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ELECTRONIC TRANSMITTAL

Date: November 22, 2022

To: Scott Hamlett
shamlett@northernim.com
Northern Iron & Machine

From: Theodore Knutson, MS, P.E.
Knutson Ventilation

Cc: Shawn Conners sconners@northernim.com
Chris Olson colson@northernim.com
Gerhard Knutson, PhD, CIH (Knutson Ventilation)
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Re: Northern Iron & Machine – Hood Certifications
Project 630-004

Enclosed: ☒ Herewith ☐ Under Separate Cover
Sent Via: ☐ Overnight Delivery ☐ US First Class ☒ Email

<input checked="" type="checkbox"/> SENDING	<input type="checkbox"/> RETURNING	<input type="checkbox"/> ACTION REQUIRED
<input type="checkbox"/> For Approval	<input type="checkbox"/> Approved	<input type="checkbox"/> Return with Redline Comments
<input type="checkbox"/> For Your Info	<input type="checkbox"/> Approved as Noted	<input type="checkbox"/> Proceed with Fabrication
<input type="checkbox"/> Preliminary	<input type="checkbox"/> Not Approved	<input type="checkbox"/> Revise and Resubmit
<input checked="" type="checkbox"/> Revised		<input type="checkbox"/> Other
<input type="checkbox"/> Final		

Sets	Date	Description
1	11/22/22	Hood Certification – EQUI 23 revised

Remarks:

Receipt: ☐ Please Sign, Scan, Email
☒ Please Email to Verify Receipt
☐ Receipt Not Required

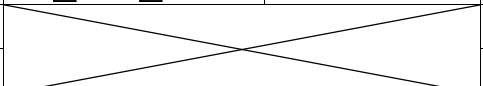
Signed: _____ Date: _____

Hood evaluation and certification

Air Quality Permit Program

Doc Type: Permit Application

- 1a) AQ Facility ID number: 12300088 1b) Agency Interest ID number: 3518
- 2) Facility name: _____
- 3) Date: 11/22/2022
- 4) Emission unit numbers: 23
- 5) Emission unit characteristics:
Dust created by cut off saw (left hood) and a sanding wheel (right hood). Only one hood operates at a time.
- 6) Pollutant(s) emitted: Particulate Matter
PM < 2.5 Micron
PM < 10 Micron
- 7) Is there a recommended hood design for this application in the Industrial Ventilation Manual referenced in the instructions?
☒ Yes, go to question 8.
☐ No, go to question 20.
- 8) Edition of the Manual referenced: 26th
- 9) Page copies included? ☒ Yes
- 10) Attach a separate page with a drawing of recommended and actual hood dimensions; indicate if the recommended dimensions are minimum or maximum or constrained in some other way. Provide all of the following information, as explained in the instructions.
If you insert NA, provide an explanation of the reason that the information is not required:

	Recommended		Actual	
		Units		Units
11) Capture velocity*	NA		NA	
12) Hood air flow	740 & 880	cfm	1,520 & 1,690	cfm
	<input checked="" type="checkbox"/> min <input type="checkbox"/> max			
13) Hood face velocity	NA		NA	
14) Slot velocity	NA		NA	
15) Plenum velocity	NA		NA	
	<input type="checkbox"/> min <input type="checkbox"/> max			
16) Duct velocity	3,500	fpm	4,352 & 4,838	fpm
	<input checked="" type="checkbox"/> min <input type="checkbox"/> max			
17) Fan rotation speed			1,762	rpm
18) Fan power draw			8.6	amps

*Justify this value as the design capture by referencing attached Manual pages. List page numbers here: VS-80-17 & VS-80-30 & VS-80-32

- 19) Attach a separate page showing the capture velocity test plan on a drawing or a sketch.
- 20) If the hood design does not conform to the recommendations of the Manual, or if there is no recommended design for this application, describe your plans to determine the hood capture efficiency below. Refer to instructions before completing:

Hood certification

This certification must be signed by a responsible official and submitted with any application for which the applicant claims a capture efficiency for pollutant-collecting hoods as described in the instructions for Form GI-05A by having the design of the hood evaluated by qualified personnel. The Permittee must measure an air-flow indicator for each hood and maintain a yearly summary of these measurements for a minimum of five years.

