INSTITUTE OF INTERNATIONAL CONTAINER LESSORS

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Floorboard Quality Assurance Program

IICL TB 006 was prepared under the supervision of a sub-committee chaired by representatives from IICL member companies:

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Floorboard Quality Assurance Programme

INTRODUCTION

This procedure provides guidance for the quality assurance auditing of plywood mills that supply container flooring. The procedure focuses on the steps in the plywood manufacturing process that are most critical to the production of high quality container flooring. Although there are variations in production processes among plywood mills, the critical manufacturing process steps addressed in this procedure are common to all plywood manufacturing, and the control of these processes is the key to producing a quality product.

Page 2 illustrates a generic plywood manufacturing process flow chart that is divided into three main sections: Green End, Dry End and Quality Control.

Each of these sections is further divided into its major manufacturing steps. The process steps that are most critical to the quality of the final product are shaded in the flow charts.

Each critical process step is then listed with a series of quality checks that the mill operator should be doing to ensure the control of that step. As the manual is general in scope, very few specific numeric quality control standards are listed. The auditor should expect that the mill operator can knowledgably address each quality check listed, have an internal standard for each, and an ongoing procedure to confirm and record that the standards are being met.

In the reference section of the manual, "Key Process Parameters to Produce Quality Plywood" summarizes the critical process steps and gives many typical values to help the auditor judge the reasonableness of the operator's standards. In addition, there are forms to aid the auditor in recording certain key process parameters. At the end of the manual is a checklist to guide the auditor through the auditing process.

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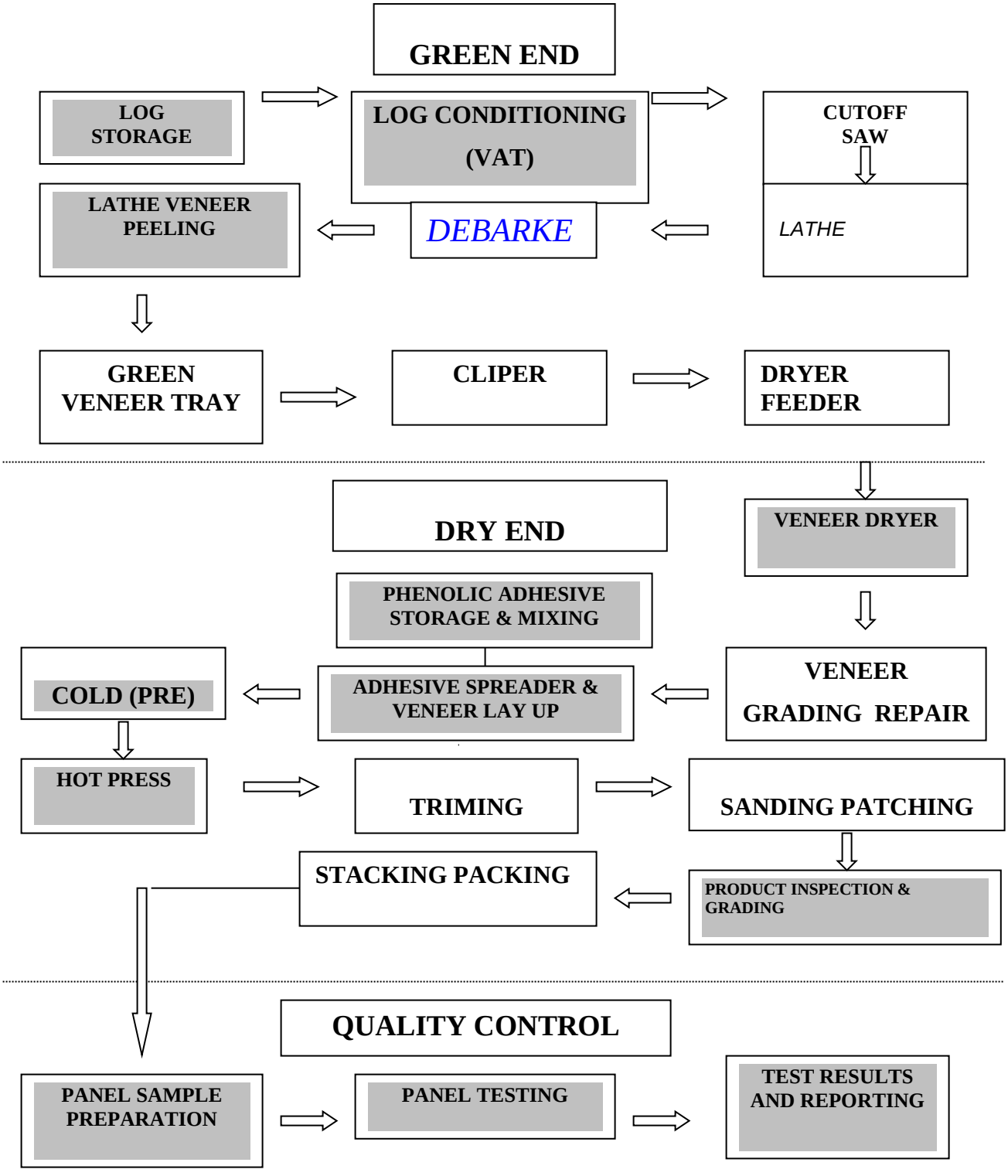
PLY MANUFACTURING PROCESS FLOW CHART



