

SkillsUSA WI Technical Standards

The following rules are for the state contest only. Students/Teams that qualify for the national contest need to adhere to the rules and guidelines for that national contest. The rules can be found in the *Skills USA Championships Technical Standards* available from [SkillsUSA Publication Sales](#). For both state and national contests, you should also watch for contest updates sent from the Wisconsin SkillsUSA state office. For national contests, you can find contest updates at the national [SkillsUSA](#) website at <https://www.skillsusa.org/>.

C0₂ DRAGSTER Middle School / High School

PURPOSE

To evaluate students' ability to design and construct a CO₂ cartridge powered vehicle within specifications and understanding of metric measurement.

GENERAL REGULATIONS

People entering this contest must follow all rules listed below as well as the “**General Regulations**” of the Wisconsin Skills Championships. The “General Regulations” can be found at: http://www.skillsusa-wi.org/wordpress/?page_id=130. You will be held accountable for knowing and following all rules and guidelines of the Wisconsin Skills Championships.

RESUME

All competitors must create a one-page résumé. See Sample Resume on Page 7 of this document.

CLOTHING REQUIREMENT

For men: Official red blazer, windbreaker or sweater, black dress slacks, white dress shirt, plain black tie, black socks and black shoes.

For women: Official red blazer, windbreaker, or sweater, black dress slacks or skirt, white collarless blouse or white blouse with small, plain collar that may not extend onto the lapels of the blazer, black sheer or skin tone hose and black shoes.

Clothing Exception: Students competing in another event may wear the required SkillsUSA dress for that competition to the CO₂ Dragster contest without being penalized.

IMPORTANT NOTE (Clothing Requirement for Awards Ceremony): Contestants must wear official SkillsUSA attire as defined by the national standards when going on stage to be presented any awards they may have earned. Students who are not wearing official SkillsUSA attire will not be allowed on stage.

ELIGIBILITY

This contest is open to active SkillsUSA members.

A limit of **four** students from each school may enter.

This is a state-only contest. There is no corresponding national contest.

- *Winning this contest does not qualify the participant to attend the National Leadership and Skills Contest.*

OBSERVER RULE

Observers are not allowed in the judging area prior to the race. Observation of the race is encouraged, however, observers who interfere with either the race or the judging process will be required to leave the race area.

If inconsistencies are noticed with the launching system, observers (advisors or contestants) may respectfully bring observations to the attention of the technical chair or judges.

CONTEST PROCEDURES

1. Entries will be placed either the Junior Division (grades 6-8), or the Senior Division/Secondary (grades 9-12).
2. Chapters may have no more than four entries.
3. Dragsters not conforming to the safety-related specifications will be disqualified.
 - Disqualified dragsters will not be eligible for any prizes or awards.
4. Dragsters not conforming to any assessed specifications not related to safety will be subjected to a penalty but will still be allowed to compete.
5. CO₂ Dragster judging criteria:
 - Refer to the CO₂ Dragster Specifications Sheet (Page 4) and Contest Rating Sheet (Page 9) for judging criteria
 - **NOTE:** The judge's decision will be final.
6. Each student will provide **three** (8-gram) CO₂ cartridges "engines."

SCOPE OF THE CONTEST

The contest will consist of the following parts - compliance with specifications, design/drawing, construction, resume, contestant attire, and race performance.

1. **Compliance with Specifications**
 - a) Four specifications related to safety are mandated to be checked on each dragster. (Refer to the CO₂ Dragster Contest Rating Sheet on Page 9)
 - Any dragster found to not to confirm to any safety standard will be disqualified from the competition.
 - b) The judges will select four additional specifications to check on every dragster within the division classification.
 - Any assessed specification found to be outside of the specification limits will incur a penalty, either points or added time.
 - c) Body Blank (balsa wood is recommended; however, dragster body may be 3D printed using PLA filament). Refer to the specifications on Page 4 for minimum and maximum specifications for the body blank.
 - d) The body of the dragster shall be one piece all-wood construction. No parts – such as body strengtheners, fenders, plastic canopy, exhausts, or air foils – may be glued, attached to, or enclosed within the dragster. **No glue may be added to the dragster.** Air foils, fenders and other appearance items may be designed and engineered into the original body blank. Bearings and lubricants may be used in construction.
 - e) 3D printed PLA dragsters are to be unfinished.
 - f) Wooden dragster bodies are to be clear coated or painted. **No bare wood.**