Emission unit ID(s)	Control equipment ID	Hood capture efficiency	Pollutant(s) controlled	Tested air-flow indicator from evaluation (indicator: , units:)
23	13/30	80	Particulate Matter	
23	13/30	80	PM < 2.5 micron	
23	13/30	80	PM < 10 micron	

Responsible official

Print name: _____ Title: _____

Signature: _____ Date (mm/dd/yyyy): _____

Hood evaluation instructions

- 1a) **AQ Facility ID number** – Fill in your Air Quality (AQ) Facility Identification (ID) number as listed on Form GI-01, item 1a.
- 1b) **Agency Interest ID number** – Fill in your Agency Interest ID number. This is an ID number assigned to your facility through the Tempo database. If you don't know this number, leave this line blank.
- 2) **Facility name** – Enter your facility name.
- 3) **Date** – Fill in the date this form is completed.
- 4) **Emission unit numbers** – Fill in the emission unit number(s) for the emission unit(s) served by this hood.
- 5) **Emission unit characteristics** – Provide a description of the type(s) of emission unit(s) controlled by this hood. If the units are identical or similar to descriptions in the "Industrial Ventilation - A Manual of Recommended Practices", 21st ed. (Manual), use the terms in the Manual to describe the units. Describe how the pollutants are emitted from the unit, including such characteristics as the speed and direction of release and temperature compared to surrounding temperature.
- 6) **Pollutant(s) emitted** – List the pollutants, using the same names as on Form GI-05A.
- 7) **Is there a recommended design for this application in the Manual?** – It is expected that a hood that conforms to the Manual requirements will be designed to achieve nearly 100% capture. Indicate if this type of emission unit has a recommended hood design in the Manual.
 - a) Grain-Receiving Pits (floor dumps) – Section 13.99 (28th edition) Miscellaneous Operations identifies that a hood design of "Booth", and a minimum Air Volume of 200 actual cubic feet per minute (acfm)/ft² open face area are appropriate. The Permittee must identify how minimum rates are achieved if cross-drafts are present. When slots are less than 0.5(L) apart, they act as a plain opening.
 - b) Unloading – Section 13.50 (28th edition) Material Transport identifies that a ventilation rate of 150 to 200 acfm/ft² of enclosure opening is appropriate for unloading operations. The Permittee must identify how minimum rates are achieved if cross-drafts are present.