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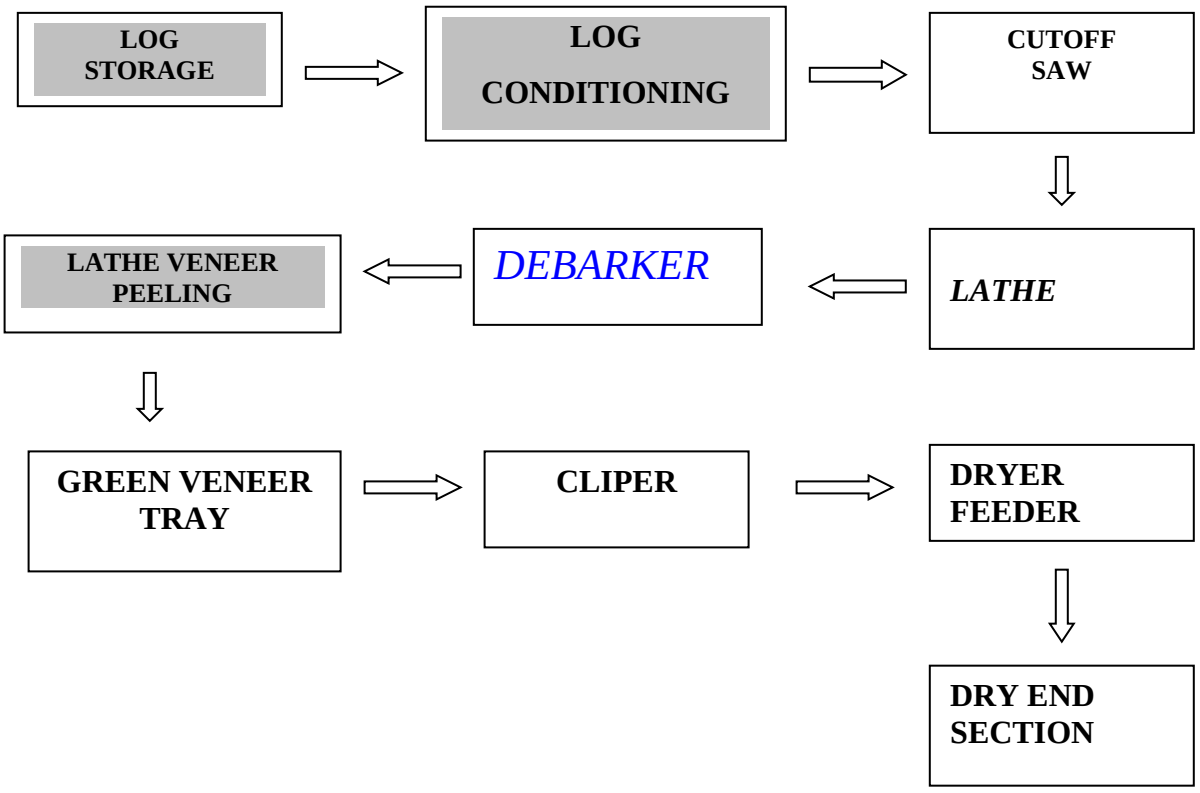
GREEN END



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FACTORY VIRTUAL AUDIT

IICL CONTAINER PLYWOOD FLOORING FACTORY AUDIT

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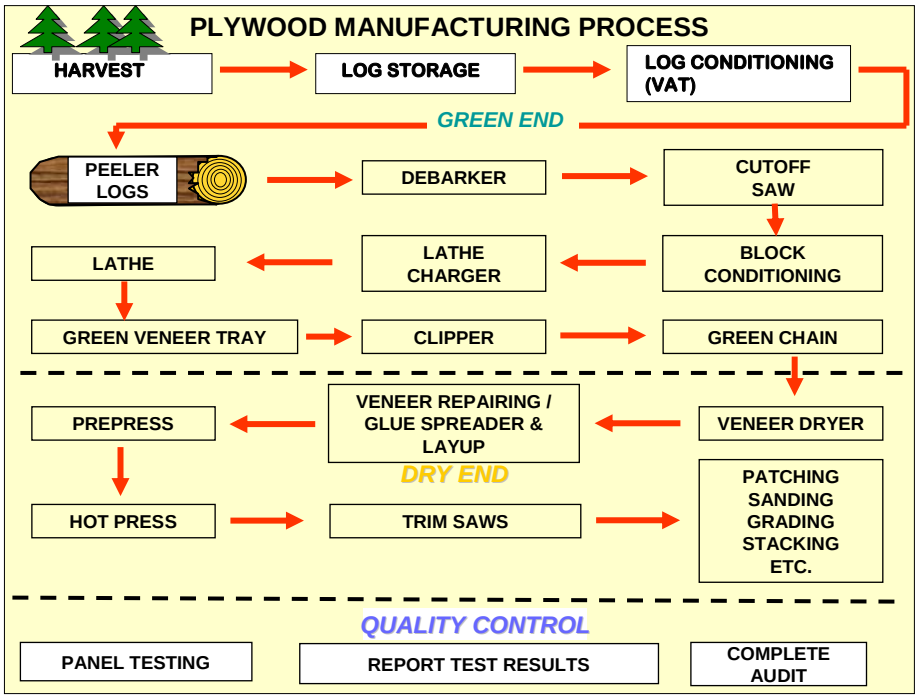

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Log Storage

• Are logs being sprayed to maintain moisture and quality and protect from infestation?
• Are identification tags used to show species, country of origin, etc.?

Log Storage

• Are end seals used to prevent splits?

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Log Storage

• Are any other methods used to protect the wood from damage or infestation?

Log Storage

• Does Manufacturer check moisture content of logs and record species, diameter, and moisture?

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Log Conditioning

- What is vat temperature?
- Are different species separated in different vats?

Veneer Peeling

- Are logs inspected prior to peeling?
- Are wood species, moisture content, and log age being recorded?
- What are allowable veneer thickness tolerances?
- Are these tolerances being achieved?

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Veneers After Peeling

• What is the condition of veneers after peeling? Are wane or fish tails present?

Veneer Grading

• Is moisture content measured after the drying oven?
• What is the acceptable moisture content for the species?
• Is veneer thickness checked?
• Is veneer wavy, flat, wrinkled, or split?
• Are veneers free of dry natural wood resins?

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Veneer Grading

• Are veneers graded properly for faces, cross bands, and core?

Veneer Repairing

• Are all rotten and dead areas properly removed?

• Are repairs being kept to a minimum?

• Is taping being done properly?

• Are there gaps or uneven/overlap areas at the edges of the repairs?

• Are the repair pieces made with the same species of wood?

Note: Purchased veneers should be checked for quality, thickness, and moisture content.

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Veneer Layup

- What is the specified layup?
- Where multiple species are used for a board, what is the specified sequence and combination of species?
- Are veneers aligned and stacked uniformly?
- Are there any gaps or overlaps in the veneer sheets?

Resin Storage

- Is the factory making it's own resin or purchasing it?
- If purchasing, does the factory have certificate of analysis for each resin delivery?
- Is there a procedure in place for acceptance or rejection of a resin delivery (check PH, viscosity, solid content)?

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Resin Storage

- What is the specified temperature of the resin?
- Is temperature of resin checked?
- Does the factory have any suggested “use instructions” for the phenolic?

Phenolic Adhesive Mixing

- Are mixing procedures being followed? Specifically:
  - Is adhesive mix checked by weight and component?
  - Is the mixing time and temperature as per the specification?
  - Is the viscosity and pH being checked

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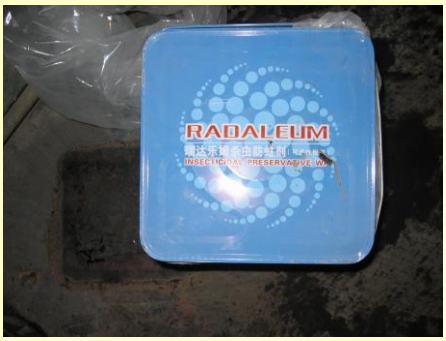
Phenolic Adhesive Mixing

- What is the total amount (in kg) of adhesive being mixed per shift?
- How many mixed are made per shift?
- Are technical data sheets and adhesive mixing instructions posted?
- Are mixing drums and agitators kept clean when not in use?
- Is the Chemical treatment approved by the AQIS?

