Case Rocket Team - Helios and Selene
Team 203 Project Technical Report for the 2025 IREC

Mitchell S. Milun[1]
Case Western Reserve University, Cleveland, OH, 44106, United States

Rohan Rajappan[2] and Kathleen W. White[3]
Case Western Reserve University, Cleveland, OH, 44106, United States

Garrett O. Miller[4] and Dhruv Raman[5]
Case Western Reserve University, Cleveland, OH, 44106, United States

Serena J. Lynas[6]
Case Western Reserve University, Cleveland, OH, 44106, United States

Natalie J. Vu[7]
Case Western Reserve University, Cleveland, OH, 44106, United States

Mauro A. Torres[8] and Paul A. Queheillalt[9]
Case Western Reserve University, Cleveland, OH, 44106, United States

Robbie M.P. Shepherd[10] Ryan J. Pappalardo[11] Arlo F. Wheeler[12] Alexander D. Stone[13] Daniel J. Cohen[14] Zoe L. Kao[15]
McKenzie B. Roman[16] Andrea D. Silva[17]
Case Western Reserve University, Cleveland, OH, 44106, United States

The Case Rocket Team (CRT) is an undergraduate rocketry team from Case Western Reserve University in Cleveland, Ohio which intends to compete in the 30,000 ft AGL Commercial-Off-The-Shelf (COTS) category of the 2025 International Rocket Engineering Competition (IREC). CRT has designed and built a rocket, Helios, and payload, Selene, to compete in this year's competition. Helios, with an entirely custom-composite airframe, is the first competition rocket built by the team to have a fully integrated Airbrakes system. Selene, the payload, has an experimental goal of testing the feasibility of rollable glass under high loading conditions. A custom flight computer, Sirin, is controlling both the Airbrakes mechanism and payload experiment. The team's goal is to elevate the performance of CRT rockets in the 30K COTS category from the previous two years, displaying the ability of the team to continually innovate and reach new heights in amateur rocketry.

[1]Competition Lead, Mechanical and Aerospace Engineering, 10900 Euclid Ave, Cleveland, OH, 44106, United States
[2]Aerostructures Lead, Engineering Physics and Mathematics, 10900 Euclid Ave, Cleveland, OH, 44106, United States
[3]Aerostructures Lead, Mechanical and Aerospace Engineering, 10900 Euclid Ave, Cleveland, OH, 44106, United States
[4]Airbrakes Lead, Mechanical and Aerospace Engineering, 10900 Euclid Ave, Cleveland, OH, 44106, United States
[5]Airbrakes Lead, Mechanical and Aerospace Engineering, 10900 Euclid Ave, Cleveland, OH, 44106, United States
[6]Avionics Lead, Mathematics and Physics, Computer Science, 10900 Euclid Ave, Cleveland, OH, 44106, United States
[7]Composites Research & Development Lead, Mechanical and Aerospace Engineering, 10900 Euclid Ave, Cleveland, OH, 44106, United States
[8]Payload Lead, Mechanical and Aerospace Engineering, 10900 Euclid Ave, Cleveland, OH, 44106, United States
[9]Payload Lead, Mechanical and Aerospace Engineering, 10900 Euclid Ave, Cleveland, OH, 44106, United States
[10]Engineering Physics and Astronomy, 10900 Euclid Ave, Cleveland, OH, 44106, United States
[11]CNC Lead, Chemistry, 10900 Euclid Ave, Cleveland, OH, 44106, United States
[12]Recovery Lead, Mechanical Engineering, 10900 Euclid Ave, Cleveland, OH, 44106, United States
[13]Mechanical and Aerospace Engineering, 10900 Euclid Ave, Cleveland, OH, 44106, United States
[14]Mechanical and Aerospace Engineering, 10900 Euclid Ave, Cleveland, OH, 44106, United States
[15]Mechanical and Aerospace Engineering, 10900 Euclid Ave, Cleveland, OH, 44106, United States
[16]Base Station Lead, Mechanical Engineering, 10900 Euclid Ave, Cleveland, OH, 44106, United States
[17]President, Mechanical and Aerospace Engineering, 10900 Euclid Ave, Cleveland, OH, 44106, United States

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I. Nomenclature

A	=	amps
AGL	=	above ground level
Ah	=	amp hours
$APRS$	=	Automatic Packet Reporting System
CAD	=	computer aided design
C_d	=	coefficient of drag
cal	=	caliber
CF	=	carbon fiber
CFD	=	computational fluid dynamics
cm	=	centimeter
CNC	=	computer numerical control
$COTS$	=	commercial off-the-shelf
CRT	=	Case Rocket Team
$CWRU$	=	Case Western Reserve University
DC	=	direct current
$DTEG$	=	Design, Test, & Evaluation Guide
$ESRA$	=	Experimental Sounding Rocket Association
FEA	=	finite element analysis
FOS	=	factor of safety
ft	=	feet
g	=	grams
$GPIO$	=	general purpose input/output
GPS	=	global positioning system
Hz	=	hertz
hr	=	hour
ID	=	internal diameter
in	=	inches
IMU	=	inertial measurement unit
$IREC$	=	Intercollegiate Rocket Engineering Competition
JST	=	Japanese Solderless Terminal
ksi	=	kilopounds per square inch
lb	=	pounds
lbf	=	pounds-force
LED	=	light-emitting diode
$LiFePO4$	=	lithium-ion phosphate (Battery)
$Li-ion$	=	lithium-ion (Battery)
mAh	=	milliamp hours
MDF	=	medium-density fibreboard
MHz	=	megahertz
m	=	meters
mA	=	milliamp
mm	=	millimeters
N	=	newtons
NAR	=	National Association of Rocketry
$NFPA$	=	National Fire Protection Association
Ns	=	newton-seconds
OD	=	outer diameter
$oz-in$	=	ounce-inch
$PETG$	=	polyethylene terephthalate glycol
PID	=	proportional–integral–derivative
RF	=	radio frequency
s	=	seconds

SDL	=	Space Dynamics Laboratory
SDR	=	software defined radio
$SRAD$	=	student researched and developed
TRA	=	Tripoli Rocketry Association
UNC	=	Unified National Coarse
V	=	volts

II. Introduction

The Case Rocket Team is an undergraduate aerospace design team at Case Western Reserve University. Team members have a wide array of academic disciplines with a heavy focus on aerospace and mechanical engineering. For IREC 2025, the team has designed a rocket, Helios, and a payload, Selene. The IREC team is led by Competition Lead Mitchell Milun, and is composed of five subteams: Aerostructures, led by Kathleen White and Rohan Rajappan; CNC Manufacturing, led by Ryan Pappalardo; Airbrakes, led by Garrett Miller and Dhruv Raman; Payload, led by Paul Quehellialt and Mauro Torres; and Avionics, led by Serena Lynas.

Aerostructures was responsible for simulation, design, manual manufacturing, and composite fabrication of the rocket airframe, in addition to the recovery system and electronics bay in the rocket. Aerostructures also led the integration and assembly of the rocket. CNC Manufacturing was responsible for designing all CAM files and performing CNC operations for a significant portion of all machined components for Helios. Airbrakes was responsible for the design and manufacturing of the Airbrakes system, as well as the software implementation of the algorithm used to control the Airbrakes flaps. Payload was responsible for the design, manufacturing, and testing of the rollable glass experiment inside the 3U CubeSat payload for the SDL competition. Avionics was responsible for the design and implementation of the SRAD flight computer, Sirin.

Figure 1 shows an organizational chart detailing the organizational structure described in the paragraph above.

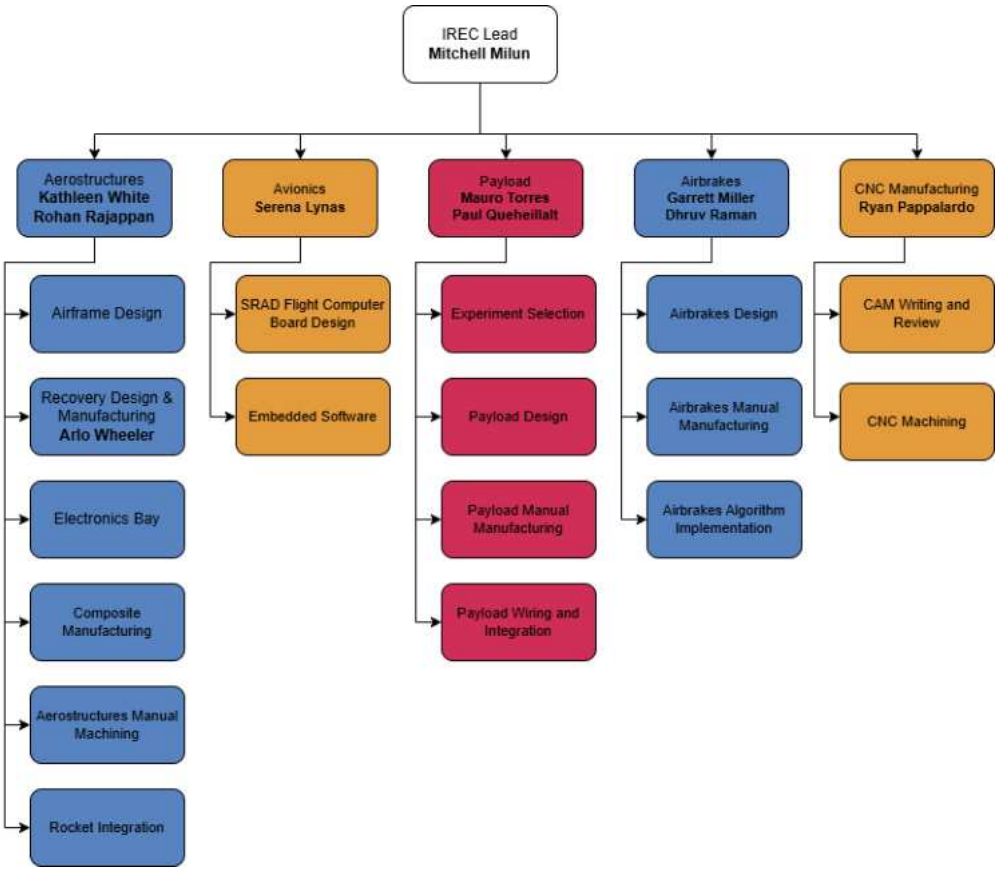


Fig. 1 Case Rocket Team Organizational Chart

III. System Architecture Overview



Fig. 2 Helios and Selene

Helios consists of four primary subsystems: Propulsion, Airframe, Recovery, and Airbrakes, as well as two secondary subsystems: Sirin and Base Station. Helios utilizes an AeroTech O5500X-PS motor, and is capable of reaching an altitude of approximately 32,300 ft AGL at Midland, Texas, without the actuation of the Airbrakes mechanism. With the actuation of the Airbrakes mechanism, Helios is capable of reaching an apogee altitude within 500 ft of 30,000 ft AGL.

The airframe of Helios is composed of five sections: fin can, lower body, recovery section, electronics bay, and nose cone. The fin can has an integrated boat tail to increase altitude. The lower body tube houses the Airbrakes and Propulsion subsystems of the rocket. The electronics bay is housed in the nose cone and consists of all electronic devices for tracking Helios and controlling recovery events. The recovery section houses the Payload and Recovery sections of the rocket.

Helios is designed to separate at apogee at the joint between the upper body and lower body tubes. Helios falls as one recoverable section, with the Payload subsystem, Selene, bolted onto a bulkhead in the recovery section of the airframe. Helios falls under drogue while the main parachute is held in a deployment bag until it reaches 1,500 ft AGL.

Sirin is a custom flight computer which controls the actuation of the Airbrakes mechanism by running the Airbrakes algorithm. Additionally, Sirin controls the experiment within Selene. Base Station is a ground-based support system, assisting in the tracking of Helios during and after flight, via radio communications.

General vehicle characteristics are summarized in Tables 1 and 2.

Characteristic	Value	Unit
Vehicle Weight	38.75	lbs
Launch Weight	75.75	lbs
Length	118	in
Diameter	5.982	in
Fin Root Chord	12	in
Fin Span	16.982	in
CG Location (at ignition, from tip)	72.573	in

Table 1 Launch Vehicle Characteristics

Characteristic	Value	Unit
Apogee	31768	ft
Maximum Velocity	2056	ft/s
Maximum Velocity	1.80	Mach
Maximum Acceleration	799.80	ft/s^2
Maximum Acceleration	24.86	G
Time to Apogee	38.6	s
Flight Time	344	s
Velocity Under Drogue	134	ft/s
Ground Hit Velocity	25.1	ft/s
Rail Departure Velocity	133	ft/s
CP Location (at ignition, from tip)	88.937	in
Maximum Stability	4.54	cal
Stability at Mach 0.8	3.34	cal
Rail Departure Stability	1.73	cal

Table 2 Flight Characteristics

A. Propulsion

Helios uses an AeroTech O5500X-PS motor. The motor contains 9,779 g of propellant, with a total mass of 16,783 g. The motor has a total impulse of 21,384.0 Ns, with a maximum thrust of 7,551.5 N. The motor burns in 4.0 s. The O5500X-PS motor was chosen due to its large impulse and availability for purchasing; it was the only COTS motor available during the year which was capable of propelling the rocket to 30,000 ft. The thrust curve for the O5500X-PS is shown in Figure 3.



Fig. 3 AeroTech O5500X-PS Thrust Curve [1]

The motor is retained via a 3/8-16 UNC threaded rod that screws into the forward closure. The threaded rod is affixed to the motor retention bulkhead in the upper Airbrakes assembly, with two sets of jam nuts on each side of the bulkhead to retain the threaded rod in its position. The bulkhead is positioned at the top of the motor tube, which is

attached to the airframe via the tube interface bulkhead. Additionally, a #10-24 UNC $\times$ 0.25 set screw grips the forward closure to ensure the motor does not rotate during flight. The set screw is retained by a 3D-printed block with a heat-set insert which is epoxied onto the motor tube via ES6029 Structural Epoxy. Figures 4 illustrate the threaded rod and set screw retention methods.

