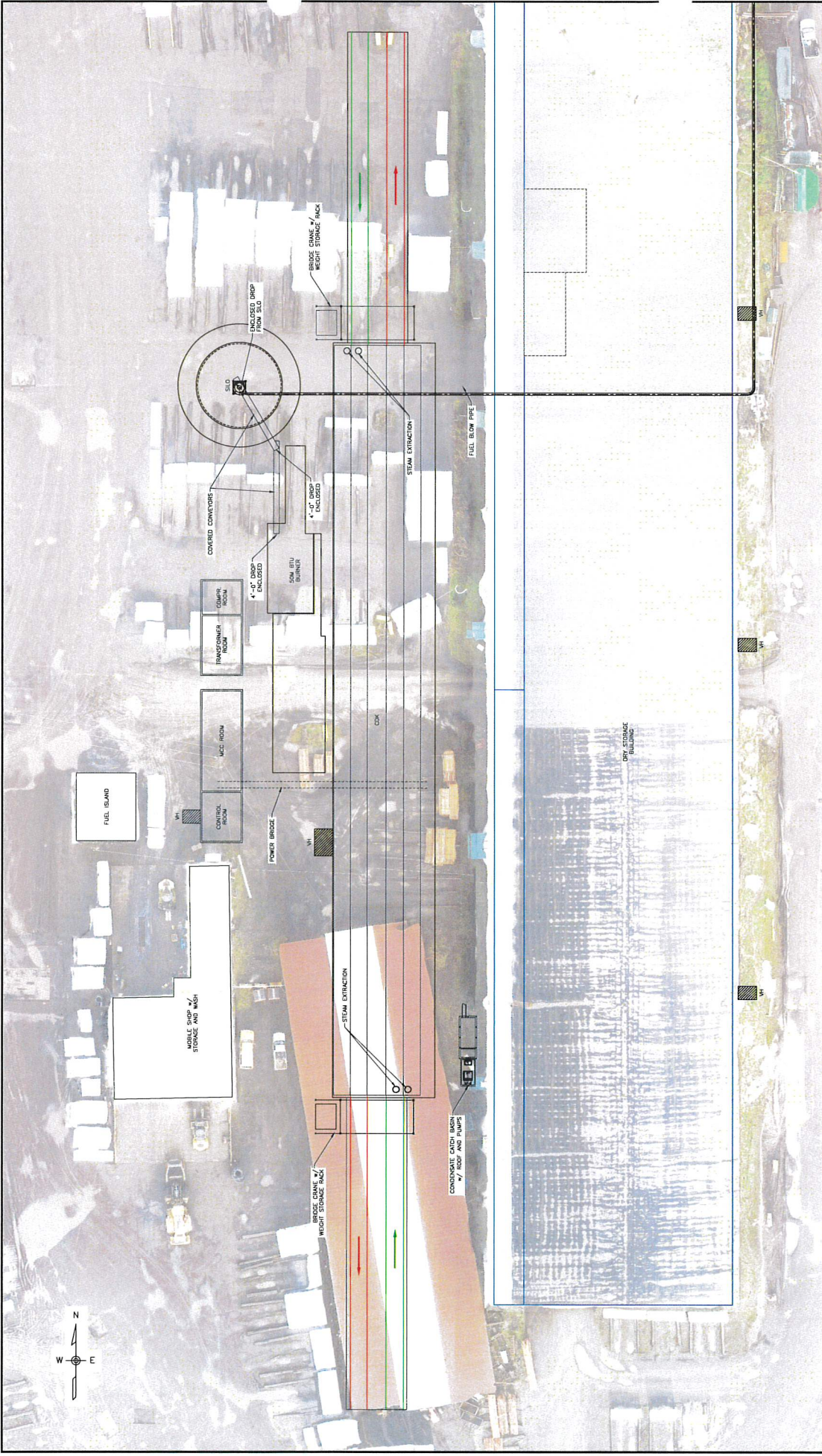


## **APPENDIX B. SITE PLANS AND PROCESS FLOW DIAGRAM**

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**PRELIMINARY**  
NOT FOR CONSTRUCTION  
DATE: 06-21-2023

**CROW ENGINEERING**  
CIVIL  
STRUCTURAL  
MECHANICAL  
ELECTRICAL  
PLUMBING  
P.O. BOX 1115  
BENTONVILLE, AR 72716  
501.211.2118  
crowingengineering.com

**Weyerhaeuser**  
Raymond, Washington  
**PLANT MODERNIZATION**  
CDK  
AREA PLAN

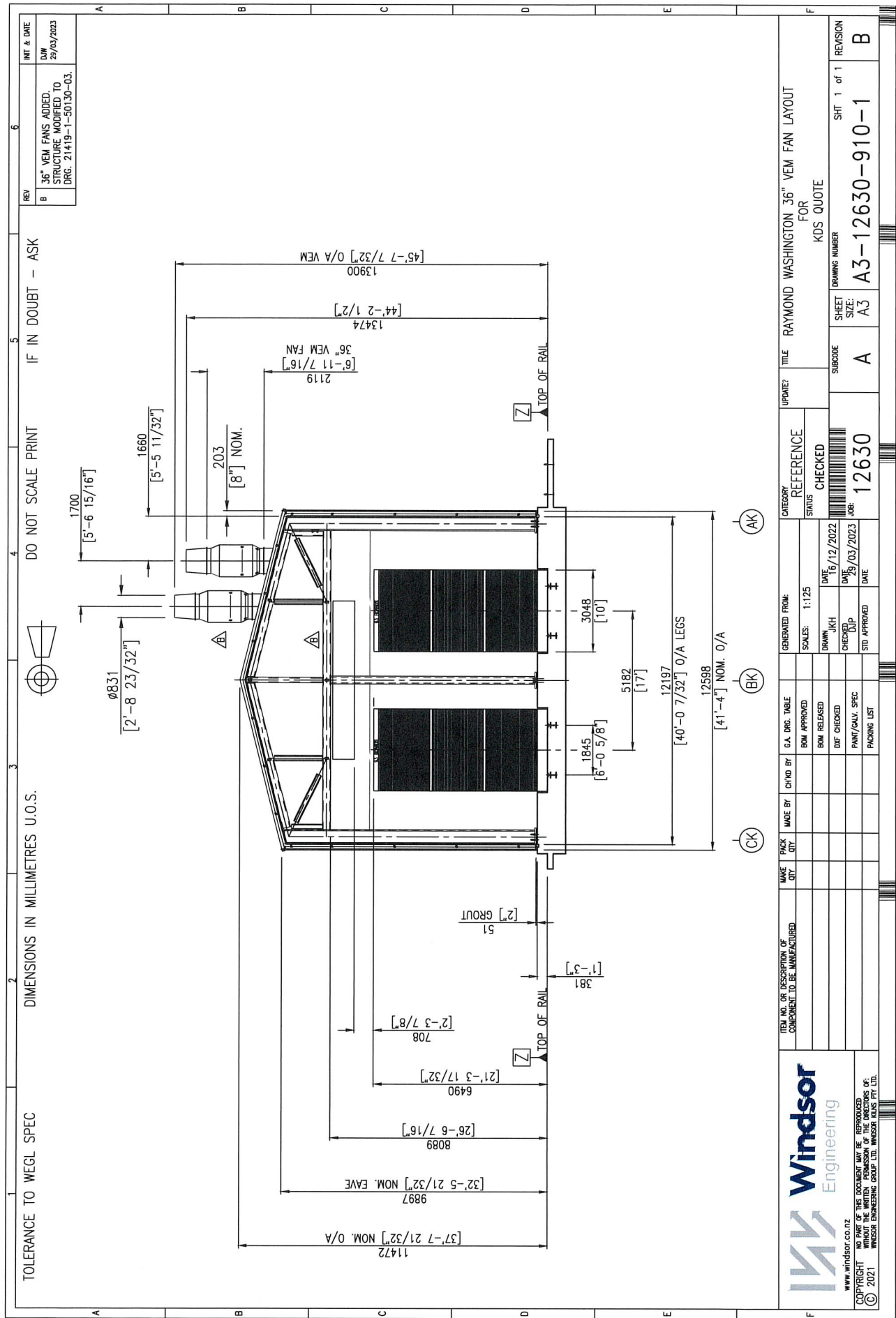
NO.	REV.	DATE	DESCRIPTION
1	A	06/21/2023	ISSUED FOR PERMIT
2	B	06/21/2023	ISSUED FOR CONSTRUCTION

