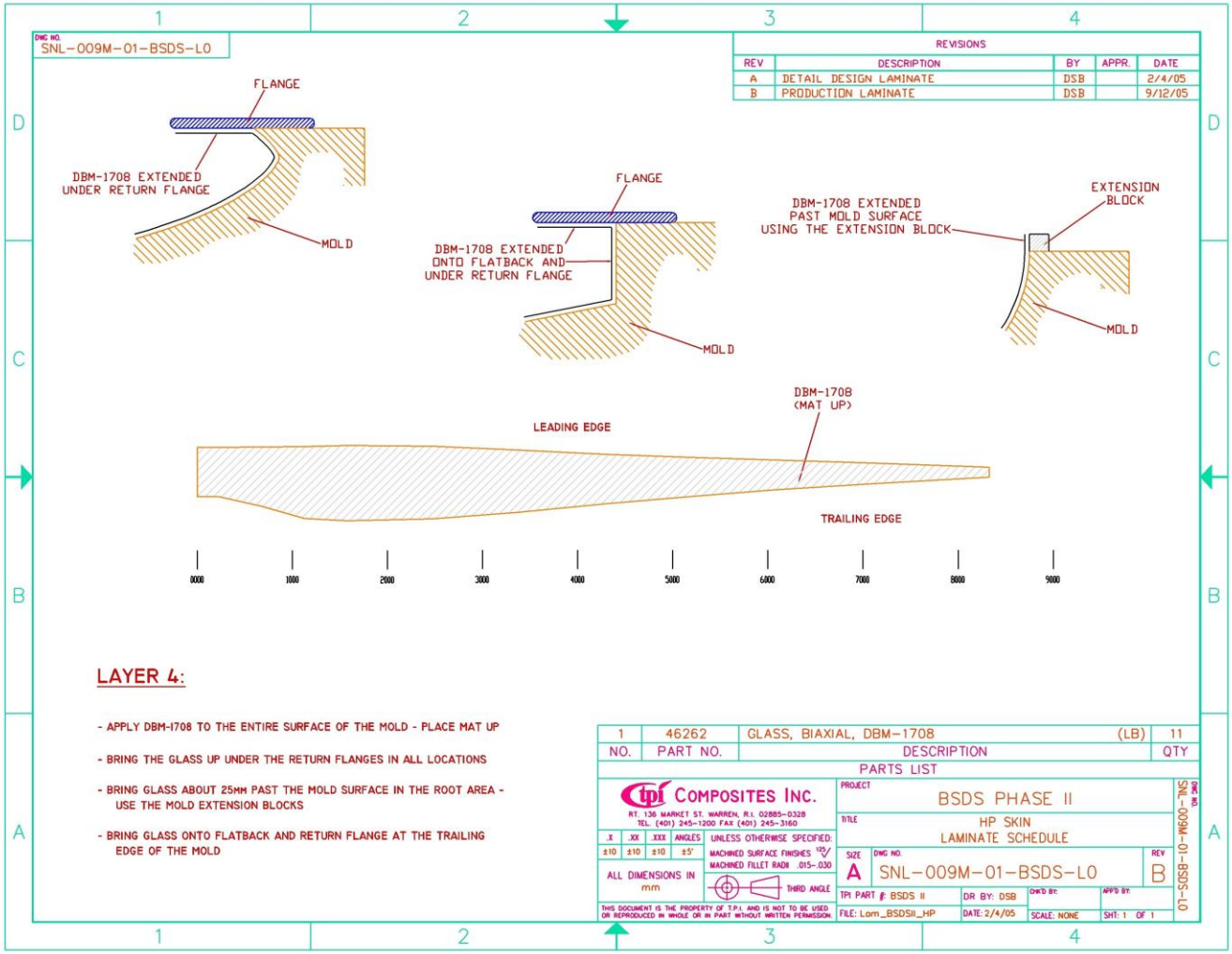
TITLE: HP SKIN LAMINATE SCHEDULE

SIZE: A | DWG NO.: SNL-009M-01-BSDS-L0 | REV: B

TPI PART #: BSDS II | DR BY: DSB | CHK'D BY: | APP'D BY:

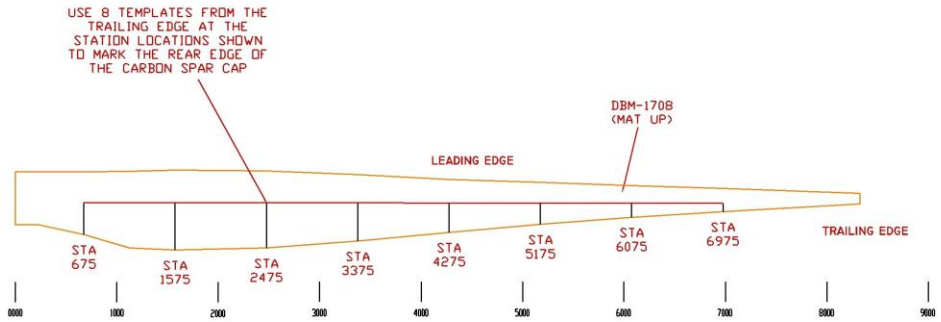
FILE: Lam_BSDSII_HP | DATE: 2/4/05 | SCALE: NONE | SHT: 1 OF 1

DWG NO. SNL-009M-01-BSDS-L0


DWG NO.
SNL-009M-01-BSDS-L0
REVISIONS
REV | DESCRIPTION | BY | APPR. | DATE
A | DETAIL DESIGN LAMINATE | DSB | | 2/4/05
B | PRODUCTION LAMINATE | DSB | | 9/12/05
FLANGE
DBM-1708 EXTENDED UNDER RETURN FLANGE
MOLD
FLANGE
DBM-1708 EXTENDED ONTO FLATBACK AND UNDER RETURN FLANGE
MOLD
DBM-1708 EXTENDED PAST MOLD SURFACE USING THE EXTENSION BLOCK
EXTENSION BLOCK
MOLD
DBM-1708 (MAT UP)
LEADING EDGE
TRAILING EDGE
0000
1000
2000
3000
4000
5000
6000
7000
8000
9000
LAYER 4:
- APPLY DBM-1708 TO THE ENTIRE SURFACE OF THE MOLD - PLACE MAT UP
- BRING THE GLASS UP UNDER THE RETURN FLANGES IN ALL LOCATIONS
- BRING GLASS ABOUT 25MM PAST THE MOLD SURFACE IN THE ROOT AREA - USE THE MOLD EXTENSION BLOCKS
- BRING GLASS ONTO FLATBACK AND RETURN FLANGE AT THE TRAILING EDGE OF THE MOLD
1 | 46262 | GLASS, BIAXIAL, DBM-1708 | (LB) | 11
NO. | PART NO. | DESCRIPTION | QTY
PARTS LIST
TPI COMPOSITES INC.
RT. 136 MARKET ST. WARREN, R.I. 02885-0328
TEL. (401) 245-1200 FAX (401) 245-3160
.X .XX .XXX ANGLES
±10 ±10 ±10 ±5°
UNLESS OTHERWISE SPECIFIED:
MACHINED SURFACE FINISHES 125√
MACHINED FILLET RADII .015-.030
ALL DIMENSIONS IN mm
THIRD ANGLE
THIS DOCUMENT IS THE PROPERTY OF T.P.I. AND IS NOT TO BE USED OR REPRODUCED IN WHOLE OR IN PART WITHOUT WRITTEN PERMISSION.
PROJECT
BSDS PHASE II
TITLE
HP SKIN
LAMINATE SCHEDULE
SIZE A
DWG NO. SNL-009M-01-BSDS-L0
REV B
TPI PART #: BSDS II
DR BY: DSB
CHK'D BY:
APP'D BY:
FILE: Lam_BSDSII_HP
DATE: 2/4/05
SCALE: NONE
SHT: 1 OF 1
DWG NO. SNL-009M-01-BSDS-L0

DWG NO. SNL-009M-01-BSDS-L0

REVISIONS				
REV	DESCRIPTION	BY	APPR.	DATE
A	DETAIL DESIGN LAMINATE	DSB		2/4/05
B	PRODUCTION LAMINATE	DSB		9/12/05



LOCATE REAR EDGE OF CARBON SPAR CAP:

- LOCATE THE REAR EDGE OF THE CARBON SPAR CAP
- USE THE 8 TEMPLATES PROVIDED (A DIFFERENT SET FOR EACH OF THE LP AND HP SKINS)
- PLACE THE TEMPLATES AT THE CORRECT STATION (MEASURED FROM THE ROOT)
- PLACE THE TEMPLATES UP AGAINST THE TE
- MARK THE LOCATION OF THE REAR EDGE OF THE CARBON SPAR CAP
- DRAW (OR SNAP) STRAIGHT LINES BETWEEN THE EIGHT POINTS

NO.	PART NO.	DESCRIPTION	QTY

PARTS LIST

TPI COMPOSITES INC.
RT. 136 MARKET ST. WARREN, R.I. 02885-0328
TEL. (401) 245-1200 FAX (401) 245-3160

.X	.XX	.XXX	ANGLES
±10	±10	±10	±5°

UNLESS OTHERWISE SPECIFIED:
MACHINED SURFACE FINISHES 125√
MACHINED FILLET RADII .015-.030

ALL DIMENSIONS IN mm

THIRD ANGLE

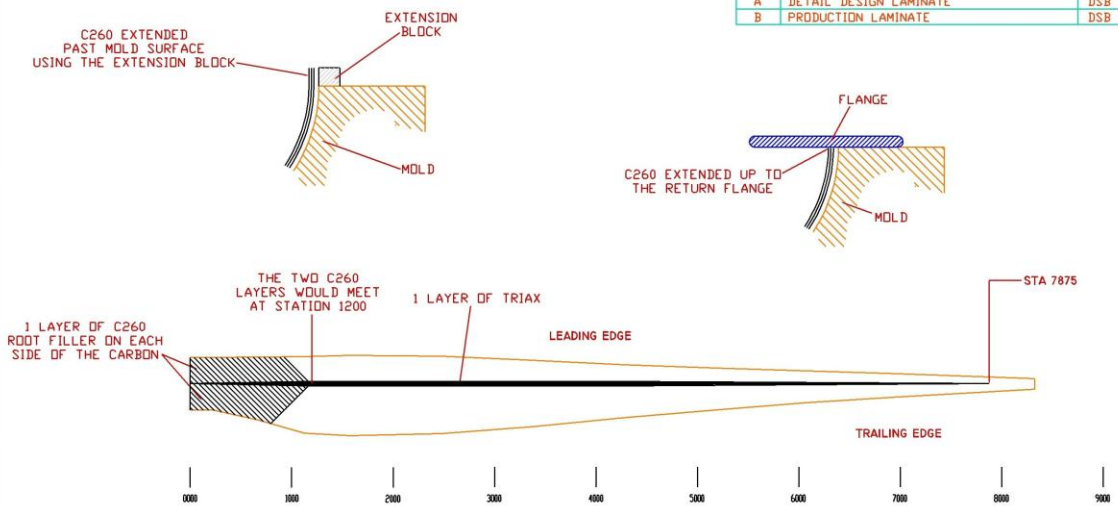
THIS DOCUMENT IS THE PROPERTY OF T.P.I. AND IS NOT TO BE USED OR REPRODUCED IN WHOLE OR IN PART WITHOUT WRITTEN PERMISSION.

PROJECT: BSDS PHASE II
TITLE: HP SKIN LAMINATE SCHEDULE
SIZE: A
DWG NO.: SNL-009M-01-BSDS-L0
REV: B
TPI PART #: BSDS II
DR BY: DSB
CHK'D BY:
APP'D BY:
FILE: Lam_BSDSII_HP
DATE: 2/4/05
SCALE: NONE
SHT: 1 OF 1

DWG NO. SNL-009M-01-BSDS-L0

DWG NO. SNL-009M-01-BSDS-L0

REVISIONS				
REV	DESCRIPTION	BY	APPR.	DATE
A	DETAIL DESIGN LAMINATE	DSB		2/4/05
B	PRODUCTION LAMINATE	DSB		9/12/05



LAYER 5 AND LAYER 6:

- APPLY 1 LAYER SAERTEX HYBRID TRIAX TO THE SPAR CAP AREA SHOWN ABOVE
- USE THE LINE MARKED IN THE PREVIOUS STEP TO ALIGN THE REAR EDGE OF THE CARBON SPAR CAP
- THIS TRIAX LAYER WILL COME TO A POINT AT STA 7875
- INSERT 1 LAYER OF C260 ROOT FILLER PIECES ON BOTH SIDES OF THE CARBON IN THE ROOT AREA AS SHOWN
- EXTEND THE FILLER PIECES UP PAST THE MOLD SURFACE IN THE ROOT AREA AS SHOWN IN THE INSERT

NO.	PART NO.	DESCRIPTION		QTY
2	85200	GLASS, UNIDIRECTIONAL, C260, 26oz	(LB)	AR
1	46016	SAERTEX CARBON/GLASS HYBRID TRIAXIAL	(LB)	AR

PARTS LIST

TPI COMPOSITES INC.
RT. 136 MARKET ST. WARREN, R.I. 02885-0328
TEL. (401) 245-1200 FAX (401) 245-3160

.X	.XX	.XXX	ANGLES
±10	±10	±10	±5°

UNLESS OTHERWISE SPECIFIED:
MACHINED SURFACE FINISHES 125√
MACHINED FILLET RADII .015-.030

ALL DIMENSIONS IN mm

THIRD ANGLE

THIS DOCUMENT IS THE PROPERTY OF T.P.I. AND IS NOT TO BE USED OR REPRODUCED IN WHOLE OR IN PART WITHOUT WRITTEN PERMISSION.

PROJECT: BSDS PHASE II

TITLE: HP SKIN LAMINATE SCHEDULE

SIZE: A | DWG NO.: SNL-009M-01-BSDS-L0 | REV: B

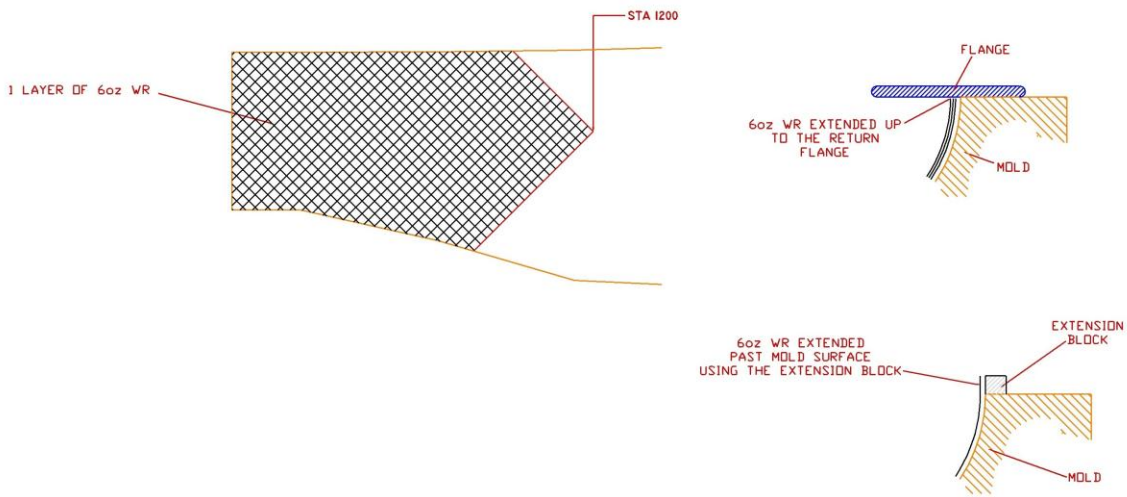
TPI PART #: BSDS II | DR BY: DSB | CHK'D BY: | APP'D BY:

FILE: Lam_BSDSII_HP | DATE: 2/4/05 | SCALE: NONE | SHT: 1 OF 1

DWG NO. SNL-009M-01-BSDS-L0

DWG NO. SNL-009M-01-BSDS-L0

REVISIONS				
REV	DESCRIPTION	BY	APPR.	DATE
A	DETAIL DESIGN LAMINATE	DSB		2/4/05
B	PRODUCTION LAMINATE	DSB		9/12/05



LAYER 7:

- APPLY 1 LAYER 6oz WR TO THE ROOT AREA SHOWN ABOVE
- THE FIBERS SHOULD RUN IN THE +/-45° DIRECTION
- EXTEND THE 6oz WR UP PAST THE MOLD SURFACE IN THE ROOT AREA AS SHOWN IN THE INSERT
- THE POINT OF THE FABRIC SHOULD COME TO 1200MM

NO.	PART NO.	DESCRIPTION	QTY
1	TBD	GLASS, 6oz WOVEN ROVING (LB)	AR

PARTS LIST

TPI COMPOSITES INC.
RT. 136 MARKET ST. WARREN, R.I. 02885-0328
TEL. (401) 245-1200 FAX (401) 245-3160

.X	.XX	.XXX	ANGLES
±10	±10	±10	±5°

UNLESS OTHERWISE SPECIFIED:
MACHINED SURFACE FINISHES 125√
MACHINED FILLET RADII .015-.030

ALL DIMENSIONS IN mm

THIRD ANGLE

THIS DOCUMENT IS THE PROPERTY OF T.P.I. AND IS NOT TO BE USED OR REPRODUCED IN WHOLE OR IN PART WITHOUT WRITTEN PERMISSION.