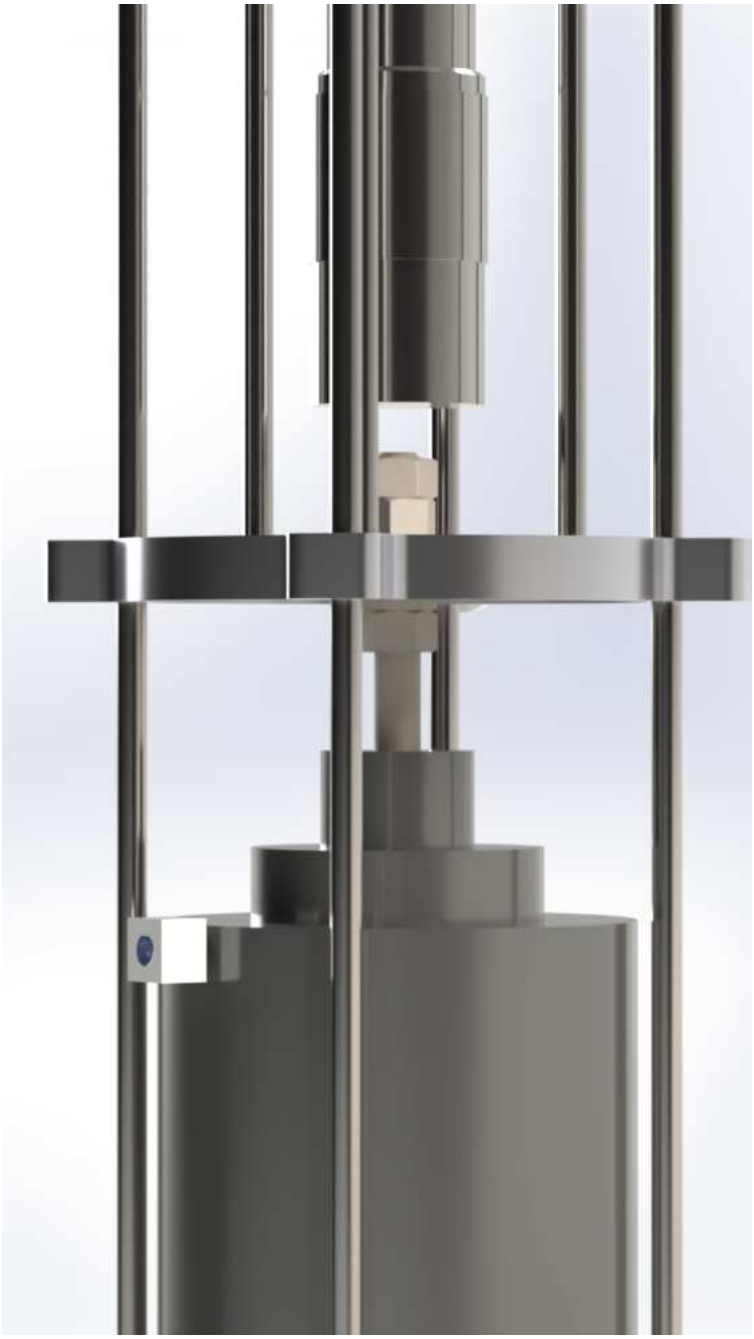


Fig. 4 Threaded Rod and Set Screw Motor Retention Method

B. Airframe

The Helios airframe is entirely SRAD composite. To ensure proper RF transparency for recovery, the nose cone is composed of fiberglass, while all other SRAD composite components are carbon fiber. All transmitting electronics are housed in the nose cone. The Airbrakes system has a separate electronics bay for actuating the Airbrakes mechanism

and recording external camera footage during launch. None of the components in the electronics bay for Airbrakes require RF transmission. The nose cone tip, also SRAD, is 6061 aluminum. All tubes in the airframe, as well as the boat tail, are composed of carbon fiber. The nose cone has a nominal outer diameter of 6.00 in to accommodate the thicker material and an inner diameter of 5.75 in, restricted by requirements for the nose cone coupler. The upper and lower body tubes, as well as the widest end of the fin can, have a nominal outer diameter of 5.86 in. Fully assembled, the airframe has a length of 118 in.

Three nylon #2-56 UNC shear pins connect the payload coupler and the upper body tube; these two components will separate at apogee to allow recovery to deploy. The nose cone and nose cone coupler are epoxied together with PRO-SET LAM-135 Epoxy Resin and 224 Hardener. All other connections - nose cone coupler to upper body tube, payload coupler to lower body tube, lower body tube to tube interface bulkhead, and tube interface bulkhead to fin can - are mechanically fastened connections, each with six #10-24 UNC $\times$ 0.375 bolts to improve the efficiency of integration of Helios due to conformity of exterior bolt sizes. The bolted connection between the nose cone coupler and upper body tube has 3D-printed carriers for the nuts on the inside of the bulkhead. The payload coupler and lower body tube are connected via bolts through the payload retention bulkhead.

1. Fin Can

The fin can is designed to be 16 in long, with a 7 in long straight cylindrical section and a 9 in conical section with a 5.33°draft angle which tapers from a 5.86 in OD and 5.579 in ID to a 3.9 in OD and 3.825 in ID. The conical section acts as an integrated boat tail to reduce overall drag of the rocket. These two sections were fabricated as one component from six layers of 6K carbon fiber sleeve laminated into one composite structure with PRO-SET LAM-135 Epoxy Resin and 224 Hardener, hand laid-up over a 3D-printed mold.

Fin flutter calculations were done in AeroFinSim [2] to ensure the fins would withstand the aerodynamic loads placed on them during flight that cause fin flutter and divergence. Due to the requirement in Section 8.2.2 of the DTEG [3] to have a fin flutter velocity at least 1.5 times the maximum velocity of the rocket during flight, a minimum fin thickness of 0.30 in was found. The maximum velocity of the rocket from simulations is found to be 2066.1 ft/s, so the minimum fin flutter velocity is required to be 3099.15 ft/s. In AeroFinSim, the material used is CCRT T300 FBRT-934 7-MILL, which results in the lowest critical fin flutter velocities for any of the carbon fiber options in software. With these simulations, the factor of safety for fin flutter velocities is found to be 1.69, without considering the structural benefits of the tip-to-tip layup. Exact fin flutter and divergence mach numbers are shown in Table 3.

Critical (Not to Exceed) Velocity		
Divergence (Mach)	Flutter (Mach)	Lift Slope (CN-a)
5.25	3.36	9.22

Table 3 Pines Method Flutter and Divergence Analysis Results

The fins were fabricated by laminating two layers of 3K carbon fiber weave over each side of a G10 fiberglass sheet measuring 0.25 in thick. The laminating process brought the thickness of the composite to 0.331 in. After beveling to fins in a CNC router, the fins were attached to the boat tail with 1.0 in radius fillets made from ES6029 Aeropoxy Structural Epoxy, and tip-to-tip layups were performed with 3K carbon fiber for additional strength. This resulted in a final fin thickness of 0.345 in. More information on the fin manufacturing process can be found in Section III.B.6.

For the Airbrakes system operation, four semi-rectangular cut-outs were removed from the fin can via a Dremel. This allowed the flaps of the boat tail to actuate and alter the drag of the rocket, as described in Section III.E.2.

2. Lower Body

The lower body of Helios is composed of the lower body tube, the fin can, and the Airbrakes and propulsion systems. The lower body tube was fabricated from five layers of 3K carbon fiber weave laminated with PRO-SET LAM-135 Epoxy Resin and 224 Hardener, hand laid-up over a steel mandrel. The lower body tube has nominal dimensions of outer diameter 5.86 in, inner diameter 5.75 in, wall thickness 0.06 in, and length 55.5 in.

Via the tube interface bulkhead, the Airbrakes superstructure is affixed to both the fin can and the lower body tube with five #10-24 UNC $\times$ 0.5 bolts radial bolts for each connection. A sixth bolt to attach the lower body tube to the Airbrakes superstructure acts jointly as the bolted connected for the 1515 rail button, which has a singular #10-24 UNC

flat head bolt. Note that all bolts on the tube interface bulkhead are located radially symmetrically in six directions, although only five locations have bolts.

3. Recovery Section

The recovery section of Helios includes the location between the payload retention bulkhead, which is bolted through both the lower body tube and payload coupler via six #10-24 UNC $\times$ 0.375 bolts radial bolts, and the electronics bay bulkhead in the nose cone. The payload and recovery systems are housed in the recovery section of the airframe.

The payload retention bulkhead affixes the payload, Selene, to the airframe via four #10-24 UNC bolts. The payload retention bulkhead has clearance holes drilled in it, while the lower bulkhead in the payload frame is threaded to allow for attachment once the payload is already fully assembled.

4. Electronics Bay

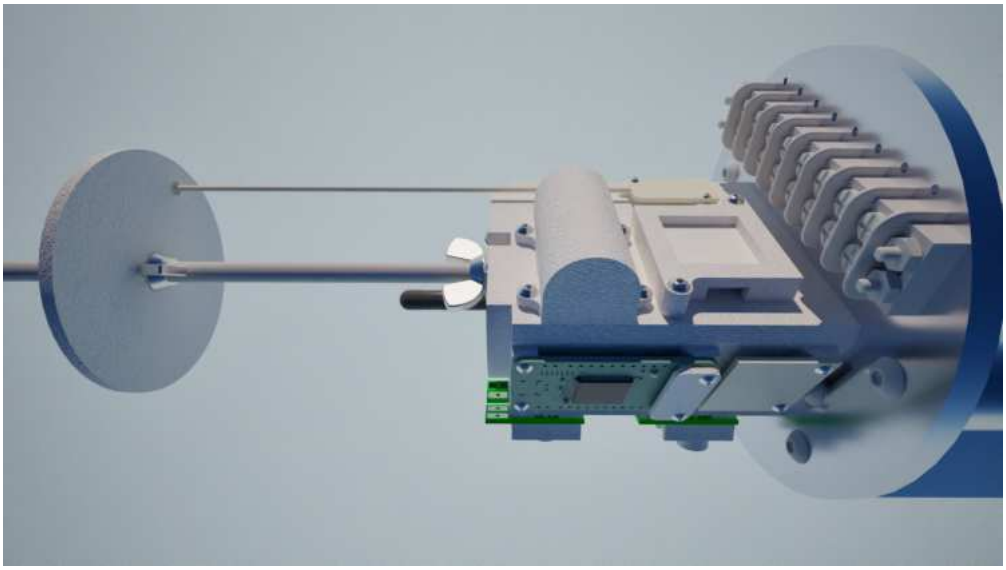


Fig. 5 Electronics Bay of Helios

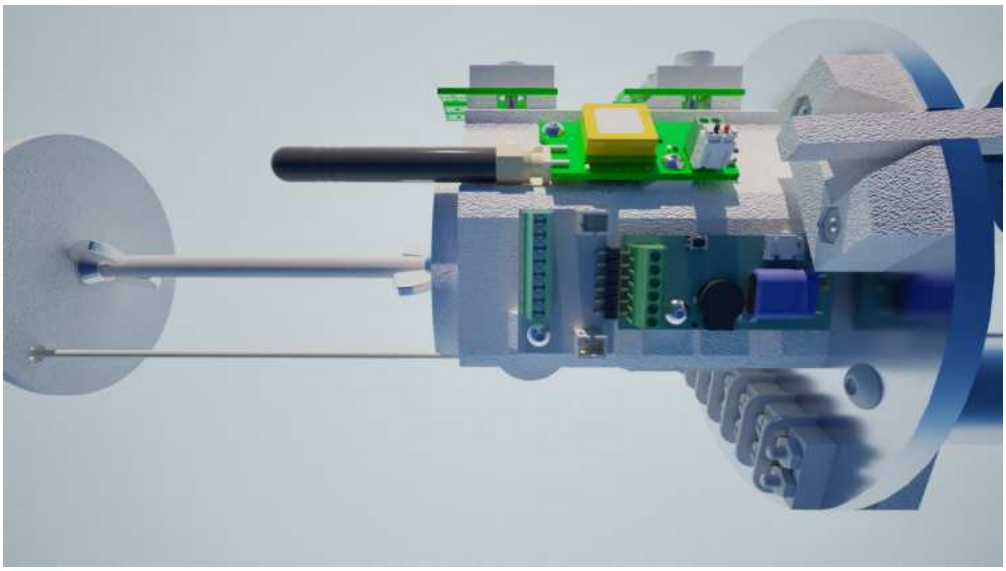


Fig. 6 Electronics Bay of Helios

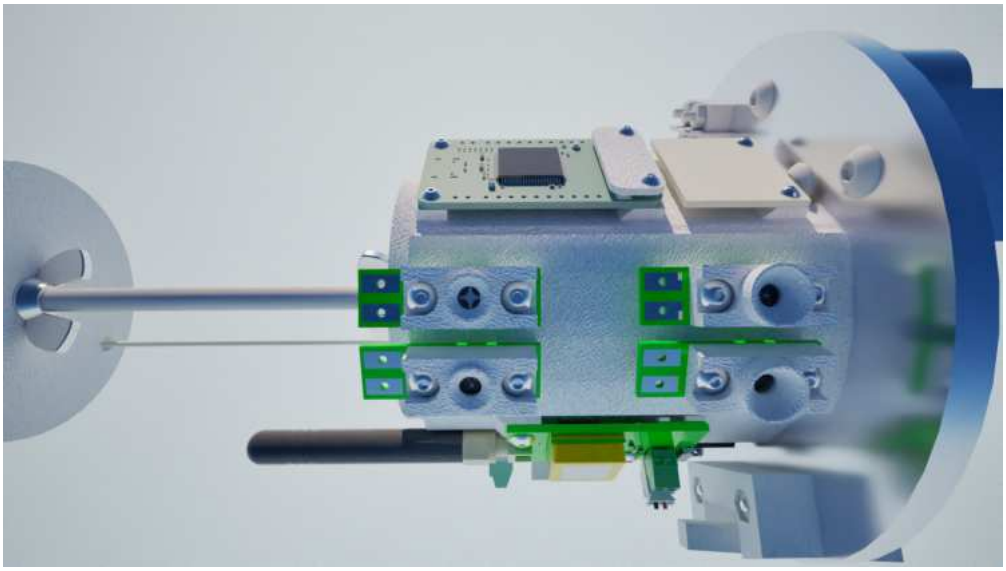


Fig. 7 Electronics Bay of Helios

The electronics bay resides in the fiberglass nose cone for RF transmission. The electronics are protected from ejection charges by the electronics bay bulkhead, a 0.25 in thick 6061-T6 aluminum bulkhead. This bulkhead has a notch cut in it to interface with a clocking notch that is secured with epoxy into the nose cone. This ensures consistent radial positioning of the electronics bay, so screw switches always line up with the corresponding holes. This bulkhead has two charge wells for drogue deployment and a Tendie Descendie Duo for main parachute deployment. The bulkhead experiences drogue deployment force, calculated as 100.3 lbf. More information about the Tendie Descendie Duo and deployment forces are in Section III.C. SolidWorks FEA was used to determine that the minimum FOS at this loading is 9.2, as shown in Figure 8. The electronics bay assembly is held at its specified location via tension, as a 1/4-20 UNC threaded rod goes through the center of the electronics bay sled, held via tension by an eye nut on the bottom of the electronics bay bulkhead and internal threads in the nose cone tip.