Phenolic Adhesive Mixing



- Is the Chemical treatment approved by the AQIS?

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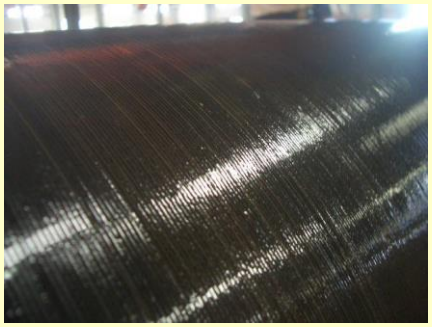
Adhesive Spreader



- Is moisture content of veneers checked prior to adhesive application?
- Are the spreader rollers worn?
- Does the grooving meet the adhesive supplier's requirements?
- Is adhesive spread uniformly across roller from side to side and end to end?

- Is the suggested adhesive spread rate posted?
- Is the adhesive spread checked and recorded? How often?
- Is the adhesive spread increased during hot weather to prevent premature dry out?

Adhesive Spreader

- Are veneer sheets stacked uniformly and aligned to ensure even pressure in presses?
- What is the maximum time between adhesive application and cold press?

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Cold Press

- Is the panel pressure in the cold press recorded?
- Is the line time between cold and hot press recorded?
- How is cold press duration controlled?
- Is resin tack checked between the cold and hot press?

Hot Press

- What is the pressure being applied to the panel in the hot press (kg/sq. cm)?
- Is this as specified?
- Is the set point temperature checked and recorded during each shift?
- Are the inlet and outlet temperatures recorded?
- Is loading time minimized to prevent premature drying of resin?
- Are platens clean and straight and are panels aligned vertically in press?

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Hot Press

- For the floor specification being produced, what is the hot press time?
- Are innermost bondline temperatures being measured on several platens?
- Is this press time being followed?

Product Inspection

- Is bond quality checked after hot press?
- Are there any noticeable overlaps or voids in the veneers?
- Are panels checked for correct thickness, length, width, straightness, and squareness?

- Is putty used to fill cracks in the top or bottom face, or gaps on the board edges?
- Are boards selected by the factory QC at random for testing?

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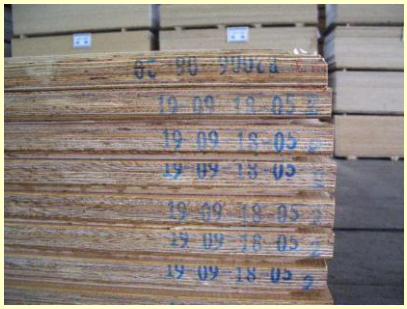
Product Identification

• Is flooring manufacturer's brand logo and name stamped on the board face and edge?

• Is manufacture date stamped on board edge?



• Are the adhesive spreader and hot press numbers stamped on the board edge?

Product Testing

• Which tests are being performed by the flooring factory?

- Boiling Test
- IICL Short Span Test
- Tensile Shear Test (ASTM D906)
- Modulus of Elasticity (MOE)
- Planar Shear Test (ASTM 2718-00)
- IICL Floor Strength Test

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Product Testing

• What is the test frequency for each test?

• Does the factory record the test results?

• Are all test instruments calibrated and certified by a third party?

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REFERENCES

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Key Process Parameters To Produce Quality Plywood

Veneer Quality

Target moisture content of 6.0-8.0% - high MC of 10-12% can result in blows during hot pressing.
Surface inactivation checked for bondability using water drop test.
Thickness control +/- .05 mm – prevents thick and thin problems at adhesive spreader & hot press.
Veneer graded properly for faces, crossbands & cores to obtain maximum panel strength.
Use of properly redried veneer – exclude 0-3.0% moisture content veneer or poor bonds can be expected.
Veneer surface temperature – maximum of 40-42C to prevent dry out of adhesive spread.
Cold veneer (4C) in unheated plants can slow resin cure and extend press cycles.
Part sheets must have same thickness when used to make complete sheet in layup.

Adhesive

Use a quality phenolic resin specifically formulated for structural hardwood plywood.
Cure speed can be adjusted by the addition of an accelerator.
Percent adhesive solids mix – 34-38%, higher adhesive solids increases bond strength and wood failure.
Adhesive spread – 175-194 grams/sq m (36-40 lbs/MSGL).
Mix viscosity – 4,000-6,000 cps @25C which allows proper application of adhesive by spreader.

Adhesive Spreader

Condition of spreader – bearings, doctor roll, rolls parallel etc.
Condition of spreader rolls – smooth rolls will not carry suggested adhesive load.
Correct roll grooving – 14 per inch, 20 too fine to carry adequate adhesive spread.
Regroove rolls if they are worn more than 1/3 and keep grooves clean and free of dried adhesive.
Visual examination of adhesive spread – uniform across sheet of veneer and top & bottom equal.
Adhesive spreads should be adjusted when veneer and plant temperatures increase to prevent dryout.

Cold Press

Consolidation and vertical alignment of veneer stacks for ease and fast loading of hot press.
Adequate stand time to obtain resin tack by loss of water from bond line.
Assembly time allows the adhesive time to increase penetration into high density wood.
Insure that phenolic resin does not precure or dryout prior to hot pressing.
Pressure should be 75% of hot press to provide adequate prepress.

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Hot Press

Condition of the platens – smooth clean surface and not warped for efficient heat transfer.
Press temperature controls +/- 2.5C to give uniform platen temperatures.
Press should be loaded and closed in less than 2 minutes to prevent precure of adhesive on bottom ply.
Full panel pressure should be reached as fast as possible – maximum of 60 seconds.
Uniform and correct pressure applied to panel – 14 kgs/sq cm (200 psi).
Correct cycle time for 28 mm panel to get best bond and maximum production.
Achieve the required inner most bond line temperature to cure phenolic adhesive – 110-115C.
Complete adhesive cure when checked out of the hot press.
Two stage press cycle with degas period for thick 28 mm panels to reduce chance of blows plus faster cycles.
Hot stacking is not recommended – large stacks of plywood can exotherm and cause degradation of wood.
Stack height should be limited to 3-4 press loads to allow for proper cooling of panels, especially in the center.