DATE: 06/21/2023 2:00 PM  
SCALE: 1"=20'-0"

PROJECT: 20348-100010-12  
SHEET: 100010-12-10

THIS PLAN AND SPECIFICATIONS ARE THE PROPERTY OF CROW ENGINEERING. NO PART OF THIS PLAN OR SPECIFICATIONS MAY BE REPRODUCED OR TRANSMITTED IN ANY FORM OR BY ANY MEANS, ELECTRONIC OR MECHANICAL, INCLUDING PHOTOCOPYING, RECORDING, OR BY ANY INFORMATION STORAGE AND RETRIEVAL SYSTEM, WITHOUT THE WRITTEN PERMISSION OF CROW ENGINEERING. THE ENGINEER'S LIABILITY IS LIMITED TO THE DESIGN AND CONSTRUCTION OF THE PROJECT. THE ENGINEER DOES NOT WARRANT OR REPRESENT THAT THE PROJECT WILL BE COMPLETED ON TIME, WITHIN BUDGET, OR WITHOUT CHANGES. THE ENGINEER'S LIABILITY IS LIMITED TO THE DESIGN AND CONSTRUCTION OF THE PROJECT. THE ENGINEER DOES NOT WARRANT OR REPRESENT THAT THE PROJECT WILL BE COMPLETED ON TIME, WITHIN BUDGET, OR WITHOUT CHANGES.















## **APPENDIX C. EQUIPMENT SPECIFICATIONS**

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234 Industrial Drive  
Hendersonville,  
NC 28739, USA  
Tel: 800 274 5456  
Tel: 828 891 8115  
Fax: 828 891 5451  
www.kdskilns.com

**Date:** July 28, 2022

**Ref:** Q22-CDK-0107-A

**Weyerhaeuser Company**  
1740, 51 Ellis St  
Raymond, WA 98577

**Attention:** Mike Stimson, Nick Brooks

**Re:** KDS Windsor CDK

Dear Mike & Nick:

We would like to submit our proposal for the supply of one new high capacity CDK-351 system including burner, silo, vapor extract modules and controls. This system's designed drying capacity rate is 310MM bdf/yr per CDK of 2" Douglas Fir @ 93 layers. All this equipment on offer represents the cutting edge of this technology. We are confident that we will exceed your expectations and you will have the highest performance direct fired CDK system currently possible.

### **KDS Windsor Offer:**

We are offering the supply, delivery and installation of one **KDS Windsor HC-CDK-351 system** including green sawdust gasification burner systems with DrySpec® and DryTrack® CDK controls systems.

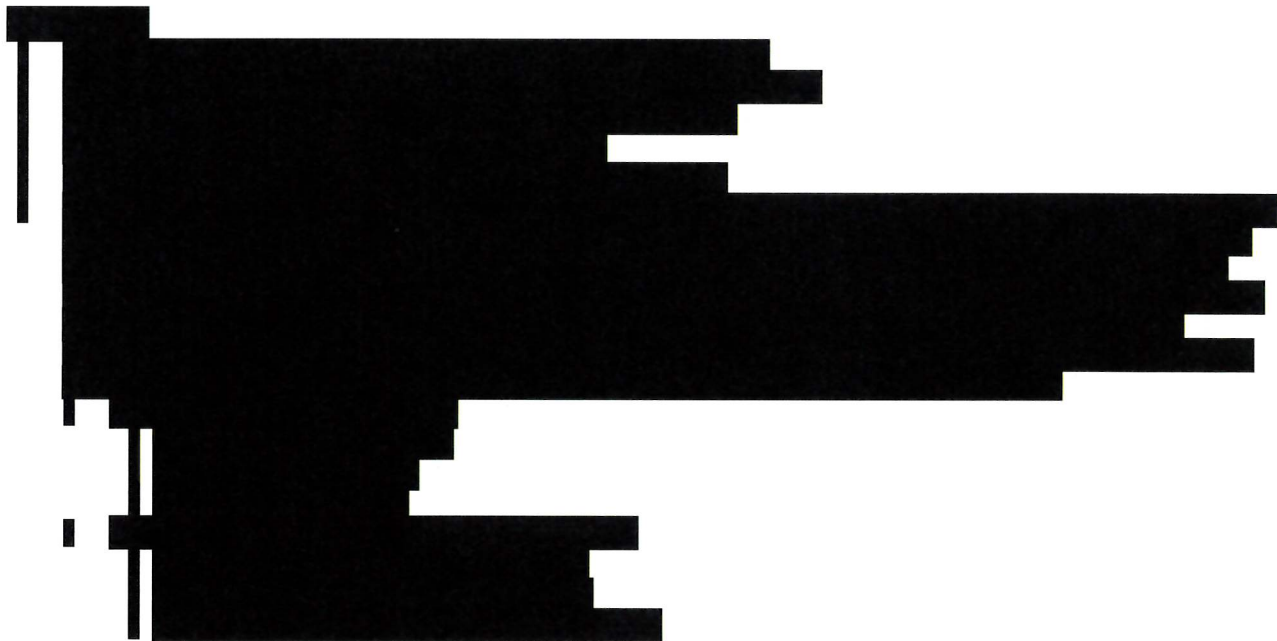
#### **System design:**

- The target final MC is 15%
- The heat plant will use a KDS Windsor 50MM btu/hr green sawdust gasifier per CDK



## Pricing And Commercial Items:

CDK Items:	Cost
One HC-CDK-351 system with 50MM green sawdust gasifier	
Mechanical installation	
Freight to site	
DrySpec® and DryTrack® CDK controls	
Stainless Steel Fan Tubes in ER Chambers	
316 Stainless Steel upgrade in ER Chambers	
Drawings for carts and weights	
Drag chain hopper	
Four extra refractory duct sections	
Extended incline screw	
Vapor Extraction Modules	
Extra RTD's	
One 40' x 84' silos with unloaders	
Halo system	
<b>Total with all options</b>	





## Key Features Of The KDS Windsor Offer:

- Robust CDK chambers with tray and cladding design that create a unique ventilated housing.
- Fully baffled plenum dividers in the energy recovery (ER) sections giving 3 zones per ER chamber to provide industry leading conditioning, MC standard deviation and fuel efficiency.
- Kiln duty fiber brush horizontal baffles along the top of each stack.
- Fully customized DrySpec® CDK controls including all operational, safety, comprehensive alarm features and fully automatic push rate control from startup to shut down.
- DryTrack® CDK MC System on each track giving real-time, MC readings that are used to automatically adjust the push rate to achieve a desired final MC target with low standard deviation and high-grade recovery.
- Catwalk with stair access the entire length of the CDK.
- Green sawdust gasifier system that is cleanest burning and highest heat output in the industry.
- Decades of experience designing drying systems with both direct and indirect heating systems.