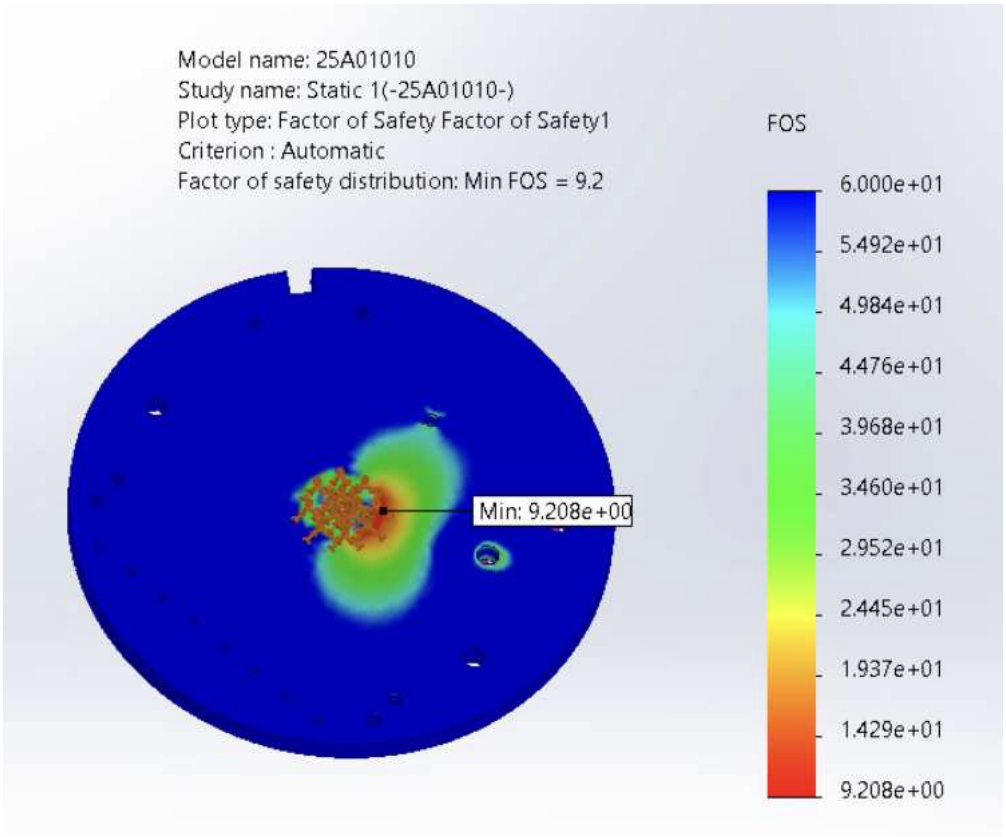


Fig. 8 FEA of Electronics Bay Bulkhead

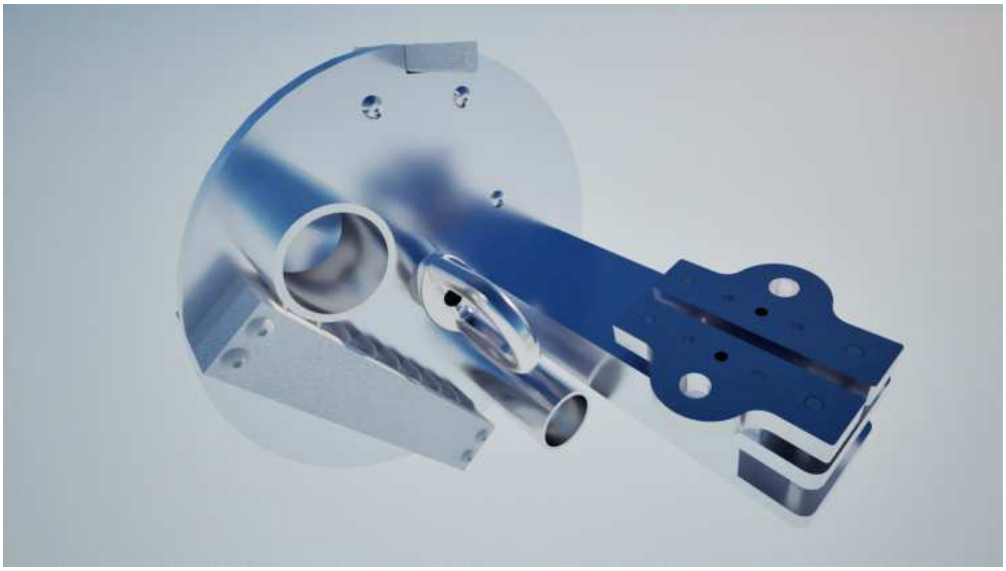


Fig. 9 Bottom of Electronics Bay Bulkhead

The electronics bay sled is fully 3D-printed for manufacturing ease. PETG filament was used for its good mix of strength, thermal resilience, and ease of printing. Bolted connections are made with heat set inserts. For mounting the EasyMini, Raven4, Featherweight GPS, and battery mount to the electronics bay sled, #4-40 UNC heat set inserts are used. For Sirin, #2-56 UNC heat set inserts are used, and for the Elvin RocketBeacon, #0-80 UNC heat set inset inserts

are used. To lock the rotation of the electronics bay sled about the central threaded rod, a #10-24 set screw is used, with an aptly sized heat set insert.

Battery capacities are chosen to ensure ample runtime for all components. All flight computers and GPS trackers use 18650 Li-ion batteries which have a capacity of 2.6 Ah. The Elvin RocketBeacon uses a 16340 Li-ion battery, with a capacity of 0.7 Ah, due to a low current draw. Power draw analysis for each component in the electronics bay is summarized in Table 4.

Component	Battery Capacity (mAh)	Current Draw (mA)	Nominal Runtime (hr)
EasyMini	2600	7.0	371.4
Raven4	2600	18.0	144.4
FeatherWeight	2600	112.0	23.2
ElvinBeacon	700	16.7	42.0
Sirin	2600	200.0	13.0

Table 4 Electronics Bay Power Draw Analysis

COTS screw switches are used to power up each component. Screw switches are used instead of key and magnetic switches due to their simplicity in use and verification procedures. Separate batteries and screw switches are used for each component to ensure full redundancy.

A wiring diagram for all components in the electronics bay is shown in Figure 10.

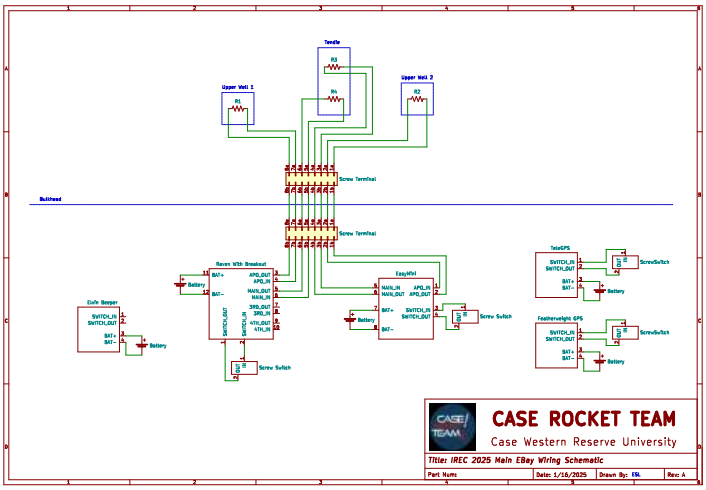


Fig. 10 Wiring Diagram for Electronics Bay

5. Nose Cone

This year, the nose cone shape was a design choice the team considered more heavily and changed from previous IREC rockets. After developing confidence in producing composite parts with complex geometry, this became a feasible task for the team to take on. For Helios, the nose cone is a Von Kármán Ogive, or an LD-Haack with $C = 0$. Initially, the nose cone was to be a power series of $x^{\frac{1}{2}}$. This design decision changed as the mass budget was built and the competition location change. The change in location caused the rocket to spent a different amount of time in the transsonic region during flight, significantly altering the simulated apogee altitude. After simulating the rocket with a Von Kármán Ogive, the simulated apogee altitude increased. The decision to pursue these shapes was based on readings from Richard Nakka's website, the USAF Missile DATCOM reports, and anecdotal evidence from rocketry hobbyists. Specifically, the image in Figure 11 was used for a simple understanding of what shapes to consider.

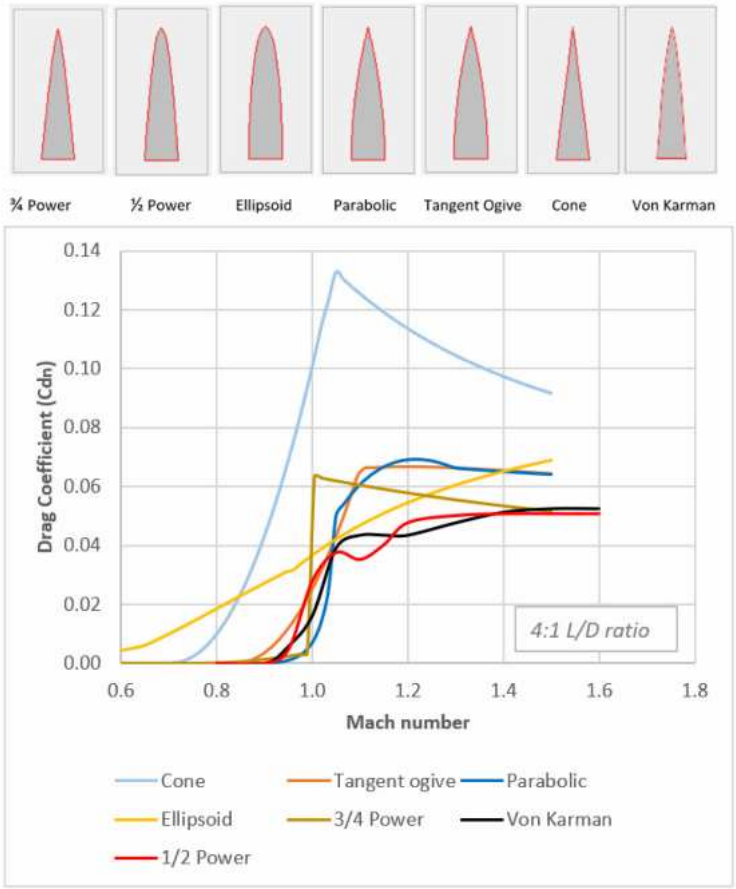


Fig. 11 Drag Coefficients of Various Nose Cone Shapes at Varying Mach Numbers

6. Manufacturing

Airframe Tubing All of the airframe tubes, seen in Figure 12, were fabricated from five layers of 3K twill weave carbon fiber laminated with PRO-SET LAM-135 Epoxy Resin and 224 Hardener via hand layups. Outer tubes were fabricated using a steel mandrel with nominal dimensions of 70 in length, 5.75 in outer diameter, and 5.25 in inner diameter. Inner tubes were fabricated using a machined aluminum mandrel with dimensions 24 in length, 5.64 in outer diameter, and 5 in inner diameter.

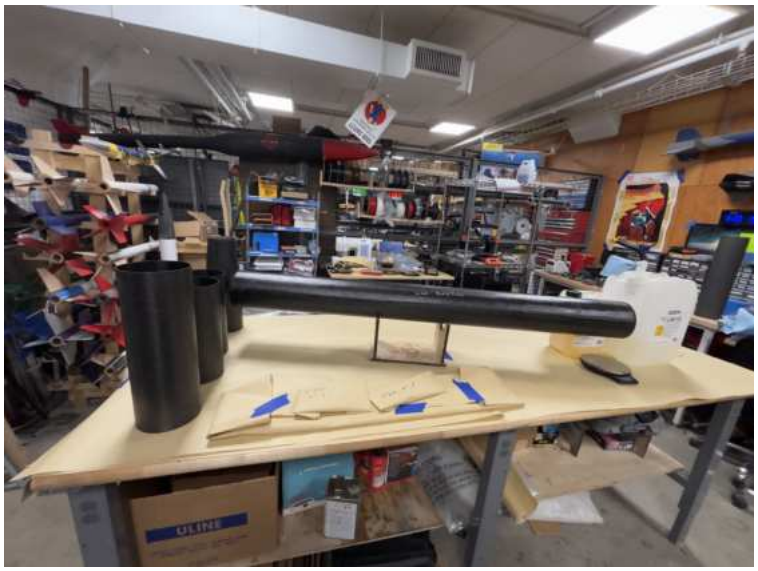


Fig. 12 Airframe Tubes

All tubular mandrels underwent the same initial surface preparation, where the mandrel was fully wiped down with acetone before Partall Coverall Film was applied to the surface, spread evenly, and polished to an even surface finish. This initial surface preparation was only performed once for each mandrel. Subsequently and before each layup, the mandrels were sprayed with Crown Dry Graphite Lubricant 8076 for a thin layer of lubricant with uniform coverage. Also prior to each layup, one layer of Mylar was wrapped around the graphite-sprayed tube and secured along the overlapping seam with flash tape. The Mylar was wrapped to be tight but able to slide across the mandrel. Mylar was used rather than some other plastic material due to its rigidity, which prevents wrinkles from forming during the layup process. The setup for the layup process for the lower body tube can be seen in Figure 13.



Fig. 13 Lower Body Tube Layup Setup

The five layers of 3K carbon fiber sleeve were all rolled from one continuous piece of fabric, as seen in Figure 14, and intended to achieve a thickness of 0.06 in. Unforeseen supply chain issues required the use of PRO-SET LAM-224 Hardener, which has a fifteen minute pot life, rather than the preferred 226 Hardener, which has a forty-minute pot life. This required the layups to be performed faster than preferred. Once a mandrel was fully prepared with a Mylar wrap,

the Mylar was coated with epoxy and the edge of the fabric was carefully placed along the overlapping seam of the Mylar to ensure proper alignment. The first layer of fabric was then carefully wrapped around the mandrel, which was slowly rotated while paying special attention to alignment of the fabric. For each layer, the fabric was coated with epoxy before the next layer was applied. The outermost layer was soaked heavily with epoxy to minimize air pockets within the composite. Once the layup was completed, the composite was left to cure for a minimum of twelve hours before being removed from the mandrel. To remove the composite, the mandrel was removed from its jig, propped upright, and the Mylar slid and composite tube slid off together. The Mylar was then easily removed from inside the composite tube.



Fig. 14 Carbon Fiber Used for Lower Body Tube Layup

Once removed from the mandrel, the tube was cut on both ends with a horizontal bandsaw to approximately 0.1 in greater than the final desired length, and the remaining length was sanded so the tube fit exactly with the other interfaces.

Nose Cone and Boat Tail Both the nose cone and the boat tail were fabricated using sleeve material instead of weave, and the layups were performed over 3D-printed mandrels. The mandrels were printed using PETG filament in multiple pieces, then pieced together and attached with superglue. The surfaces of the mandrels were then prepared with 3M Bondo Short Strand Fiberglass Reinforced Filler to fill in and smooth out any cracks. The mandrels were then coated in Fibreglast 683 Gelcoat. The boat tail mandrel was lastly prepared with Smooth-On Universal Mold Release. When removing the boat tail composite after the layup, there was significant adhesion between the Gelcoat and the composite. Learning from this, the nose cone mandrel repeated the same surface preparation process, but then was additionally coated in a layer of Partall Coverall Film to act as a secondary air inhibitor for Gelcoat curing. The application of the

Partall Coverall Film can be seen in Figure 15. This change notably improved the release of the nose cone and resulted in a sizable part of the mold being able to be released fully without destruction.



Fig. 15 Spraying of the Partall Coverall Film onto the Nose Cone Mandrel

The boat tail was fabricated using six layers of 6K carbon fiber sleeve, all at the same diameter of 6 in. Sleeve was used rather than weave to accommodate the diameter change in the boat tail's geometry. To place each layer, the sleeve was compressed to a diameter larger than that of the mandrel in order to be placed in the correct position over the mandrel, then pressed down from the center outwards and shaped around the mandrel, with special attention being given to ensuring the weave remained relatively parallel to the length of the boat tail. This process can be seen in Figure 16. Each layer was then laminated with PRO-SET LAM-135 Epoxy Resin and 224 Hardener before moving onto the next layer. After the layup was complete, the composite was then left to cure for 24 hours before removal from the mandrel.



Fig. 16 Placing Sleeve During the Boat Tail Layup

The nose cone was fabricated using three different diameters of fiberglass sleeve, 3 in, 4 in, and 6 in, in order to accommodate the diameter change along the SRAD nose cone. The sleeves were placed during the layup such that every part of the mandrel was covered with roughly three layers of fiberglass, so that the entire nose cone would be roughly the same thickness. The specific layering and locations of the sleeves can be seen in Figure 17, where the first layer that was laminated is the lowest on the diagram, then the second layer, then finally the last layer on top . On the diagram, the length of the mandrel, length of the layup, and length of the final cut (to be done once the composite had cured) are all noted in inches. The locations of where the sleeves should be placed were then noted in relation to where the composite was to be cut off to meet the aluminum nose cone tip (blue text), along with the diameter of the mandrel at that location (black text). The range of diameters that the sleeves could stretch/compress to was also noted in the diagram. The layup was performed using this diagram as reference for layering, with each layer being laminated with PRO-SET LAM-135 Epoxy Resin and 224 Hardener before moving onto the next layer. After the layup was complete, the composite was then left to cure for 24 hours before removal from the mandrel.