Bond Quality

Check wood failure out of the hot press – use plywood knife or chisel test – minimum of 75%.
Select panels from various hot press platens for routine daily Lab testing.
Record date, time, platen number and press load number for the test panel selected for Lab testing records.
Test a plywood panel for every four hours of production.
Plywood tensile shear (ASTM D 906) – check outer and innermost bond lines with wood failure determined.
Planar shear (rolling shear) ASTM D 2718-00 using five point bending method.
Determine moisture content and density on veneer used to produce test panels.
Report bond quality to press operator immediately after testing.

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Moisture Meters

- Ensure that the correct types of moisture meters are being used.
- A pin probe type meter should be used to check moisture on logs. A non pin dielectric meter should be used to check surface moisture on veneers.
- Observe how the calibration of the moisture meters is done at several work stations. Ensure calibration follows practices recommend by the manufacturer of the gauge(s).
- Ensure the moisture meter instructions are being followed correctly.

Hot Press Temperature Check

Account _____
Date _____

Adhesive Mix

- Resin _____
- Wheat Flour _____
- Other _____

Construction	Range #1	Range #2	Range #3
Plys/Thickness			
Face			
X-Band			
Core			

Platen Temperature Setting _____ °C
Measured _____ °C

Cycle Time (under full pressure)

- Timer _____
- Stop Watch _____

Press Number _____
_____

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_____

Panel & Platen Number _____

_____

_____

Time, Minutes	Innermost Bond Line Temperature, °C		
	Panel 1	Panel 2	Panel 3
0			

Auditor _____

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How to Calculate Adhesive Spread

In order to control costs as well as the uniformity and efficiency of the plywood operation, it is important to know and control the amount of adhesive spread. A convenient and inexpensive instrument to measure spread is a wet film gauge, although it is not easily usable on a corrugated bond line such as may be deposited by a grooved roll spread.

The readings, in mills wet film thickness, are convertible into pounds per thousand square feet by the formula:

$$\text{Spread (lbs./M sq. ft.)} = \frac{\text{Wet film thickness (mils) x Weight per gallon (lbs.)}}{1.6\ ^*}$$

*A gallon of adhesive uniformly spread in a film one mil thick will cover 1,604 sq. ft.

Here's a method for use with veneers, based on a single bond line: 1) Cut pieces of test veneer 12x13" from material of the thickness and type to be passed through the spreader. 2) Weigh on a gram scale. 3) Pass through a double-roll spreader adjusted to provide a uniform spread on top and bottom rolls. 4) Weigh the veneer and applied adhesive. 5) Subtract #4 from #2. The weight in grams of a 12x13" piece, spread on both sides, is approximately the same as the spread in pounds per thousand square feet of single bond line.

Table 1. Adhesive Spread Computation Example

Item	Weight
Veneer 12x13"	80 grams
Veneer and adhesive, both sides	110 grams
Spread	30 grams

The spread of 30 grams is equivalent to 30 lbs./M sq. ft. of adhesive spread. Normally a spread of 40 lbs./M sq. ft., plus or minus 5 lbs., is used in plywood. Increasing the spread will increase the allowable assembly time, which may be desirable on hot, dry days. Increased speed will also increase squeeze-out, with resultant rundown.

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Table 2. Comparison of Adhesive Spread in Various Terms of Measurement

Film Thickness in Mils	Pounds of Adhesive per M Sq. Ft.	Gallons of Adhesive per M Sq. Ft.	Sq. Ft. of Coverage per Gallon of Adhesive
1	5½	0.6	1667
2	11¼	1.3	769
3	16¾	1.9	526
4	22½	2.5	400
5	28	3.1	323
6	33¾	3.7	270
7	39¼	4.4	227
8	45	5.0	200
9	50½	5.6	179
10	56	6.2	161

Table 2 is based on an adhesive weighing 9 lbs. per gallon. For adhesives with different weights, a suitable correction factor must be applied. To obtain certain roll spreader rates, a leading roll spreader manufacturer makes the composite grooving recommendations given in Table 3.

Table 3. Composite Grooving Recommendations

Spread Rate Adhesive per M Sq. Ft. Bond Line	Grooving
20 – 30 lbs.	20 x ½ in.
25 – 35 lbs.	18 x ½ in.
30 – 40 lbs.	16 x ½ in.
35 – 45 lbs.	14 x ½ in.
40 – 50 lbs.	12 x ½ in.
45 – 60 lbs.	10 x ½ in.
55 – 70 lbs.	8 x ½ in.

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Dimension Checks

Company Location _____
Date _____

Grading	Inspected With:						Title:		
Date of Manufacture	Sample #	Thickness Measurements				Average	Group Average	% MC	Veneer
		Veneer Corners							Surface Characteristics
		1	2	3	4				
	1								
	2								
	3								
	4								
	5								
	6								
	7								
	8								
	9								
	10								
	11								
	12								
	13								
	14								
	15								
	16								
	17								
	18								
	19								
	20								

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FLOORBOARD QUALITY ASSURANCE PROGRAM

AUDIT FORM INSTRUCTIONS

Each auditor will be required to fill out in detail the “Audit Form” denoted at the end of this bulletin.

Over the following pages you will find the ensuing information:

1. Audit Scoring System – Denotes the scoring legend for the audit form.
2. Sample Audit Form – Supplied for your guidance.
3. Audit Form - The audit form should denote all information included on the cover page as wall as all sections, including photos if applicable, in the audit form.

The audit company will be required to forward the completed audit report via e-mail to the attention of the IICL Director of Technical Services (technical@iicl.org).

Reports should be received by the IICL no later than two days following completion of the audit.

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AUDIT SCORING SYSTEM

1. Each item on the audit form should be "scored" (in column A) by the auditor using the following 1 – 10 scoring system.

5	Very good
4	Good
3	Barely Acceptable
2	Poor
1	Unacceptable

2. The IICL has pre-assigned a category and weighting (columns B & C) for each line item, to reflect the fact that certain items are much more important to quality than others.

			Weighting
Category	**A** -	Critical to quality	5
	B -	Less critical to quality	2
	C -	Not important	1

3. A "maximum weighted score"(column D) for the audit of 780 is therefore theoretically possible. (This assumes a maximum score of 10 by the auditor for each line item …….obviously very unlikely.)

4. The auditor report will automatically calculate the "actual weighted score" (column E) for each line item and finally the overall score expressed as a percentage.