## KDS Windsor CDK Design Principles:

The KDS Windsor CDK system has a reverse flow double track design and incorporates preheating, drying, cooling, equalizing and conditioning phases all in one extended chamber. The lumber stacks traverse through the kiln in opposite directions on the two tracks. The lumber is automatically advanced, based on temperature, time and with the DryTrack CDK option, the moisture content of the lumber in the MD (main drying) section by the pusher units.

The KDS Windsor Fresh Air Injection provides both dry bulb and wet bulb temperature control. Through controlling optimum wet bulb depression (dry bulb temperature – wet bulb temperature), drying is accomplished using lower temperatures while maximizing production. This method of drying produces the highest quality and aesthetically pleasing dried lumber.



The CDK system control is via our DrySpec® CDK kiln management program integrated with our optional DryTrack® CDK in-kiln moisture measurement system. The KDS Windsor CDK design is capable of using combinations of time, temperature and MC of the lumber exiting the central MD section to control the rate of drying, i.e. the advancement of the lumber stacks. Each track can be controlled independently - this means that you could have different board thicknesses on each track if you wanted.

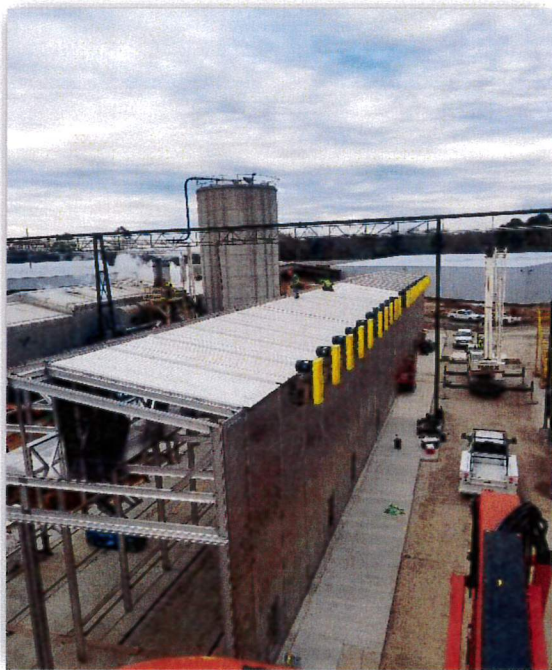
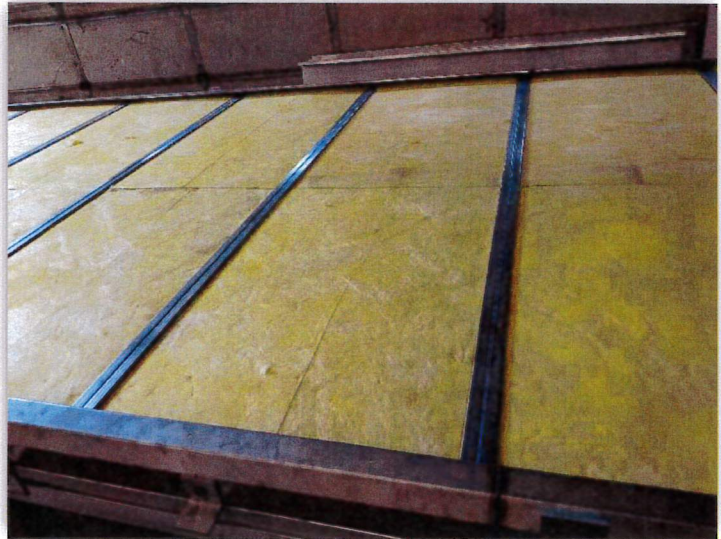
The DryTrack® CDK system is the only field proven system that can both measure lumber moisture content and control the CDKs push decisions. Simply being able to read a moisture content is only a portion of the drying requirement. Moisture based push control is essential to maximize the drying efficiency, production rate, and quality of the lumber being dried. This KDS Windsor exclusive capability is the result of years of research and development of the proper use of the moisture content data gathered from the drying process. To date, the DryTrack® push control algorithm stands alone in CDK lumber drying technology. Currently, dozens of CDKs are operating successfully using moisture-based push control.



## CDK Equipment Description:

KDS Windsor's equipment design is driven in response to the harsh environment created by a continuous high temperature lumber drying process. Our design targets the following CDK specific issues:

- CDKs by design, run continuously and don't dry out inside
- Moving parts need to be serviced while the CDK is running
- Temperatures and air flow need to be consistent in both fan directions for tight standard deviation
- Reliable lumber pushes, push distance accuracy and regular push intervals are required for consistent drying
- Maintaining proper airflow distribution and accurately reading MC with moving lumber
- Reducing the risk of fires in an open environment which cannot be sealed shut



### CDK structure and panels

The KDS Windsor CDKs structure is constructed with all aluminum and stainless steel materials including stainless steel footings and fasteners in the MD section and the ER structure is constructed from 316 stainless steel materials. The C-formed inner skins are fabricated from 304 stainless steel in the MD, 316 stainless steel in the ER and the outer cladding is corrugated aluminum. Together these components create our robust, floating, vented, and self-draining CDK housing. Numerous, sealed entry and exit man-doors are provided for access to and emergency egress from every section of the CDK.

### Fan wall and motor truss

Material thickness on the fan wall and motor truss will be 3mm with a 12" wide fan orifice. There is also a vertical support leg added under the tube in the motor truss at the propeller end.



### CDK fan systems

The KDS Windsor fan systems are designed with low loss Gates Polychain timing belts and sheaves for efficient use of horsepower. The fan system's internal bearings are externally lubricated via pre-assembled, stainless-steel grease lines accessible from the exterior catwalk. Fan shafts utilize SKF spherical bearings. KDS Windsor CDKs use Smithco kiln fans. This proposal includes stainless steel fan assemblies in the ER sections. The MD section fan assemblies are painted steel design.



During commissioning the fan blade angle will be set to achieve the required air flow and heat transfer into the lumber through the sticker openings with optimum electrical efficiency. Precise pitch setting is achieved using a proprietary pitch setting tool developed by Windsor. Fans are all dynamically balanced in the field to minimize vibration and maximize belt life.