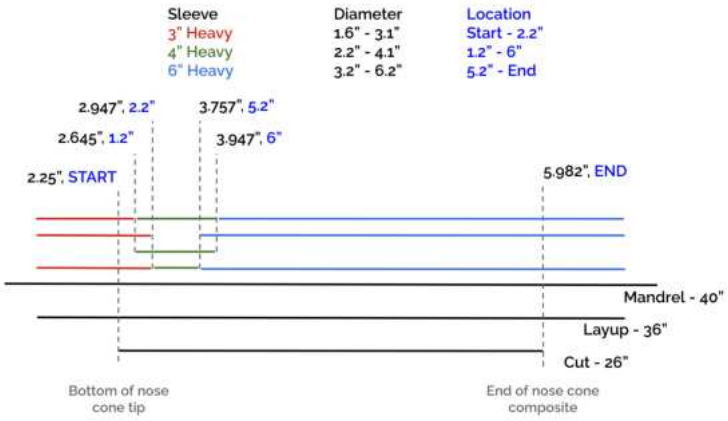


Fig. 17 Diagram of Layers for the Nose Cone Layup

For both the boat tail and nose cone, after having sat to cure for 24 hours, the 3D-printed mandrels were broken out of the composite structures. As mentioned above, the nose cone mandrel was significantly easier to remove from its composite due to the addition of a Partall Cover Film layer during surface preparation. The remaining composites then underwent the same cutting and sanding process as the airframe tubes, described in the section above.

Fins The fins were fabricated by laminating two layers of 3K carbon fiber weave over each side of a 0.25 in thick G10 fiberglass sheet using PRO-SET LAM-135 Epoxy Resin and 224 Hardener. To increase the multi-axial strength of this composite layer, the sheets of carbon fiber were cut such that when placed on the fiberglass sheet, the weave of one sheet was angled at a 45 degree angle relative to the weave of the other sheet. Once the G10 fiberglass sheet was wiped down using acetone, it was coated with epoxy, as seen in Figure 18, and the first sheet of carbon fiber was carefully placed on top, paying careful attention that it was roughly centered in relation to the fiberglass sheet. This layer was then coated with epoxy, and then the next layer was placed and coated in the same fashion.



Fig. 18 Coating the Fin Plate in Epoxy

Immediately after laminating the carbon fiber, the entire composite fin plate was then put through a vacuum bagging process to compress the layers together while the epoxy cured. This was done to increase the strength of the composite and ensure that the composite was fully saturated with epoxy. To prepare for the vacuum bagging process, a layer of peel ply film was laid on to one side of the composite and pressed down, ensuring that the epoxy soaked into the film. This was followed by a layer of perforated film, which was pressed down in the same fashion. Then, two layers of breather cloth were placed on top. Then, the entire setup was flipped, and the process of layer peel ply, perforated film, and breather cloth was repeated on the other side.

Once the preparation was complete, the entire setup was placed inside of a vacuum bag, with the gasket connector placed to the side of the setup, but still inside the bag. The bag was then sealed with double-sided sealant tape. A hole was then cut in the bag above the gasket connector, so that the through-bag connector could be connected to the gasket connector. The vacuum was then turned on, and the entire setup was checked for potential air leaks. Once it was confirmed that there was a complete seal, the vacuum was left to run for at least twelve hours. The fin plate during the vacuum bagging process can be seen in Figure 19. After twelve hours, the vacuum was turned off, the vacuum bag cut, and the setup removed from the vacuum bag. The breather cloth, perforated film, and peel ply were then removed from the composite. The removal of these materials can be seen in Figure 20. The edges of the fin plate were then sanded down, as the carbon fiber had extended beyond the G10 fiberglass sheet.



Fig. 19 Vacuum Bagging the Fin Plate



Fig. 20 Fin Plate After Vacuum Bagging

The shape of each fin was then cut out from the fin plate using a waterjet, amounting to six fins total, which allowed for two extra fins to be made if necessary. The fins were then beveled using a CNC machine. A fixture plate was placed into the CNC while toe clamps were used to hold down each fin, and then a ball nose diamond-coated end mill was used to cut the bevels out of the fins in several passes. After CNC operations, the fins were then sanded smooth by hand.

Fin Can To manufacture the fin can, firstly the surface of the boat tail was lightly sanded in preparation for tacking. The tacking of the fins was done using J-B Weld ClearWeld 5 minute epoxy, placing a small amount along each edge of the fin where it contacted the boat tail at the fin's root chord. To ensure the fins were aligned and equally spaced around the boat tail, they were placed inside a 3D-printed fin-alignment jig printed from a combination of PLA and ABS filament. The jig had to be printed in multiple parts and then puzzle-pieced together due to its size, which required the use of whatever filaments were available, hence the mix of filament types.

After tacking, fillets were created along each of the fins at their root chords using ES6029 Aeropoxy Structural Epoxy. The fillets were created in order to strengthen the fins, and to provide a smooth transition from the boat tail to the fins in preparation for the carbon fiber layup. The outline of the fillets was created using painter's tape, as seen in Figure 21. Then, the epoxy was poured along the general area of the fillet then shaped by dragging a 3D-printed rounded fillet tool with a 1 in radius at an angle along the root chord of the fin. After waiting three to four hours, the painters tape was then removed, and the fillets were left to finish curing for at least nine more hours. Fillets were created two at a time as seen in Figure 22, left to cure, then the fin can was rotated to complete the next set of fillets. After all the fillets were completed and cured, they were then sanded to ensure a smooth transition.



Fig. 21 Outline of Fin Fillets Using Painter's Tape



Fig. 22 A Finished Set of Fin Fillets

Four tip-to-tip layups were then performed on each side of the fin can, each with three layers of 3K carbon fiber. Carbon fiber sheets were laser cut in order to fit the desired area they were to cover - the first layer covered the fillets, the second layer covered everything except the fin bevels, and the third layer covered the entire area of that side of the fin can. To increase the multi-axial strength of this composite layer, the second and third sheets of carbon fiber were cut such that the weave of one sheet was angled at a 45 degree angle relative to the weave of the other sheet. Each layer was laminated using PRO-SET LAM-135 Epoxy Resin and 224 Hardener before placing the next layer. Figure 23 shows the laminating of the second layer of carbon fiber on one side of the fin can.

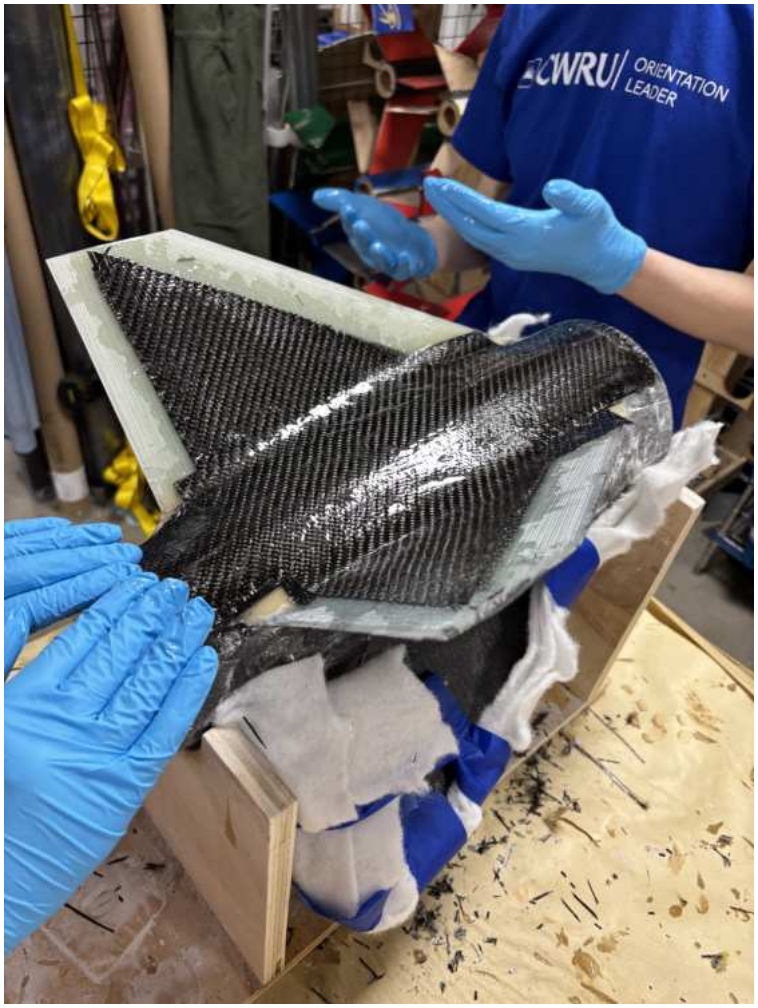


Fig. 23 Laminating of the Second Layer of Carbon Fiber for a Fin Can Tip-to-Tip Layup

Immediately after performing each tip-to-tip layup, the fin can was then put through a vacuum bagging process to compress the layers together while the epoxy cured. This was done to increase the strength of the composite and ensure that the composite was fully saturated with epoxy. To prepare for the vacuum bagging process, as with the fins, layers of peel ply film and then perforated film were each laid onto the tip-to-tip layup and pressed down, ensuring that the epoxy soaked into each layer. Then, two layers of breather cloth were placed on top. Additionally, 3D-printed semi-spherical stoppers were placed into either end of the open boat tail to stop a ensure the bag did not get sucked into the tube and rip.

Once the preparation was complete, the entire setup was placed inside of a vacuum bag, with the gasket connector placed on top of one of the fins, as this was the flattest surface available. The bag was then sealed with double-sided sealing putty tape. A hole was then cut in the bag above the gasket connector, so that the through-bag connector could be connected to the gasket connector. The vacuum was then turned on, and the entire setup was checked for potential air leaks. Once it was confirmed that there was a complete seal, the vacuum was left to run for at least twelve hours. The fin can inside the vacuum bag can be seen in Figure 24. After twelve hours, the vacuum was turned off, the vacuum bag cut, and the setup removed from the vacuum bag. The breather cloth, perforated film, and peel ply were then removed from the fin can. The entire tip-to-tip layup and vacuum bagging was then repeated on each remaining side of the fin can.



Fig. 24 Fin Can Tip-to-Tip Layup Vacuum Bagging

Once tip-to-tip layups were completed, the entire fin can was sanded to remove any rough edges from overhanging carbon fiber, or leftover breather cloth that had stuck to the surface of the fin can.

Machined Components The payload retention bulkhead and Tendie Descendie Duo charge wells were cut out on a CNC Mill to maintain precision and to manage complex geometry from weight relief features. These components were made from 7075-T6 aluminum and delrin, respectively. The centering rings and tube interface bulkhead were also made on a CNC Mill from 6061-T6 aluminum and were sanded to fit around the motor tube. The body of the Tendie Decendie Duo was machined on a manual mill due to its simple design. Gauge pins, as well as the final Tendie Descendie Duo plate assembly, were used to test the precision of the interface holes on the Tendie Descendie Duo body. The charge wells and nose cone tip, composed of 6061-T6 aluminum, were cut on a horizontal bandsaw and turned down on a manual lathe. The electronics bay bulkhead, which has a two-dimensional profile, was cut out from a plate of 6061-T6 aluminum using a waterjet.

Painting The outer tubes of the rocket were covered in slight ridges from the saturation and curing of epoxy within the carbon fiber. All tubes were lightly sanded to prepare for primer. The nose cone was treated in a slightly different manner. Since the nose cone was made using fiberglass sleeves, there were large bumps on the surface. As such, the nose cone was sanded heavily using an orbital sander. Finish 1 2K Urethane Primer was used as a thick layer to fill in the majority of pinholes and provide a smooth surface finish. The primer was then sanded to smooth out any imperfections and prepare for the sealer. The rocket was then sprayed with Autoborne 6013 Silver Sealer. This sealer acts as a primer and presents a silver base for the dye-based paints. Vinyls were cut out and used for stenciling and details. The dyes and

any additives were sprayed onto Helios for coloring. The general painting scheme, although lacking specific details, can be seen in 25. Additionally, the typography selections for the naming and numbers can be seen in 26. The last layers sprayed on the rocket are multiple coats of Finish 1 FC720 Automotive Clear Coat. At this point in the process, the fin can be re-joined the rocket to be sprayed. FC720 was sprayed on in many heavy layers to smooth out the surface. The fin can was sprayed with extra layers as it was a simpler choice to spray more layers of clear coat rather than covering it in laminating epoxy and sanding.

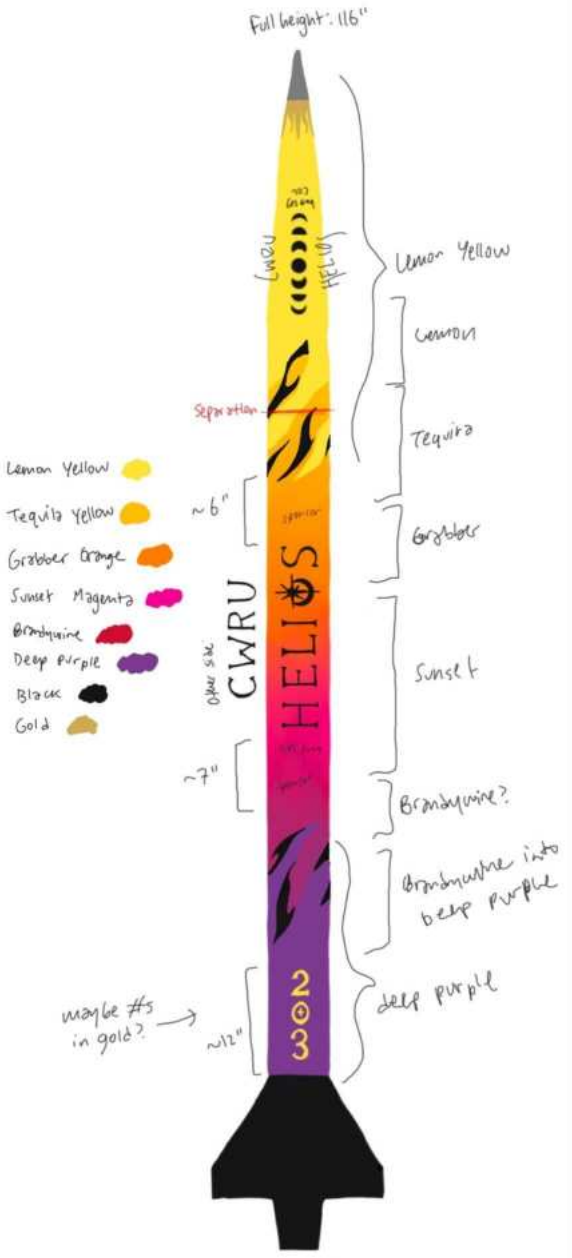


Fig. 25 General Painting Scheme



Fig. 26 Typography of Naming and Numbers

C. Recovery

Helios will be recovered in one section. The parachutes are to sized to fit within the descent rates outlined in Sections 6.3 and 6.4 of the DTEG [3]. The parachutes selected and relevant information are summarized in Table 5.