5. The audit report will finally automatically calculate the "Audit Result %".

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Floor Quality Assurance Program
Audit From

		Reviewed		Photos		Audit			Weighted	Actual Weighted
		Yes	No	Yes	No	Score	Category	Weighting	Max. Score	Score
	LOG STORAGE					A	B	C	D	E
a)	Is end seal or blocking being used on logs to prevent splits? Note: Splits will cause problems with lathe peeling and result in splits and down grade on veneer.					5	C	1	5	5
b)	Is water being sprayed on the logs to maintain uniform moisture content, quality of wood and to protect from insects?					4	B	2	10	8
c)	Are identification tags used to show species, country and origin?					3	C	1	5	3
d)	Are any other methods used to protect the wood from damage or infestation?					2	C	1	5	2
e)	Does manufacturer check moisture content of logs and record species, diameter and moisture? **Note: See information on moisture meters in the "reference" section of this booklet.**									
	LOG CONDITIONING									
a)	If logs are conditioned, what is the recommended vat temperature, and is this being adhered to?					5	B	2	10	10
b)	Are different species separated in different vats?					4	C	1	5	4
	LATHE – VENEER PEELING									
a)	Are individual logs being inspected prior to peeling? Inspectors should be looking for knots, splits, rot, wane and tightness of grain.					3	B	2	10	6
b)	Are wood species, moisture content and age of logs being recorded?					2	C	1	5	2
c)	What are the allowable veneer thickness tolerances? Are tolerances being achieved?					1	A	5	25	5
d)	Check quality of veneer. Is the veneer rough cut? Are wane or fish tails present?					5	B	2	10	10

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	VENEER DRYING									
a)	Is moisture content of veneer being checked after drying?					4	A	5	25	20
b)	What is the acceptable moisture content for the species? **Note: See information on moisture meters in the "reference" section of this guideline.**					N/A	N/A	N/A	N/A	N/A
c)	Veneer thickness should be checked by using the four corner method. **Note: See dimension checks form in the "reference" section of this guideline.**					2	C	1	5	2
d)	Is veneer wavy, flat, wrinkled or split? Ideal condition is for smooth cut flat sheets of veneer.					1	C	1	5	1
e)	Are veneers free from dry natural wood resins?									

	VENEER GRADING AND REPAIRING									
a)	Are veneers graded properly for faces, cross bands and core conditions?					2	A	5	25	10
b)	Are repairs kept to a minimum? Is taping being done properly? Minimum amount of tape should be used to obtain the best adhesive bonds.					3	B	2	10	6
c)	Are the repairs made with the same species of wood?					4	C	1	5	4
d)	Purchased veneers should be checked for quality, thickness and moisture content.					5	B	2	10	10
e)	Are all of the rotten and dead knot areas properly removed?					5	A	5	25	25
f)	Are there gaps or uneven overlap areas at the edge of the repairs?					4	B	2	10	8

	VENEER LAYUP AND SPECIES									
a)	What is the specified layup?					3	A	5	25	15
b)	Where multiple species in a board, what is the specified sequence and combination of species?					2	B	2	10	4
c)	Are these specifications being adhered to?					1	A	5	25	5
d)	Are there any gaps or overlaps in the veneer sheets?					1	B	2	10	2
e)	Are veneer sheets organized by grade for faster layup?					2	B	2	10	4

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	RESIN STORAGE									
a)	What is the specified temperature of the resin?					3	C	1	5	3
b)	Is temperature of resin checked?					4	C	1	5	4
c)	Is the factory making its own resin or buying it?					5	C	1	5	5
d)	Is a Certificate of Analysis being provided for each truck load of resin delivered to the plant? Note: Resin properties listed should be checked to insure that they are within the specification.					1	C	1	5	1
e)	Is there a procedure in place for accepting or rejecting a truck load of resin not manufactured to specification? If so, who has this authority to reject the truck load?					2	A	5	25	10
f)	Are Technical Data Sheets listing the physical properties of the phenolic adhesive available?					3	B	2	10	6
g)	Have any "Use Instructions" been provided for the phenolic?					4	C	1	5	4
h)	Does the plant check pH and viscosity of incoming resin?					5	B	2	10	10

	PHENOLIC ADHESIVE MIXING									
a)	Are the technical data sheets and adhesive mix posted at the mixing station?					5	B	2	10	10
b)	Check that mix procedures are being correctly followed. Specifically, check the following:					4	B	2	10	8
	1) Adhesive mix by components and weight.					3	B	2	10	6
	2) Mixing time and temperature of adhesive mixture.					2	B	2	10	4
	3) Viscosity and pH of adhesive mix at 25C.					1	B	2	10	2
	4) Total pounds of adhesive being mixed and number of mixes made per eight hour shift.					5	C	1	5	5
C)	Is the Chemical treatment being used approved by the AQIS?					4	A	5	25	20

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	ADHESIVE SPREADER									
a)	Inspect the adhesive spreader to make sure it is operational and that applicator rolls are not worn. Check that proper roll grooving is being used and that it meets the adhesive supplier's requirements.				3	B	2	10	6
b)	Is adhesive spread uniformly across the veneer sheet side to side and end to end? Suggested spread rate 175-194 grams/sq m. **Note: For more information on calculating adhesive spread see "How to calculate adhesive spread" in the reference section of this guideline.**				2	A	5	25	10
c)	Is the adhesive spread schedule posted for each panel construction used and how often is it checked? Note: Request/observe several adhesive spread checks and ensure results are recorded.				1	A	5	25	5
d)	Is adhesive spread increased during hot weather to prevent premature dry out?				1	B	2	10	2
e)	Moisture content of veneer should be checked at the adhesive spreader. Target of 6-8%.Note: See information on moisture meters in the "reference" section of this guideline.				2	A	5	25	10
f)	Are veneer sheets being stacked uniformly and aligned to insure even pressure in hot press?				3	A	5	25	15
g)	Time on each stack after lay up is completed should be as short as possible to minimize any potential resin dry out. Note: If the resin dries out in the bond line, reduced tack can be expected resulting in poor panel consolidation.				4	B	2	10	8

	COLD PRESS									
a)	Is stand time after spreader on the line prior to cold pressing kept to a minimum?				5	B	2	10	10
b)	Is the panel pressure in the cold press recorded periodically? Note: Target pressure to be 75% of the hotpress pressure.				5	A	5	25	25
c)	Is line time between cold and hot presses recorded? Note: Line time will depend on resin formulation, adhesive spread and plant temperature. Minimum line time should be between 20-30 minutes and maximum should be between 2-3 hours.				4	B	2	10	8
d)	Is resin tack checked between cold and hot presses? Note: Resin tack can be checked by lifting the veneers and touching the bond line with your finger tips. Veneers should require some force to separate. Look for any dry out prior to loading the hot press. If the bond line is dried out, resin will not transfer to the other face and low wood failure can be expected due to poor penetration.				3	B	2	10	6