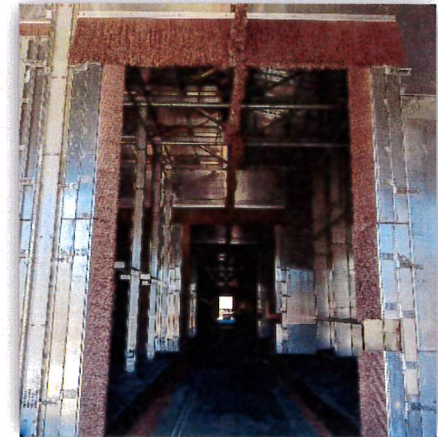
Aluminum walkways above the distribution duct provide access to the CDK fans and distribution duct slide gates. Stainless steel handrails offer fall protection along the length of the outer edges of the walkway in both the MD and ER sections.





### **CDK divider walls and baffling**

Each ER is divided into three individual sections to optimize airflow while maximizing energy recovery, equalization and conditioning in each. Section dividers consist of an aluminum and stainless-steel wall through the entire CDK cross-section creating the three separate compartments. The divider walls are baffled horizontally above the lumber stack with kiln duty fiber brush baffle. Divider wall vertical baffling is achieved using spring loaded aluminum baffles. Airflow is directed through the lumber sticker openings using a high temp fiber brush overhead baffle system.



The KDS Windsor baffling system creates unfavorable conditions in the ER chambers for a fire to start. The individual ER sections reduce the amount of available oxygen and create a high humidity environment particularly in the inner ER section immediately following the MD section (it's literally raining in this section). The majority of CDK fires have occurred as the lumber exits the MD section. The KDS Windsor design has never experienced a CDK fire during normal operation.



### **Distribution ducts and downcomers**

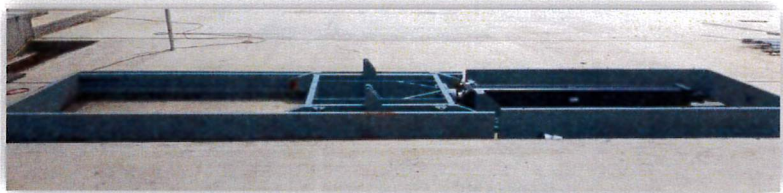
The heat downcomers between tracks in the MD sections are designed to reheat the kiln air as it exits the first track prior to entering the second track of lumber. These downcomers have been designed to be highly aerodynamic for enhanced airflow with minimal disruption compared to diamond-shaped downcomers. To evenly distribute airflow through the slots an 8' divider sheet has been added to the top half of the downcomers.

Each downcomer is provided with a ground level manual adjustment for balancing the air volume equally throughout the main drying chamber. Ground level damper controls make it safer to adjust air flow by eliminating the need for ladders or lifting equipment. The downcomers will be adjusted and set during commissioning.

All distribution ducts are designed and built to insure uniform air distribution throughout the MD chamber. Distribution ducts are constructed from heavy gauge, painted steel.

### **Hydraulic pusher units**

Each KDS Windsor CDK includes a hydraulic pusher system on each track just outside the green lumber point of entry. Pusher systems use Parker hydraulic pumps and cylinders for advancement of the lumber and an MTS Temposonic

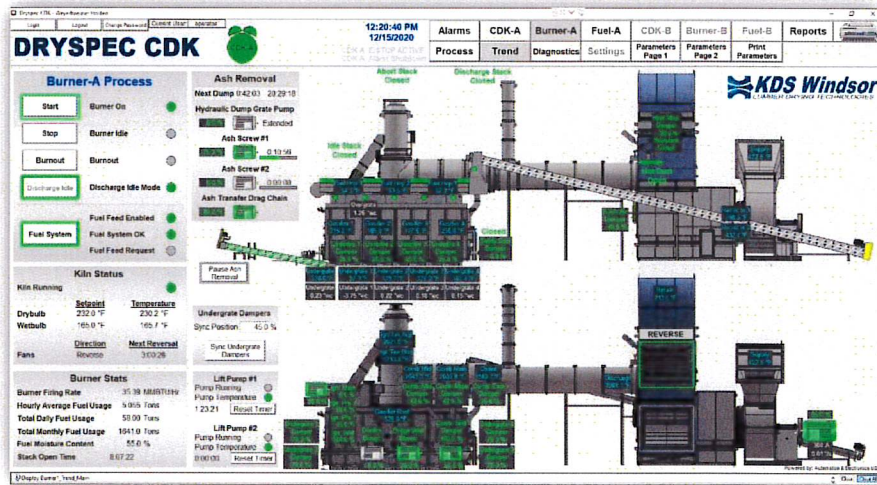


linear distance transducer for accurate positioning. Greaseable steel "dogs" with counterweights contact the kiln cart cross member to advance the load. Pusher frames and foundations are designed to eliminate reactive up lifting forces from pushing up on the lumber carts. The pusher will have the ability to fold down the cart arms when in the fully retracted.



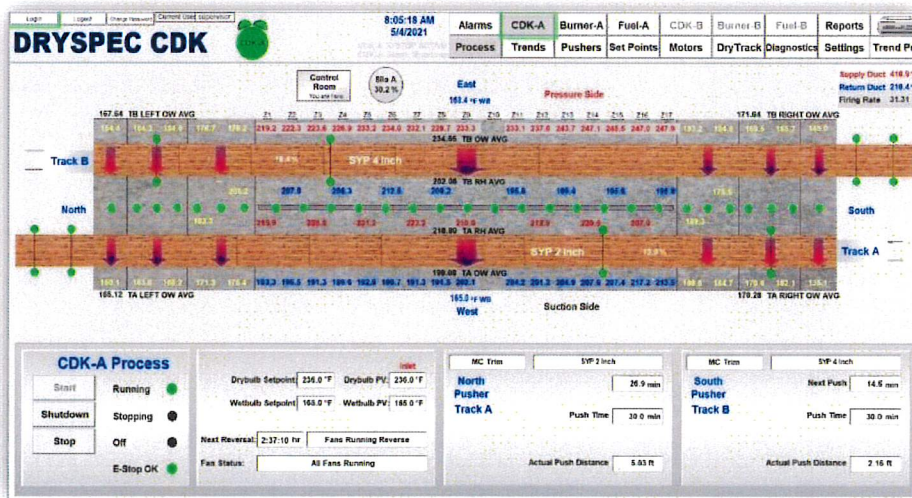
## CDK controls

Operator controls are customized by our programmers to the meet needs of the site. During commissioning, alarm needs and configurations, site layouts, geographic orientation and site-specific equipment such as wood fuel delivery systems are integrated into the HMI and PLC systems. Additional equipment controls, custom reporting and SQL data exchange can be added if desired and will be discussed and agreed upon prior to commissioning.



KDS Windsor CDK controls use all commercially available Allen-Bradley components and software. Being the leader in USA control systems, Allen-Bradley components and support are readily available if needed. CDK PLC systems utilize the ControlLogix platform with Logix 5000 software and the PLC programming software version can be matched to site preference. The site customized HMI will be built using Allen-Bradley Factory Talk software.