- g) If the dragster is 3D printed, size of dragster may not exceed the form defined by the wood body blank specification outlined in the Specifications on Page 4. The form of dragster shall be enclosed by the outer shell with a honeycomb reinforced interior. (Cavities for interior wheel designs are permitted in both PLA and wood). Wall thickness of 3D printed dragster shall be a minimum of 3 mm around the entire outer surface. Mass requirements of PLA and wood dragsters shall be identical.
- h) If the dragster body weight is less than the minimum specification, a penalty will be assessed at 0.050 seconds added to the Race Results for each gram of weight that the dragster is under the minimum specification. This is to offset the unfair advantage of an underweight dragster while still allowing the vehicle to compete.

2. Design/Drawing

- a) Every entry must be submitted with a drawing of the completed dragster. A three-view (front, top and side view) drawing with dimensions shall be made either full scale on 11" x 17" paper or half-scale on 8 1/2" x 11" paper. A sample of this drawing to be used as a reference can be found on Page 8 of this document.
- b) Each dimension shown on the sample drawing must be included (minimum).
- c) Standard engineering procedures/practices should be followed if additional information is included.
- d) Drawings may be made using a CAD system, ink or graphite.
- e) Originals or blueprint copies will be accepted.
- f) The Title Block will include a space to enter the contestant number which will be assigned during your SkillsUSA chapter's registration. Contestants are required to enter their contestant number (assigned upon registration) in the title block prior to turn-in of your dragster and drawing. (See Figure 1, Page 8 for an example of the drawing sheet layout).

3. Quality of Construction

Each dragster will be evaluated on the following construction details.

- Craftsmanship – geometry, uniformity and symmetry
- Appearance and finish sanding, no file marks or blemishes
- Construction of dragster meets requirements and matches the drawing

4. Contestant Attire

Contestants are expected to wear official SkillsUSA attire during the competition (Refer to Clothing Requirement on Page 1).

5. Resume

Each contestant will submit a resume. (Refer to Sample Resume on Page 7).

6. Race Performance

The performance of each qualified dragster will be scored as outlined in the CO₂ Dragster Contest Rating Sheet (Refer to Page 9).

CO₂ Dragster Specifications (Bolded specifications are mandated to be checked)

Area of Specification		Limitations	
		Minimum	Maximum
a.	Axle diameter	3 mm	3 mm
b.	Axle length	42 mm	70 mm
c.	Axles bearing (inside diameter)	3.5 mm	4.5 mm
d.	Axle hole diameter	3.5 mm	4.5 mm
e.	Bottom of axle hole to bottom of dragster	5 mm	10 mm
f.	Axle hole position (from either end)	9 mm	100 mm
g.	Axle secured into wheel hub – Ref. 3(f) [DQ'd if loose]	---	---
h.	Dragster body length * (one solid piece)	200 mm	305 mm
i.	Dragster body height (maximum) at rear w/wheels	---	75 mm
j.	Dragster body weight (Without CO ₂ cartridge installed)	50 grams	170 grams
k.	Dragster body width at axles**	35 mm	42 mm
l.	Total body width across the wheels (maximum)	---	90 mm
m.	Power plant depth of hole [DQ item]	50 mm	52 mm
n.	Power plant housing (minimum) thickness [DQ item]	---	3 mm
o.	Power plant hole diameter	19 mm	22 mm
p.	Power plant low point – bottom of hole to floor (wheels on)	26 mm	40 mm
q.	Power plant center line (from lower dragster body)	22 mm	47 mm
r.	Screw eye (eyelet inside diameter)	3 mm	5 mm
s.	Screw eyes (fit and distance between) – Ref. 3(i) [DQ item]	150 mm	270 mm
t.	Wheels, front (diameter) (2 per axle) unmodified	32 mm	37 mm
u.	Wheels, front (width at track touch point) HS Only ***	2 mm	5 mm
v.	Wheels, rear (diameter) (2 per axle) unmodified	30 mm	40 mm
w.	Wheels, rear (width at track touch point) HS Only ***	15 mm	18 mm
x.	Wheel base (centerline to centerline of front to rear axles)	105 mm	270 mm
y.	Height of the cartridge hole (floor to centerline)	35.5 mm	50 mm
z.	Power Plant 8-gram CO₂ Cartridge Required, snug fit [DQ item]	---	8 grams

* Assembled without CO₂ cartridge

**Measured across the body at the bottom outside edge of the axle hole.

*** Bearing is defined as component used to reduce friction between axle and dragster (straw, etc.). If a larger bearing is used, it must be recessed fully into the sidewall of the dragster with a counterbore hole, flush with the outer edge of the dragster.