Parachute	Size (in)	Type	Descent Rate (ft/s)
Drogue	28	Elliptical	133.4
Main	84	Toroidal	25.1

Table 5 Parachute Sizing and Descent Rates



Fig. 27 Main Parachute



Fig. 28 Drogue Parachute

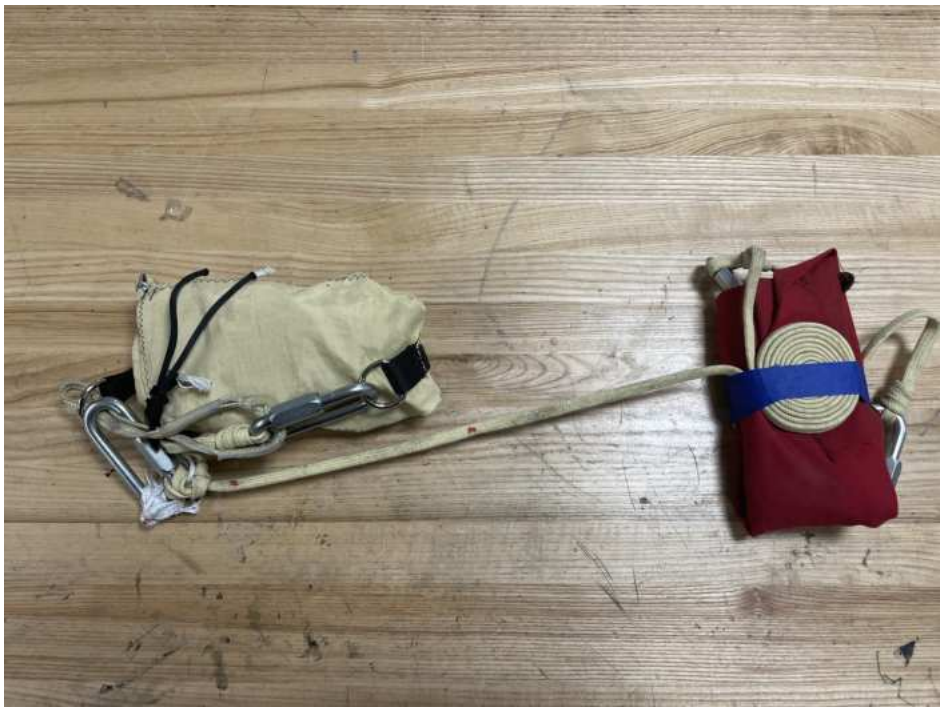


Fig. 29 Main and Drogue Parachutes Packed in Deployment Bag and Fire Blanket

The recovery system deploys in two events. The 28 in ellipsoidal drogue parachute, which has a C_d of 1.5, deploys at apogee during separation. The drogue parachute is connected to the payload retention bulkhead via 3/8 in tubular Kevlar recovery lines. The 3/8 in tubular Kevlar is rated to 3600 lbf. A short 3/8 in tubular Kevlar line is secured to the payload retention bulkhead using two eye bolts on either side of the payload. The main recovery line is attached to the short Kevlar line via a quick link, securing the drogue parachute to the lower body of the rocket. The main recovery line also connects the drogue to the electronics bay bulkhead via the SRAD Tendie Decendie Duo described below. The force of drogue deployment is 100.3 lbf, including a shock factor of 2.

The 84 inch toroidal main parachute, with a C_d of 2.1, is held in a deployment bag made of Kevlar fabric which is secured to the electronics bay bulkhead with a small loop of 3/8 in tubular Kevlar. A Brunnian link [4] is used to tie the loop of 3/8 in tubular Kevlar at the Tendie Descendie Duo. Utilizing a Brunnian link for the Tendie allows for redundancy, as, if either pin fails to eject, the line will still be released. The main parachute deploys at 1500 ft AGL. The EasyMini and Raven4 ignite two redundant ejection charges that deploy the Tendie Descendie Duo; The force from the drogue then pulls out the main parachute from the deployment bag. The main recovery line connects the main parachute to an eye nut threaded on to the threaded rod in the electronics bay. The force of main deployment is 1271.6 lbf, including a shock factor of 2.

All sections of the main recovery line are sized to allow both parachutes to clear the couplers before unfurling, as well as to allow at least eighteen inches of clearance between the nose cone and lower body at all times. The total recovery line length is 349 in. More detailed recovery diagrams can be found in Figures 30, 31, and 32.

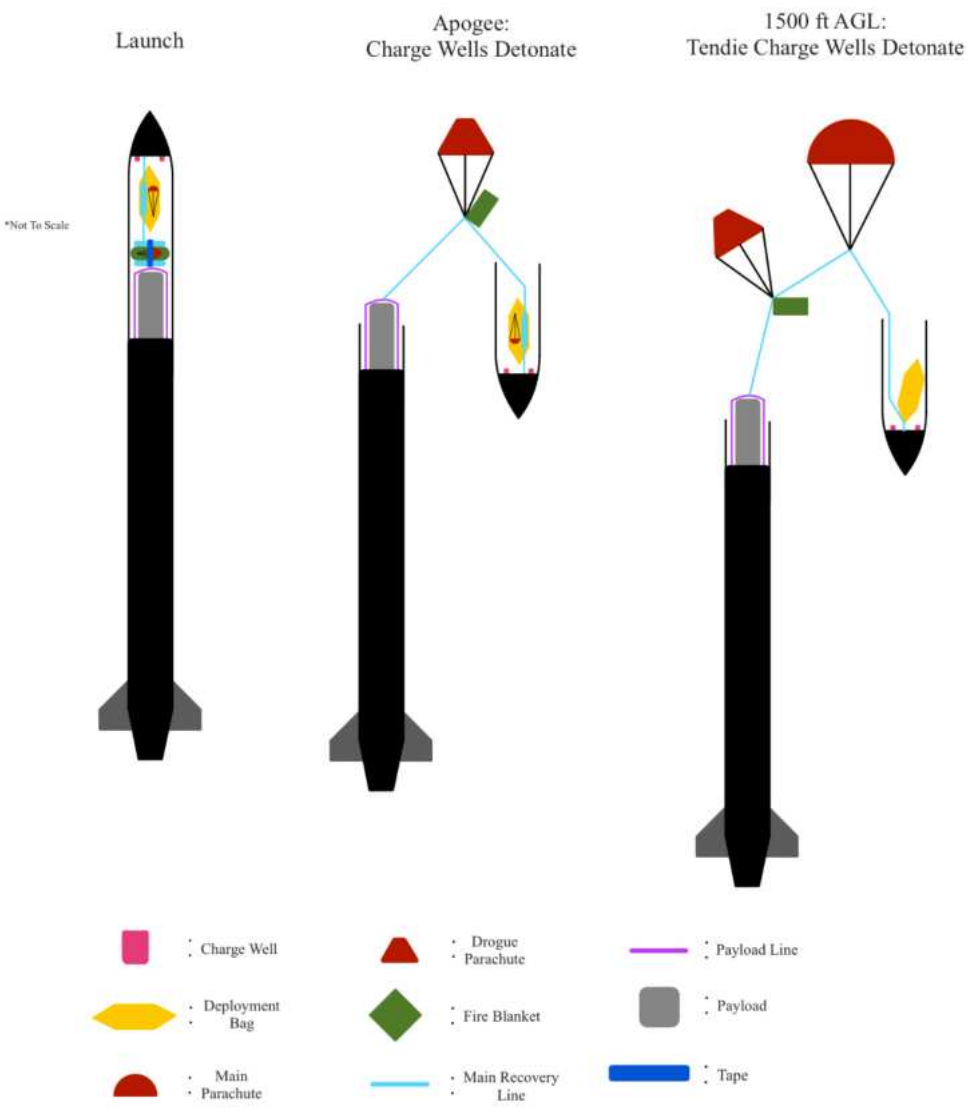


Fig. 30 Recovery Diagram

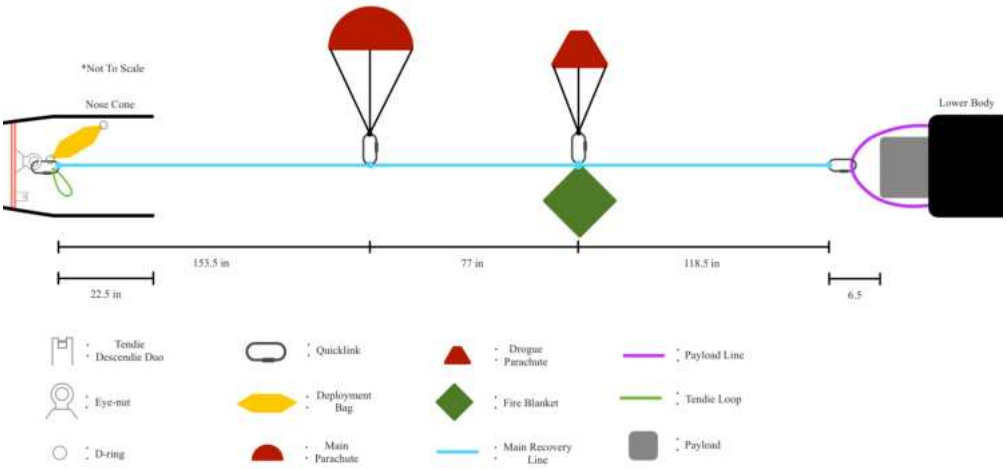


Fig. 31 Recovery Line Diagram

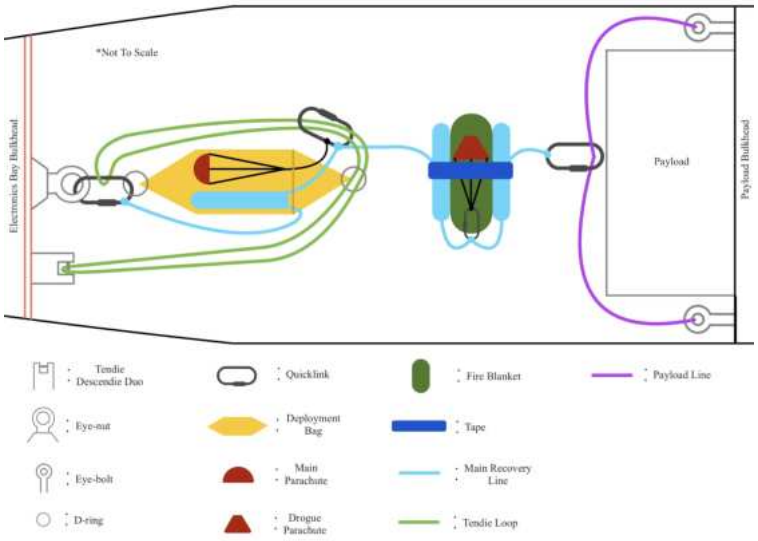


Fig. 32 Recovery Packing Diagram

At apogee, the electronics bay fires two redundant black powder charge wells to separate the upper body tube from the lower body tube. The EasyMini altimeter fires the primary charge, sized at 5 g of black powder. 1 second later, the backup charge of 6 g of black powder, fired by the Raven4, is triggered. After apogee, Helios descends at a rate of 133.4 ft/s, with the main parachute wrapped in the deployment bag. Once Helios falls to 1500 ft AGL, both the EasyMini and the Raven4 fire the Tendie Descendie Duo, causing the main parachute to exit the deployment bag and deploy fully. Once the main parachute is fully deployed, the rocket descends at a rate of 25.1 ft/s to achieve a safe landing.

Tendie Descendie Duo The Tendie Descendie Duo is an SRAD device that has the same function as a COTS Tender Descender, but is able to mount to a bulkhead instead of in-line with the parachutes. This is the team's third year using the device, and after its effective utilization at the 2023 and 2024 Spaceport America Cups, small changes were implemented into the design which do not affect the operation of the device. The Tendie Descendie Duo utilizes two independent charges to ensure redundancy. The Tendie Descendie Duo holds a short length of Kevlar line that prevents the main parachute from deploying until it is released. It has two black powder charge wells, each with a plate holding the dowel pins to secure the line. The line is wrapped around the two dowel pins using a Brunnian link, so that when

either charge well is fired, the main parachute is released. For the launch at IREC, the pins are set to release at 1,500 ft AGL. The Tendie Descendie Duo was designed to withstand all expected deployment loads.

There were two changes in the Tendie Descendie Duo design from previous years. First off, the pins, shown in Figure 33, are press fit into the Tendie plate instead of held in via set screws, improving assembly operations. Secondly, the body of the Tendie is taller than in previous years to allow for the Tendie plates to eject more easily since there are more components on the recovery section of the electronics bay bulkhead.

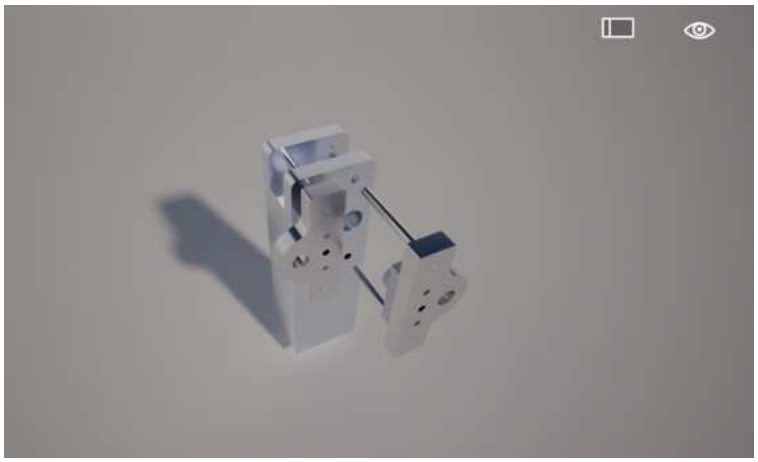


Fig. 33 Tendie Descendie Duo with Exposed Plate Assembly

Parachute Construction The main parachute was constructed from twelve panels (gores) made from ultra low porosity nylon. The gores were laid on a board of MDF using spray adhesive. The gore patterns were then cut out by a drag knife on a CNC router, as shown in Figure 34. The gores were sewn together via a sewing machine to make the canopy and the 1/8 in spectra microline shroud lines were attached. The parachute was washed with acetone and water to remove remnants of the spray adhesive.



Fig. 34 Gore Cutting Process on CNC Router

The drogue parachute was constructed from eight gores made of zero porosity nylon. Since zero porosity nylon did not adhere to the MDF during drag knife operations, the drag knife was used to cut a template in the MDF and the gores were cut using a knife. The gores were sewn together and T-11 nylon cord was used to make the shroud lines.

Black Powder Sizing Based on drag separation analysis, the separation joint was held together by three #2-56 UNC nylon shear pins. Nominally, these three shear pins require 69.7 lbf to shear, and to supply triple the force required, the targeted force cause by black powder combustion was 209.1 lbf. With an internal diameter of 5.75 in, an internal

pressure of 8.05 psi is required. Assuming the unoccupied volume is 484 in^3, which takes into account the volume of Selene and the recovery equipment, and using the Ideal Gas Law, the calculated value of black powder was found to be 4.771 grams of black powder. For ease of integration, this was rounded to 5 g. The backup charge will use 6 g, to increase the probability of successful separation.

Bolt and Thread Shear For bolt shear calculations, the applied load was assumed to be the main deployment force in the worst case, which occurs when the main parachute deploys instantly. The nominal deployment force is calculated to 636 lbf. Since instant deployment would qualify as shock loading, a shock factor of 2 was applied to the load, causing the force of the load to assumed to be 1272 lbf. #10-24 UNC bolts were used, to conform with all other external bolts for improved assembly and integration, and the chosen rail buttons use #10-24 UNC flat head bolts. The shear area for one #10-24 UNC bolt is 0.01548 in^2, calculated with the minor diameter. The chosen bolts are listed on McMaster-Carr with a tensile strength of 120 ksi, and since a shear strength was not listed, it was assumed that it would be 60% of the tensile strength, leading to the shear strength to be assumed to be 72 ksi. With this shear strength, a #10-24 UNC bolt can withstand 1114.7 lbf. Six bolts were chosen, resulting in an FOS of 5.14. While these calculations are quite conservative compared to the required FOS of other load-bearing components on Helios, the decrease in performance associated with more bolts was quite small, hence the very conservative number of bolts.

The possibility of the nose cone tip threads shearing was also considered. Assuming 1 inch of 1/4-20 thread engagement in a 6061-T6 nose cone tip, the load required to shear those threads is 7175 lbf, with an assumed shear area of 0.3417 in^2 and a shear strength of 21 ksi. With a main deployment force of 1272 lbf, this results in a FOS of 5.64.