- 8) **Edition of the Manual referenced** – Fill in the edition number of the Manual you use. Preferably this should be the latest edition, but some recent older editions may have the same design recommendations for many emission units.
- 9) **Page copies** – Provide a copy of the pages of the Manual you used to evaluate this hood.
- 10) **Drawing of recommended and actual hood dimensions** – On a separate sheet, provide a sketch of the shape and dimensions of the hood as recommended by the Manual, including numerical dimensions and a sketch of the hood as constructed and installed. Indicate on the sketch of the recommended hood if a dimension is a minimum or maximum.
- 11) **Design capture velocity** – Fill in the capture velocity used to design this collection hood, including units. Also fill in the actual capture velocity.
- 12) **Minimum recommended and actual air flow into hood** – Fill in the minimum air flow recommended by the Manual. In many cases this must be calculated using the capture velocity. Fill in the actual air flow for this hood. This can be based on the design for this hood or on testing. Include the units for both numbers.
- 13) **Recommended and actual hood face velocity** – If the Manual recommends a hood face velocity, fill it in. Otherwise, fill in NA. Fill in the actual face velocity. Include units.
- 14) **Recommended and actual slot velocity** – If the Manual recommends a slot velocity, fill it in. Otherwise, fill in NA. Fill in actual slot velocity. Include units.
- 15) **Recommended and actual plenum velocity** – “Plenum velocity” most commonly refers to the case in which the air enters the hood through slots and then passes through a duct of constant cross-sectional area before entering the transition to the smaller duct that leads to the control device. The duct immediately behind the slots is the “plenum.” If the Manual recommends a plenum velocity, fill it in. Otherwise, fill in NA. Fill in the actual plenum velocity. Include the units for both numbers.
- 16) **Recommended and actual duct velocity** – If the Manual recommends a duct velocity, fill it in. Otherwise, fill in NA. Fill in the actual duct velocity. Include the units for both numbers.
- 17) **Fan rotation speed** – Fill in the actual fan rotation speed, including the units.
- 18) **Fan power draw** – Fill in the actual fan power draw, including the units.
- 19) **Show the capture velocity test plan on a drawing or a sketch.** On a separate sheet, provide this information.
- 20) **If the hood design does not conform...** – If you answer No to question 7, or the hood cannot be certified as meeting the Manual requirements, you cannot automatically use a capture efficiency of 80% for this hood. The following is guidance on some actions you can take to determine a capture efficiency.

If you are applying for an operating permit and if the capture efficiency has been determined by performance testing in accordance with Minn. R. 7017.2001 to 7017.2060, and the test report has been reviewed and approved by the Minnesota Pollution Control Agency (MPCA), the determined efficiency must be used.

Hoods that do not conform to the recommended design and operating practices in the Manual, must be either evaluated and brought into conformity with those design and operating practices or tested in accordance with Minn. R. 7017.2001 to 7017.2060, including the requirement for a pretest meeting, and the test report reviewed and approved by the MPCA, to determine a capture efficiency. Hood evaluations must be conducted by qualified personnel. The Responsible Official must sign the *CR-02 Hood evaluation and certification*. The certification and evaluation must be submitted with the application.

You may propose an alternative capture efficiency based on engineering calculations approved by the Commissioner. The calculations must be prepared by qualified personnel, such as a Certified Industrial Hygienist. The MPCA has developed a protocol for conducting a Building Capture Study as an option. To request a copy of the protocol, contact the air quality permit writing assistant at beckie.olson@state.mn.us or 651-757-2123.