PROJECT: BSDS PHASE II

TITLE: HP SKIN LAMINATE SCHEDULE

SIZE: A | DWG NO.: SNL-009M-01-BSDS-L0 | REV: B

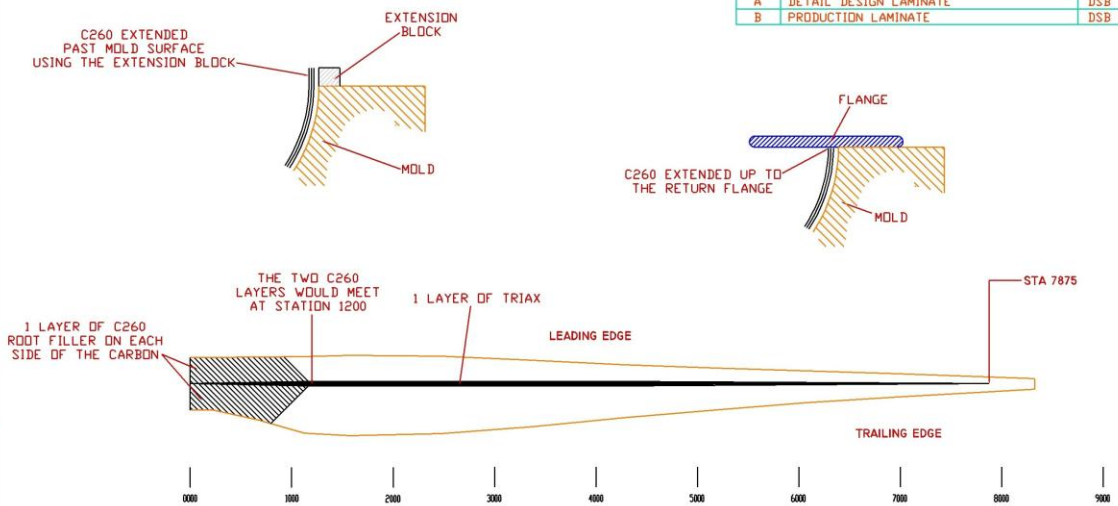
TPI PART #: BSDS II | DR BY: DSB | CHK'D BY: | APP'D BY:

FILE: Lam_BSDSII_HP | DATE: 2/4/05 | SCALE: NONE | SHT: 1 OF 1

DWG NO. SNL-009M-01-BSDS-L0

DWG NO. SNL-009M-01-BSDS-L0

REVISIONS				
REV	DESCRIPTION	BY	APPR.	DATE
A	DETAIL DESIGN LAMINATE	DSB		2/4/05
B	PRODUCTION LAMINATE	DSB		9/12/05



LAYER 8 AND LAYER 9:

- APPLY 1 LAYER SAERTEX HYBRID TRIAX TO THE SPAR CAP AREA SHOWN ABOVE
- THIS TRIAX LAYER WILL COME TO A POINT AT STA 7875
- INSERT 1 LAYER OF C260 ROOT FILLER PIECES ON BOTH SIDES OF THE CARBON IN THE ROOT AREA AS SHOWN
- EXTEND THE FILLER PIECES UP PAST THE MOLD SURFACE IN THE ROOT AREA AS SHOWN IN THE INSERT

NO.	PART NO.	DESCRIPTION		QTY
2	85200	GLASS, UNIDIRECTIONAL, C260, 26oz	(LB)	AR
1	46016	SAERTEX CARBON/GLASS HYBRID TRIAXIAL	(LB)	AR

PARTS LIST

TPI COMPOSITES INC.
RT. 136 MARKET ST. WARREN, R.I. 02885-0328
TEL. (401) 245-1200 FAX (401) 245-3160

.X	.XX	.XXX	ANGLES
±10	±10	±10	±5°

UNLESS OTHERWISE SPECIFIED:
MACHINED SURFACE FINISHES 125√
MACHINED FILLET RADII .015-.030

ALL DIMENSIONS IN mm

THIRD ANGLE

THIS DOCUMENT IS THE PROPERTY OF T.P.I. AND IS NOT TO BE USED OR REPRODUCED IN WHOLE OR IN PART WITHOUT WRITTEN PERMISSION.

PROJECT: BSDS PHASE II

TITLE: HP SKIN LAMINATE SCHEDULE

SIZE: A | DWG NO.: SNL-009M-01-BSDS-L0 | REV: B

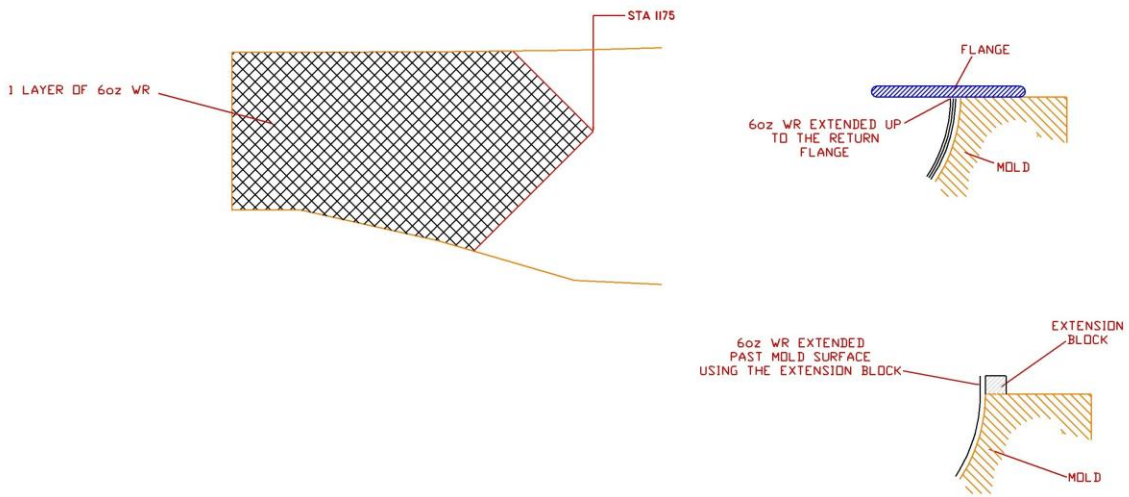
TPI PART #: BSDS II | DR BY: DSB | CHK'D BY: | APP'D BY:

FILE: Lam_BSDSII_HP | DATE: 2/4/05 | SCALE: NONE | SHT: 1 OF 1

DWG NO. SNL-009M-01-BSDS-L0

DWG NO. SNL-009M-01-BSDS-L0

REVISIONS				
REV	DESCRIPTION	BY	APPR.	DATE
A	DETAIL DESIGN LAMINATE	DSB		2/4/05
B	PRODUCTION LAMINATE	DSB		9/12/05



LAYER 10:

- APPLY 1 LAYER 6oz WR TO THE ROOT AREA SHOWN ABOVE
- THE FIBERS SHOULD RUN IN THE +/-45° DIRECTION
- EXTEND THE 6oz WR UP PAST THE MOLD SURFACE IN THE ROOT AREA AS SHOWN IN THE INSERT
- THE POINT OF THE FABRIC SHOULD COME TO 1175MM

NO.	PART NO.	DESCRIPTION	QTY
1	TBD	GLASS, 6oz WOVEN ROVING (LB)	AR

PARTS LIST

TPI COMPOSITES INC.
RT. 136 MARKET ST. WARREN, R.I. 02885-0328
TEL. (401) 245-1200 FAX (401) 245-3160

.X	.XX	.XXX	ANGLES
±10	±10	±10	±5°

UNLESS OTHERWISE SPECIFIED:
MACHINED SURFACE FINISHES 125√
MACHINED FILLET RADII .015-.030

ALL DIMENSIONS IN mm

THIRD ANGLE

THIS DOCUMENT IS THE PROPERTY OF T.P.I. AND IS NOT TO BE USED OR REPRODUCED IN WHOLE OR IN PART WITHOUT WRITTEN PERMISSION.

PROJECT: BSDS PHASE II

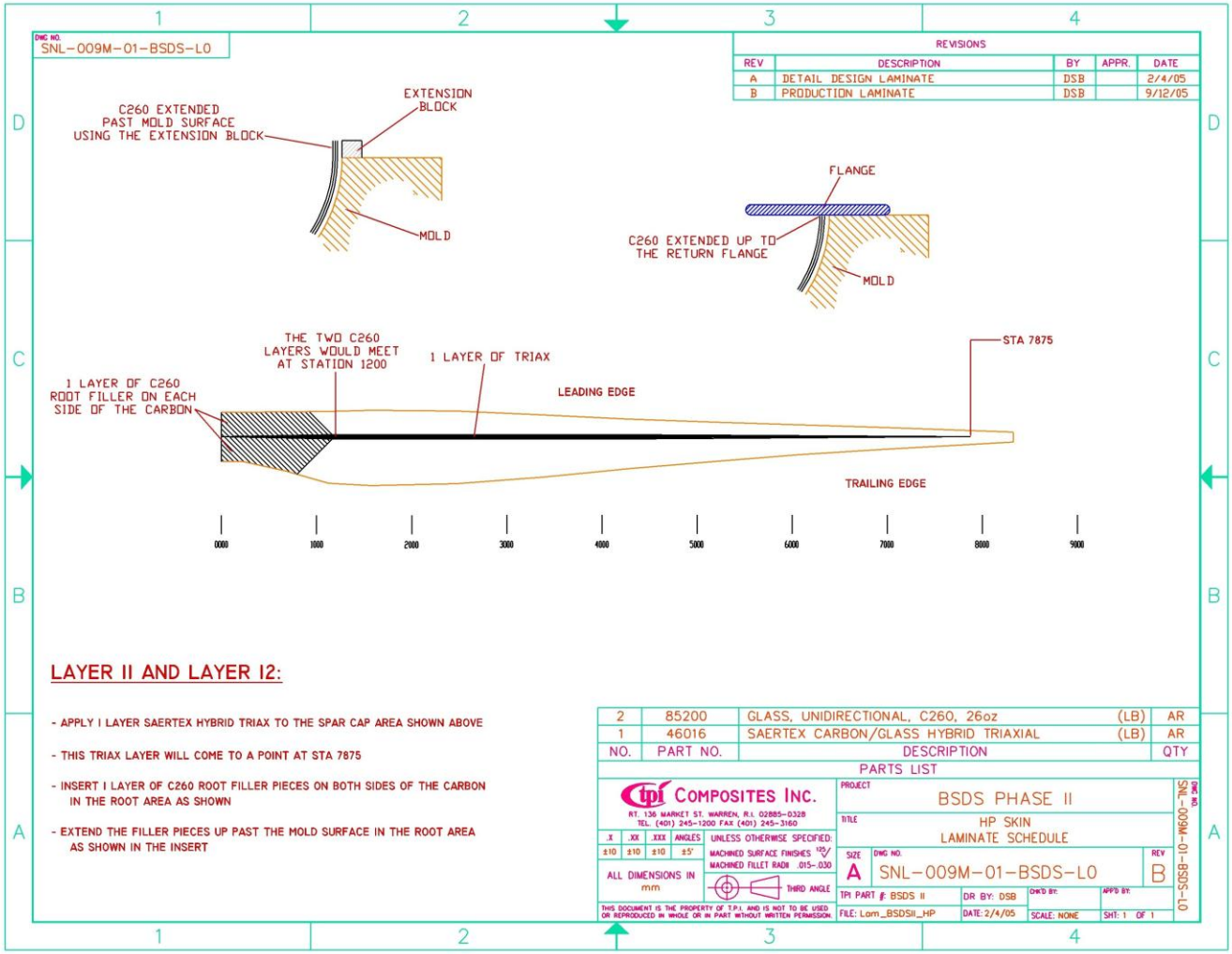
TITLE: HP SKIN LAMINATE SCHEDULE

SIZE: A | DWG NO.: SNL-009M-01-BSDS-L0 | REV: B

TPI PART #: BSDS II | DR BY: DSB | CHK'D BY: | APP'D BY:

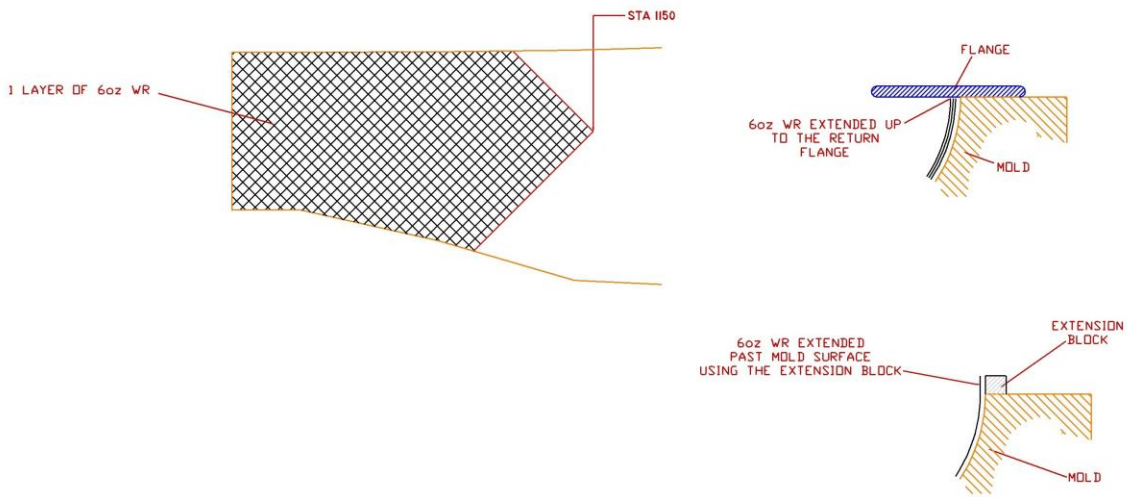
FILE: Lam_BSDSII_HP | DATE: 2/4/05 | SCALE: NONE | SHT: 1 OF 1

DWG NO. SNL-009M-01-BSDS-L0


DWG NO.
SNL-009M-01-BSDS-L0
REVISIONS
REV | DESCRIPTION | BY | APPR. | DATE
A | DETAIL DESIGN LAMINATE | DSB | | 2/4/05
B | PRODUCTION LAMINATE | DSB | | 9/12/05
C260 EXTENDED PAST MOLD SURFACE USING THE EXTENSION BLOCK
EXTENSION BLOCK
MOLD
FLANGE
C260 EXTENDED UP TO THE RETURN FLANGE
MOLD
THE TWO C260 LAYERS WOULD MEET AT STATION 1200
1 LAYER OF TRIAX
STA 7875
1 LAYER OF C260 ROOT FILLER ON EACH SIDE OF THE CARBON
LEADING EDGE
TRAILING EDGE
0000
1000
2000
3000
4000
5000
6000
7000
8000
9000
LAYER 11 AND LAYER 12:
- APPLY 1 LAYER SAERTEX HYBRID TRIAX TO THE SPAR CAP AREA SHOWN ABOVE
- THIS TRIAX LAYER WILL COME TO A POINT AT STA 7875
- INSERT 1 LAYER OF C260 ROOT FILLER PIECES ON BOTH SIDES OF THE CARBON IN THE ROOT AREA AS SHOWN
- EXTEND THE FILLER PIECES UP PAST THE MOLD SURFACE IN THE ROOT AREA AS SHOWN IN THE INSERT
2 | 85200 | GLASS, UNIDIRECTIONAL, C260, 26oz | (LB) | AR
1 | 46016 | SAERTEX CARBON/GLASS HYBRID TRIAXIAL | (LB) | AR
NO. | PART NO. | DESCRIPTION | QTY
PARTS LIST
TPI COMPOSITES INC.
RT. 136 MARKET ST. WARREN, R.I. 02885-0328
TEL. (401) 245-1200 FAX (401) 245-3160
.X .XX .XXX ANGLES
±10 ±10 ±10 ±5°
UNLESS OTHERWISE SPECIFIED:
MACHINED SURFACE FINISHES 125√
MACHINED FILLET RADII .015-.030
ALL DIMENSIONS IN mm
THIRD ANGLE
THIS DOCUMENT IS THE PROPERTY OF T.P.I. AND IS NOT TO BE USED OR REPRODUCED IN WHOLE OR IN PART WITHOUT WRITTEN PERMISSION.
PROJECT
BSDS PHASE II
TITLE
HP SKIN
LAMINATE SCHEDULE
SIZE A
DWG NO. SNL-009M-01-BSDS-L0
REV B
TPI PART #: BSDS II
DR BY: DSB
CHK'D BY:
APP'D BY:
FILE: Lam_BSDSII_HP
DATE: 2/4/05
SCALE: NONE
SHT: 1 OF 1
DWG NO. SNL-009M-01-BSDS-L0

DWG NO. SNL-009M-01-BSDS-L0

REVISIONS				
REV	DESCRIPTION	BY	APPR.	DATE
A	DETAIL DESIGN LAMINATE	DSB		2/4/05
B	PRODUCTION LAMINATE	DSB		9/12/05



LAYER 13:

- APPLY 1 LAYER 6oz WR TO THE ROOT AREA SHOWN ABOVE
- THE FIBERS SHOULD RUN IN THE +/-45° DIRECTION
- EXTEND THE 6oz WR UP PAST THE MOLD SURFACE IN THE ROOT AREA AS SHOWN IN THE INSERT
- THE POINT OF THE FABRIC SHOULD COME TO 1150MM

NO.	PART NO.	DESCRIPTION	QTY
1	TBD	GLASS, 6oz WOVEN ROVING (LB)	AR

PARTS LIST

TPI COMPOSITES INC.
RT. 136 MARKET ST. WARREN, R.I. 02885-0328
TEL. (401) 245-1200 FAX (401) 245-3160

.X	.XX	.XXX	ANGLES
±10	±10	±10	±5°

UNLESS OTHERWISE SPECIFIED:
MACHINED SURFACE FINISHES 125√
MACHINED FILLET RADII .015-.030

ALL DIMENSIONS IN mm

THIRD ANGLE

THIS DOCUMENT IS THE PROPERTY OF T.P.I. AND IS NOT TO BE USED OR REPRODUCED IN WHOLE OR IN PART WITHOUT WRITTEN PERMISSION.