- Minimum and maximum inside hole diameters of bearing must match specifications.
- Axle hole diameter, in-between counterbored holes, must match specifications. (See Specifications on Page 4 and drawing on Page 8)

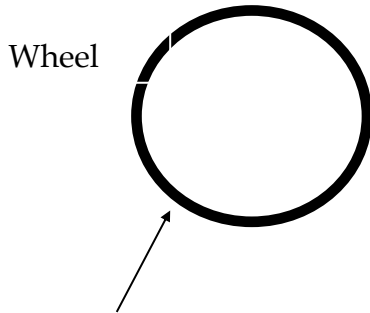
Dragster Specificaton Notes:

- Dragsters will be subject to point deductions if they fail to fall within the range of the specifications outlined in this document.
- Dragster will be disqualified if they fail to meet any safety-related specification, or if the dragster is deemed unsafe to race by the judges.
- Wheels must be made entirely from plastic. The outside surface of the wheels must not be modified. Flash from the injection molding process may be removed.
- Specifications are taken from the current “Pitsco – Metric Dragster” go/no-go gauge. For guidance in the design and construction of the CO₂ dragster and for complete rules, drawing specifications, and a go/no-go gauge contact Pitsco at (800) 835-0686.

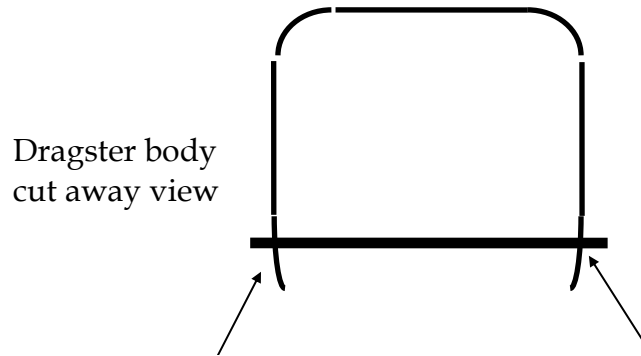
Racing

- a. Dragsters will be run through an electronically timed system. Every effort will be made to race the dragsters one at a time to eliminate irregularities from inconsistent cartridge piercing. If inconsistent cartridge piercing is noticed by racing staff or judges, or if there are problems with the timing system, racing results points shall not be included in the judges’ evaluation. The technical committee chair will make this decision based on input from the judges.
- b. No repair or maintenance on entries will be allowed after entries have been secured by the judges.
- c. Any entry damaged during the race will be evaluated by the technical committee chair to determine whether or not it will be allowed to race again.
- d. In the event that a dragster is damaged by conference personnel, the technical committee chair will make a ruling as to whether or not the dragster may be repaired by the student who entered it. This is the only reason a STUDENT would be allowed to touch his or her dragster after registration.
- e. Undamaged wheels which come off during the contest may be replaced as determined by the technical committee chair. Damaged wheels may not be replaced.
- f. In the interest of safety, axles must be fully engaged (inserted) in the wheel hub. Judges may shake the dragster rigorously or remove wheels prior to the race to verify that the wheels will stay attached and that the axle is fully engaged in the hub. If the wheels cannot be attached securely to the axle, the dragster will be disqualified. The dragster must have live axles (Axle must turn with wheels).
- g. The dragster shall start and end the race on all four wheels (2 in front and 2 in back). **Three wheel designs are not permitted.**
- h. The dragster will have 2 screw eyelets (Specifications “r” & “s” on Page 4) securely fastened onto the bottom of the dragster body to race.
- i. If parts break off during race, the dragster will be disqualified.
- j. Judges reserve the right to refuse to race a dragster based on safety concerns.