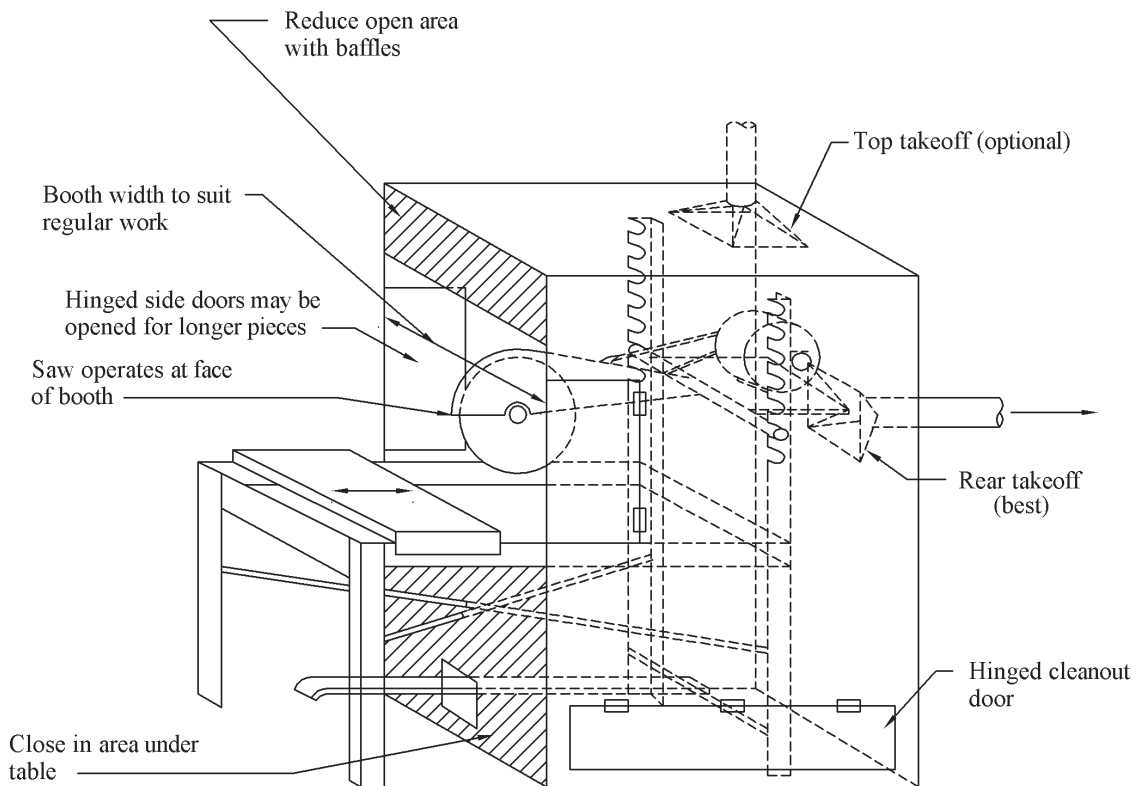
If you are applying for a modification to an existing emission unit with a hood to collect emissions, for the purpose of determining if the proposed change is a Title I modification, you may not assume a capture efficiency for the hood unless the use of the hood is part of a federally enforceable permit (For the definition of Title I modification, refer to Minn. R. 7007.0100, subp. 26.). You may assume a capture efficiency of 80% for a hood included in a federally enforceable permit if the hood has been evaluated and conforms with the design and operating practices recommended in the Manual, American Conference of Governmental Industrial Hygienists, Lansing, Michigan, 1991". The evaluation shall be conducted by qualified personnel from a testing company, as defined in Minn. R. 7011.0060, subp. 4a. The Responsible Official must sign the *CR-02 Hood evaluation and certification*. The certification and evaluation must be submitted with the application.

The results of the evaluation must be kept on site. The owner or operator must make this evaluation available for examination and copying upon request of the Commissioner and must, upon request, submit these records to the Commissioner by the time specified in the request.

Hood certification instructions

- 1) **Hood Certification** -- For each hood to be certified, fill in the ID number(s) of the emission unit(s) served by that hood, the ID number(s) of the control equipment, the capture efficiency of each hood to be certified, an airflow indicator that was established during the evaluation, and the pollutant(s) controlled. The Permittee must measure an airflow indicator, such as fan rotation speed, fan power draw, face velocity, or other comparable air flow indicator for each hood. Refer to the instructions for Form GI-05A for restrictions on the efficiency that may be claimed and documentation required to claim a capture efficiency. This form must be completed and submitted to the MPCA, as well as kept on file at the facility.
 - a. For a hood certified to meet the design requirements of "Industrial Ventilation - A Manual of Recommended Practice, American Conference of Governmental Industrial Hygienists," when a performance test has not been completed, fill in 80% for the capture efficiency.
 - b. If performance test has been completed, fill in the capture efficiency determined by test.
 - c. Alternative - propose alternative capture efficiency based on engineering calculations approved by the Commissioner. Prior approval of calculations needed before submitting modifications; this is likely in addition to a building capture study.
- 2) **Signature block** -- this form must be signed by a responsible official as defined in Minn. R. 7007.0100, subp. 21.