PROJECT: BSDS PHASE II

TITLE: HP SKIN LAMINATE SCHEDULE

SIZE: A | DWG NO.: SNL-009M-01-BSDS-L0 | REV: B

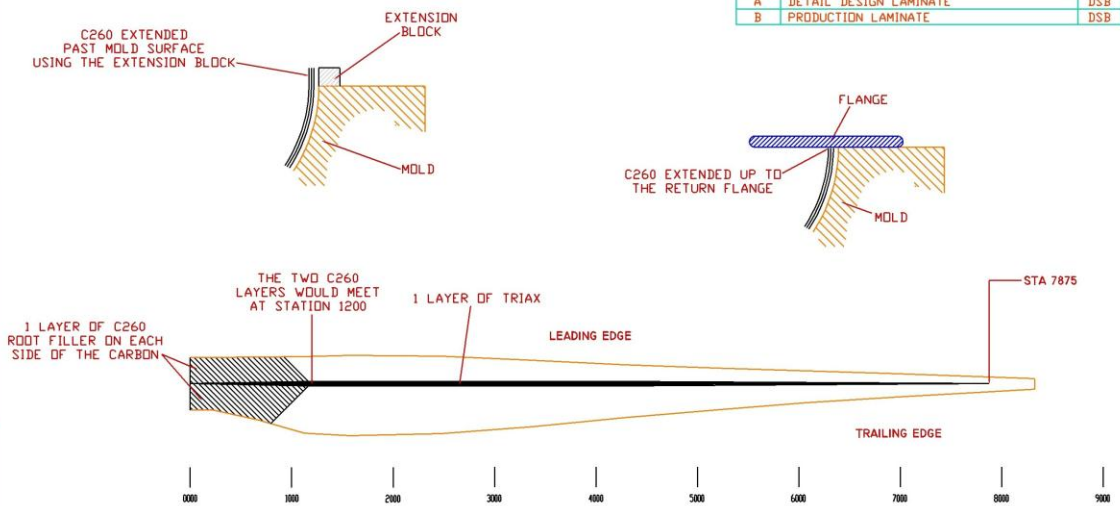
TPI PART #: BSDS II | DR BY: DSB | CHK'D BY: | APP'D BY:

FILE: Lam_BSDSII_HP | DATE: 2/4/05 | SCALE: NONE | SHT: 1 OF 1

DWG NO. SNL-009M-01-BSDS-L0

DWG NO. SNL-009M-01-BSDS-L0

REVISIONS				
REV	DESCRIPTION	BY	APPR.	DATE
A	DETAIL DESIGN LAMINATE	DSB		2/4/05
B	PRODUCTION LAMINATE	DSB		9/12/05



LAYER 14 AND LAYER 15:

- APPLY 1 LAYER SAERTEX HYBRID TRIAX TO THE SPAR CAP AREA SHOWN ABOVE
- THIS TRIAX LAYER WILL COME TO A POINT AT STA 7875
- INSERT 1 LAYER OF C260 ROOT FILLER PIECES ON BOTH SIDES OF THE CARBON IN THE ROOT AREA AS SHOWN
- EXTEND THE FILLER PIECES UP PAST THE MOLD SURFACE IN THE ROOT AREA AS SHOWN IN THE INSERT

NO.	PART NO.	DESCRIPTION		QTY
2	85200	GLASS, UNIDIRECTIONAL, C260, 26oz	(LB)	AR
1	46016	SAERTEX CARBON/GLASS HYBRID TRIAXIAL	(LB)	AR

PARTS LIST

TPI COMPOSITES INC.
RT. 136 MARKET ST. WARREN, R.I. 02885-0328
TEL. (401) 245-1200 FAX (401) 245-3160

.X	.XX	.XXX	ANGLES
±10	±10	±10	±5°

UNLESS OTHERWISE SPECIFIED:
MACHINED SURFACE FINISHES 125√
MACHINED FILLET RADII .015-.030

ALL DIMENSIONS IN mm

THIRD ANGLE

THIS DOCUMENT IS THE PROPERTY OF T.P.I. AND IS NOT TO BE USED OR REPRODUCED IN WHOLE OR IN PART WITHOUT WRITTEN PERMISSION.

PROJECT: BSDS PHASE II

TITLE: HP SKIN LAMINATE SCHEDULE

SIZE: A | DWG NO.: SNL-009M-01-BSDS-L0 | REV: B

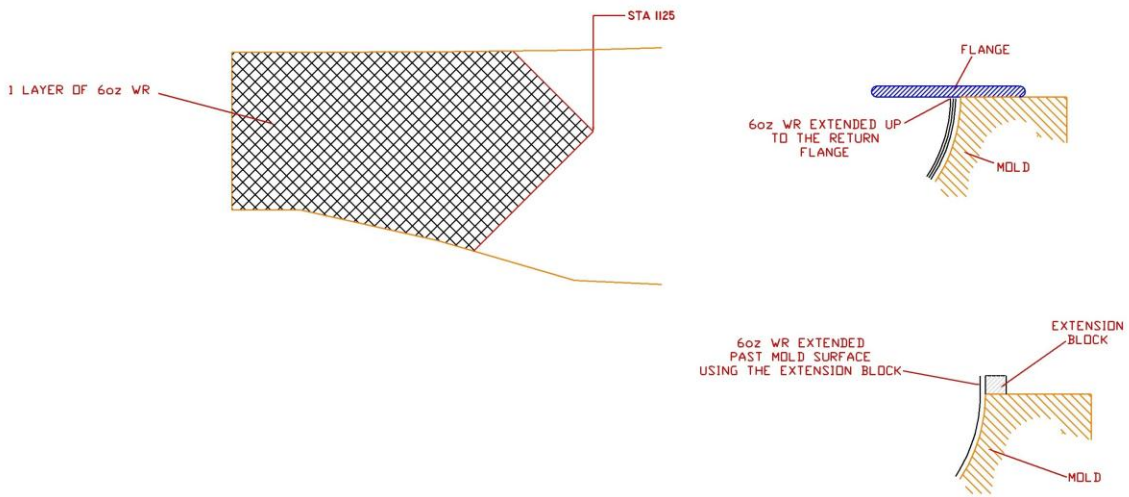
TPI PART #: BSDS II | DR BY: DSB | CHK'D BY: | APP'D BY:

FILE: Lam_BSDSII_HP | DATE: 2/4/05 | SCALE: NONE | SHT: 1 OF 1

DWG NO. SNL-009M-01-BSDS-L0

DWG NO. SNL-009M-01-BSDS-L0

REVISIONS				
REV	DESCRIPTION	BY	APPR.	DATE
A	DETAIL DESIGN LAMINATE	DSB		2/4/05
B	PRODUCTION LAMINATE	DSB		9/12/05



LAYER 16:

- APPLY 1 LAYER 6oz WR TO THE ROOT AREA SHOWN ABOVE
- THE FIBERS SHOULD RUN IN THE +/-45° DIRECTION
- EXTEND THE 6oz WR UP PAST THE MOLD SURFACE IN THE ROOT AREA AS SHOWN IN THE INSERT
- THE POINT OF THE FABRIC SHOULD COME TO 1125MM

NO.	PART NO.	DESCRIPTION	QTY
1	TBD	GLASS, 6oz WOVEN ROVING (LB)	AR

PARTS LIST

TPI COMPOSITES INC.
RT. 136 MARKET ST. WARREN, R.I. 02885-0328
TEL. (401) 245-1200 FAX (401) 245-3160

.X	.XX	.XXX	ANGLES
±10	±10	±10	±5°

UNLESS OTHERWISE SPECIFIED:
MACHINED SURFACE FINISHES 125√
MACHINED FILLET RADII .015-.030

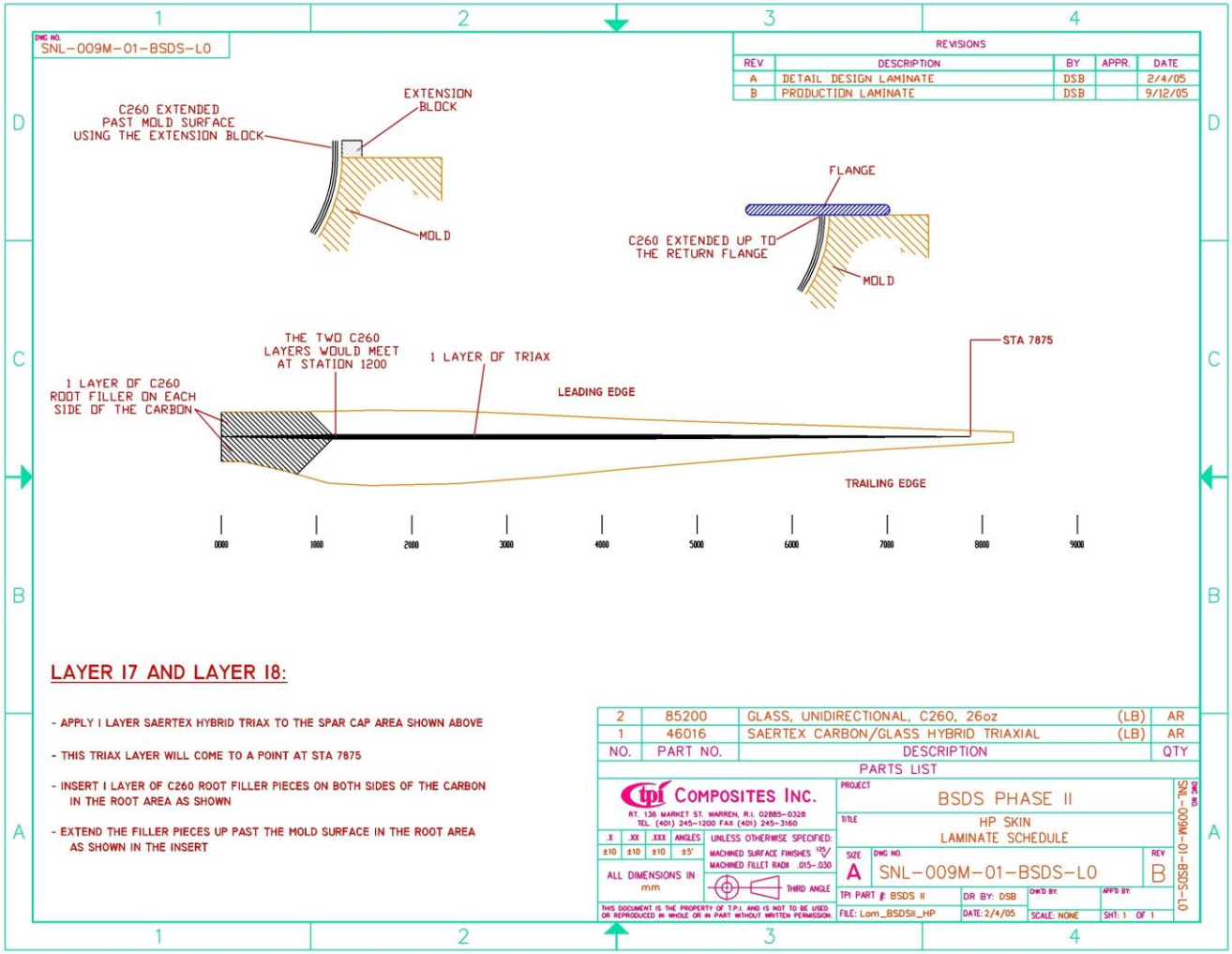
ALL DIMENSIONS IN mm

THIRD ANGLE

THIS DOCUMENT IS THE PROPERTY OF T.P.I. AND IS NOT TO BE USED OR REPRODUCED IN WHOLE OR IN PART WITHOUT WRITTEN PERMISSION.

PROJECT: BSDS PHASE II
TITLE: HP SKIN LAMINATE SCHEDULE
SIZE: A | DWG NO.: SNL-009M-01-BSDS-L0 | REV: B
TPI PART #: BSDS II | DR BY: DSB | CHK'D BY: | APP'D BY:
FILE: Lam_BSDSII_HP | DATE: 2/4/05 | SCALE: NONE | SHT: 1 OF 1

DWG NO. SNL-009M-01-BSDS-L0



LAYER 17 AND LAYER 18:

- APPLY 1 LAYER SAERTEX HYBRID TRIAX TO THE SPAR CAP AREA SHOWN ABOVE
- THIS TRIAX LAYER WILL COME TO A POINT AT STA 7875
- INSERT 1 LAYER OF C260 ROOT FILLER PIECES ON BOTH SIDES OF THE CARBON IN THE ROOT AREA AS SHOWN
- EXTEND THE FILLER PIECES UP PAST THE MOLD SURFACE IN THE ROOT AREA AS SHOWN IN THE INSERT

NO.	PART NO.	DESCRIPTION		QTY
2	85200	GLASS, UNIDIRECTIONAL, C260, 26oz	(LB)	AR
1	46016	SAERTEX CARBON/GLASS HYBRID TRIAXIAL	(LB)	AR

PARTS LIST

TPI COMPOSITES INC.
RT. 136 MARKET ST. WARREN, R.I. 02885-0328
TEL. (401) 245-1200 FAX (401) 245-3160

.X	.XX	.XXX	ANGLES
±10	±10	±10	±5°

UNLESS OTHERWISE SPECIFIED:
MACHINED SURFACE FINISHES 125√
MACHINED FILLET RADII .015-.030

ALL DIMENSIONS IN mm

THIRD ANGLE

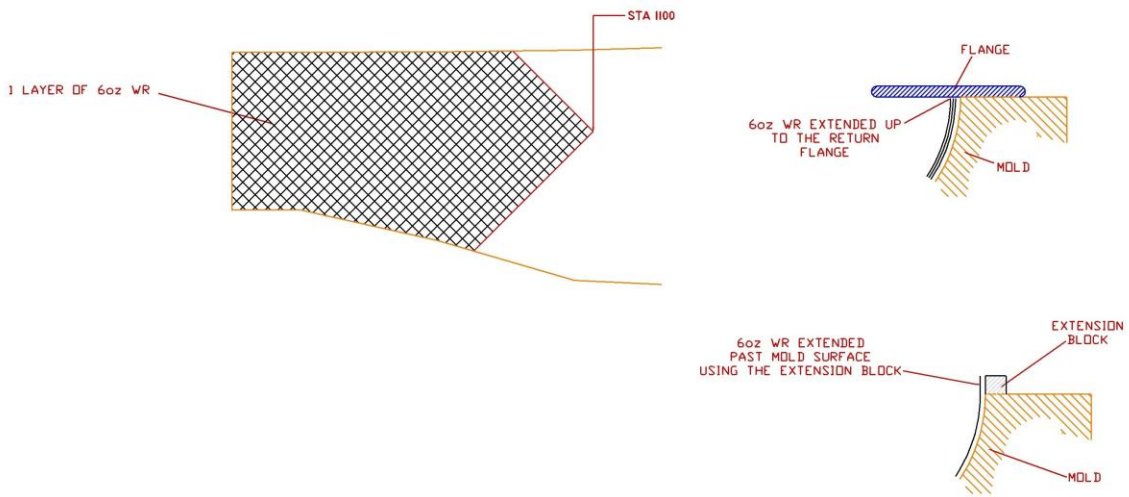
THIS DOCUMENT IS THE PROPERTY OF T.P.I. AND IS NOT TO BE USED OR REPRODUCED IN WHOLE OR IN PART WITHOUT WRITTEN PERMISSION.