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	HOT PRESS									
a)	Is the hot press heated?					2	A	5	25	10
b)	Is pressure being applied to the panel?					1	A	5	25	5
c)	What is the pressure (kgs/cm) applied in the hot press?					1	A	5	25	5
d)	Is this as specified?Note: A chart should be posted for correct panel pressure for each size panel. Target for hardwood plywood is 14 kgs/sq cm.					2	A	5	25	10
e)	Is information on platen temperature set point available and recorded during the shift?					3	A	5	25	15
f)	Are inlet and outlet temperatures recorded for the hot press? Note: Temperature difference should be less than 10C.					4	A	5	25	20
g)	Ensure innermost bondline temperature checks are done on several platens. Target of 110-115C at the innermost bond line is necessary to cure most phenolic resins.Note: See "Hot press temperature check" form in the reference section of this guideline for process checks necessary in this area.					5	A	5	25	25
h)	Ensure that heat and pressure are applied to the panel as quickly as possible to ensure complete and proper resin cure. **Note: Loading time should be minimized to prevent premature and uneven drying of resin.**					5	A	5	25	25
i)	Are platens clean and straight and are panels aligned vertically in the press after loading? Note: This will insure uniform panel pressure.					4	A	5	25	20
j)	For the floor specification being built, what is the hot press time? Is this being adhered to?					3	A	5	25	15

	PRODUCT INSPECTION & GRADING									
a)	Is bond quality checked using hammer test after hot press?					2	A	5	25	10
b)	Interview workers at each work station to insure that they are aware of QC procedures for their position.					1	C	1	5	1
c)	Are boards selected at random for testing? Ensure samples meet required test criteria.					5	B	2	10	10
d)	Ensure that workers are aware of all veneer grades used for face, core and backs.					4	B	2	10	8
e)	Ensure that tolerances for thickness, length, width, straightness and squareness are checked on finished panels. Note: See "Dimension Checks" in the reference section of this guideline for further information on dimensional checks.					3	A	5	25	15

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f)	Ensure that all panels are inspected for voids and overlaps. Note: Voids are not allowed in structural plywood.					2	B	2	10	4
g)	Ensure that all panels are properly identified with the manufacturers' logo (or mark) and batch number.					1	B	2	10	2
	PRODUCT IDENTIFICATION									
a)	Is the flooring manufacturers broad name and log stamped on the board edge?					5	B	2	10	10
b)	Is the manufacturer date stamped on the board edge, in accordance with the IICL's identification requirements?					4	B	2	10	8
	PANEL SAMPLE PREPARATION									
a)	Verify that each panel sample is properly identified with the following:									
	1. Product type, e.g. apitong, eucalyptus, etc.					2	B	2	10	4
	2. Date and shift of manufacture.					1	B	2	10	2
	3. Sample number.					1	B	2	10	2
	4. Production batch number.					2	B	2	10	4
	PANEL TESTING									
a)	Review laboratory testing procedures and/or Q.C. Manual.					3	B	2	10	6
b)	Review testing done on a daily basis. At the very minimum, the following tests must be performed:					4	B	2	10	8
	1. Boiling Test (Accelerated Aging Test)					5	B	2	10	10
	2. Planar (rolling) shear, ASTM D2718-001					5	B	2	10	10
	3. IICL short span bending test					4	A	5	25	20
	4. Tensile shear, ASTM D906					3	A	5	25	15
	5. Modules of elasticity (MOE)					2	A	5	25	10
	6. IICL Floor Strength Test					1	B	2	10	2
	Note: For test information, see IICL technical bulletin IICL TB001 available at www.iicl.org.									

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		Reviewed		Photos		Audit			Weighted	Actual Weighted
		Yes	No	Yes	No	Score	Category	Weighting	Max. Score	Score
	PANEL TESTING					A	B	C	D	E
a)	Inspect wood failure on the broken test specimens being tested. Note: An average of 85% wood failure is required for structural plywood per ASTMD 5266-92					5	A	5	25	25
b)	Ensure that lab testing equipment is calibrated yearly. Note last calibration date.					4	B	2	10	8
c)	Review the amount of plywood which has been down graded or rejected since the last audit.					3	B	2	10	6
d)	What is the test frequency required for each test? Are these frequencies being adhered to?					2	A	5	25	10
e)	Ascertain who has the authority to down grade and reject plywood. In case of rejection, is plywood being tagged properly to prevent shipment?					1	C	1	5	1
f)	Is there a tracking system for the plywood tested? If so, does this system include the pass/fail results, the reason for rejection, the date of manufacture and batch number on all plywood?					1	B	2	10	2
g)	Is the procedure in the event of a test failure acceptable and effective? Is this procedure adhered to?					2	B	2	10	4

	Total					268			1275	756
	Audit Result (%)									59%

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Floorboard Quality Assurance Program

Audit Form

Date:

Audit Company:

Auditor:

Signature:

Plywood Manufacturer:

Signature:

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Check logs in the yard for the following:

		Reviewed		Photos		Audit			Weighted	Actual Weighted
		Yes	No	Yes	No	Score	Category	Weighting	Max. Score	Score
	LOG STORAGE					A	B	C	D	E
a)	Is end seal or blocking being used on logs to prevent splits? Note: Splits will cause problems with lathe peeling and result in splits and down grade on veneer.						C	1	5	
b)	Is water being sprayed on the logs to maintain uniform moisture content, quality of wood and to protect from insects?						B	2	10	
c)	Are identification tags used to show species, country and origin?						C	1	5	
d)	Are any other methods used to protect the wood from damage or infestation?						C	1	5	
e)	Does manufacturer check moisture content of logs and record species, diameter and moisture? **Note: See information on moisture meters in the "reference" section of this booklet.**						B	2	10	
	LOG CONDITIONING									
a)	If logs are conditioned, what is the recommended vat temperature, and is this being adhered to?						B	2	10	
b)	Are different species separated in different vats?						C	1	5	
	LATHE – VENEER PEELING									
a)	Are individual logs being inspected prior to peeling? Inspectors should be looking for knots, splits, rot, wane and tightness of grain.						B	2	10	
b)	Are wood species, moisture content and age of logs being recorded?						C	1	5	
c)	What are the allowable veneer thickness tolerances? Are tolerances being achieved?						A	5	25	
d)	Check quality of veneer. Is the veneer rough cut? Are wane or fish tails present?						B	2	10	