FIGURE
VS-80-17



$Q = 250 \text{ cfm/ft}^2$ of open face area
Minimum duct velocity = 4000 fpm
 $h_e = 0.50 V_{p_d}^2$ (no taper)
 $h_e = 0.25 V_{p_d}^2$ (with 45° taper)



TITLE

ABRASIVE CUT-OFF
SAW

FIGURE

VS-80-17

DATE

1-07

CHECK CODES, REGULATIONS, AND LAWS (LOCAL, STATE, AND NATIONAL)
TO ENSURE THAT DESIGN IS COMPLIANT.

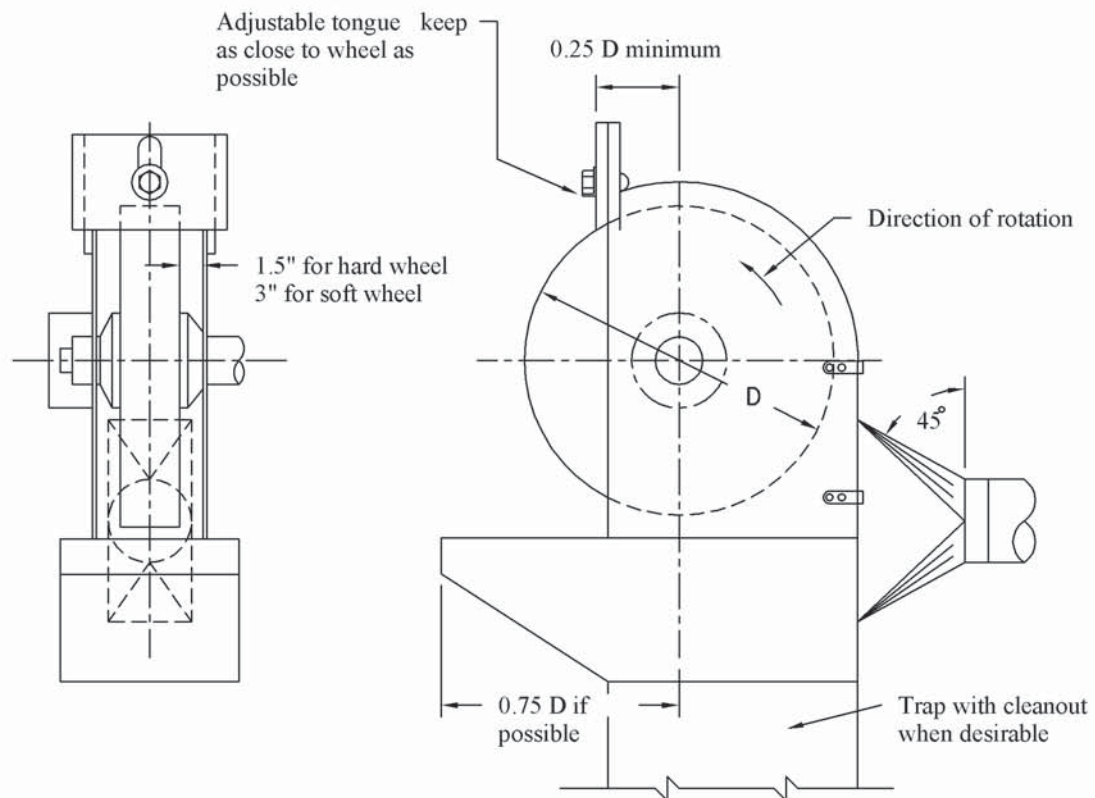


FIGURE VS-80-30

Minimum duct velocity : 3500 fpm, 4500 fpm if material is wet or sticky

$$h_e = 0.65 V P_d \text{ for straight take-off}$$

$$h_e = 0.40 V P_d \text{ for tapered take-off}$$

Wheel dia. inches	Wheel width inches	Exhaust flow rate cfm	Exhaust flow rate cfm
		Good enclosure *	Poor enclosure
Up to 9	2	300	400
over 9 to 16	3	500	610
over 16 to 19	4	610	740
over 19 to 24	5	740	1200
over 24 to 30	6	1040	1500
over 30 to 36	6	1200	2000

* not more than 25% of the wheel is exposed

Note : Consult applicable NFPA Codes, Reference 13.80.2

Caution : Do not mix ferrous and non-ferrous metals
in same exhaust system.