PROJECT: BSDS PHASE II
TITLE: HP SKIN LAMINATE SCHEDULE
SIZE: A | DWG NO.: SNL-009M-01-BSDS-L0 | REV: B
TPI PART #: BSDS II | DR BY: DSB | CHK'D BY: | APP'D BY:
FILE: Lam_BSDSII_HP | DATE: 2/4/05 | SCALE: NONE | SHT: 1 OF 1

DWG NO. SNL-009M-01-BSDS-L0

DWG NO. SNL-009M-01-BSDS-L0

REVISIONS				
REV	DESCRIPTION	BY	APPR.	DATE
A	DETAIL DESIGN LAMINATE	DSB		2/4/05
B	PRODUCTION LAMINATE	DSB		9/12/05



LAYER 19:

- APPLY 1 LAYER 6oz WR TO THE ROOT AREA SHOWN ABOVE
- THE FIBERS SHOULD RUN IN THE +/-45° DIRECTION
- EXTEND THE 6oz WR UP PAST THE MOLD SURFACE IN THE ROOT AREA AS SHOWN IN THE INSERT
- THE POINT OF THE FABRIC SHOULD COME TO 1100MM

NO.	PART NO.	DESCRIPTION	QTY
1	TBD	GLASS, 6oz WOVEN ROVING (LB)	AR

PARTS LIST

TPI COMPOSITES INC.
RT. 136 MARKET ST. WARREN, R.I. 02885-0328
TEL. (401) 245-1200 FAX (401) 245-3160

.X	.XX	.XXX	ANGLES
±10	±10	±10	±5°

UNLESS OTHERWISE SPECIFIED:
MACHINED SURFACE FINISHES 125√
MACHINED FILLET RADII .015-.030

ALL DIMENSIONS IN mm

THIRD ANGLE

THIS DOCUMENT IS THE PROPERTY OF T.P.I. AND IS NOT TO BE USED OR REPRODUCED IN WHOLE OR IN PART WITHOUT WRITTEN PERMISSION.

PROJECT: BSDS PHASE II

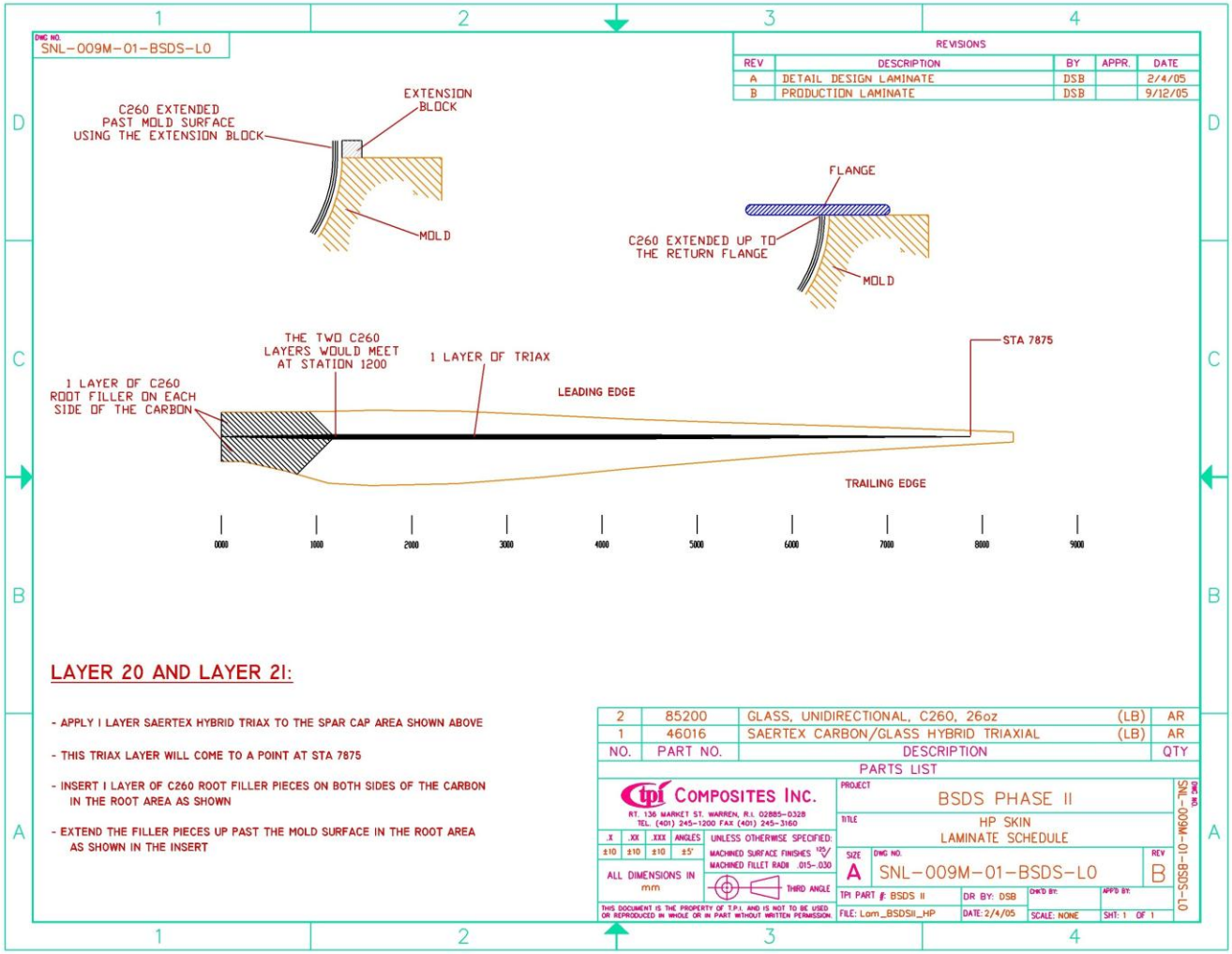
TITLE: HP SKIN LAMINATE SCHEDULE

SIZE: A | DWG NO.: SNL-009M-01-BSDS-L0 | REV: B

TPI PART #: BSDS II | DR BY: DSB | CHK'D BY: | APP'D BY:

FILE: Lam_BSDSII_HP | DATE: 2/4/05 | SCALE: NONE | SHT: 1 OF 1

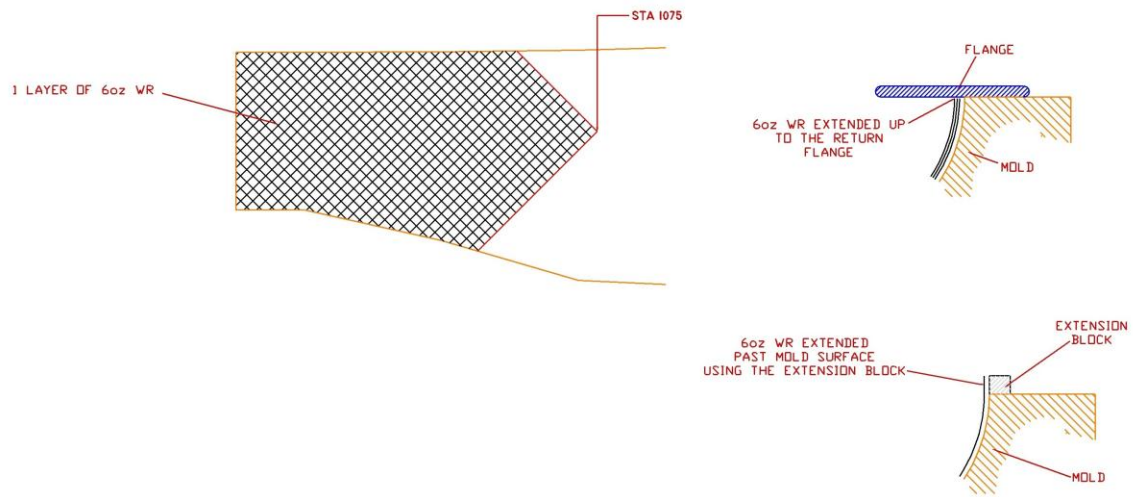
DWG NO. SNL-009M-01-BSDS-L0


DWG NO.
SNL-009M-01-BSDS-L0
REVISIONS
REV | DESCRIPTION | BY | APPR. | DATE
A | DETAIL DESIGN LAMINATE | DSB | | 2/4/05
B | PRODUCTION LAMINATE | DSB | | 9/12/05
C260 EXTENDED PAST MOLD SURFACE USING THE EXTENSION BLOCK
EXTENSION BLOCK
MOLD
FLANGE
C260 EXTENDED UP TO THE RETURN FLANGE
MOLD
THE TWO C260 LAYERS WOULD MEET AT STATION 1200
1 LAYER OF TRIAX
STA 7875
1 LAYER OF C260 ROOT FILLER ON EACH SIDE OF THE CARBON
LEADING EDGE
TRAILING EDGE
0000
1000
2000
3000
4000
5000
6000
7000
8000
9000
LAYER 20 AND LAYER 21:
- APPLY 1 LAYER SAERTEX HYBRID TRIAX TO THE SPAR CAP AREA SHOWN ABOVE
- THIS TRIAX LAYER WILL COME TO A POINT AT STA 7875
- INSERT 1 LAYER OF C260 ROOT FILLER PIECES ON BOTH SIDES OF THE CARBON IN THE ROOT AREA AS SHOWN
- EXTEND THE FILLER PIECES UP PAST THE MOLD SURFACE IN THE ROOT AREA AS SHOWN IN THE INSERT
2 | 85200 | GLASS, UNIDIRECTIONAL, C260, 26oz | (LB) | AR
1 | 46016 | SAERTEX CARBON/GLASS HYBRID TRIAXIAL | (LB) | AR
NO. | PART NO. | DESCRIPTION | QTY
PARTS LIST
TPI COMPOSITES INC.
RT. 136 MARKET ST. WARREN, R.I. 02885-0328
TEL. (401) 245-1200 FAX (401) 245-3160
.X .XX .XXX ANGLES
±10 ±10 ±10 ±5°
UNLESS OTHERWISE SPECIFIED:
MACHINED SURFACE FINISHES 125√
MACHINED FILLET RADII .015-.030
ALL DIMENSIONS IN mm
THIRD ANGLE
THIS DOCUMENT IS THE PROPERTY OF T.P.I. AND IS NOT TO BE USED OR REPRODUCED IN WHOLE OR IN PART WITHOUT WRITTEN PERMISSION.
PROJECT
BSDS PHASE II
TITLE
HP SKIN
LAMINATE SCHEDULE
SIZE A
DWG NO. SNL-009M-01-BSDS-L0
REV B
TPI PART #: BSDS II
DR BY: DSB
CHK'D BY:
APP'D BY:
FILE: Lam_BSDSII_HP
DATE: 2/4/05
SCALE: NONE
SHT: 1 OF 1
DWG NO. SNL-009M-01-BSDS-L0

DWG NO. SNL-009M-01-BSDS-L0

REVISIONS

REV	DESCRIPTION	BY	APPR.	DATE
A	DETAIL DESIGN LAMINATE	DSB		2/4/05
B	PRODUCTION LAMINATE	DSB		9/12/05



LAYER 22:

- APPLY 1 LAYER 6oz WR TO THE ROOT AREA SHOWN ABOVE
- THE FIBERS SHOULD RUN IN THE +/-45° DIRECTION
- EXTEND THE 6oz WR UP PAST THE MOLD SURFACE IN THE ROOT AREA AS SHOWN IN THE INSERT
- THE POINT OF THE FABRIC SHOULD COME TO 1075MM

NO.	PART NO.	DESCRIPTION	QTY
1	TBD	GLASS, 6oz WOVEN ROVING (LB)	AR

PARTS LIST

TPI COMPOSITES INC.
RT. 136 MARKET ST. WARREN, R.I. 02885-0328
TEL. (401) 245-1200 FAX (401) 245-3160

.X	.XX	.XXX	ANGLES
±10	±10	±10	±5°

UNLESS OTHERWISE SPECIFIED:
MACHINED SURFACE FINISHES 125√
MACHINED FILLET RADII .015-.030

ALL DIMENSIONS IN mm

THIRD ANGLE

THIS DOCUMENT IS THE PROPERTY OF T.P.I. AND IS NOT TO BE USED OR REPRODUCED IN WHOLE OR IN PART WITHOUT WRITTEN PERMISSION.

PROJECT: BSDS PHASE II

TITLE: HP SKIN LAMINATE SCHEDULE

SIZE: A | DWG NO.: SNL-009M-01-BSDS-L0 | REV: B

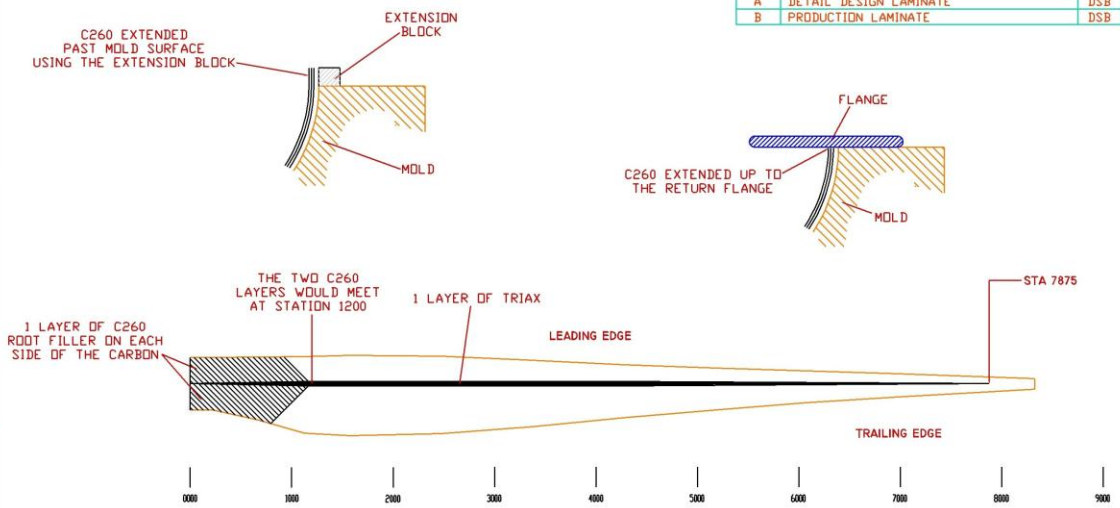
TPI PART #: BSDS II | DR BY: DSB | CHK'D BY: | APP'D BY:

FILE: Lam_BSDSII_HP | DATE: 2/4/05 | SCALE: NONE | SHT: 1 OF 1

DWG NO. SNL-009M-01-BSDS-L0

DWG NO. SNL-009M-01-BSDS-L0

REVISIONS				
REV	DESCRIPTION	BY	APPR.	DATE
A	DETAIL DESIGN LAMINATE	DSB		2/4/05
B	PRODUCTION LAMINATE	DSB		9/12/05



LAYER 23 AND LAYER 24:

- APPLY 1 LAYER SAERTEX HYBRID TRIAX TO THE SPAR CAP AREA SHOWN ABOVE
- THIS TRIAX LAYER WILL COME TO A POINT AT STA 7875
- INSERT 1 LAYER OF C260 ROOT FILLER PIECES ON BOTH SIDES OF THE CARBON IN THE ROOT AREA AS SHOWN
- EXTEND THE FILLER PIECES UP PAST THE MOLD SURFACE IN THE ROOT AREA AS SHOWN IN THE INSERT

NO.	PART NO.	DESCRIPTION		QTY
2	85200	GLASS, UNIDIRECTIONAL, C260, 26oz	(LB)	AR
1	46016	SAERTEX CARBON/GLASS HYBRID TRIAXIAL	(LB)	AR

PARTS LIST

TPI COMPOSITES INC.
RT. 136 MARKET ST. WARREN, R.I. 02885-0328
TEL. (401) 245-1200 FAX (401) 245-3160

.X	.XX	.XXX	ANGLES
±10	±10	±10	±5°

UNLESS OTHERWISE SPECIFIED:
MACHINED SURFACE FINISHES 125√
MACHINED FILLET RADII .015-.030

ALL DIMENSIONS IN mm

THIRD ANGLE

THIS DOCUMENT IS THE PROPERTY OF T.P.I. AND IS NOT TO BE USED OR REPRODUCED IN WHOLE OR IN PART WITHOUT WRITTEN PERMISSION.