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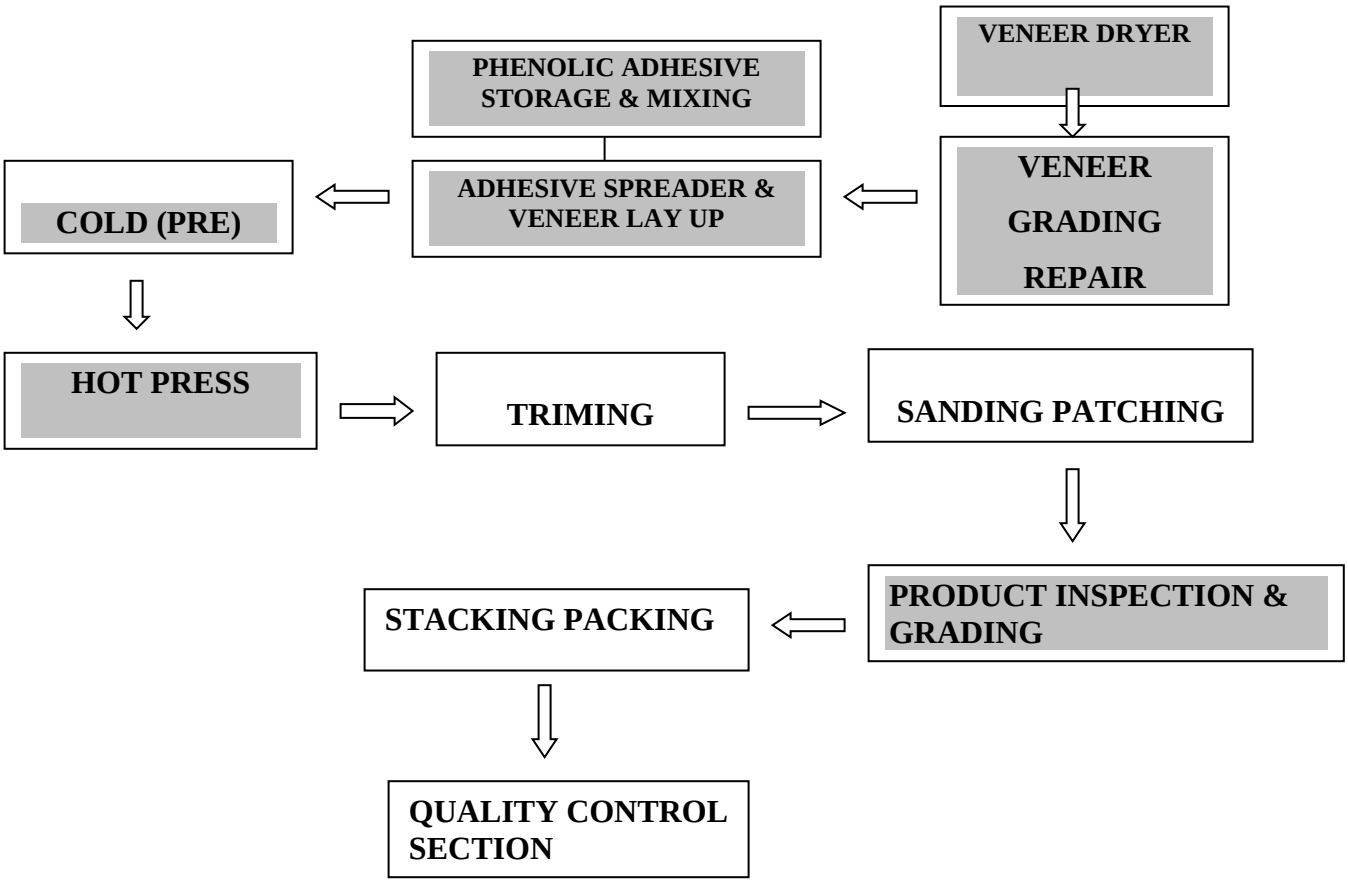
DRY END



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	VENEER DRYING									
a)	Is moisture content of veneer being checked after drying?						A	5	25	
b)	What is the acceptable moisture content for the species? **Note: See information on moisture meters in the "reference"section of this guideline.**						A	5	25	
c)	Veneer thickness should be checked by using the four corner method. **Note: See dimension checks form in the "reference" section of this guideline.**						C	1	5	
d)	Is veneer wavy, flat, wrinkled or split? Ideal condition is for smooth cut flat sheets of veneer.						C	1	5	
e)	Are veneers free from dry natural wood resins?						B	2	10	

	VENEER GRADING AND REPAIRING									
a)	Are veneers graded properly for faces, cross bands and core conditions?						A	5	25	
b)	Are repairs kept to a minimum? Is taping being done properly?Minimum amount of tape should be used to obtain the best adhesive bonds.						B	2	10	
c)	Are the repairs made with the same species of wood?						C	1	5	
d)	Purchased veneers should be checked for quality, thickness and moisture content.						B	2	10	
e)	Are all of the rotten and dead knot areas properly removed?						A	5	25	
f)	Are there gaps or uneven overlap areas at the edge of the repairs?						B	2	10	

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	VENEER LAYUP AND SPECIES									
a)	What is the specified layup?						A	5	25	
b)	Where multiple species in a board, what is the specified sequence and combination of species?						B	2	10	
c)	Are these specifications being adhered to?						A	5	25	
d)	Are there any gaps or overlaps in the veneer sheets?						B	2	10	
e)	Are veneer sheets organized by grade for faster layup?						B	2	10	

	RESIN STORAGE									
a)	What is the specified temperature of the resin?						C	1	5	
b)	Is temperature of resin checked?						C	1	5	
c)	Is the factory making its own resin or buying it?						C	1	5	
d)	Is a Certificate of Analysis being provided for each truck load of resin delivered to the plant? Note: Resin properties listed should be checked to insure that they are within the specification.						C	1	5	
e)	Is there a procedure in place for accepting or rejecting a truck load of resin not manufactured to specification? If so, who has this authority to reject the truck load?						A	5	25	
f)	Are Technical Data Sheets listing the physical properties of the phenolic adhesive available?						B	2	10	
g)	Have any “Use Instructions” been provided for the phenolic?						C	1	5	
h)	Does the plant check pH and viscosity of incoming resin?						B	2	10	

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	PHENOLIC ADHESIVE MIXING									
a)	Are the technical data sheets and adhesive mix posted at the mixing station?						B	2	10	
b)	Check that mix procedures are being correctly followed. Specifically, check the following:						B	2	10	
	1) Adhesive mix by components and weight.						B	2	10	
	2) Mixing time and temperature of adhesive mixture.						B	2	10	
	3) Viscosity and pH of adhesive mix at 25C.						B	2	10	
	4) Total pounds of adhesive being mixed and number of mixes made per eight hour shift.						C	1	5	
c)	Is the Chemical treatment being used approved by the AQIS?						A	5	25	