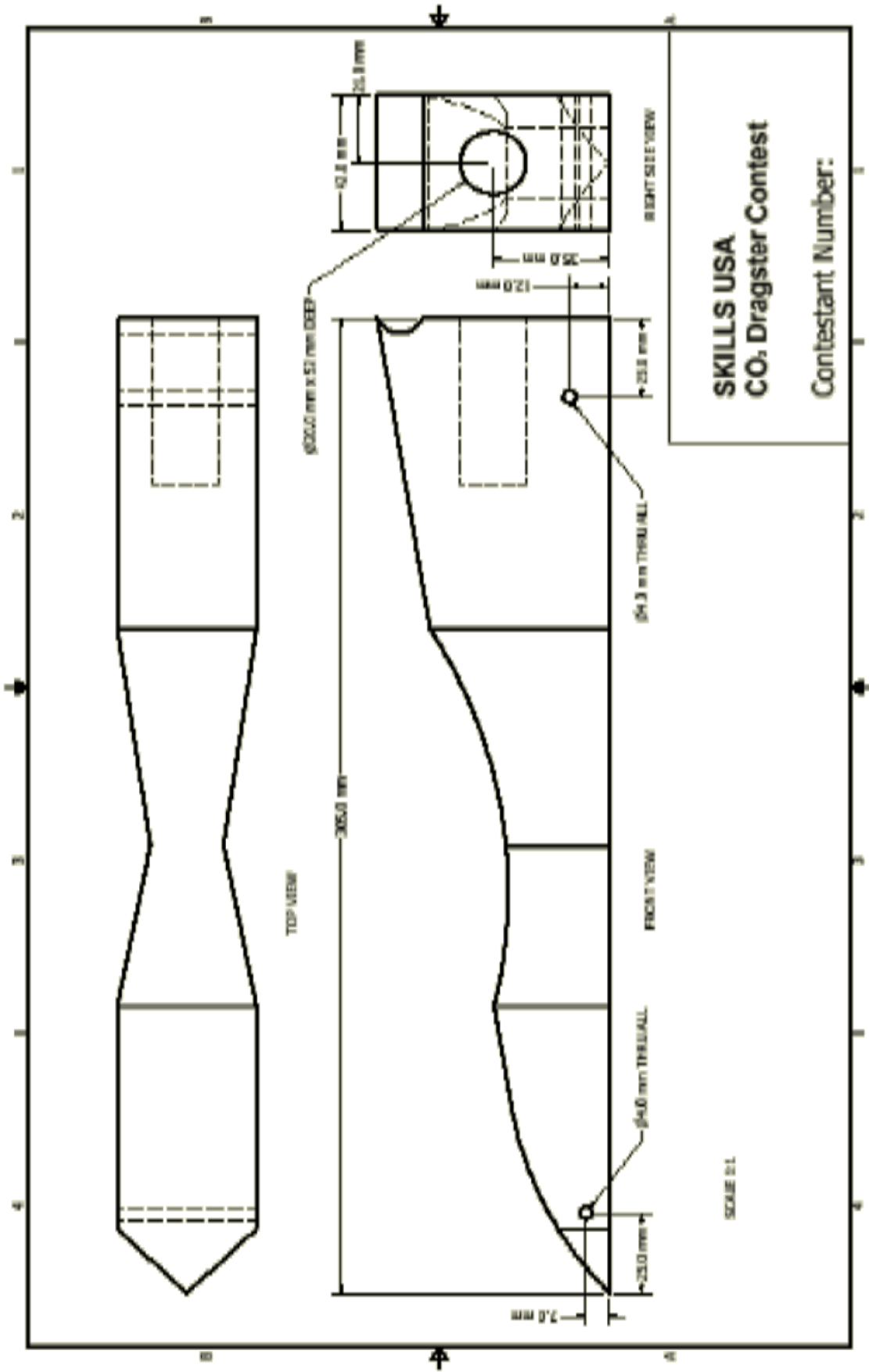
Note: CO₂ dragster kits, specification “Go/No-go Gauges”, and “Metric Dragster” rule books may be purchased from PITSCO, Box 1328, Pittsburg, KS 66762 or call (800) 835-0686.



Wheel surface may not be modified.



Arrows illustrate the points where the dragster body width will be measured. Across the bottom of the axle holes (at axle).