Drag Separation

$$N = \frac{M_1 D_2 - M_2 D_1}{M_1 + M_2} \tag{1}$$

Drag separation was analyzed using Equation 1 taken from the MIT Rocket Team [5]. In Equation 1, D and M are the drag forces and masses of the lower section, 1, and the upper section, 2, of the rocket. N is the normal force between the two sections, and, if N is negative, there will be force attempting to separate the joint. If the magnitude of this force were to reach a high enough magnitude that it would sever the shear pins, then drag separation would occur.

CFD work indicates that at 0.8 Mach and an altitude of 23,000 ft AGL, 500 N of drag will be generated by the rocket, with 400 N of drag on Airbrakes, and 100 N of drag on the rest of the rocket. Based on OpenRocket estimates, 20 N of drag are exerted on the rocket above the separation joint, meaning 480 N are exerted below the separation joint. This means that, with the maximum drag generated by Airbrakes, 4% of the drag from Helios is above the separation joint, and 96% is below. Additionally, 22.5% of the mass of Helios is above the separation joint, and 77.5% of the mass is below it . This results in a maximum tension at the separation joint of 20.8 lbf. Given a nominal shear pin breaking force of 69.7 lbf, the FOS would be 3.3. Even if all 500 N of drag were applied below the separation joint, the FOS would only drop to 2.73.

D. Payload



Fig. 35 Selene with 1 Frame Plate Translucent

1. Introduction and Motivation

Selene is designed to evaluate the mechanical behavior of ultra-thin rollable glass during rocket launch conditions. The core hypothesis is that this material, with a thickness of 100 microns, could offer a lightweight alternative to traditional satellite reflectors. The experiment is built to simulate the deployment and loading environment such materials might face in real world applications, while keeping the entire process contained within the payload bay of Helios. This experiment was started by Dr. Benjamin Monreal from the CWRU Physics Department. The initial idea

for the experiment involved the payload deploying a pair of flaps after rocket separation at apogee into the air. A sheet of glass would unfold across the flaps, simulating the unfolding mechanism of a reflecting telescope. This idea was abandoned, as the unfolding mechanism presented recovery issues. The flaps could interfere with the recovery lines, and any broken glass had a chance of tearing into the parachute. Additionally, it was deemed extremely likely that the glass would shatter after deployment due to its brittleness. The updated design features one stationary piece of glass to act as a control piece and one piece of glass that will unroll during launch along a track in the 3D-printed glass sled. This revision was implemented into Selene as the current working model.

The experiment was designed in partnership with Dr. Monreal from the CWRU Physics Department. The primary goal of the experiment is to test the strength and durability of Corning Willow Glass [6] during the launch and recovery of the rocket. The primary design constraint provided by Dr. Monreal was that the glass would deploy during ascent, so that the entire unfurling process could be monitored. The primary data collection method will involve recording live footage of the glass unfurling process to verify the structural integrity of the glass pieces. Additionally, several piezoelectric sensors will be placed along both the control piece and the experimental piece.

2. Frame

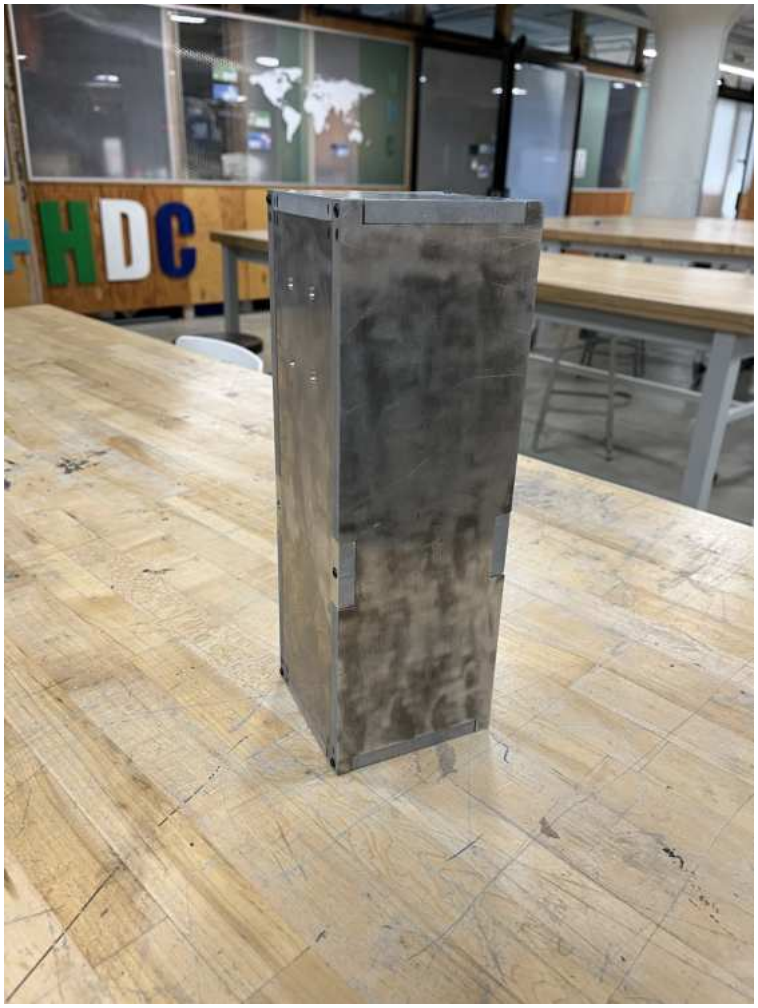


Fig. 36 Assembled Selene Frame

The frame of Selene has a 3U CubeSat form factor that encloses the components. The frame consists of four aluminum frame plates, an upper bulkhead, and a lower bulkhead. All frame plates and bulkheads are made of 0.375 in thick 6061-T6 aluminum. All components are attached to each other with #4-40 UNC, #6-32 UNC, and #8-32 UNC

socket head bolts. In addition, the lower bulkhead has threaded holes for four #10-24 UNC bolts that provide a bolted connection to the payload retention bulkhead which is secured to the airframe of Helios via radial bolts, as described in Section III.B. The frame contains the experiment within the payload, protecting the subsystems of Helios from potential glass breakage. The outline of the frames were cut out using a waterjet, and pockets were manually milled on the inside face to provide weight relief.



Fig. 37 Bottom of Selene Frame with Threaded Holes for Payload Retention

3. Theory of Operations

Before launch, the onboard circuitry is activated after the rocket is installed on the launch rail by manually turning the screw switch. Once launch acceleration is detected, Selene initiates its test sequence. A servo motor begins to unfurl a coiled strip of glass along a fixed 3D-printed track, allowing for the study of the behavior of the Willow Glass under sustained vibration and stress during flight. The interior of the payload is lit by a low-power LED to ensure the cameras have clear visibility of the deployment.

Multiple options for when the glass would unfurl were considered. Ultimately, the decision was made to unfurl the glass as soon as launch is detected, as that is when the largest forces will be applied on Helios and Selene due to the large acceleration caused by the O5500X motor. As shown in Figure 3, peak thrust occurs within the first two seconds of launch; thus, to best monitor the behavior of Willow Glass at high loading during unfurling, the glass must unfurl before motor burnout.

Five piezoelectric sensors are mounted directly onto the moving glass. These sensors record changes in the potential difference in the glass caused by strain, providing a timeline of the forces acting on it throughout the flight. Two

additional sensors are mounted to a static control surface inside the frame to provide baseline data for comparison. The onboard cameras are triggered by Sirin, which will record video of the deployment. After recovery, the piezoelectric data will be compared against flight logs from the accelerometer on Sirin to analyze how the glass responded during ascent, and whether those responses differed from the control sensors.



Fig. 38 Glass Sled of Selene

4. Electronics Sled

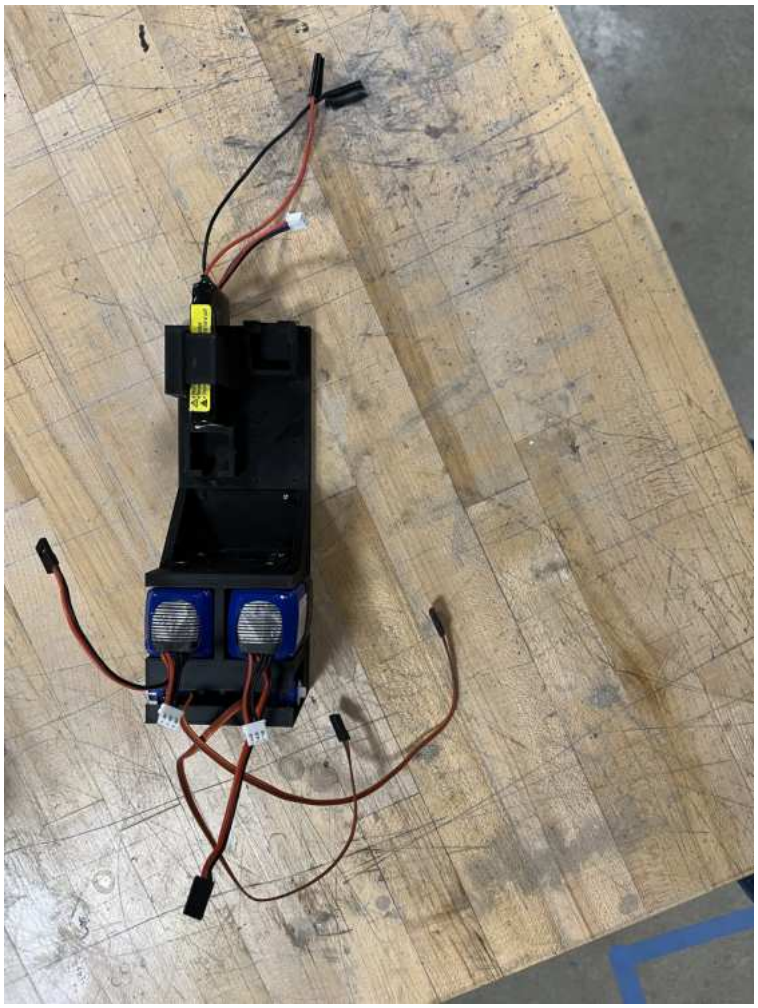


Fig. 39 Electronics Sled of Selene with Batteries Inserted

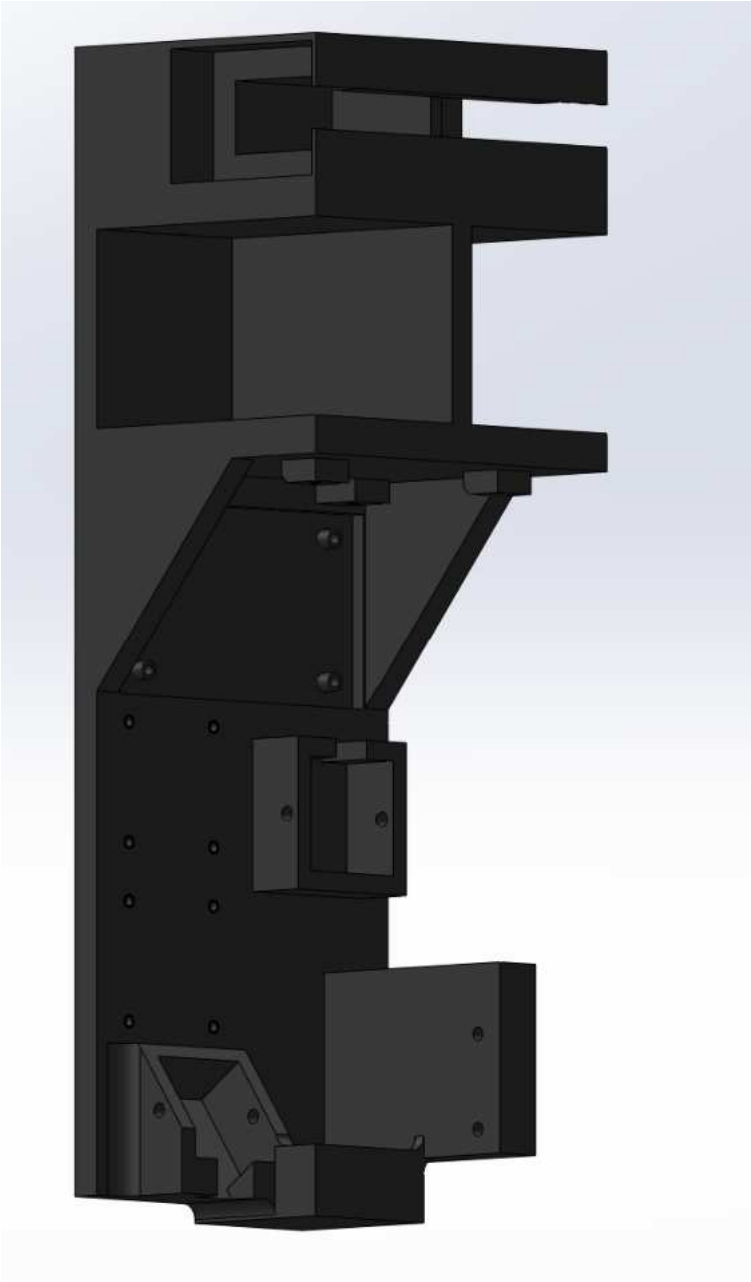


Fig. 40 Electronics Sled of Selene in CAD

The electronics sled for Selene was developed to keep all components securely mounted, accessible, and resistant to the vibrations and stresses of flight. The sled was 3D-printed in PLA, chosen for its ease of fabrication, lightweight properties, and sufficient strength for internal payload use. It attaches directly to one of the frame's internal plates using four #6-32 UNC bolts, anchoring the assembly firmly within the payload bay. The layout of the sled was designed to allow most components to be inserted into shaped slots with minimal clearance, allowing them to be held in place by the tight geometry of the print. While not a press-fit, the tolerances are small enough that components stay firmly in place during handling and flight. Removing the bolts requires a large enough amount of force that unintended loads will not shift nor dislodge any components. This strategy was especially useful for compact components such as the battery packs and servo motors, which could be quickly installed and held reliably by the sled's shape. Key electronics including the Power Distribution Board, the Sirin, and both camera modules were mounted using dedicated #6-32 UNC bolts. These provide secure mounting and alignment as well as easy removal for testing or troubleshooting.

5. Electronic Architecture and Power Distribution

The electronics system for Selene was developed with both modularity and reliability in mind. Early in the design process, the team decided to centralize all logic and control within Sirin, the SRAD flight computer. Sirin was chosen for its available GPIO pins and familiarity among the team member developers. From the start, the requirements to control a servo, trigger two onboard cameras, manage illumination, and collect analog voltage data from multiple piezoelectric sensors were understood and defined in the requirements. A further requirement for the system involved being compact and self-powered.