	ADHESIVE SPREADER									
a)	Inspect the adhesive spreader to make sure it is operational and that applicator rolls are not worn. Check that proper roll grooving is being used and that it meets the adhesive supplier's requirements.						B	2	10	
b)	Is adhesive spread uniformly across the veneer sheet side to side and end to end? Suggested spread rate 175-194 grams/sq m. **Note: For additional information on calculating adhesive spread rate see "How to calculate adhesive spread" in the reference section of this guideline.**						A	5	25	
c)	Is the adhesive spread schedule posted for each panel construction used and how often is the spread checked? Note: Request and observe several adhesive spread checksand ensure results are recorded.						A	5	25	
d)	Is adhesive spread increased during hot						B	2	10	

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	weather to prevent premature dry out?									
e)	Moisture content of veneer should be checked at the adhesive spreader. Target of 6-8%.Note: See information on moisture meters in the “reference” section of this guideline.						A	5	25	
f)	Are veneer sheets being stacked uniformly and aligned to insure even pressure in hot press?						A	5	25	
g)	Time on each stack after lay up is completed should be as short as possible to minimize any potential resin dry out. Note: If the resin dries out in the bond line, reduced tack can be expected resulting in poor panel consolidation.						B	2	10	

	COLD PRESS									
a)	Is stand time after spreader on the line prior to cold pressing kept to a minimum?						B	2	10	
b)	Is the panel pressure in the cold press recorded periodically? Note: Target pressure to be 75% of the hotpress pressure.						A	5	25	
c)	Is line time between cold and hot presses recorded? Note: Line time will depend on resin formulation, adhesive spread and plant temperature. Minimum line time should be between 20-30 minutes and maximum should be between 2-3 hours.						B	2	10	
d)	Is resin tack checked between cold and hot presses? Note: Resin tack can be checked by lifting the veneers and touching the bond line with your finger tips. Veneers should require some force to separate. Look for any dry out prior to loading the hot press. If the bond line is dried out, resin will not transfer to the other face andlow wood failure can be expected due to poor penetration.						B	2	10	

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	HOT PRESS									
a)	Is the hot press heated?						A	5	25	
b)	Is pressure being applied to the panel?						A	5	25	
c)	What is the pressure (kgs/cm) applied in the hot press?						A	5	25	
d)	Is this as specified?Note: A chart should be posted for correct panel pressure for each size panel. Target for hardwood plywood is 14 kgs/sq cm.						A	5	25	
e)	Is information on platen temperature set point available and recorded during the shift?						A	5	25	
f)	Are inlet and outlet temperatures recorded for the hot press? Note: Temperature difference should be less than 10C.						A	5	25	
g)	Ensure innermost bondline temperature checks are done on several platens. Target of 110-115C at the innermost bond line is necessary to cure most phenolic resins.Note: See “Hot press temperature check” form in the reference section of this guideline for process checks necessary in this area.						A	5	25	
h)	Ensure that heat and pressure are applied to the panel as quickly as possible to ensure complete and proper resin cure. **Note: Loading time should be minimized to prevent premature and uneven drying of resin.**						A	5	25	
b)	Are platens clean and straight and are panels aligned vertically in the press after loading? Note: This will insure uniform panel pressure.						A	5	25	
c)	For the floor specification being built, what is the hot press time? Is this being adhered to?						A	5	25	

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	PRODUCT INSPECTION AND GRADING									
a)	Is bond quality checked using hammer test after hot press?						A	5	25	
b)	Interview workers at each work station to insure that they are aware of QC procedures for their position.						C	1	5	
c)	Are boards selected at random for testing? Ensure samples meet required test criteria.						B	2	10	
d)	Ensure that workers are aware of all veneer grades used for face, core and backs.						B	2	10	
e)	Ensure that tolerances for thickness, length, width, straightness and squareness are checked on finished panels. Note: See "Dimension Checks" in the reference section of this guideline for further information on dimensional checks.						A	5	25	
f)	Ensure that all panels are inspected for voids and overlaps. Note: Voids are not allowed in structural plywood.						B	2	10	
g)	Ensure that all panels are properly identified with the manufacturers' logo (or mark) and batch number.						B	2	10	

	PRODUCT IDENTIFICATION									
a)	Is the flooring manufacturers broad name and log stamped on the board edge?						B	2	10	
b)	Is the manufacturer date stamped on the board edge, in accordance with the IICL's identification requirements?						B	2	10	

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QUALITY CONTROL

	PANEL SAMPLE PREPARATION									
a)	Verify that each panel sample is properly identified with the following:									
	1. Product type, e.g. apitong, eucalyptus, etc.						B	2	10	
	2. Date and shift of manufacture.						B	2	10	
	3. Sample number.						B	2	10	
	4. Production batch number.						B	2	10	

	PANEL TESTING								
a)	Review laboratory testing procedures and/or Q.C. Manual.					B	2	10	
b)	Review testing done on a daily basis. At the very minimum, the following tests must be performed:					B	2	10	
	1. Boiling Test (Accelerated Aging Test)					B	2	10	
	2. Planar (rolling) shear, ASTM D2718-001					B	2	10	
	3. IICL short span bending test					A	5	25	
	4. Tensile shear, ASTM D906					A	5	25	
	5. Modules of elasticity (MOE)					A	5	25	
	6. IICL Floor Strength Test					B	2	10	
	Note: For test information, see IICL technical bulletin IICL TB001 available at www.iicl.org.								

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	PANEL TESTING								
a)	Inspect wood failure on the broken test specimens being tested. Note: An average of 85% wood failure is required forstructural plywood per ASTMD 5266-92.					A	5	25	
b)	Ensure that lab testing equipment is calibrated yearly. Note last calibration date.					B	2	10	
c)	Review the amount of plywood which has been down graded or rejected since the last audit.					B	2	10	
d)	What is the test frequency required for each test? Are these frequencies being adhered to?					A	5	25	
e)	Ascertain who has the authority to down grade and reject plywood.In case of rejection, is plywood being tagged properlyto prevent shipment?					C	1	5	
f)	Is there a tracking system for the plywood tested? If so, does this system include the pass/fail results, the reason for rejection, the date of manufacture andbatch number on all plywood?					B	2	10	
g)	Is the procedure in the event of a test failure acceptable and effective? Is this procedure adhered to?					B	2	10	

Total				1295	
Audit Result (%)					0%

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