SKILLS USA
CO₂ Dragster Contest
 Contestant Number:

Figure 1 - CO₂ Dragster Drawing

WISCONSIN SKILLSUSA CHAMPIONSHIPS

CO₂ Dragster Contest Rating Sheet

Contestant Number: _____

[] Middle School (Junior Level)

[] High School (Senior Level)

ITEMS EVALUATED	Points Possible	Points Earned	RUBRIC / REMARKS
<p>CO₂ Dragster Specifications</p> <p>NOTE: Six (6) mandated specifications will be measured on every dragster. If the CO₂ dragster fails to meet any of the mandated safety specifications, it will be disqualified.</p> <ul style="list-style-type: none"> ▪ Dragster Weight (50 – 170 grams) _____ grams ▪ 8-gram CO₂ cartridge [] Yes [] No 	6		<p>DQ'd for Safety Specification? [] Yes [] No</p> <ul style="list-style-type: none"> [] loose wheel hub-to-axle fit [] power plant specification [] screw eye specification [] part broke off during race [] prohibited 3-wheel design [] CO₂ cartridge over 8-grams
<p>Craftsmanship & Appearance</p> <ul style="list-style-type: none"> ▪ No blemishes, file or saw marks ▪ No rough areas or burn marks ▪ Finished appearance of fine quality and detail ▪ Appearance of dragster matches drawing 	4		<ul style="list-style-type: none"> [] 4 pts. Excellent Quality & Appearance [] 3 pts. Good Quality & Appearance [] 2 pt. Fair Quality & Appearance [] 1 pt. Low Quality & Appearance
<p>Construction</p> <ul style="list-style-type: none"> ▪ Solid one-piece construction, no glue ▪ 3D Printed PLA dragster, unfinished ▪ No body strengtheners ▪ No fenders, exhaust, canopy, airfoils 	4		<ul style="list-style-type: none"> [] 4 pts. Construction meets all requirements [] 3 pts. Fails 1 requirement [] 2 pt. Fails 2 requirements [] 1 pt. Fails more than 2 requirements
<p>Contestant Attire</p> <ul style="list-style-type: none"> ▪ Red Blazer, Jacket, or Sweater ▪ White Shirt / Blouse ▪ Black Dress Pants / Slacks or Skirt (knee length) ▪ Black Socks / Skin Tone or Sheer Black Hose ▪ Black Shoes ▪ Black Tie (Men only) ▪ No hat 	4		<ul style="list-style-type: none"> [] 4 pts. Attire meets all requirements [] 3 pts. Fails 1 requirement [] 2 pts. Fails 2 requirements [] 1 pt. Fails more than 2 requirements
<p>Contestant Resume</p> <ul style="list-style-type: none"> ▪ Professional Appearance ▪ Contact Information ▪ Consistent Format ▪ One Page Only ▪ Includes Career Goal or Objective ▪ Employment or Accomplishments Provided ▪ Skills Provided. No spelling or grammar errors 	4		<ul style="list-style-type: none"> [] 4 pts. Resume includes all required elements [] 3 pts. Lacks 1 required element [] 2 pts. Missing 2 required elements [] 1 pt. Missing more than 2 required elements
<p>Race Results</p> <ul style="list-style-type: none"> ▪ Displayed Time: _____ seconds ▪ Weight Penalty: Add (_____) seconds ▪ Adjusted Time: _____ seconds 	13		<p>Weight Penalty: Add 0.050 seconds per each gram underweight. Use Adjusted Time to calculate Race Results points.</p> <p>1st Place = 13 pts. 4th Place = 4 pts. 2nd Place = 10 pts. 5th Place = 1 pt. 3rd Place = 7 pts.</p>
TOTAL	35		FINAL PLACE: _____

FINAL PLACE: _____

CO₂ DRAGSTER TRACK SET-UP PARAMETERS

- ✚ This information is for persons who will be determining suitable locations for the dragster race, as well as those who will be setting up the CO₂ dragster race track.
- ✚ Distance requirements include area for spectators to watch the event, as well as allowing sufficient space for traffic to pass through the area.
 - **Racing Zone**
 - Track Widths
 - (Single Track) 3 feet minimum width
 - (Two Tracks) 7 feet minimum width
 - Track Length 65 feet, 7 inches (20 meters)
 - **Staging Zone**
 - 4 - 6 feet
 - Zone behind the track for track timing equipment, judges table, and sufficient space for staging dragsters for racing.
 - **Deceleration Zone**
 - 2 - 3 feet
 - This area allows for towels or other padding to be placed to allow for safe deceleration of the dragsters.
 - **Restricted Area**
 - Recommended 5 – 6 feet from CO₂ track
 - Area designed to keep spectators and through traffic away from the track to prevent them from crossing over and tripping over the lines and wires, or bumping into and upsetting the track set-up.
 - It is recommended to set the track up near a wall so that only one side will need to have a barrier.