The system begins with three 6.6 V LiFePO4 battery packs, two 2000 mAh, and one 900 mAh. All three batteries are connected in parallel. This circuit provides the payload a total of 4900 mAh with a stable output voltage that matches the operating range of Sirin. Keeping the output voltage within this range minimizes the need for power conversion to the flight computer itself. The batteries are connected to a central Power Distribution Board (PDB) that manages regulation and protection. The PDB is an SRAD circuit board designed to improve the wire management within the payload and conserve space for the experiment and other components. The PDB contains one integrated circuit that connects the various actuators, sensors, and batteries to the Sirin, conserving volume within the 3U CubeSat form factor. A wiring diagram for Selene is shown in Figure 41

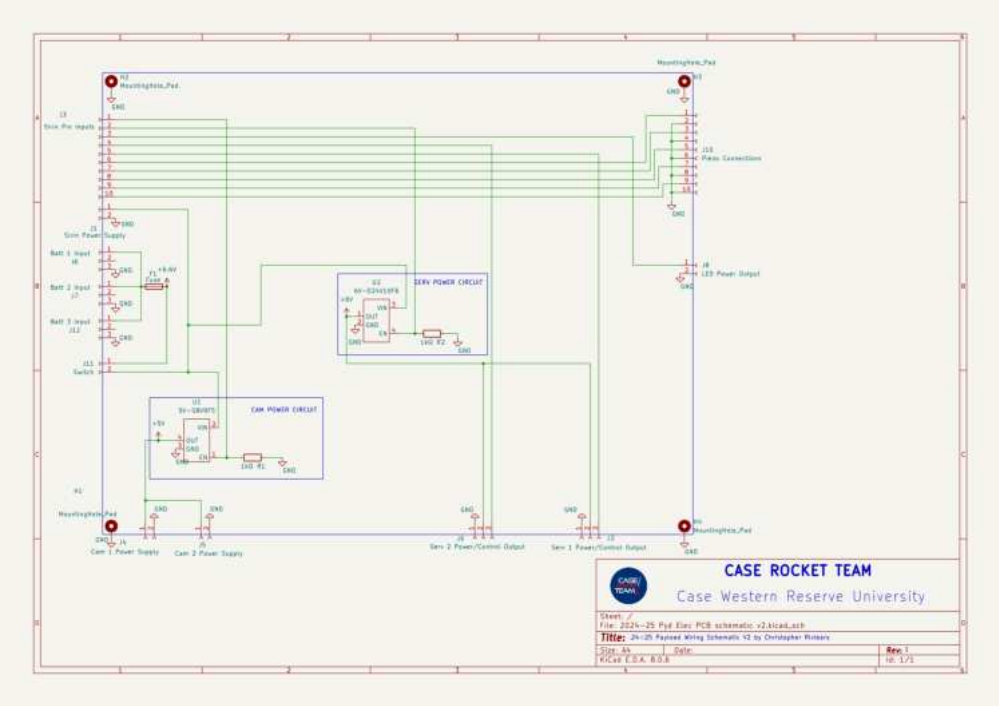


Fig. 41 Wiring Diagram for Selene

The primary function of the PDB is to supply power to the components. In previous payloads the team has designed, each battery in the payload was connected directly to each component. In Selene, the PDB distributes the power from every battery to each component. The main components integrated into the PDB are the cameras, servo motors, LED, and piezoelectric sensors. To power the cameras and servos, a 5 V and 6 V regulator board are used to step down the voltage to the levels that are safe for the cameras and servos to operate at. To prevent the components from running for the entire time that the rocket is on the rail, Sirin outputs a signal to the PDB which goes to the shutdown pins of the voltage regulators, preventing power from flowing into them when the rocket is waiting on the launch pad. The PDB also contains pass-through connections for the piezoelectric sensors. These sensors monitor the stresses on the glass while rolled and unrolled during flight, providing a majority of the data for the experiment. Using the PDB allows all the sensors to be connected to a common ground without directly attaching five wires to Sirin. The PDB also contains the LED connection to light the interior of the payload. Finally, the PDB contains a power switch that is connected to an externally accessible screw switch, which allows the entire circuit to be closed once on the rail. It also contains a 10 A fuse to protect the system in case of electrical failure. A PDB diagram is shown in Figure 42.

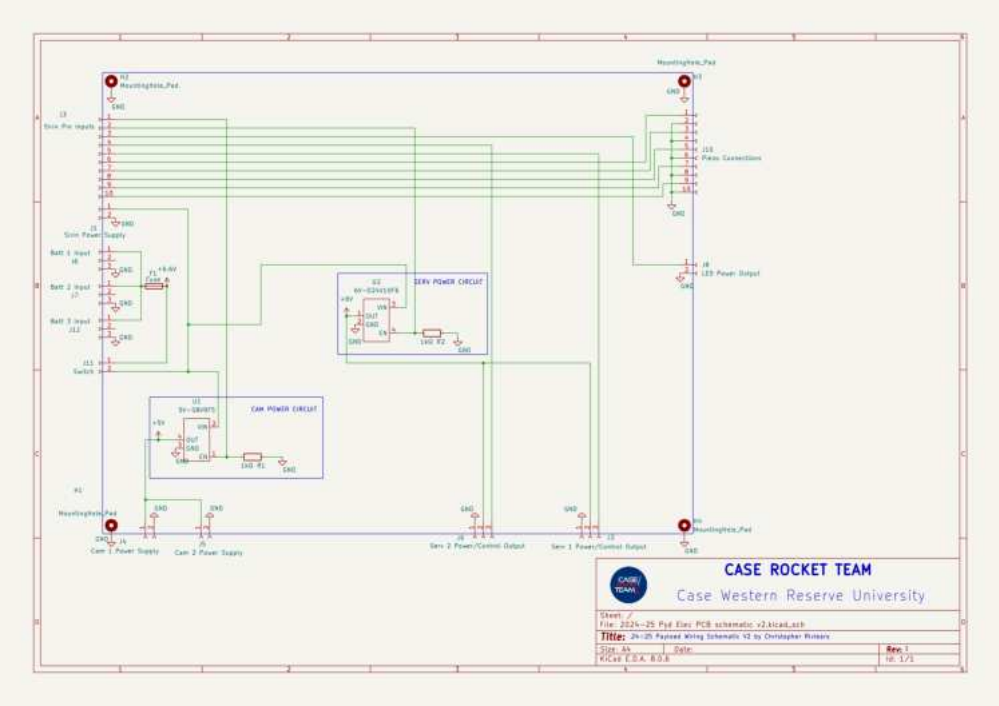


Fig. 42 PCB Diagram for Selene

E. Airbrakes

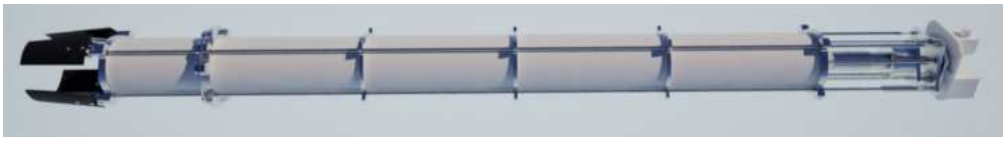


Fig. 43 Airbrakes Superstructure

1. Overview

The Airbrakes subsystem is designed to dynamically deploy flaps on ascent to actively control drag to target the desired apogee. This aims to mitigate the effects of varying motor performance and atmospheric conditions on the rocket's apogee, as well as account for errors in manufacturing changing the mass or drag of the rocket. The Airbrakes system uses barometer and accelerometer data to determine the current state of the rocket, then adjusts flap positioning based on the current estimated trajectory.

The upper mechanism uses an electric motor with an encoder to turn a lead screw and create linear motion in the moving plate. This motion is then transferred through the actuation tubes to the flap linkages. These linkages then convert the linear motion to angular motion of the flaps, adjusting the drag produced. The flaps extend from the boat tail, preventing them from reducing rocket stability to an unsafe level, as they are located below the center of pressure of the rocket throughout ascent. Further details about the operation of Airbrakes can be found in Section III.E.4 and Section III.E.5.

This system is comprised of three main components: the superstructure, the upper mechanism, and the lower mechanism. The superstructure holds the upper and lower mechanisms together, while providing a simple interface with the rest of the rocket. The upper mechanism contains the drive system, as well as connections to the electronics bay where the control computer resides. The lower mechanism consists of the flaps and their associated linkages, which is where the drag is produced.

2. Structure

Superstructure The primary function of the superstructure is to connect the upper and lower mechanisms together. The superstructure is built around the motor tube, as the flaps are at the bottom of the rocket, extending through the boat tail, while the upper mechanism is above motor tube. The motor tube provides structural rigidity to the Airbrakes subsystem, and several parts of the system act as centering rings for the motor tube, simplifying construction. All components of the superstructure are epoxied to the motor tube, as the motor tube is not thick enough for bolts to be effective. From top to bottom, the superstructure consists of the motor retainer bulkhead, three centering rings, the tube interface bulkhead, and the actuation mount bulkhead.

The motor retention bulkhead serves a dual purpose, motor retention and upper mechanism attachment. The threaded rod for motor retention is connected to this bulkhead, which the motor threads onto in order to keep it retained after burnout, as shown in Figure 4. The bulkhead also connects the upper mechanism to the superstructure, further discussed in Section III.E.2. There is also a set screw mount located on the motor tube, shown in Figure **??**, which interfaces with the forward closure of the motor to ensure it cannot unthread from the motor retainer bulkhead.

There are three centering rings spaced equally between the motor retainer and tube interface bulkheads. These rings mainly serve to prevent buckling in the actuation tubes. The long actuation tubes bend significantly when unsupported, so centering rings were added with bushings to prevent this. After the addition of three centering rings the unsupported distance is reduced by a factor of four, providing a sixteen-fold increase in buckling resistance. Each centering ring weighs only 0.12 lbs, so they lead to an overall mass reduction due to the ability to use thinner walled tubes in the superstructure. The rings also aid in alignment of the subsystem during integration, aiding in ease of assembly.



Fig. 44 Tube Interface Bulkhead

The tube interface bulkhead serves to further stabilize the actuation tubes, connect the airframe to the boat tail, and transfer loads from the Airbrakes subsystem to the airframe. The presence of this bulkhead further reduces the length of unsupported actuation tube sections, aiding in the rigidity of the system. The main purpose of the bulkhead, however, is to connect the subsystem to the rest of the airframe. The bulkhead is connected to both the lower airframe and boat tail, each by six #10-24 UNC radial bolts. This is the only connection to the airframe, which was done to make manufacturing and integration easier, as there are fewer radial bolts to align and insert. Since this the only connection the Airbrakes subsystem has to the airframe, these bolts take all of the drag load of the Airbrakes. As this bulkhead connects the boat tail to the airframe, the thrust of the motor also passes through it, due to the force transfer through the boat tail. The minimum FOS for the tube interface bulkhead is 16, which occurs due to motor thrust assuming the weakest load path.

At the bottom of the superstructure lies the actuation mount bulkhead, which connects the lower mechanism to the system. This bulkhead also serves as the lower centering ring for the motor tube. As the lower mechanism attaches to this bulkhead, the flap drag loads are also applied to this bulkhead. As the force is transferred to this bulkhead through

bolts, FEA was also run to ensure integrity. The factor of safety under maximum expected loads was found to be 60.



Fig. 45 Airbrakes Upper Mechanism with Airbrakes Electronics Bay

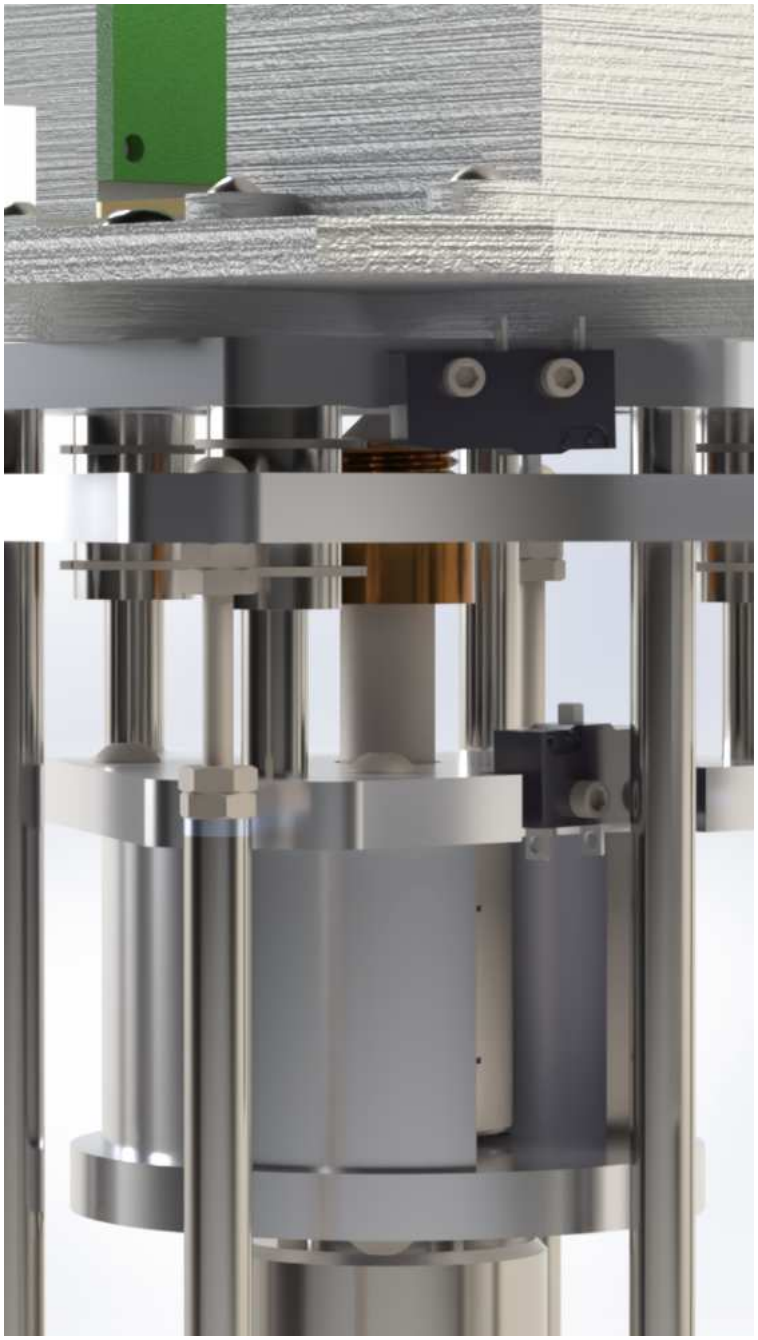


Fig. 46 Airbrakes Upper Mechanism

Upper Mechanism The upper mechanism creates the linear motion required for flap actuation and transfers it to the actuation tubes to be sent to the lower mechanism. The motion begins in the DC motor, which is controlled by Sirin, the SRAD flight computer in the attached electronics bay and mounted to the bottom of the main bulkhead. The rotation is then transferred through a coupler to a lead screw, which moves the moving plate. A thrust bearing is placed above the coupler, against the main bulkhead, to prevent it from stretching due to the force of actuation in order to improve the accuracy of the actuation. This also prevents axial load on the motor shaft which improves reliability of the motor. The moving plate has linear bearings that ride on linear rails to keep the plate square and ensure equal actuation of all flaps. The upper mechanism is held together by press fit connections on the linear rails and structural rails. Press fits were chosen due to their simplicity and strength compared to set screws. The main bulkhead is pressed onto the linear rails

which are pressed into the upper plate. The upper plate, in turn, has the structural rails pressed into it. The other end of the structural rails is pressed into the motor retainer bulkhead, which connects the mechanism to the superstructure. The main bulkhead and moving plate also have limit switches bolted on to them, which mark full extension and full retraction respectively.