TITLE

MANUAL BUFFING AND POLISHING

FIGURE

VS-80-30

DATE

1-07

CHECK CODES, REGULATIONS, AND LAWS (LOCAL, STATE, AND NATIONAL)
TO ENSURE THAT DESIGN IS COMPLIANT.

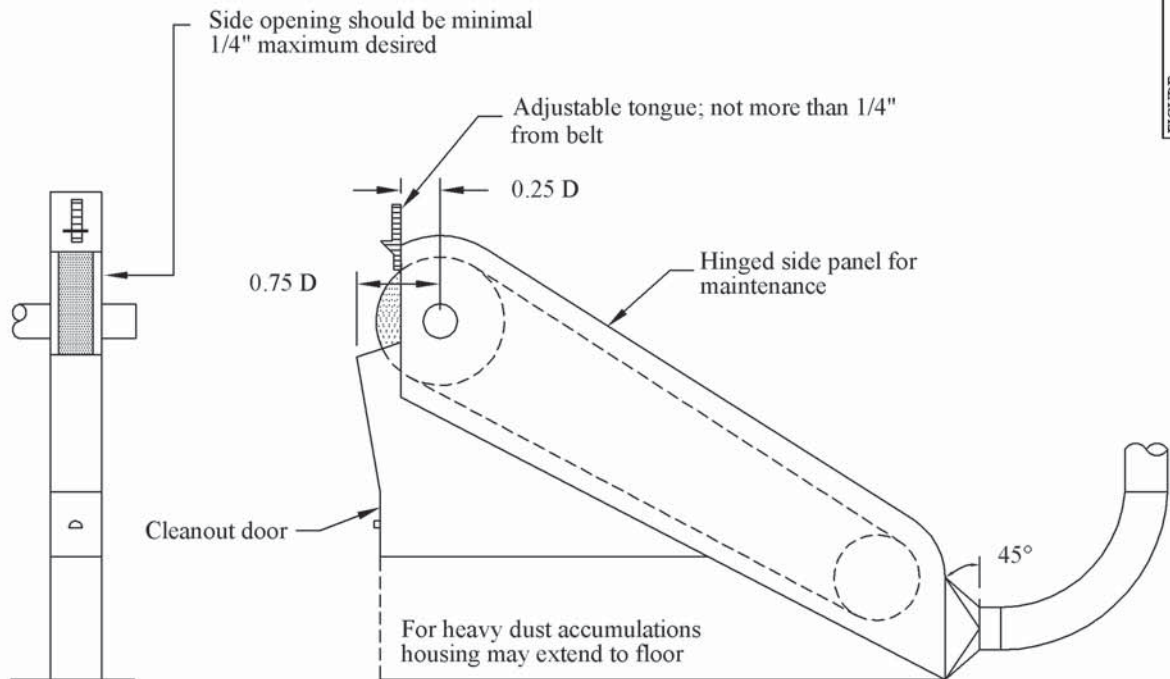


FIGURE VS-80-32

Belt width inches	Exhaust flow rate cfm	Exhaust flow rate cfm
	Good enclosure *	Enclosure
1 1/2	220	300
2	390	610
3	500	740
4	610	880
5	880	1200
6	1200	1570

* Hood as shown; no more than 25% of wheel exposed.

$$h_e = 0.40 VP_d$$

Minimum duct velocity = 3500 fpm, 4500 fpm if wet or sticky.

Notes:

1. Consult applicable NFPA Standards. See Reference 13.80.2
2. For titanium, aluminum and magnesium eliminate hopper and use 5000 fpm through hood cross section.
3. Caution: Do not mix ferrous and non-ferrous metals in same exhaust system.