Each CDK includes a NUC PC the included PC has no moving parts and does not require forced air to keep the power supply cooled. Considering the dirty mill environment, the all solid state, fan-less design improves longevity.



Accurate temperature measurements are critical to the lumber drying process. All CDK temperature sensors will be industrial self-diagnosing RTD's. Each RTD sensor is fitted into a mineral insulated metal sheath (stainless steel 1/4" OD) to provide a robust and impact resistant fitting. All RTD leads are protected with armored cable and high

temperature insulation. All terminations and connections are external to the CDK in aluminum terminal heads. RTD's are engineered to be placed in specific areas throughout the CDK. Reheat sensors are installed in refractory lined heat shields to reduce radiant heat influences and provide true entering and exiting air temperatures.



### **DryTrack® CDK**

The DryTrack® CDK system consists of 4 sensor assemblies and 2 DryTrack® meter cards per track. Sensors are located at each dry end of the MD section to read the lumber M.C. as it exits the drying section. Painted steel sensor arms and supports are rigidly mounted to the CDK structure. During operation, sensor arms are raised into position to contact stainless steel plates inserted by the operator at designated sticker openings. Prior to pushing, arms are lowered to clear any protruding sticks or boards.

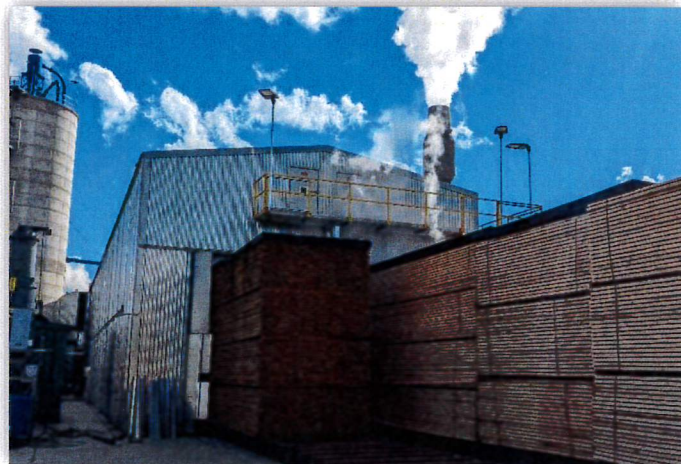


Arms are raised and lowered using pneumatic cylinders located outside the kiln wall. Through wall penetrations are used to pass the stainless-steel lifting cable that connects the pneumatic cylinder to the sensor arm. An additional insulated wall penetration is used to connect the meter card to the sensor. All electronics are located outside the kiln keeping them out of the harsh CDK environment. Meter card enclosures are kept under positive air

pressure to keep contaminants out and allows KDS Windsor to offer a 3-year replacement warranty on all meter cards.

### **Vapor extraction unit**

Extraction modules at each end of the CDK are designed to reduce ground level water vapor by pulling the vapor through a powered stack and projecting it up away from the end of the CDK. Extraction units use a bifurcated fan with a variable speed motor. The 4' long, all aluminum and stainless-steel units are attached to each end of the CDK. Vapor extraction units will pull the majority of the water vapor that normally exits the end doors up high into the atmosphere to avoid the potential fog hazard in loading area.





## KDS Windsor Green Sawdust Gasification Burner System:

The KDS green sawdust gasification burner system generates combustible gases from green sawdust. The combustible gases are transferred through the ignition tee to begin the combustion process. Secondary gas burners individually manage inlet air for complete and clean combustion. The clean heated air is pulled through a large mixing chamber and combined with both return air from the CDK and outside air then forced into the CDK through a large recirculation blower for process heat.

The KDS Windsor green sawdust gasification burner system is the most sophisticated and highly automatically controlled burner available. Numerous temperatures and air pressures are monitored to trigger alarms and shutdowns if necessary. Automatic control is achieved through more than a dozen points of adjustment to shape the temperature profile from gasification to clean, complete combustion. Accurate temperature control is the result of combinations of variable speed blowers, proportioning inlet vane



dampers and electro-pneumatically controlled butterfly dampers. Multiple PID and cascading control loops automatically maintain temperatures to deliver consistent heat and the cleanest dried lumber. Advanced control loops and an intuitive operator interface reduces the time required for site personnel to monitor the burner system and minimizes the need for adjustments.

The KDS Windsor burner system is the product of years of research and field experience transitioning from using green sawdust to heat batch kilns to the unique requirements of heating CDKs. Our design has proven to meet or exceed its rated output allowing us to offer the highest production guarantees available.

The heat plant included with the proposed CDK is a KDS Windsor green sawdust gasification burner system. The burner system is comprised of highly-engineered and robust components including:

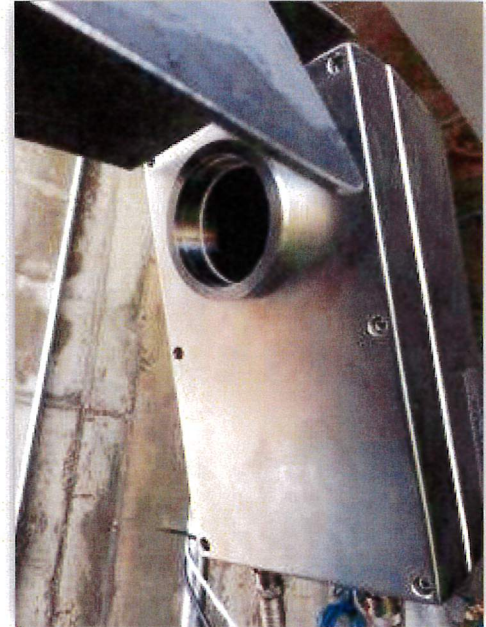
- Unique dual stack design for safety and ease of use.
- Multiple under-grate air inlets for even air distribution as it enters the pile.
- American made, CNC machined cast iron grates.
- Unique bridgwall with pile management air system.
- Factory poured and cured refractory lined green sawdust gasification chamber.
- Factory poured and cured refractory tee and burner abort stack assembly with sleeved intake for pre-heat of gas combustion air and failsafe shutdown.
- Secondary gas burner system with 3 individual burner chambers.
- Factory poured and cured refractory hot duct sections between burner chambers and the mixing chamber.
- Factory poured and cured refractory lined discharge stack for keeping combustion ducts hot during idle periods for quick burner system re-starts.



### Wood fuel moisture monitoring system

We have included our proprietary, real time, automatic wood fuel moisture content measuring system which will continuously measure the MC of the fuel as it is delivered to the burner. The fuel monitoring system provides the operators real-time values of the incoming fuel MC through the Dryspec® CDK HMI control screens. Fuel MC data is monitored and recorded with historical, configurable trends.

Note: If wood fuel moisture content is beyond the maximum allowable rating for the system, the heat value of the fuel is reduced and the BTU output of the burner and burner performance will be affected, including how clean it will burn. Wet fuel will negatively affect the CDK push rate.



### Grate frame supports

Each gasifier is provided with 6" x 4" x 1/4" interior grate frames and 6" x 2" x 1/4" perimeter frames. The frames are all welded construction and provide the cast iron grate support. The lower shaker grate bearings are bolted to this frame.

