Paint Booth Application Intelligence

Paint booths are walled structures used to safely contain painting and other finishing processes. Paint booths are present in a variety of industries including automotive, aviation, manufacturing, millworks, and many more. In general there are two types of paint booths: non-ducted (open face), and directly ducted (enclosed). These two types of paint booths require two different approaches to provide optimal heating and ventilation.

Non-ducted systems are treated like any make-up air application. These paint booths take the form of either a three walled structure or a designated painting area in a manufacturing plant. When walled systems are applied, filters are typically installed in the walls in order to remove particulates from the makeup air. Occasionally a filtered door will also be used. Direct ducted systems, on the other hand, are “true” paint booths in that they are fully enclosed four walled structures.

Figure 1: Open faced paint booth

Figure 2: Enclosed paint booth

While an “open faced” paint booth would simply use discharge temperature control, “enclosed” paint booths typically use a control system specifically designed for painting and finishing booths. This control system is capable of supporting the following painting/finishing processes:

Spray Only: This type of booth is used for painting only. Design priorities are to make-up the exhausted air and provide tempered air for the operator(s).

Figure 3: Open faced paint booth with filtered doors

Spray/Cure: This type of booth is used for both painting and curing. Design objectives include making-up the exhausted air, providing tempered air for the operator(s) during Spray mode, and providing elevated temperatures for Cure mode. Rupp provides a dual speed unit with a VFD for high speed / low heat in Spray mode (with operators in the booth) and low speed / high heat in Cure mode (with no operators in the booth during elevated temperatures). Booth temperatures in Spray mode are typically 70 °F and 140 – 160 °F in Cure mode. A 50% reduction in air volume is used in Cure mode to meet temperature rise requirements.

Cure Only: This type of booth is used for curing only. Design intent is to provide elevated temperatures for the curing/baking process. Typical temperatures in the booth for Cure mode are between 140 – 160 °F.

Each of these controls systems have inherent safety features built into the design which meet or exceed code requirements. These include a spray gun solenoid interlock that disengages in Cure mode, fire system interlocks, door interlocks, as well as auto-off lights in Cure mode so as to alert operators to vacate the booth.

With all direct ducted systems Rupp recommends the Auto Balance feature for the exhaust fans in the booth. This system includes a static pressure controller, pressure gauge, and variable frequency drive (VFD).

Benefits include:

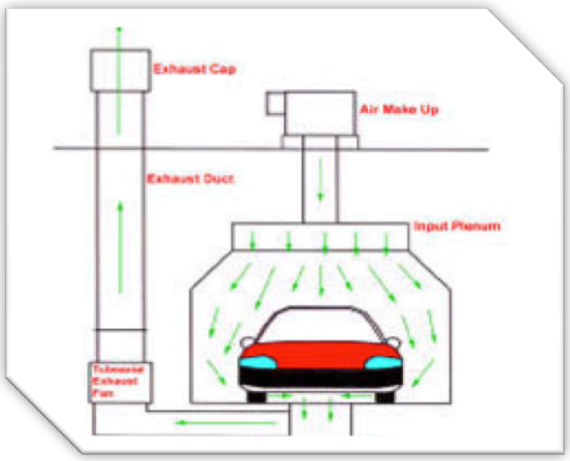
1. Continually monitoring booth pressure
2. Automatically adjusting exhaust air flow to meet booth balance requirements in ‘Spray’ and ‘Cure’ mode
3. Automatically adjust fan speed as filter load increases to maintain constant booth pressure. Exhaust fan overloads (by others) are recommended when multiple fans are tied to one VFD.

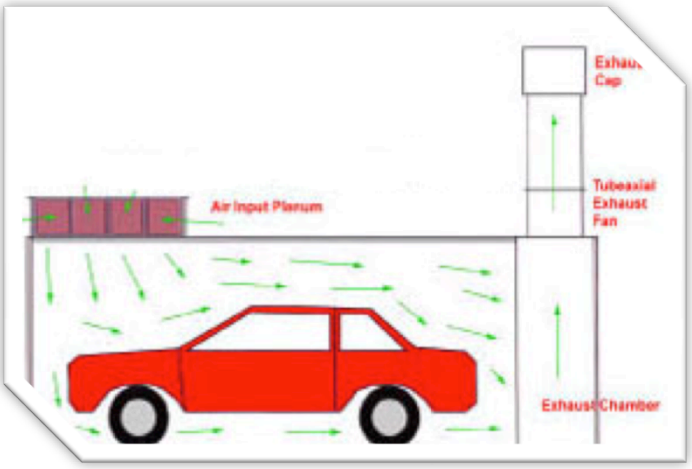
Sizing guidelines

In addition to the style of booth being used, paint booths are further delineated by the ventilation scheme used. Common ventilation techniques are:

Downdraft: MAU introduced at top of booth and exhausted from bottom. Common in vehicle shops. Generally sized at 50 fpm multiplied by the booth floor area.

Semi-downdraft: Walls typically filtered. Generally sized at 100 fpm across the face of the booth.





Side-downdraft: MAU introduced at top of booth and exhausted out the side walls. Common in auto shops. Generally sized to provide 50 fpm across the floor area.

Cross-draft: One trunkline at each the front and back of the booth. MAU introduced through front trunkline and exhausted out the back trunkline. Generally sized at 100 fpm across the face of the booth.

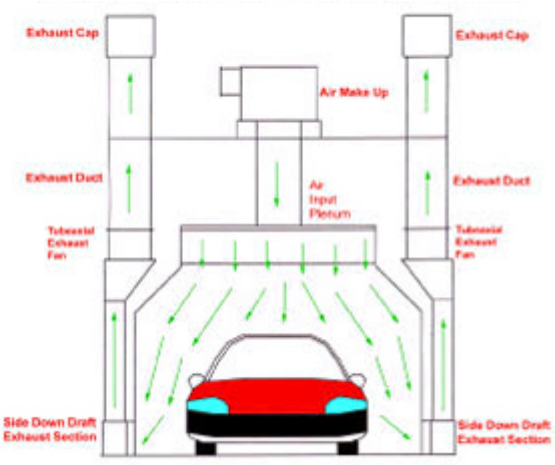


Figure 6: Side-downdraft airflow

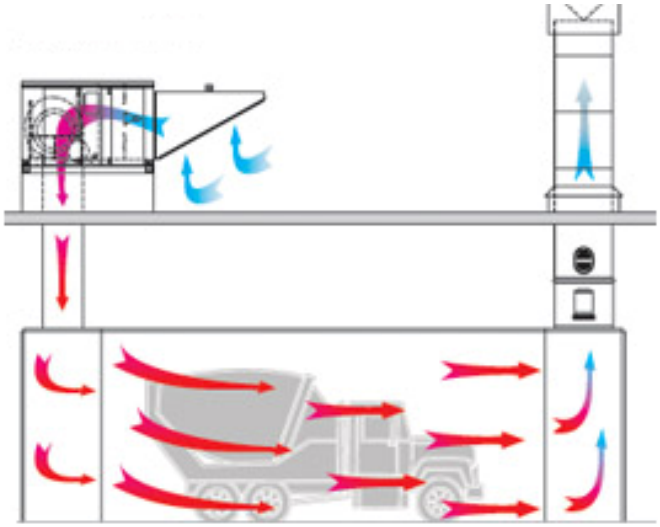


Figure 7: Cross-draft airflow