TITLE

BACKSTAND IDLER
POLISHING MACHINE

FIGURE

VS-80-32

DATE

1-07

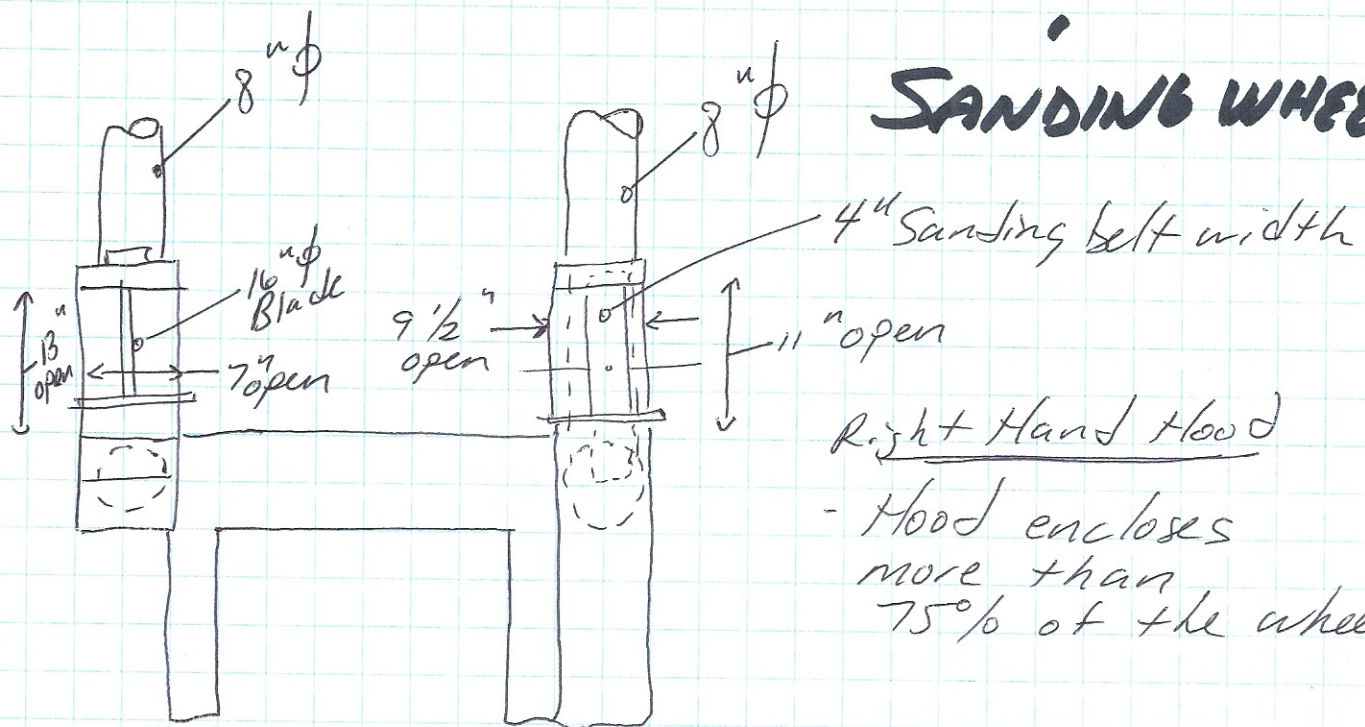
CHECK CODES, REGULATIONS, AND LAWS (LOCAL, STATE, AND NATIONAL)
TO ENSURE THAT DESIGN IS COMPLIANT.