### Grates

Each gasifier is provided with 6" wide x 41-1/2" long cast iron pinhole grates. The grates have 1/4" diameter reverse taper holes to provide efficient wood gasification and self-cleaning properties. All grate holes are CNC machined for accuracy, rather than cast into the piece. All grates are made in the U.S.A.

### KDS Fuel Tracker MC®

### Grate shaker

Each gasifier is provided with 6" wide x 41-1/2" long shaker grates complete with cast iron bearings. The grate shaking mechanism is comprised of a 2-1/2" diameter Sch. 80 pipe shaft and 3" diameter pipe sleeves complete with steel linkages and tie bars. Each end of the shaft is connected to a hydraulic cylinder. Two automatic limit switches are provided for timing the position of the shaker system.

### Gasifier walls

Gasifier walls are fabricated from 1/4" thick plate framed with 4" x 3/8" steel angles. The wall sections are a maximum of 8'-0" wide x 11'-3" high. All sections are factory poured utilizing a dense, high temperature refractory over a lightweight insulating refractory. Stainless steel refractory anchors are provided at 12" centers on the walls for anchoring the refractory. The wall sections are shipped as cast sections and field-bolted with a trowelable plastic refractory between sections. All required service access doors and observation windows are factory installed.

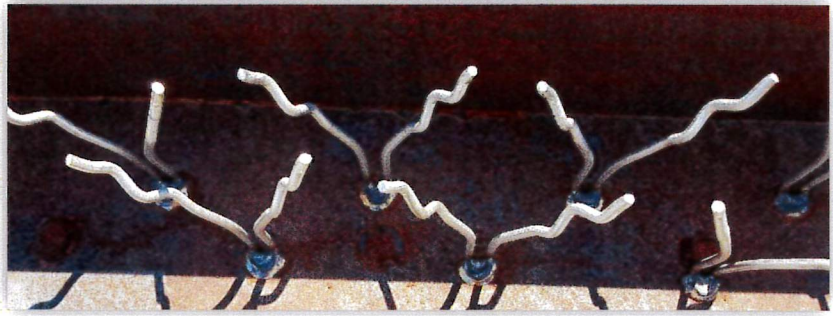


### Gasifier roof

Each gasifier roof is fabricated into three sections with a maximum width of each section 7'-0 1/2" wide. They are fabricated out of 1/4" thick steel and stiffened with structural channels. The roof has stainless steel "V" anchors factory welded on 9" centers for the refractory attachment. The dense, high temperature refractory is poured over a lightweight insulating refractory. The fuel hopper and gas outlet openings are factory cast into the roof. A set of stairs and catwalk will be provided for external access to the roof of the burner.



Note: All stainless steel wall and roof anchors are 3/8" diameter, single piece formed and twisted rod which are bent in a U-shape for welding to the burner steel. This allows for approximately 2" of weld on the inside and 3" of weld on the outside of the bend, substantially stronger than stud welding only. The weld is critical to minimize the possibility of roof refractory collapses.



#### **Automatic idle control air actuation system**

The burner is provided with our innovative automatic idle control air system with safety blowback shield. Designed with operator safety in mind, this system will automatically open the side door during a shutdown to allow the burner to enter a controlled idle mode and eliminates the requirement for operators to intervene. The door opening can be adjusted from the operator screen as more or less air is desired to control idle temperatures.

#### **Gasifier internal bridgewall design**

A 23" thick poured refractory wall section is located approximately 4'-0" from the rear wall where the observation window is located. This wall separates the sawdust section from the rear of the burner wall nearly doubling the gas volume in the gasifier section above the grates versus systems without a bridgewall. This additional volume provides longer gas retention time and produces cleaner hot gasses exiting the chamber and entering the kiln recirculation air system due to the increased distance of the fuel to the suction point.



The bridgewall forced air system is also included with an air injection blower system to stoke the fuel bed above the shaker grates to maintain pile thickness. An additional water pit and second ash screw are provided to minimize ash carry over into the kiln, creating cleaner lumber.

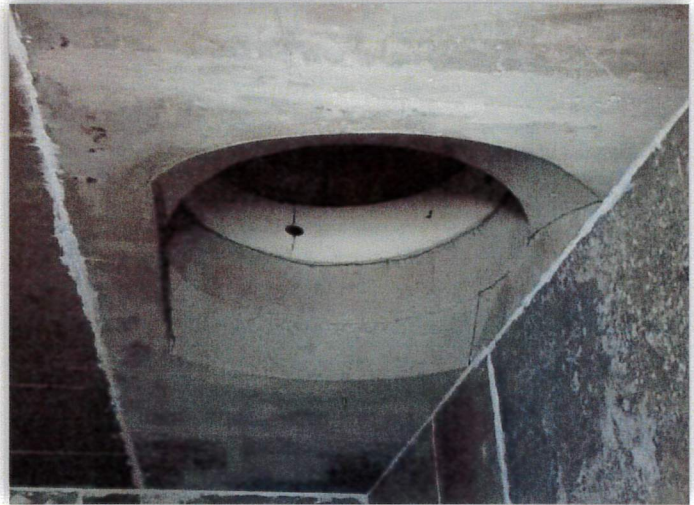
### **Primary ignition section**

A refractory lined ignition section is on top of each primary gasifier chamber and is provided with its own blower.

Gas ignition begins in this section and the burning gas is delivered to 3 individual gas burner sections. The inlet of the ignition section is elongated to lower the suction on the fuel bed and minimize any carry over into the CDK.

### **Secondary gas furnace**

A refractory lined, three section secondary gas burner is provided complete with factory installed combustion air tuyeres. The secondary gas burner is installed at the outlet of the refractory tee. A separate blower provides combustion air to the three secondary gas burner sections. At the exit of the burner section is the refractory lined choke. The outlet of the choke is connected to the refractory lined hot duct.



### **Refractory duct**

Each gasifier is provided with a straight refractory lined duct and elbow which connects from the secondary duct to the reheat mixing chamber. A structural steel frame will be provided to support the refractory ductwork to keep the weight of the ductwork off the mixing chamber.

### **Additional refractory duct sections (option)**

We will add 4 extra hot duct sections, without air injection, to give an approximate 30' distance from choke to discharge to allow for longer retention time and more thorough combustion. This will also extend the fuel incline screw approximately 20'.

### **Under-fire air**

Multiple under-grate inlet dampers are provided complete with proportional pneumatic actuation to evenly distribute the under-fire air for a uniform formation of gases (pyrolysis) from the fuel bed.



### **Ash removal screw**

Each gasifier is equipped with 2 automatic ash removal screws that are operated with an adjustable timer that allows the frequency and duration of the ash removal to be set by the operator. Each ash removal screw is 9" diameter, full pitch, running in a tubular trough (in each of the two ash pits). The screws are driven by shaft mounted reducers complete with 3 HP TEFC motors and belt drives. The screws and tube liners are high grade AR400 steel for longer service life. Both ash screws dump into a 3HP transfer screw to deliver the removed ash to the customer supplied bin.