PROJECT: BSDS PHASE II

TITLE: HP SKIN LAMINATE SCHEDULE

SIZE: A | DWG NO.: SNL-009M-01-BSDS-L0 | REV: B

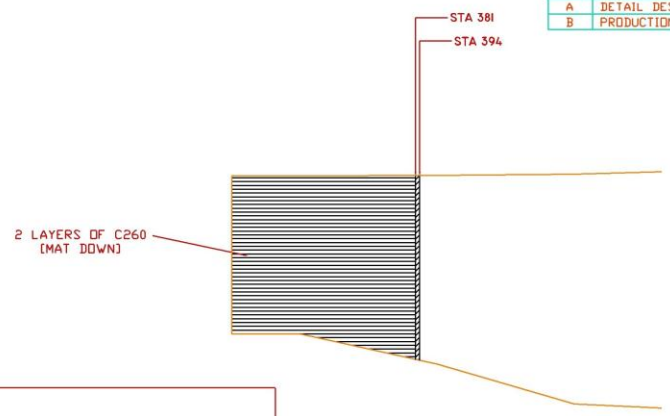
TPI PART #: BSDS II | DR BY: DSB | CHK'D BY: | APP'D BY:

FILE: Lam_BSDSII_HP | DATE: 2/4/05 | SCALE: NONE | SHT: 1 OF 1

DWG NO. SNL-009M-01-BSDS-L0

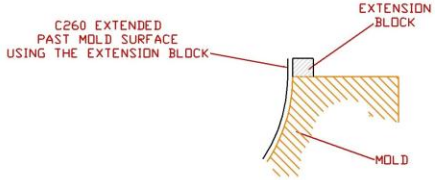
DWG NO. SNL-009M-01-BSDS-L0

REVISIONS				
REV	DESCRIPTION	BY	APPR.	DATE
A	DETAIL DESIGN LAMINATE	DSB		2/4/05
B	PRODUCTION LAMINATE	DSB		9/12/05



NOTE:

THESE TWO LAYERS MAY BE MARKED AS LAYERS 27 AND 28 IN THE BLADE KITS. THEY ARE NOW LAYERS 25 AND 26 - BECAUSE THEY WERE MOVED TO BE PLACED IN BEFORE THE THREADED RODS.



LAYERS 25-26:

- APPLY 2 LAYERs C260 TO THE ROOT AREA SHOWN ABOVE
- THE C260 LAYERS END AT STA 394 AND 381
- EXTEND THE C260 UP PAST THE MOLD SURFACE IN THE ROOT AREA AS SHOWN IN THE INSERT
- THE C260 SHOULD BE PLACED MAT DOWN

NO.	PART NO.	DESCRIPTION	QTY
1	85200	GLASS, UNIDIRECTIONAL, C260, 26oz (LB)	AR

PARTS LIST

TPI COMPOSITES INC.
RT. 136 MARKET ST. WARREN, R.I. 02885-0328
TEL. (401) 245-1200 FAX (401) 245-3160

.X	.XX	.XXX	ANGLES
±10	±10	±10	±5°

UNLESS OTHERWISE SPECIFIED:
MACHINED SURFACE FINISHES 125√
MACHINED FILLET RADII .015-.030

ALL DIMENSIONS IN mm

THIRD ANGLE

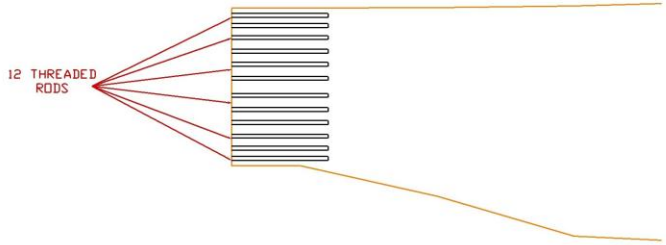
THIS DOCUMENT IS THE PROPERTY OF T.P.I. AND IS NOT TO BE USED OR REPRODUCED IN WHOLE OR IN PART WITHOUT WRITTEN PERMISSION.

PROJECT: BSDS PHASE II
TITLE: HP SKIN LAMINATE SCHEDULE
SIZE: A | DWG NO.: SNL-009M-01-BSDS-L0 | REV: B
TPI PART #: BSDS II | DR BY: DSB | CHK'D BY: | APP'D BY:
FILE: Lam_BSDSII_HP | DATE: 2/4/05 | SCALE: NONE | SHT: 1 OF 1

DWG NO. SNL-009M-01-BSDS-L0

DWG NO. SNL-009M-01-BSDS-L0

REVISIONS				
REV	DESCRIPTION	BY	APPR.	DATE
A	DETAIL DESIGN LAMINATE	DSB		2/4/05
B	PRODUCTION LAMINATE	DSB		9/12/05



LAYER 27:

- INSTALL 12 THREADED RODS
- PLACE THE RODS WITH THE CUT (ANGLED) FACE UP
- ENSURE THE BOLTS ARE TIGHTENED TO ORIENT THE RODS PERPENDICULAR TO THE END PLATE - THIS WILL COMPRESS THE FABRIC BELOW THE INSERTS
- USE ALL-THREAD BETWEEN THE NUTS AND THE THREADED ROD
- ALSO USE TEFLON TAPE TO SEAL THE RESIN

NO.	PART NO.	DESCRIPTION	QTY
1	TBD	5/8" THREADED ROD (EA)	10

PARTS LIST

TPI COMPOSITES INC.
RT. 136 MARKET ST. WARREN, R.I. 02885-0328
TEL. (401) 245-1200 FAX (401) 245-3160

.X	.XX	.XXX	ANGLES
±10	±10	±10	±5°

UNLESS OTHERWISE SPECIFIED:
MACHINED SURFACE FINISHES 125√
MACHINED FILLET RADII .015-.030

ALL DIMENSIONS IN mm

THIRD ANGLE

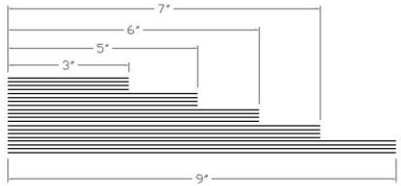
THIS DOCUMENT IS THE PROPERTY OF T.P.I. AND IS NOT TO BE USED OR REPRODUCED IN WHOLE OR IN PART WITHOUT WRITTEN PERMISSION.

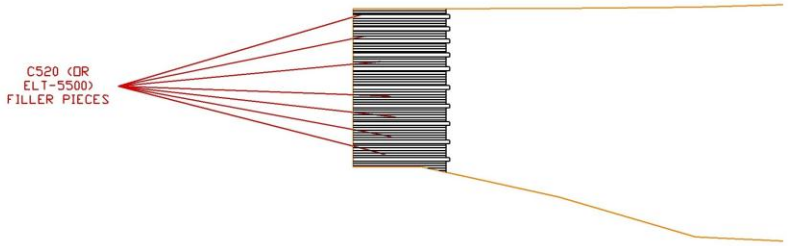
PROJECT: BSDS PHASE II
TITLE: HP SKIN LAMINATE SCHEDULE
SIZE: A
DWG NO.: SNL-009M-01-BSDS-L0
REV: B
TPI PART #: BSDS II
DR BY: DSB
CHK'D BY:
APP'D BY:
FILE: Lam_BSDSII_HP
DATE: 2/4/05
SCALE: NONE
SHT: 1 OF 1

DWG NO. SNL-009M-01-BSDS-L0

DWG NO. SNL-009M-01-BSDS-L0

REVISIONS				
REV	DESCRIPTION	BY	APPR.	DATE
A	DETAIL DESIGN LAMINATE	DSB		2/4/05
B	PRODUCTION LAMINATE	DSB		9/12/05





LAYER 28:

- INSTALL C520 (OR ELT-5500) STRIPS BETWEEN THE THREADED ROD TO FILL THE GAPS UP TO THE LEVEL OF THE TOP OF THE RODS
- SCRAP PIECES OF C520 MAY BE USED FOR THIS STEP
- EACH STACK SHOULD CONTAIN ABOUT 20 LAYERS
- THE LONGEST LAYER SHOULD BE 9 INCHES LONG
- THE SHORTEST LAYER SHOULD BE 3 INCHES LONG
- THE WIDTH SHOULD BE ABOUT 2-3/8 INCHES
- SEE THE DRAWING ABOVE FOR STACKING DETAILS

NO.	PART NO.	DESCRIPTION	QTY
1	85200	GLASS, UNIDIRECTIONAL, C260, 26oz (LB)	AR

PARTS LIST

TPI COMPOSITES INC.
RT. 136 MARKET ST. WARREN, R.I. 02885-0328
TEL. (401) 245-1200 FAX (401) 245-3160

.X	.XX	.XXX	ANGLES
±10	±10	±10	±5°

ALL DIMENSIONS IN mm

UNLESS OTHERWISE SPECIFIED:
MACHINED SURFACE FINISHES 125√
MACHINED FILLET RADII .015-.030
THIRD ANGLE

THIS DOCUMENT IS THE PROPERTY OF T.P.I. AND IS NOT TO BE USED OR REPRODUCED IN WHOLE OR IN PART WITHOUT WRITTEN PERMISSION.

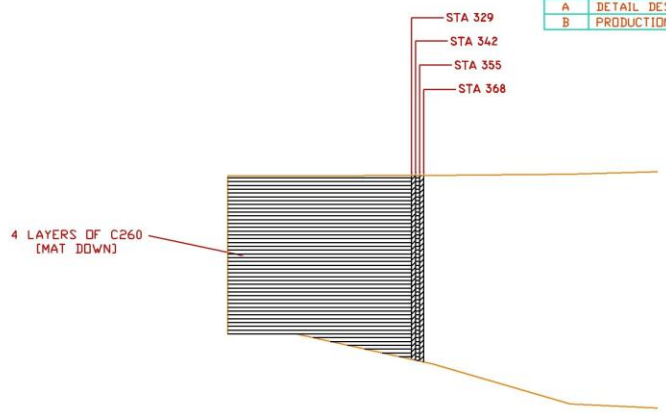
PROJECT: BSDS PHASE II
TITLE: HP SKIN LAMINATE SCHEDULE
SIZE: A | DWG NO.: SNL-009M-01-BSDS-L0 | REV: B
TPI PART #: BSDS II | DR BY: DSB | CHK'D BY: | APP'D BY:
FILE: Lam_BSDSII_HP | DATE: 2/4/05 | SCALE: NONE | SHT: 1 OF 1

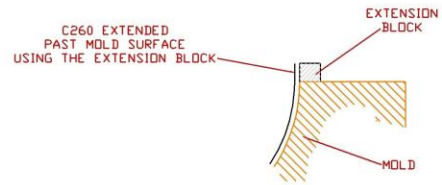
DWG NO. SNL-009M-01-BSDS-L0

DWG NO. SNL-009M-01-BSDS-L0

REVISIONS

REV	DESCRIPTION	BY	APPR.	DATE
A	DETAIL DESIGN LAMINATE	DSB		2/4/05
B	PRODUCTION LAMINATE	DSB		9/12/05





LAYERS 29-30-31-32:

- APPLY 4 LAYERs C260 TO THE ROOT AREA SHOWN ABOVE
- THE C260 LAYERS END AT STA 368, 355, 342 AND 329
- EXTEND THE C260 UP PAST THE MOLD SURFACE IN THE ROOT AREA AS SHOWN IN THE INSERT
- THE C260 SHOULD BE PLACED MAT DOWN

NO.	PART NO.	DESCRIPTION	QTY
1	85200	GLASS, UNIDIRECTIONAL, C260, 26oz (LB)	AR

PARTS LIST

TPI COMPOSITES INC.
RT. 136 MARKET ST. WARREN, R.I. 02885-0328
TEL. (401) 245-1200 FAX (401) 245-3160

.X	.XX	.XXX	ANGLES
±10	±10	±10	±5°

UNLESS OTHERWISE SPECIFIED:
MACHINED SURFACE FINISHES 125√
MACHINED FILLET RADII .015-.030

ALL DIMENSIONS IN mm

THIRD ANGLE

THIS DOCUMENT IS THE PROPERTY OF T.P.I. AND IS NOT TO BE USED OR REPRODUCED IN WHOLE OR IN PART WITHOUT WRITTEN PERMISSION.

PROJECT: BSDS PHASE II

TITLE: HP SKIN LAMINATE SCHEDULE

SIZE: A | DWG NO.: SNL-009M-01-BSDS-L0 | REV: B

TPI PART #: BSDS II | DR BY: DSB | CHK'D BY: | APP'D BY:

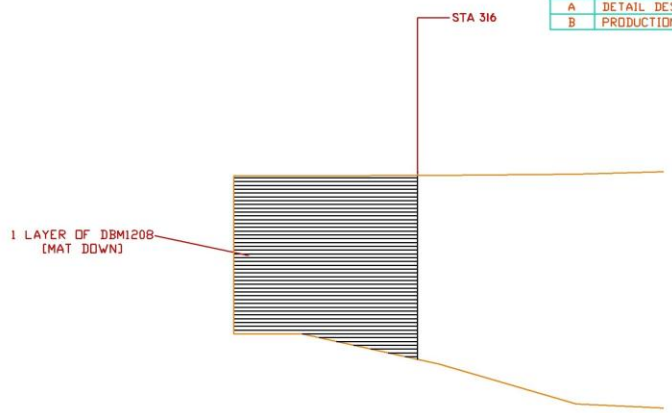
FILE: Lam_BSDSII_HP | DATE: 2/4/05 | SCALE: NONE | SHT: 1 OF 1

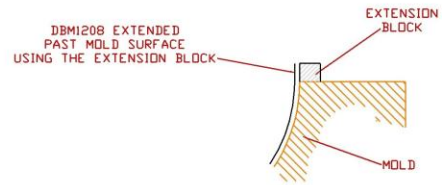
DWG NO. SNL-009M-01-BSDS-L0

DWG NO. SNL-009M-01-BSDS-L0

REVISIONS

REV	DESCRIPTION	BY	APPR.	DATE
A	DETAIL DESIGN LAMINATE	DSB		2/4/05
B	PRODUCTION LAMINATE	DSB		9/12/05





LAYERS 33:

- APPLY 1 LAYER DBMI208 TO THE ROOT AREA SHOWN ABOVE
- THE LAYERS END AT STA 316
- EXTEND THE DBMI208 UP PAST THE MOLD SURFACE IN THE ROOT AREA AS SHOWN IN THE INSERT
- THE DBMI208 SHOULD BE PLACED MAT DOWN

NO.	PART NO.	DESCRIPTION	QTY
1	46250	GLASS, DBM-1208 (LB)	AR

PARTS LIST

tpi COMPOSITES INC.
RT. 136 MARKET ST. WARREN, R.I. 02885-0328
TEL. (401) 245-1200 FAX (401) 245-3160

.X	.XX	.XXX	ANGLES
±10	±10	±10	±5°

UNLESS OTHERWISE SPECIFIED:
MACHINED SURFACE FINISHES 125√
MACHINED FILLET RADII .015-.030

ALL DIMENSIONS IN mm

THIRD ANGLE

THIS DOCUMENT IS THE PROPERTY OF T.P.I. AND IS NOT TO BE USED OR REPRODUCED IN WHOLE OR IN PART WITHOUT WRITTEN PERMISSION.

PROJECT: BSDS PHASE II

TITLE: HP SKIN LAMINATE SCHEDULE

SIZE: A | DWG NO.: SNL-009M-01-BSDS-L0 | REV: B

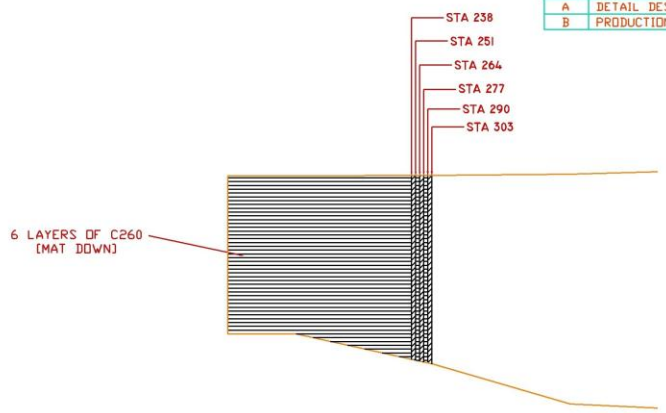
TPI PART #: BSDS II | DR BY: DSB | CHK'D BY: | APP'D BY:

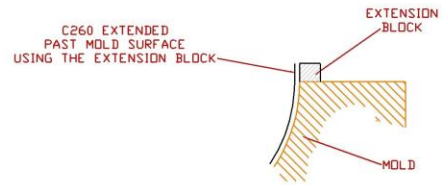
FILE: Lam_BSDSII_HP | DATE: 2/4/05 | SCALE: NONE | SHT: 1 OF 1

DWG NO. SNL-009M-01-BSDS-L0

DWG NO. SNL-009M-01-BSDS-L0

REVISIONS				
REV	DESCRIPTION	BY	APPR.	DATE
A	DETAIL DESIGN LAMINATE	DSB		2/4/05
B	PRODUCTION LAMINATE	DSB		9/12/05





LAYERS 34-35-36-37-38-39:

- APPLY 6 LAYERs C260 TO THE ROOT AREA SHOWN ABOVE
- THE C260 LAYERS END AT STA 303, 290, 277, 264, 251 AND 238
- EXTEND THE C260 UP PAST THE MOLD SURFACE IN THE ROOT AREA AS SHOWN IN THE INSERT
- THE C260 SHOULD BE PLACED MAT DOWN

NO.	PART NO.	DESCRIPTION	QTY
1	85200	GLASS, UNIDIRECTIONAL, C260, 26oz (LB)	AR

PARTS LIST

TPI COMPOSITES INC.
RT. 136 MARKET ST. WARREN, R.I. 02885-0328
TEL. (401) 245-1200 FAX (401) 245-3160

.X	.XX	.XXX	ANGLES
±10	±10	±10	±5°

UNLESS OTHERWISE SPECIFIED:
MACHINED SURFACE FINISHES 125√
MACHINED FILLET RADII .015-.030

ALL DIMENSIONS IN mm

THIRD ANGLE

THIS DOCUMENT IS THE PROPERTY OF T.P.I. AND IS NOT TO BE USED OR REPRODUCED IN WHOLE OR IN PART WITHOUT WRITTEN PERMISSION.