EQUI 23

10. Sketch

CUT-OFF SAW

SANDING WHEEL



Right Hand Hood

- Hood encloses more than 75% of the wheel

Left Hand Hood

* NOTE!

$$\text{Open Area} = \left[\frac{7" \times 13" \times 1'}{144"} + \frac{6" \times 7" \times 1'}{144"} \right] = \left[0.63 \text{ ft}^2 + 0.292 \text{ ft}^2 \right]$$

$$At \ 250 \text{ actm/ft}^2 \text{ (VS-80-17)}$$

$$Q_{req'd} = 230 \text{ actm}$$

As a result VS-80-30 poor enclosure is selected for design basis

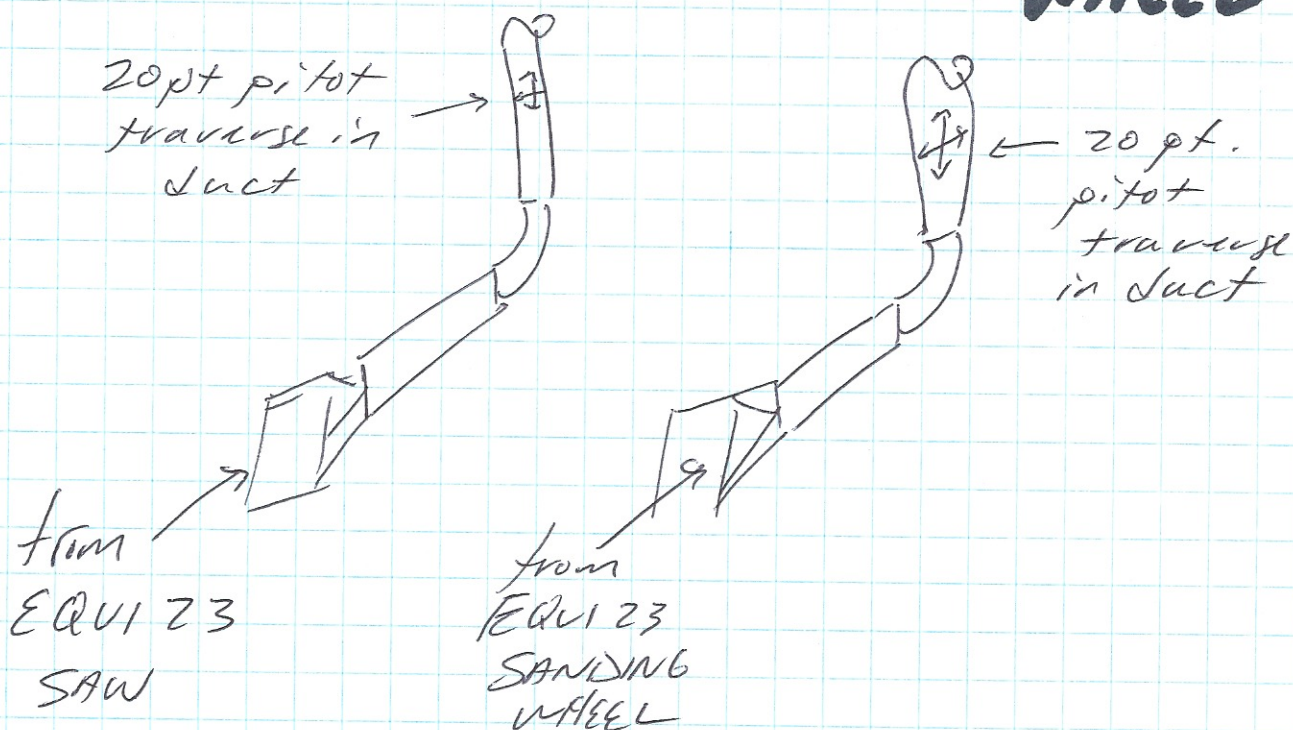
Also $3 \times$ the VS-80-17 Rate

EQUI 23

CUT-OFF
SAW ?

SANDING
WHEEL

19. Test Plan



Variable Air Volume - Only One Hood Operates at a Time

Cut-Off Saw:	Left Hand Hood Blast Gate - Open
	Right Hand Hood Blast Gate - Closed
Sanding Wheel:	Left Hand Hood Blast Gate - Closed
	Right Hand Hood Blast Gate - Open