### Hydraulic system

A 3 HP hydraulic unit is provided to operate the shaker system. The unit is provided with a solenoid valve to automatically shift the direction of the shaker grates. Two 3" diameter x 4" stroke hydraulic cylinders are provided, complete with hoses and piping.

### Abort stack

The abort stack system sits atop the refractory duct above the gasifier. The system is designed with fail-safe counterweights and automatically opens if power to the gasifier is lost or in case of alarm controlled burner shutdowns. This stack provides the safety failsafe by pulling the hot air away from the kiln when triggered in an alarm condition.

### Fuel hopper with chain drive

The all-welded steel fuel hopper is complete with 3/8" thick plate construction and 3/8" x 3" bar stiffeners on 24" centers. The bottom flange is 1/2" x 4" wide bar. A high temperature gasket tape and silicone seals the fuel hopper to the gasifier.

The fuel hopper is topped with a fuel drag chain system to level the fuel in the hopper while automatically filling in any holes in the pile. The hopper is provided with vibration type fuel level switches for operating the leveling chain. This provides controlled switching of the fuel delivery to the gasifier fuel hopper. It will also have K type thermocouples to monitor temperatures for safety shut down on fuel loss.

### Inclined screw conveyor

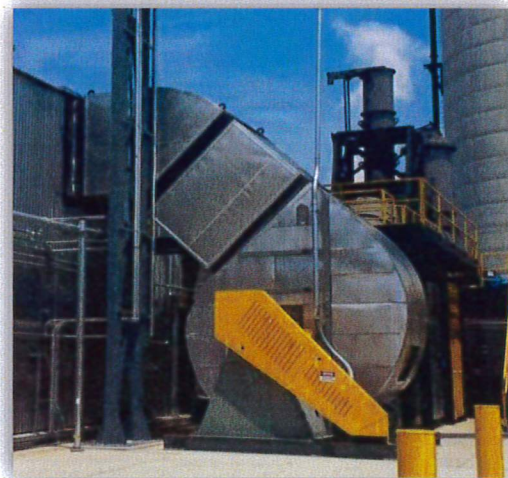
Fuel is delivered to the fuel hopper via a 14" diameter inclined screw conveyor that is provided with a half pitch screw and all required hanger bearings. The shafts are 2-7/16" diameter with 5/8" diameter hardened bolts. The conveyor is provided with a TEFC motor and shaft mount reducer. The conveyor is sized to deliver the required tonnage of green sawdust.



### Recirculation air system

A high-volume mixing chamber designed from computer modeling thoroughly mixes combustion, return and fresh air prior to delivery into the CDK. The chamber sizing is aerodynamically matched to the air volume created by the recirculation blower. The chamber joins the recirculation blower to the burner and to the CDK using our patented dual return air system. The mixing chamber is insulated with high temperature insulation and sheathed in aluminum.

Installed in the mixing chamber, a refractory lined, double hinged isolation damper separates the hot duct from the recirculation system during idle, shutdown and in alarm conditions. The damper includes a failsafe design that closes when power or air is lost. The mixing chamber is designed to allow the isolation damper to be moved completely out of



the airstream to maximize recirculation air flow. Site ports are installed in the walls of the mixing chamber for visual inspection of the burner output.

A high-performance, Class 3 recirculation air blower system specified by computer modelling for proper air flow at designed static pressure provides the required recirculation air for the CDK.



The blower motor is sized for operation with a VFD to allow for cold start-up without upsizing the motor. The blower housing is also insulated and sheathed like the mixing chamber. A large supply duct delivers air from the recirculation blower into the overhead heat distribution duct. The distribution duct uniformly delivers hot air throughout the CDK using overhead slide gates and aerodynamic reheat air downcomers.

Our patented dual return air duct system brings exiting air into the mixing chamber where it is blended with burner and fresh air. The dual return system uses control dampers to select between wall mounted and overhead ducts to return only exiting air from the CDK. The duct and damper system evens the pressure between fan directions allowing the CDK and burner to run at optimum operating levels at all times. Utilization of the dual return system provides uniform heating and maximizes burner output resulting in the highest possible lumber production.



## On-Site Work And Support:

### Commissioning

KDS Windsor engineers will attend site for up to 3 weeks to test and commission the CDK and burner to ensure it is working to the specified performance criteria. During this period our engineers will provide basic training for your operators of the equipment. Your operators and maintenance staff will need to make themselves available during this training period. The main focus will be to ensure that staff understands how to operate the equipment safely and efficiently.

On-site training will include:

- Starting - Stopping the equipment.
- Selecting and creating different schedules.
- Modifying existing and running schedules.
- Controlling the rate of advancement.
- System safety procedures for safe operation of the burner and CDK chamber.
- Trouble shooting procedures.
- CDK chamber and burner preventative maintenance planning.

### Handover and completion

After commissioning is complete and our engineer has verified the equipment functions to its designed specification, the equipment will be handed over for commercial operation and the practical completion certificate signed. Minor re-work and items to complete which do not affect the safety or commercial operation of the plant will not be grounds for not signing the practical completion certificate. Provisional manuals will be available with final copies of the manuals and as-built drawings being available within 4 weeks.



### CDK structure design

The CDK structure is designed and certified to ASCE 7-16 safety factor 1 with an importance factor of 1.0. Should your insurer require an alternative Category and importance factor there may be additional costs and delivery delays.

### **Mechanical guarantees**

All mechanical equipment supplied by KDS Windsor is covered by a 12-month replacement part guarantee. The guarantee does not cover accidental impact damage, the corrosion caused by drying of CCA or ACQ treated timber or periodic replacement of items such as door seals which are occasionally subject to mechanical damage, but easily replaced, and is conditional on the chambers being used and maintained normally and correctly in accordance with the operation and maintenance instructions. We will pass on suppliers' guarantees (normally 12 months) on all purchased items.

The burner refractory lining is warranted for a period of six months commencing at start-up. Repairs are prorated from date of start-up and will be repaired or replaced after authorization and verification by a representative of KDS.

### **Control hardware guarantee**

DrySpec®/DryTrack® PLC/PC hardware is guaranteed for 12 months only if power to them is supplied from the included uninterrupted power supply (UPS). The UPS will provide clean, regulated power to PLC and computer systems, thus protecting the systems from power surges and spikes. We cannot provide any guarantee on control or moisture content hardware components if the UPS is not in use. DryTrack® moisture measurement cards are guaranteed for 3 years.

### **Software**

Remote support is provided for six months from the date of commissioning for all DrySpec® software systems. This support is via phone or network connection provided that dedicated, direct external phone line or an Ethernet network connection via VPN is made available. Remote support cannot be provided in the event that a dedicated phone line or Ethernet connection is not available. In this case travel costs and travel time will be charged for site visits as required.

### **Safety issues**

It is important to note that the rate of lumber stack advancement and the circulating air volume in the end chambers of a CDK system impacts directly on the exiting air temperature at the open ends of the CDK's:

- Over speeding the CDK will raise the exiting air temperature.
- Insufficient air flow in the end sections will not allow sufficient heat transfer between the hot dry lumber and the cold green lumber.