PROJECT: BSDS PHASE II

TITLE: HP SKIN LAMINATE SCHEDULE

SIZE: A | DWG NO.: SNL-009M-01-BSDS-L0 | REV: B

TPI PART #: BSDS II | DR BY: DSB | CHK'D BY: | APP'D BY:

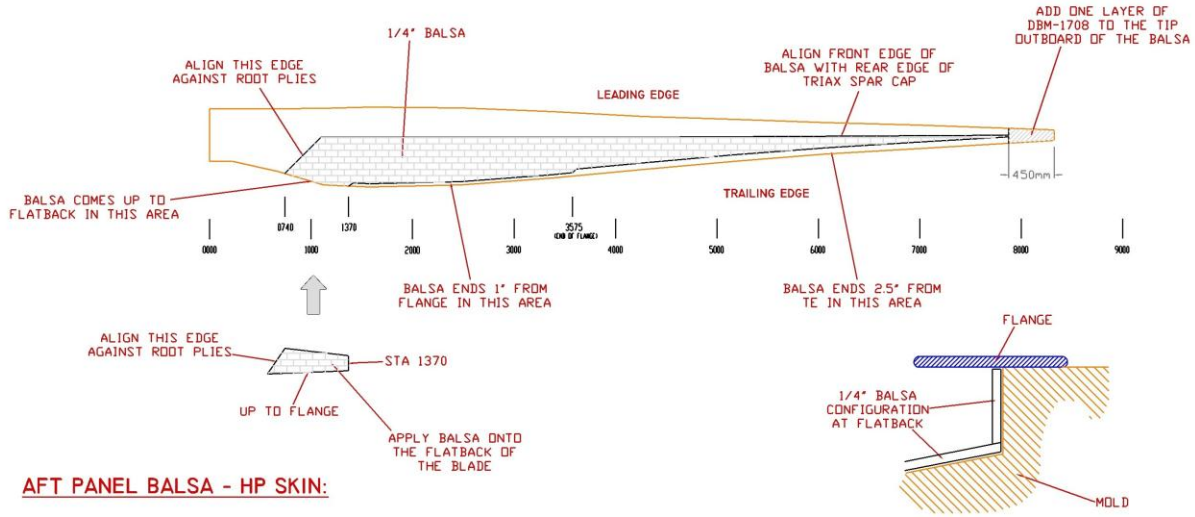
FILE: Lam_BSDSII_HP | DATE: 2/4/05 | SCALE: NONE | SHT: 1 OF 1

DWG NO. SNL-009M-01-BSDS-L0

DWG NO. SNL-009M-01-BSDS-L0

REVISIONS				
REV	DESCRIPTION	BY	APPR.	DATE
A	DETAIL DESIGN LAMINATE	DSB		2/4/05
B	PRODUCTION LAMINATE	DSB		9/12/05

HP SKIN - AFT PANEL BALSA



AFT PANEL BALSA - HP SKIN:

- APPLY 1/4" BALSA TO THE AREA SHOWN ABOVE
- USE THE HP TE BALSA TEMPLATE TO CUT THE SHAPE
- BUTT THE FRONT EDGE ALONG THE REAR EDGE OF THE TRIAX SPAR CAP
- THE BALSA SHOULD BUTT UP AGAINST THE ROOT PLIES
- THE BALSA SHOULD STOP 63.5MM (2.5 INCHES) FROM THE OUTBOARD TE
- THE BALSA SHOULD TERMINATE 450MM FROM THE TIP
- ADD A LAYER OF DBM-1708 TO THE TIP OUTBAORD OF THE END OF THE BALSA

NO.	PART NO.	DESCRIPTION		QTY
2	46262	GLASS, BIAXIAL, DBM-1708	(LB)	AR
1	46015	BALSA, 1/4"	(SF)	22

PARTS LIST

tpi COMPOSITES INC.
RT. 136 MARKET ST. WARREN, R.I. 02885-0328
TEL. (401) 245-1200 FAX (401) 245-3160

.X	.XX	.XXX	ANGLES
±10	±10	±10	±5°

UNLESS OTHERWISE SPECIFIED:
MACHINED SURFACE FINISHES 125
MACHINED FILLET RADII .015-.030

ALL DIMENSIONS IN mm

THIRD ANGLE

THIS DOCUMENT IS THE PROPERTY OF T.P.I. AND IS NOT TO BE USED OR REPRODUCED IN WHOLE OR IN PART WITHOUT WRITTEN PERMISSION.

PROJECT: BSDS PHASE II

TITLE: HP SKIN LAMINATE SCHEDULE

SIZE: A | DWG NO.: SNL-009M-01-BSDS-L0 | REV: B

TPI PART #: BSDS II | DR BY: DSB | CHK'D BY: | APP'D BY:

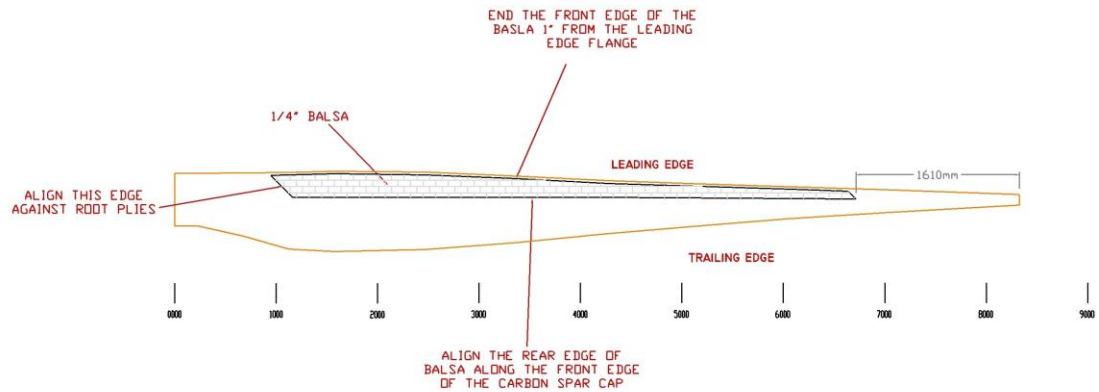
FILE: Lam_BSDSII_HP | DATE: 2/4/05 | SCALE: NONE | SHT: 1 OF 1

DWG NO. SNL-009M-01-BSDS-L0

DWG NO. SNL-009M-01-BSDS-L0

REVISIONS				
REV	DESCRIPTION	BY	APPR.	DATE
A	DETAIL DESIGN LAMINATE	DSB		2/4/05
B	PRODUCTION LAMINATE	DSB		9/12/05

HP SKIN - FORWARD PANEL BALSA



FORWARD PANEL BALSA - HP SKIN:

- APPLY 1/4" BALSA TO THE AREA SHOWN ABOVE
- USE THE HP LE BALSA TEMPLATE FOR THE BALSA SHAPE
- BUTT THE REAR EDGE OF THE BALSA ALONG THE VERY FRONT EDGE OF THE SPAR CAP
- THE BALSA SHOULD BUTT UP AGAINST THE ROOT PLIES
- THE BALSA SHOULD TERMINATE 1610MM FROM THE TIP
- THE FRONT EDGE OF THE BALSA SHOULD STOP 1" FROM THE LE FLANGE

NO.	PART NO.	DESCRIPTION		QTY
1	46015	BALSA, 1/4"	(SF)	22

PARTS LIST

tpi COMPOSITES INC.
RT. 136 MARKET ST. WARREN, R.I. 02885-0328
TEL. (401) 245-1200 FAX (401) 245-3160

.X	.XX	.XXX	ANGLES
±10	±10	±10	±5°

UNLESS OTHERWISE SPECIFIED:
MACHINED SURFACE FINISHES 125√
MACHINED FILLET RADII .015-.030

ALL DIMENSIONS IN mm

THIRD ANGLE

THIS DOCUMENT IS THE PROPERTY OF T.P.I. AND IS NOT TO BE USED OR REPRODUCED IN WHOLE OR IN PART WITHOUT WRITTEN PERMISSION.

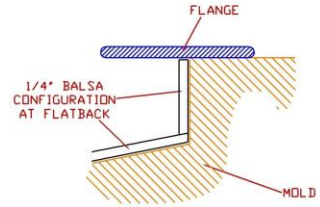
PROJECT: BSDS PHASE II
TITLE: HP SKIN LAMINATE SCHEDULE
SIZE: A
DWG NO.: SNL-009M-01-BSDS-L0
REV: B
TPI PART #: BSDS II
DR BY: DSB
CHK'D BY:
APP'D BY:
FILE: Lam_BSDSII_HP
DATE: 2/4/05
SCALE: NONE
SHT: 1 OF 1

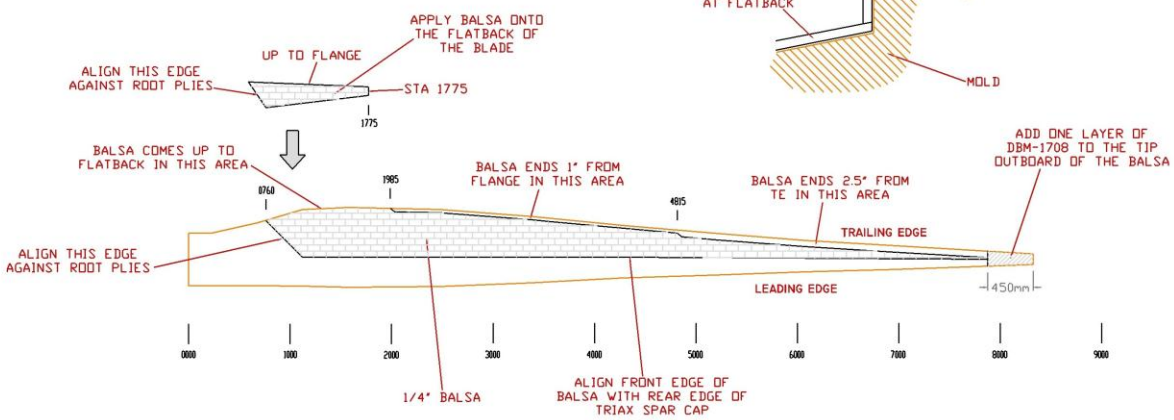
DWG NO. SNL-009M-01-BSDS-L0

DWG NO. SNL-009M-01-BSDS-L0

REVISIONS				
REV	DESCRIPTION	BY	APPR.	DATE
A	DETAIL DESIGN LAMINATE	DSB		2/4/05
B	PRODUCTION LAMINATE	DSB		9/12/05

LP SKIN - AFT PANEL BALSA





AFT PANEL BALSA - LP SKIN:

- APPLY 1/4" BALSA TO THE AREA SHOWN ABOVE
- USE THE LP TE BALSA TEMPLATE TO CUT THE SHAPE
- BUTT THE FRONT EDGE ALONG THE REAR EDGE OF THE TRIAX SPAR CAP
- THE BALSA SHOULD BUTT UP AGAINST THE ROOT PLIES
- THE BALSA SHOULD STOP 63.5MM (2.5 INCHES) FROM THE OUTBOARD TE
- THE BALSA SHOULD TERMINATE 450MM FROM THE TIP
- ADD A LAYER OF DBM-1708 TO THE TIP OUTBAORD OF THE END OF THE BALSA

NO.	PART NO.	DESCRIPTION		QTY
2	46262	GLASS, BIAXIAL, DBM-1708	(LB)	AR
1	46015	BALSA, 1/4"	(SF)	22

PARTS LIST

TPI COMPOSITES INC.
RT. 136 MARKET ST. WARREN, R.I. 02885-0328
TEL. (401) 245-1200 FAX (401) 245-3160

.X	.XX	.XXX	ANGLES
±10	±10	±10	±5°

UNLESS OTHERWISE SPECIFIED:
MACHINED SURFACE FINISHES 125√
MACHINED FILLET RADII .015-.030

ALL DIMENSIONS IN mm

THIRD ANGLE

THIS DOCUMENT IS THE PROPERTY OF T.P.I. AND IS NOT TO BE USED OR REPRODUCED IN WHOLE OR IN PART WITHOUT WRITTEN PERMISSION.

PROJECT: BSDS PHASE II

TITLE: HP SKIN LAMINATE SCHEDULE

SIZE: A | DWG NO.: SNL-009M-01-BSDS-L0 | REV: B

TPI PART #: BSDS II | DR BY: DSB | CHK'D BY: | APP'D BY:

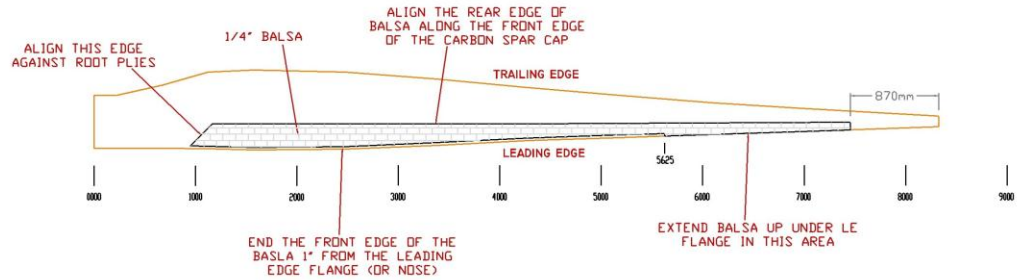
FILE: Lam_BSDSII_HP | DATE: 2/4/05 | SCALE: NONE | SHT: 1 OF 1

DWG NO. SNL-009M-01-BSDS-L0

DWG NO. SNL-009M-01-BSDS-L0

REVISIONS				
REV	DESCRIPTION	BY	APPR.	DATE
A	DETAIL DESIGN LAMINATE	DSB		2/4/05
B	PRODUCTION LAMINATE	DSB		9/12/05

LP SKIN - FORWARD PANEL BALSA



FORWARD PANEL BALSA - LP SKIN:

- APPLY 1/4" BALSA TO THE AREA SHOWN ABOVE
- USE THE LP LE BALSA TEMPLATE FOR THE BALSA SHAPE
- BUTT THE REAR EDGE OF THE BALSA ALONG THE VERY FRONT EDGE OF THE SPAR CAP
- THE BALSA SHOULD BUTT UP AGAINST THE ROOT PLIES
- THE BALSA SHOULD TERMINATE 870MM FROM THE TIP
- THE FRONT EDGE OF THE BALSA SHOULD STOP 1" FROM THE LE FLANGE UP UNTIL STA 5625
- AFTER STA 5625, THE BLASA SHOULD EXTEND UNDERNEATH THE LE FLANGE

NO.	PART NO.	DESCRIPTION		QTY
1	46015	BALSA, 1/4"	(SF)	22

PARTS LIST

tpi COMPOSITES INC.
RT. 136 MARKET ST. WARREN, R.I. 02885-0328
TEL. (401) 245-1200 FAX (401) 245-3160

.X	.XX	.XXX	ANGLES
±10	±10	±10	±5°

UNLESS OTHERWISE SPECIFIED:
MACHINED SURFACE FINISHES 125√
MACHINED FILLET RADII .015-.030

ALL DIMENSIONS IN mm

THIRD ANGLE

THIS DOCUMENT IS THE PROPERTY OF T.P.I. AND IS NOT TO BE USED OR REPRODUCED IN WHOLE OR IN PART WITHOUT WRITTEN PERMISSION.