KDS Windsor has addressed these issues by:

- Accurately controlling the CDK advance rate using our DrySpec® CDK and DryTrack® CDK systems.
- Selecting a fan and motor configuration in the end sections which will ensure effective heat transfer.
- DrySpec® CDK will monitor the exiting temperature at the open doorways and activate alarm and safety procedure should a dangerous high temperature situation arise.

The KDS Windsor CDK system includes visual and audible alarms which will signal when a push is about to occur. These safety systems will be installed at both ends of the chamber as each track is controlled independently. Both these issues need ongoing monitoring with procedures put in place by your operators so as to ensure that you do not end up with an unsafe situation at the ends of the CDK.



## Base Specifications:

<b>Stack configuration:</b>	
Nominal thickness	2"
Target thickness	1.71"
Package width	10'
Layers per package	31
# of packages high per stack	3
Sticker thickness	.75"
Bolster thickness	3.5"
Pack height	75.51"
Total stack height	233.53"
Cart height	15"
Top weight height	7"
Total load height above rail	21 – 3 1/2"
<b>General design specifications:</b>	
Number of CDK's proposed	1
CDK	CDK-351-PS-KDS
Total CDK length	Nominally 351' (may vary) + 8' for vapor extract modules= 359'
Infeed/outfeed track length	150' at each end of CDK
Total length with in/out track	659'
Guaranteed annual production	280MM bd/ft per CDK
Design operating hours/yr.	8,400
<b>CDK structure:</b>	
CDK internal structure	Aluminum structure with stainless steel column footings in the MD section, 316 stainless steel structure in the ER sections
Housing design	Walls and roof – 304 stainless steel inner tray system with corrugated aluminum exterior cladding, vented and self-draining in the MD and 316 stainless steel in the ER sections
Insulation type	Resin impregnated fiberglass
Fasteners	All stainless-steel bolts and screws
# of access doors and location	Total of 20 with 16 at ground level and 4 at fan deck level
<b>Pusher system:</b>	
Number of pushers	2 @ 5 HP each
Pusher design type	Hydraulic design (located under the load)
Pusher location	Just outside ER chambers under each green load track
Carts Linked together	Yes
Hydraulic tank capacity	Approximately 20 gallons each 2 total
<b>Heat plant data:</b>	
Heating method	Direct fired green sawdust gasifier
Fuel Type	Green sawdust
Size of heat plant in Btu/hr.	50MM btu/hr
Wood fuel MC wet basis	48% minimum, 56% maximum
Wood particle size required	9/16" screened material
Approx. max. fuel usage	8 tons/hr per burner
Incline screw motor	15 HP
Fuel hopper drag chain motor	2 @ 7.5 HP*
Combustion air blower motor	25 HP* (TBD)

Ignition air blower motor	20 HP* (TBD)
Bridgwall air blower motor	3 HP*
Ash screw motors	2 @ 3 HP* each
Ash Transfer screw motor	3 HP
Recirculation blower	400 HP* (TBD)
<b>CDK fan system:</b>	
MD fan system	21 x fans @ 76" – 8 blade Smithco
MD fan motor	40 HP* Toshiba motors (TBD)
ER fan system	Each ER = 7 fans @ 76" – 4 blade Smithco x 2 ER's = 14 fans total
ER fan motor	25 HP* Toshiba motors (TBD)
Total # of fans per CDK	35
CDK fan motor controls	VFD
Internal/External drive	External 4-bearing shaft
Direct coupled or belt drive	Gates Polychain Drives
Fan bearing grease Lines	All SST lines w-SST flex tubes from exterior catwalk to bearings
MD fan shafts	2-7/16" T.G.P. steel
ER fan shafts	2-3/16" T.G.P. stainless steel
MD fan shaft support tubes	6" x 8" x 3/8" steel tube - Painted
ER fan shaft support tubes	6" x 8" x 3/8" stainless steel tube and bearing supports
Fan system belt guards	OSHA approved design with hinge style swing open
<b>Air baffling system:</b>	
Overhead baffling	Kiln duty fiber brush baffles above each track
Vertical baffling	Aluminum spring return sidewall baffles on each side of load
Number of vertical baffles	<ul style="list-style-type: none"> <li>MD = 4 pair with 1 pair at each load door</li> <li>ER = 6 pair in each ER = 12 pair total</li> </ul>
Zones per ER	3
<b>Wet bulb control system:</b>	
Control method	Fresh air inlet damper plus tubeaxial fan forced air
# of W.B. sensors	2
W.B. assembly access	Via sidewall access doors
Tim air blower motor option	15 HP*
<b>Vapor extraction modules:</b>	
Vapor extraction motors	20 HP* each
<b>DrySpec® CDK control system:</b>	
PLC	Allen-Bradley ControlLogix
HMI	Allen-Bradley FactoryTalk
DrySpec® CDK control PC	All solid state, fan-less NUC PC
# of D.B.'s in MD chamber	64 RTD's
# of D.B.'s in ER chambers	6 in each ER = 12 total in ER's
* Motor requires VFD by client	



## Scope of Supply:

Concrete foundations and site work:	By KDS Windsor	By client
• Site survey, soil testing, concrete testing and professionally engineered design of civil work		✓
• Profile layouts and point load information	✓	
• Required PE stamped foundation drawings for the CDK and burner	✓	
• Required PE stamped electrical drawings		✓
• Purchase of groundwork, site leveling and compaction to minimum 2500 PSF load bearing capacity per our design		✓
• Concrete supply and installation for CDK foundations		✓
• Rails, rail fixings, and pit covers		✓
• Electrical wiring, conduit, MCC equipment and field installation		✓
• Fire suppression system		✓
• Control and MCC room		✓
• On-site Coordinator		✓
• Obtain building permits		✓
• Provide 480 VAC @ required amps to MCC room		✓
• Provide condensate drain piping to CDK to accept 17,000 gallons daily per CDK		✓
• Provide dry compressed air @ 85 psi to sensor lift arm assemblies, including all required piping		✓
• Responsibility to receive, unload and inspect all items for shipping damage, note the bill of lading and notify KDS Windsor within 48 hours of receipt of shipment. KDS Windsor will not be responsible for any damages that have not been handled as described above. Individual boxes do not have to be opened for inspection.		✓
<b>Installation:</b>		
• CDK installation supervisor, crew and tools	✓	
• KDS Windsor site staff accommodation, meals and local travel costs	✓	
• Telehandler forklift for installation crew		✓
• Hydraulic fluid and welding gases as required		✓
• Crane hire	✓	
• Provide sufficient 120-volt power at the kiln(s) location, for use by KDS Windsor installation personnel, with a minimum of eight power receptacles fed by two minimum 30 amp breakers.		✓
• Provide clean water for wet bulb sensors and for burner water pit		✓
• Provide drinking water and sanitary facilities for installation crew		✓
• Receptacle for debris resulting from KDS Windsor installation work and removal from site		✓
<b>Training and manuals:</b>		
• Training of site operators on CDK operation, maintenance and safety	✓	
• Supply of operating and maintenance manuals - 2 sets	✓	
<b>Fuel delivery:</b>		
• Supply an adequate amount of fuel into burner so that the burner will never run out of fuel		✓