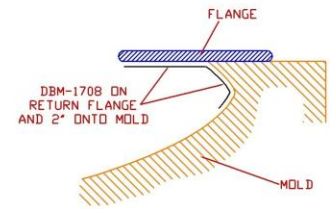
PROJECT: BSDS PHASE II
TITLE: HP SKIN LAMINATE SCHEDULE
SIZE: A | DWG NO.: SNL-009M-01-BSDS-L0 | REV: B
TPI PART #: BSDS II | DR BY: DSB | CHK'D BY: | APP'D BY:
FILE: Lam_BSDSII_HP | DATE: 2/4/05 | SCALE: NONE | SHT: 1 OF 1

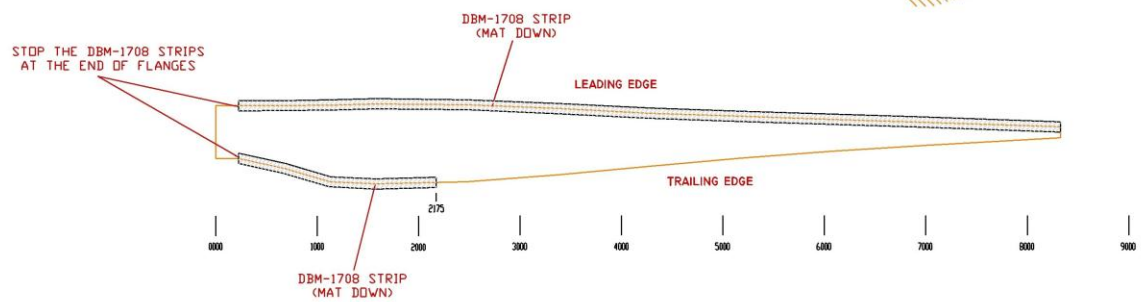
DWG NO. SNL-009M-01-BSDS-L0

DWG NO. SNL-009M-01-BSDS-L0

REVISIONS				
REV	DESCRIPTION	BY	APPR.	DATE
A	DETAIL DESIGN LAMINATE	DSB		2/4/05
B	PRODUCTION LAMINATE	DSB		9/12/05

HP SKIN - FLANGE REINFORCEMENT





FLANGE REINFORCEMENT - HP SKIN:

- APPLY STRIPS OF DBM-1708 TO THE LE AND TE FLANGES AS SHOWN ABOVE
- THE STRIPS SHOULD EXTEND 2" DOWN ONTO THE BLADE
- THE STRIPS SHOULD COVER THE ENTIRE WIDTH OF THE FLANGE

NO.	PART NO.	DESCRIPTION	QTY
1	46262	GLASS, BIAXIAL, DBM-1708 (LB)	11

PARTS LIST

TPI COMPOSITES INC.
RT. 136 MARKET ST. WARREN, R.I. 02885-0328
TEL. (401) 245-1200 FAX (401) 245-3160

.X	.XX	.XXX	ANGLES
±10	±10	±10	±5°

UNLESS OTHERWISE SPECIFIED:
MACHINED SURFACE FINISHES 125√
MACHINED FILLET RADII .015-.030

ALL DIMENSIONS IN mm

THIRD ANGLE

THIS DOCUMENT IS THE PROPERTY OF T.P.I. AND IS NOT TO BE USED OR REPRODUCED IN WHOLE OR IN PART WITHOUT WRITTEN PERMISSION.

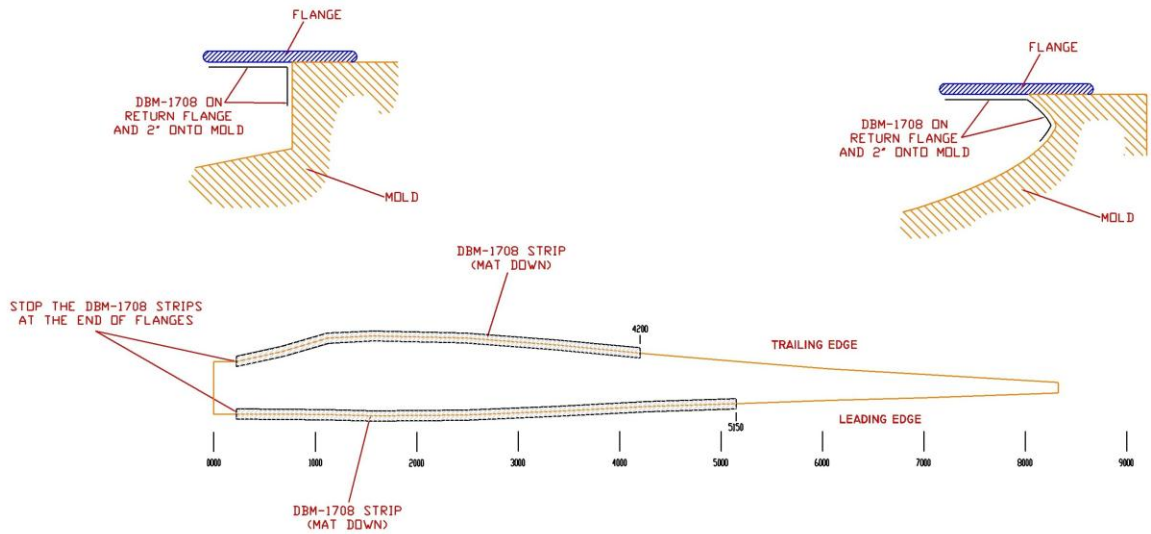
PROJECT: BSDS PHASE II
TITLE: HP SKIN LAMINATE SCHEDULE
SIZE: A | DWG NO.: SNL-009M-01-BSDS-L0 | REV: B
TPI PART #: BSDS II | DR BY: DSB | CHK'D BY: | APP'D BY:
FILE: Lam_BSDSII_HP | DATE: 2/4/05 | SCALE: NONE | SHT: 1 OF 1

DWG NO. SNL-009M-01-BSDS-L0

DWG NO. SNL-009M-01-BSDS-L0

REVISIONS				
REV	DESCRIPTION	BY	APPR.	DATE
A	DETAIL DESIGN LAMINATE	DSB		2/4/05
B	PRODUCTION LAMINATE	DSB		9/12/05

LP SKIN - FLANGE REINFORCEMENT



FLANGE REINFORCEMENT - LP SKIN:

- APPLY STRIPS OF DBM-1708 TO THE LE AND TE FLANGES AS SHOWN ABOVE
- THE STRIPS SHOULD EXTEND 2" DOWN ONTO THE BLADE
- THE STRIPS SHOULD COVER THE ENTIRE WIDTH OF THE FLANGE

NO.	PART NO.	DESCRIPTION	QTY
1	46262	GLASS, BIAXIAL, DBM-1708 (LB)	11

PARTS LIST

TPI COMPOSITES INC.
RT. 136 MARKET ST. WARREN, R.I. 02885-0328
TEL. (401) 245-1200 FAX (401) 245-3160

.X	.XX	.XXX	ANGLES
±10	±10	±10	±5°

UNLESS OTHERWISE SPECIFIED:
MACHINED SURFACE FINISHES 125√
MACHINED FILLET RADII .015-.030

ALL DIMENSIONS IN mm

THIRD ANGLE

THIS DOCUMENT IS THE PROPERTY OF T.P.I. AND IS NOT TO BE USED OR REPRODUCED IN WHOLE OR IN PART WITHOUT WRITTEN PERMISSION.

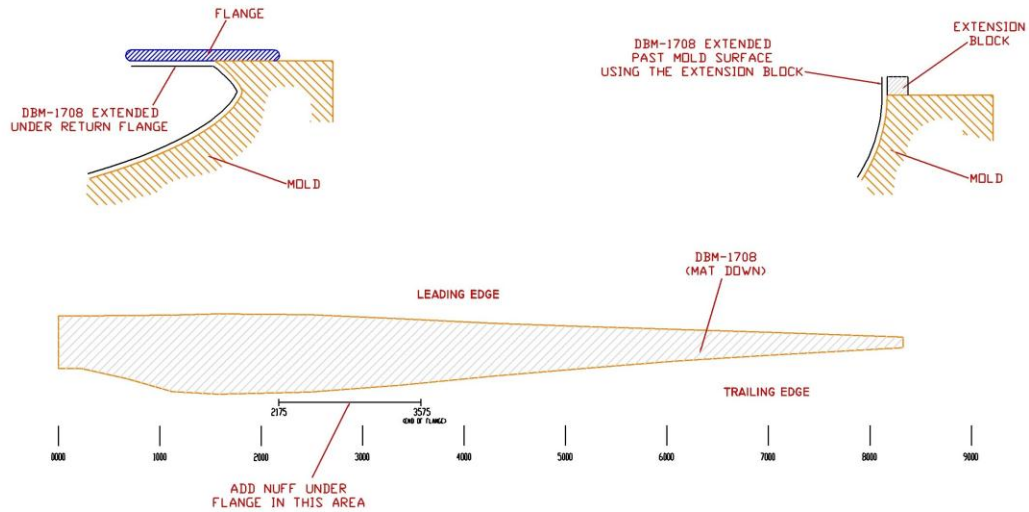
PROJECT: BSDS PHASE II
TITLE: HP SKIN LAMINATE SCHEDULE
SIZE: A | DWG NO.: SNL-009M-01-BSDS-L0 | REV: B
TPI PART #: BSDS II | DR BY: DSB | CHK'D BY: | APP'D BY:
FILE: Lam_BSDSII_HP | DATE: 2/4/05 | SCALE: NONE | SHT: 1 OF 1

DWG NO. SNL-009M-01-BSDS-L0

DWG NO. SNL-009M-01-BSDS-L0

REVISIONS				
REV	DESCRIPTION	BY	APPR.	DATE
A	DETAIL DESIGN LAMINATE	DSB		2/4/05
B	PRODUCTION LAMINATE	DSB		9/12/05

HP SKIN - LAYER #40



LAYER 40 - HP SKIN:

- APPLY DBM-1708 TO THE ENTIRE SURFACE OF THE MOLD - PLACE MAT DOWN
- BRING THE GLASS UP UNDER THE RETURN FLANGES IN ALL LOCATIONS
- BRING GLASS ABOUT 25MM PAST THE MOLD SURFACE IN THE ROOT AREA - USE THE MOLD EXTENSION BLOCKS
- ADD NUFF UNDER THE FLANGES IN THE AREAS SHOWN

NO.	PART NO.	DESCRIPTION	QTY
1	46262	GLASS, BIAXIAL, DBM-1708 (LB)	11

PARTS LIST

TPI COMPOSITES INC.
RT. 136 MARKET ST. WARREN, R.I. 02885-0328
TEL. (401) 245-1200 FAX (401) 245-3160

.X	.XX	.XXX	ANGLES
±10	±10	±10	±5°

UNLESS OTHERWISE SPECIFIED:
MACHINED SURFACE FINISHES 125√
MACHINED FILLET RADII .015-.030

ALL DIMENSIONS IN mm

THIRD ANGLE

THIS DOCUMENT IS THE PROPERTY OF T.P.I. AND IS NOT TO BE USED OR REPRODUCED IN WHOLE OR IN PART WITHOUT WRITTEN PERMISSION.

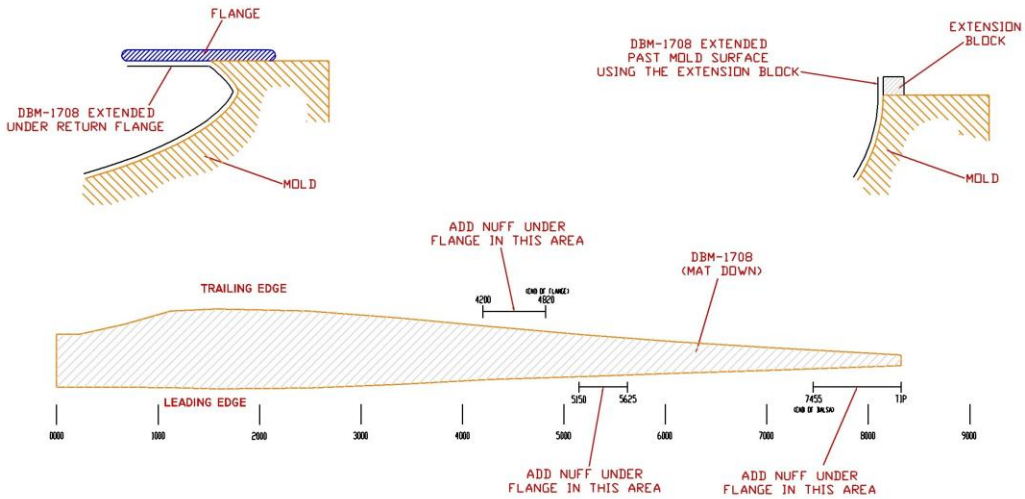
PROJECT: BSDS PHASE II
TITLE: HP SKIN LAMINATE SCHEDULE
SIZE: A
DWG NO.: SNL-009M-01-BSDS-L0
REV: B
TPI PART #: BSDS II
DR BY: DSB
CHK'D BY:
APP'D BY:
FILE: Lam_BSDSII_HP
DATE: 2/4/05
SCALE: NONE
SHT: 1 OF 1

DWG NO. SNL-009M-01-BSDS-L0

DWG NO. SNL-009M-01-BSDS-L0

REVISIONS				
REV	DESCRIPTION	BY	APPR.	DATE
A	DETAIL DESIGN LAMINATE	DSB		2/4/05
B	PRODUCTION LAMINATE	DSB		9/12/05

LP SKIN - LAYER #40



LAYER 40 - LP SKIN:

- APPLY DBM-1708 TO THE ENTIRE SURFACE OF THE MOLD - PLACE MAT DOWN
- BRING THE GLASS UP UNDER THE RETURN FLANGES IN ALL LOCATIONS
- BRING GLASS ABOUT 25MM PAST THE MOLD SURFACE IN THE ROOT AREA - USE THE MOLD EXTENSION BLOCKS
- ADD NUFF UNDER THE FLANGES IN THE AREAS SHOWN

NO.	PART NO.	DESCRIPTION	QTY
1	46262	GLASS, BIAXIAL, DBM-1708 (LB)	11

PARTS LIST

TPI COMPOSITES INC.
RT. 136 MARKET ST. WARREN, R.I. 02885-0328
TEL. (401) 245-1200 FAX (401) 245-3160

.X	.XX	.XXX	ANGLES
±10	±10	±10	±5°

ALL DIMENSIONS IN mm

UNLESS OTHERWISE SPECIFIED:
MACHINED SURFACE FINISHES 125√
MACHINED FILLET RADII .015-.030
THIRD ANGLE

THIS DOCUMENT IS THE PROPERTY OF T.P.I. AND IS NOT TO BE USED OR REPRODUCED IN WHOLE OR IN PART WITHOUT WRITTEN PERMISSION.

PROJECT: BSDS PHASE II
TITLE: HP SKIN LAMINATE SCHEDULE
SIZE: A | DWG NO.: SNL-009M-01-BSDS-L0 | REV: B
TPI PART #: BSDS II | DR BY: DSB | CHK'D BY: | APP'D BY:
FILE: Lam_BSDSII_HP | DATE: 2/4/05 | SCALE: NONE | SHT: 1 OF 1

DWG NO. SNL-009M-01-BSDS-L0

APPENDIX C: BSDS LAYUP DRAWINGS -- SHEAR WEB

DWG NO. SNL-009M-01-BSDS-L0

REVISIONS				
REV	DESCRIPTION	BY	APPR.	DATE
A	DETAIL DESIGN LAMINATE	DSB		2/4/05
B	PRODUCTION LAMINATE	DSB		9/13/05

BSDS PHASE II
8.325 METER WINDBLADE

LAMINATE SCHEDULE
SHEAR WEB
REV B

NOTE: ALL DIMENSIONS HAVE A TOLERANCE OF ±10MM

NO.	PART NO.	DESCRIPTION	QTY

PARTS LIST

TPI COMPOSITES INC.
RT. 136 MARKET ST. WARREN, R.I. 02885-0328
TEL. (401) 245-1200 FAX (401) 245-3160

.X	.XX	.XXX	ANGLES
±10	±10	±10	±5°

UNLESS OTHERWISE SPECIFIED:
MACHINED SURFACE FINISHES 125√
MACHINED FILLET RADII .015-.030

ALL DIMENSIONS IN mm

THIRD ANGLE

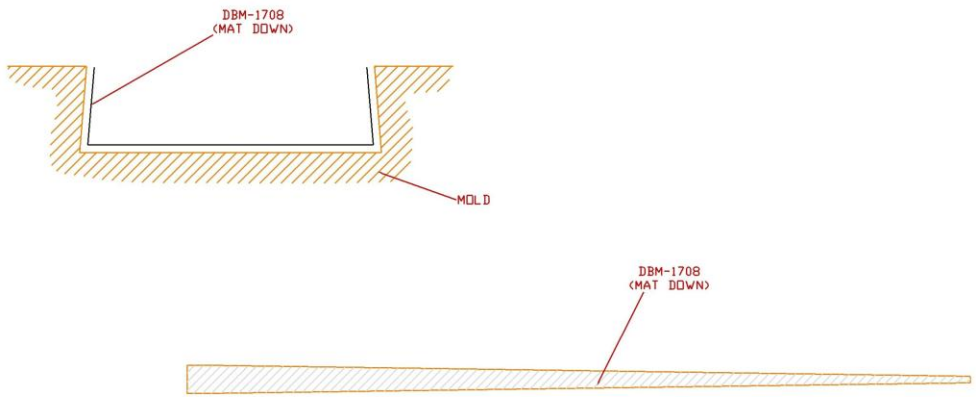
THIS DOCUMENT IS THE PROPERTY OF T.P.I. AND IS NOT TO BE USED OR REPRODUCED IN WHOLE OR IN PART WITHOUT WRITTEN PERMISSION.

PROJECT: BSDS PHASE II
TITLE: SHEAR WEB LAMINATE SCHEDULE
SIZE: A
DWG NO.: SNL-009M-01-BSDS-L0
REV: B
TPI PART #: BSDS II
DR BY: DSB
CHK'D BY:
APP'D BY:
FILE: Lam_BSDSII_SW
DATE: 2/4/05
SCALE: NONE
SHT: 1 OF 1

DWG NO. SNL-009M-01-BSDS-L0

DWG NO. SNL-009M-01-BSDS-L0

REVISIONS				
REV	DESCRIPTION	BY	APPR.	DATE
A	DETAIL DESIGN LAMINATE	DSB		2/4/05
B	PRODUCTION LAMINATE	DSB		9/13/05



LAYER I:

- APPLY DBM-1708 TO THE ENTIRE MOLD SURFACE
- THE 1708 SHOULD BE PLACED MAT DOWN

NO.	PART NO.	DESCRIPTION	QTY
1	46262	GLASS, BIAXIAL, DBM-1708 (LB)	AR

PARTS LIST

tpi COMPOSITES INC.
RT. 136 MARKET ST. WARREN, R.I. 02885-0328
TEL. (401) 245-1200 FAX (401) 245-3160

.X	.XX	.XXX	ANGLES
±10	±10	±10	±5°

UNLESS OTHERWISE SPECIFIED:
MACHINED SURFACE FINISHES 125√
MACHINED FILLET RADII .015-.030

ALL DIMENSIONS IN mm

THIRD ANGLE

THIS DOCUMENT IS THE PROPERTY OF T.P.I. AND IS NOT TO BE USED OR REPRODUCED IN WHOLE OR IN PART WITHOUT WRITTEN PERMISSION.

PROJECT: BSDS PHASE II

TITLE: SHEAR WEB LAMINATE SCHEDULE

SIZE: A | DWG NO.: SNL-009M-01-BSDS-L0 | REV: B

TPI PART #: BSDS II | DR BY: DSB | CHK'D BY: | APP'D BY:

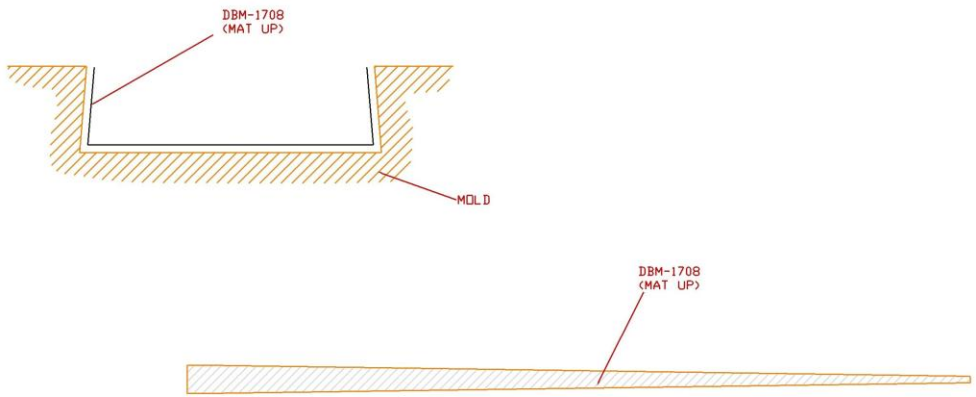
FILE: Lam_BSDSII_SW | DATE: 2/4/05 | SCALE: NONE | SHT: 1 OF 1

DWG NO. SNL-009M-01-BSDS-L0

DWG NO. SNL-009M-01-BSDS-L0

REVISIONS

REV	DESCRIPTION	BY	APPR.	DATE
A	DETAIL DESIGN LAMINATE	DSB		2/4/05
B	PRODUCTION LAMINATE	DSB		9/13/05



LAYER 2:

- APPLY DBM-1708 TO THE ENTIRE MOLD SURFACE
- THE 1708 SHOULD BE PLACED MAT UP

NO.	PART NO.	DESCRIPTION		QTY
1	46262	GLASS, BIAXIAL, DBM-1708	(LB)	AR

PARTS LIST

tpi COMPOSITES INC.
RT. 136 MARKET ST. WARREN, R.I. 02885-0328
TEL. (401) 245-1200 FAX (401) 245-3160

.X	.XX	.XXX	ANGLES
±10	±10	±10	±5°

UNLESS OTHERWISE SPECIFIED:
MACHINED SURFACE FINISHES 125√
MACHINED FILLET RADII .015-.030

ALL DIMENSIONS IN mm

THIRD ANGLE

THIS DOCUMENT IS THE PROPERTY OF T.P.I. AND IS NOT TO BE USED OR REPRODUCED IN WHOLE OR IN PART WITHOUT WRITTEN PERMISSION.

PROJECT: BSDS PHASE II

TITLE: SHEAR WEB LAMINATE SCHEDULE

SIZE: A | DWG NO.: SNL-009M-01-BSDS-L0 | REV: B

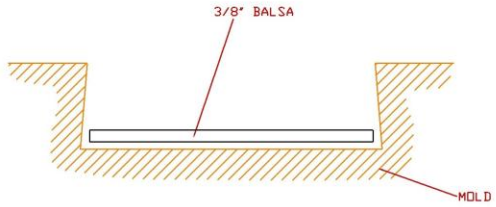
TPI PART #: BSDS II | DR BY: DSB | CHK'D BY: | APP'D BY:

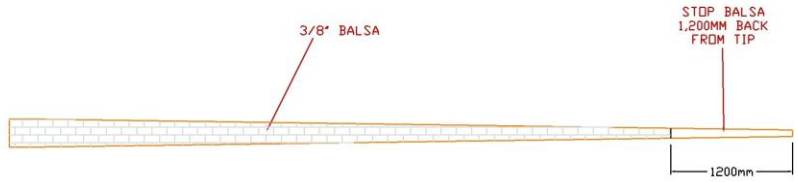
FILE: Lam_BSDSII_SW | DATE: 2/4/05 | SCALE: NONE | SHT: 1 OF 1

DWG NO. SNL-009M-01-BSDS-L0

DWG NO. SNL-009M-01-BSDS-L0

REVISIONS				
REV	DESCRIPTION	BY	APPR.	DATE
A	DETAIL DESIGN LAMINATE	DSB		2/4/05
B	PRODUCTION LAMINATE	DSB		9/13/05





LAYER 3:

- APPLY 3/8" BLASA TO THE WEB (NOT THE FLANGES) AS SHOWN ABOVE
- DO NOT PUT BALSA IN LAST 1,200MM OF WEB

NO.	PART NO.	DESCRIPTION	QTY
1	47057	BALSA, 3/8" (SF)	AR

PARTS LIST

TPI COMPOSITES INC.
RT. 136 MARKET ST. WARREN, R.I. 02885-0328
TEL. (401) 245-1200 FAX (401) 245-3160

.X	.XX	.XXX	ANGLES
±10	±10	±10	±5°

UNLESS OTHERWISE SPECIFIED:
MACHINED SURFACE FINISHES 125√
MACHINED FILLET RADII .015-.030

ALL DIMENSIONS IN mm

THIRD ANGLE

THIS DOCUMENT IS THE PROPERTY OF T.P.I. AND IS NOT TO BE USED OR REPRODUCED IN WHOLE OR IN PART WITHOUT WRITTEN PERMISSION.

PROJECT: BSDS PHASE II

TITLE: SHEAR WEB LAMINATE SCHEDULE

SIZE: A | DWG NO.: SNL-009M-01-BSDS-L0 | REV: B

TPI PART #: BSDS II | DR BY: DSB | CHK'D BY: | APP'D BY:

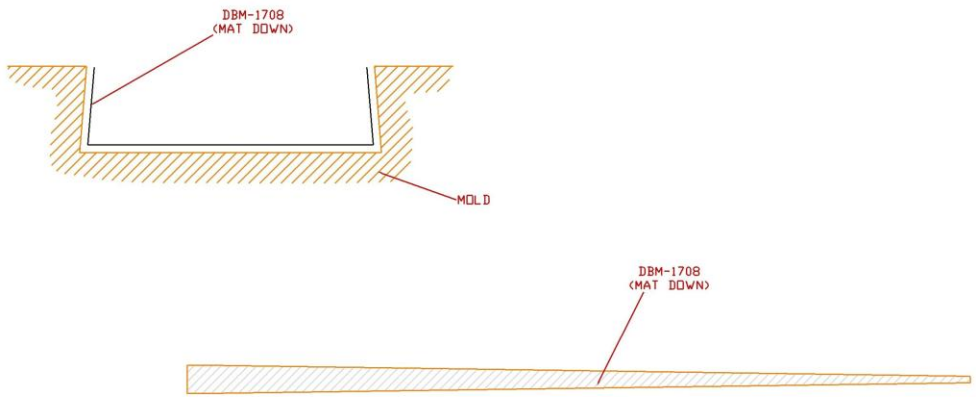
FILE: Lam_BSDSII_SW | DATE: 2/4/05 | SCALE: NONE | SHT: 1 OF 1

DWG NO. SNL-009M-01-BSDS-L0

DWG NO. SNL-009M-01-BSDS-L0

REVISIONS

REV	DESCRIPTION	BY	APPR.	DATE
A	DETAIL DESIGN LAMINATE	DSB		2/4/05
B	PRODUCTION LAMINATE	DSB		9/13/05



LAYER 4:

- APPLY DBM-1708 TO THE ENTIRE MOLD SURFACE
- THE 1708 SHOULD BE PLACED MAT DOWN

NO.	PART NO.	DESCRIPTION	QTY
1	46262	GLASS, BIAXIAL, DBM-1708 (LB)	AR

PARTS LIST

tpi COMPOSITES INC.
RT. 136 MARKET ST. WARREN, R.I. 02885-0328
TEL. (401) 245-1200 FAX (401) 245-3160

.X	.XX	.XXX	ANGLES
±10	±10	±10	±5°

UNLESS OTHERWISE SPECIFIED:
MACHINED SURFACE FINISHES 125√
MACHINED FILLET RADII .015-.030

ALL DIMENSIONS IN mm

THIRD ANGLE

THIS DOCUMENT IS THE PROPERTY OF T.P.I. AND IS NOT TO BE USED OR REPRODUCED IN WHOLE OR IN PART WITHOUT WRITTEN PERMISSION.

PROJECT: BSDS PHASE II

TITLE: SHEAR WEB LAMINATE SCHEDULE

SIZE: A | DWG NO.: SNL-009M-01-BSDS-L0 | REV: B

TPI PART #: BSDS II | DR BY: DSB | CHK'D BY: | APP'D BY:

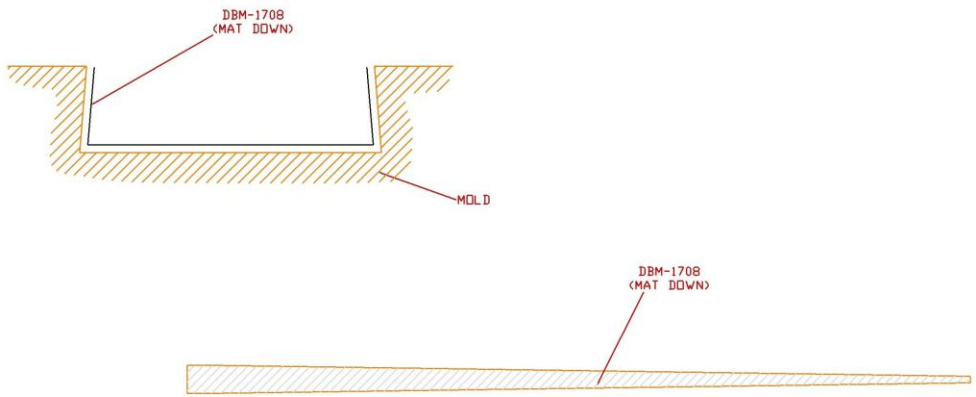
FILE: Lam_BSDSII_SW | DATE: 2/4/05 | SCALE: NONE | SHT: 1 OF 1

DWG NO. SNL-009M-01-BSDS-L0

DWG NO. SNL-009M-01-BSDS-L0

REVISIONS

REV	DESCRIPTION	BY	APPR.	DATE
A	DETAIL DESIGN LAMINATE	DSB		2/4/05
B	PRODUCTION LAMINATE	DSB		9/13/05



LAYER 5:

- APPLY DBM-1708 TO THE ENTIRE MOLD SURFACE
- THE 1708 SHOULD BE PLACED MAT DOWN

NO.	PART NO.	DESCRIPTION	QTY
1	46262	GLASS, BIAXIAL, DBM-1708 (LB)	AR

PARTS LIST

TPI COMPOSITES INC.
RT. 136 MARKET ST. WARREN, R.I. 02885-0328
TEL. (401) 245-1200 FAX (401) 245-3160

.X	.XX	.XXX	ANGLES
±10	±10	±10	±5°

UNLESS OTHERWISE SPECIFIED:
MACHINED SURFACE FINISHES 125√
MACHINED FILLET RADII .015-.030

ALL DIMENSIONS IN mm

THIRD ANGLE

THIS DOCUMENT IS THE PROPERTY OF T.P.I. AND IS NOT TO BE USED OR REPRODUCED IN WHOLE OR IN PART WITHOUT WRITTEN PERMISSION.

PROJECT: BSDS PHASE II

TITLE: SHEAR WEB LAMINATE SCHEDULE

SIZE: A | DWG NO.: SNL-009M-01-BSDS-L0 | REV: B

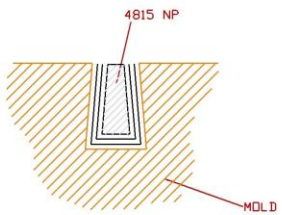
TPI PART #: BSDS II | DR BY: DSB | CHK'D BY: | APP'D BY:

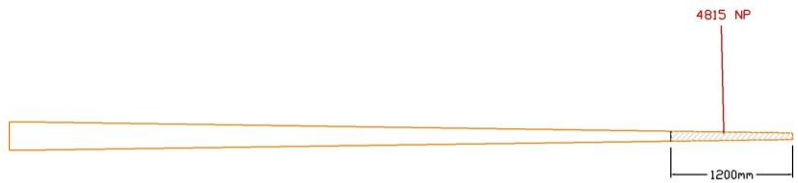
FILE: Lam_BSDSII_SW | DATE: 2/4/05 | SCALE: NONE | SHT: 1 OF 1

DWG NO. SNL-009M-01-BSDS-L0

DWG NO. SNL-009M-01-BSDS-L0

REVISIONS				
REV	DESCRIPTION	BY	APPR.	DATE
A	DETAIL DESIGN LAMINATE	DSB		2/4/05
B	PRODUCTION LAMINATE	DSB		9/13/05





LAYER 6:

- APPLY 4815 NEEDLE PUNCH TO THE LAST 1,200MM OF THE WEB

NO.	PART NO.	DESCRIPTION	QTY
1	?	GLASS, 4815 NEEDLE PUNCH (LB)	AR

PARTS LIST

tpi COMPOSITES INC.
RT. 136 MARKET ST. WARREN, R.I. 02885-0328
TEL. (401) 245-1200 FAX (401) 245-3160

.X	.XX	.XXX	ANGLES
±10	±10	±10	±5°

UNLESS OTHERWISE SPECIFIED:
MACHINED SURFACE FINISHES 125√
MACHINED FILLET RADII .015-.030

ALL DIMENSIONS IN mm

THIRD ANGLE

THIS DOCUMENT IS THE PROPERTY OF T.P.I. AND IS NOT TO BE USED OR REPRODUCED IN WHOLE OR IN PART WITHOUT WRITTEN PERMISSION.

PROJECT: BSDS PHASE II
TITLE: SHEAR WEB LAMINATE SCHEDULE
SIZE: A
DWG NO.: SNL-009M-01-BSDS-L0
REV: B
TPI PART #: BSDS II
DR BY: DSB
CHK'D BY:
APP'D BY:
FILE: Lam_BSDSII_SW
DATE: 2/4/05
SCALE: NONE
SHT: 1 OF 1

DWG NO. SNL-009M-01-BSDS-L0

DISTRIBUTION

1	MS0899	Technical Library	9536 (electronic copy)

Sandia National Laboratories