Fig. 47 Airbrakes Main Bulkhead



Fig. 48 Airbrakes Moving Plate

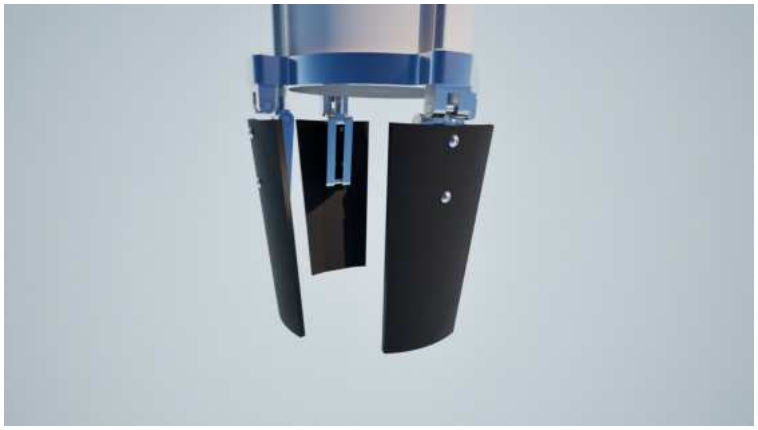


Fig. 49 Airbrakes Lower Mechanism

Lower Mechanism The lower mechanism is comparatively simple, consisting of the flap mount, flap linkage, actuation linkage, flap, and actuation tube linkage connector. The lower mechanism is a four-bar linkage, specifically an offset slider crank mechanism, with the actuation tube as the slider. This converts the linear motion transferred by the actuation tubes to the desired angular motion of the flaps. The linkage lengths chosen provide a range of motion of -5.8 degrees to +40 degrees relative to the axis of the rocket, with approximately 0.6 in of linear travel while forces on the components are relatively low. The flap linkage, when the Airbrakes flaps are not deployed, is 0.375 in from the bulkhead, 0.25 in from the ID of the rocket, and is 2 in long. The actuation linkage is 1.75 in long, and the actuation tubes are offset 0.35 in from the flap mount. The linkages connect via dowel pins, with reamed holes acting as the bearing surfaces. The pins are press fit into the flap mount and actuation linkages to keep the lower mechanism together. Press fits were chosen over retaining rings or set screws due to ease of assembly and reliability.



Fig. 50 Flap Linkage



Fig. 51 Actuation Linkage

The flaps bolt on to the flap linkage and are made of forged carbon fiber. This manufacturing method was chosen because of the high strength of carbon fiber as well as the complex geometry of the flap part. The final flap dimensions are 4.5 in long and 2 in wide at the center, with a taper matching the boat tail angle. This results in the remaining sections of the boat tail having no taper, maximizing the structural integrity.



Fig. 52 Top View of Flaps



Fig. 53 Bottom View of Flaps

3. Electronics Bay

The Airbrakes electronics are housed in their own independent electronics bay which is mounted to the upper plate of the upper mechanism. This houses the control electronics and a camera, as well as their associated batteries and screw switches. The components in the electronics bay are one Sirin board, one DRV8871 motor driver, one RunCam Split-H, two screw switches, and six 18650 Li-Ion batteries. Four batteries are for the Airbrakes system, while the other two power the RunCam. The mounts are entirely 3D-printed PETG and have heat-set inserts for bolts to screw into, aiding in reliability and strength. The electronics bay also has a wire guide which extends down alongside the upper mechanism; it is used to ensure wires from the motor and lower limit switch remain sufficiently far from the moving plate during flight.



Fig. 54 Wire Guide for Airbrakes Electronics Bay

4. Analysis

Design Constraints The main determining factor for the design of the Airbrakes subsystem is the rocket's center of gravity. There is not enough space to place the Airbrakes upper mechanism alongside the motor tube, so it must be placed above the motor tube. This causes the system to be above the center of gravity after burnout. On deployment, the system would shift the center of pressure forward significantly, potentially reducing the rocket stability to an unsafe level. The flaps are therefore placed in the boat tail and deployed using actuation tubes to prevent instability.

Another major design constraint is the amount of space the system can occupy. Space is radially limited to 0.78 in for the lower mechanism, as the system must fit between the motor tube and boat tail. Vertically, space is limited by the amount of surface drag that can be added while still reaching sufficient altitude to use the system. If the Airbrakes upper mechanism occupied too much space vertically, the added skin drag would reduce apogee to a level that would render the system useless.

The upper mechanism must also be able to produce enough linear force to actuate the flaps into the airstream. This constraint was the primary driver in lead screw and motor selection, as they were each selected to be capable of producing enough force to actuate the flaps in a timely manner when acting together.

Operational Parameters The Airbrakes subsystem was designed to be able to reduce the rocket's apogee from 33,000 ft to 30,000 ft. This is larger than the discrepancy predicted by the simulations, intended to ensure the system is more than capable of reaching the desired apogee altitude of 30,000 ft. The flaps are designed to only deploy once the rocket is under Mach 0.8 to ensure accuracy of the control system, further discussed in Section III.E.5. A physics simulation

was used to determine the total drag increase required, then simple drag calculations were used to find an initial estimate of flap size. CFD, examples of which are shown in Figures 55 and 56, was then run to find the actual drag produced, and the size was updated based on that data. The simulation found that a 330% increase in drag was required to reduce apogee by 3000 ft, and the chosen flaps can increase drag by 380%. The motor was then sized using preliminary drag and actuation force estimates and is capable of fully actuating the system in less than 0.75 s with zero loading force or in less than 1.5 s assuming maximum load for the full deployment. Under realistic conditions, maximum deployment is expected to take less than 1 s. Further details can be found in Section III.E.4. Since the rocket spends approximately 23 seconds in the actuation window, this speed is sufficient to ensure consistent operation.

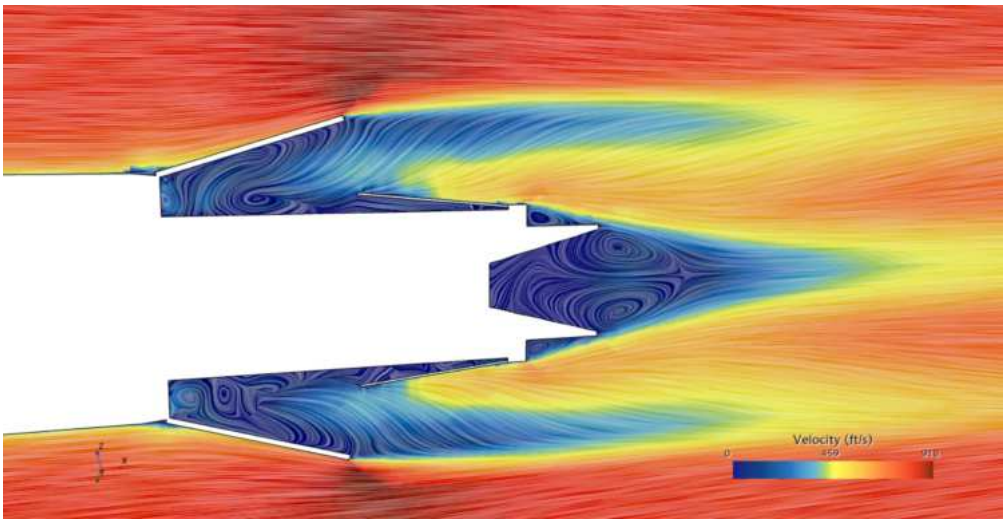


Fig. 55 CFD for Helios with Airbrakes Flaps Deployed

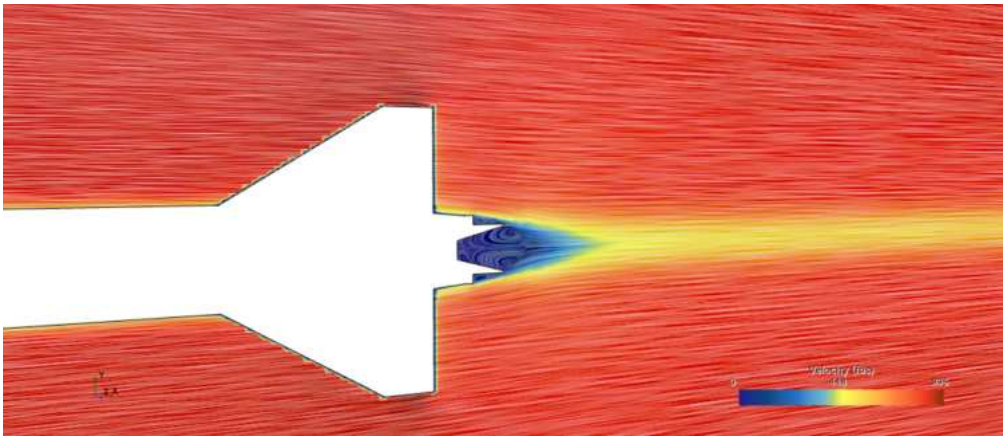


Fig. 56 CFD for Helios with Airbrakes Flaps not Deployed

Force Analysis A key part of the analysis for the Airbrakes mechanism is understanding the forces transfer through the linkages, both for FEA purposes and for sizing the motor. A MATLAB script was written to solve the four-bar linkage forces, and, as full CFD data was not available, it was assumed drag force varied linearly with deployment angle. This assumption reduced accuracy slightly, but, since maximum force occurs near maximum deployment, the error is small. Following this section are graphs of actuation force at various angles. In the Figures below, R1 is the force on the pin at the fore end of the flap linkage, R2 is the aft end of the flap linkage, and R3 is the force at the actuation tube linkage connector. Positive X is aft of the rocket and positive Y is radial out. The plots cover the entire range of motion of the flaps.

The results of this analysis were used for FEA on the linkages and associated components, as well as motor sizing. The total force on the actuation tubes, including estimated friction in the bushings from radial loads, is 185 lbf. With the chosen 3/8-8 ACME lead screw a motor torque of 144 oz-in is required. The chosen motor produces 144 oz-in at 231 rpm, which produces a maximum actuation time of 1.43 s. At no load, the motor spins at 437 rpm, actuating fully in 0.76 s. These speeds occur when the the motor is operating at its rated 12 V, however the battery pack used can supply up to 16.8 V, and actuation does not require full torque at all times, so full actuation can be assumed to take less than 1 s in real-world use.

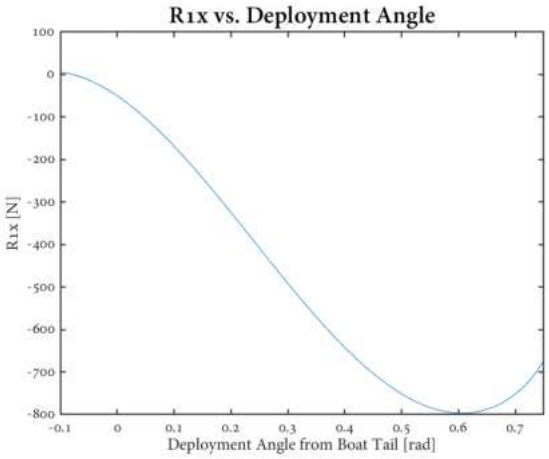


Fig. 57 R1-x

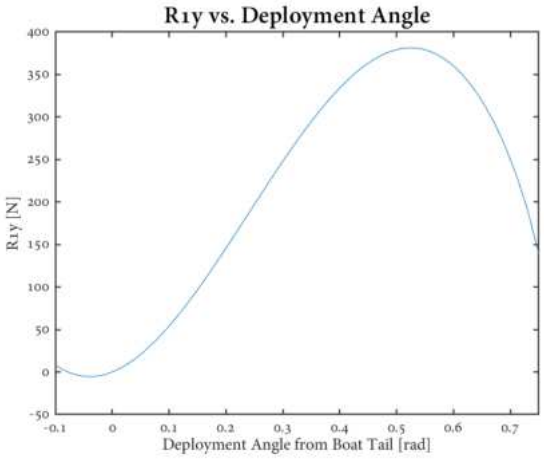


Fig. 58 R1-y

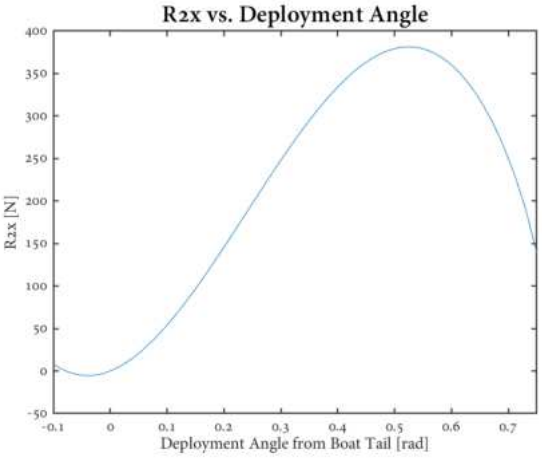


Fig. 59 R2-x

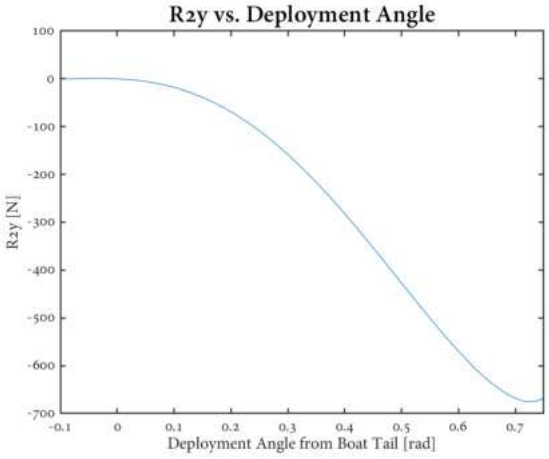


Fig. 60 R2-y

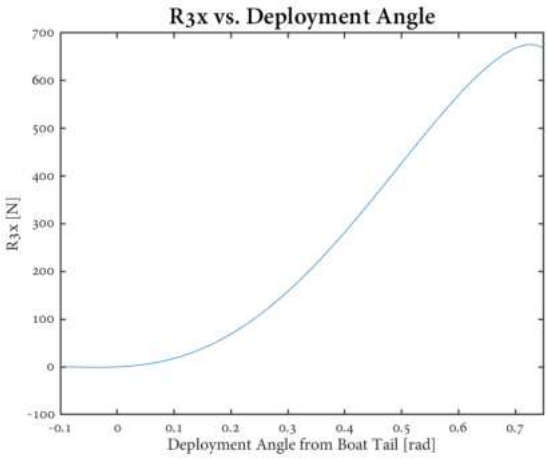


Fig. 61 R3-x

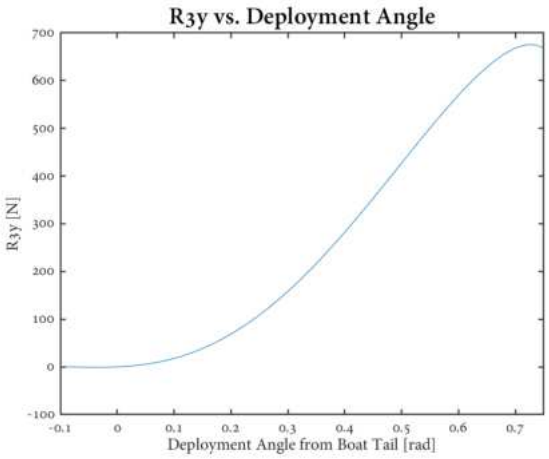


Fig. 62 R3-y

5. Algorithm

The Airbrakes algorithm is designed to regulate the apogee of Helios by actively adjusting the Airbrakes in the coast phase of flight. Part of the algorithm runs in flight, while some of the calculations are done before launch.

Before flight, base characteristics of Helios (including the dry mass, base coefficient of drag, cross sectional area, and other parameters) are determined and fed into CRT's custom simulation environment, RIPTIDE. RIPTIDE generates a set of trajectory curves based on different Airbrakes angles, as shown in Figure 63. It starts at the target apogee and, for each angle, iterates backward to 0.8 Mach, plotting the trajectory curve on a velocity-altitude graph. These trajectories are then curve-fitted, outputting a function of velocity and altitude that maps to the required angle needed to reach the target apogee. RIPTIDE can also be configured to take in specific pressure and temperature data, allowing simulations to be run shortly before launch with the most accurate weather data.

This approach increases the efficiency of the in-flight algorithm. By creating a single function that outputs the correct flap angle, we can avoid running complex physics calculations every time the state updates. Additionally, rather than calculating the predicted apogee for each flap angle at each starting velocity and altitude, giving us three independent variables to modify, we begin at the target apogee and calculate in reverse to the starting point for each flap angle, which is only one independent variable. This reduces the complexity of the simulation and allows us to run more complex calculations in a smaller time window.

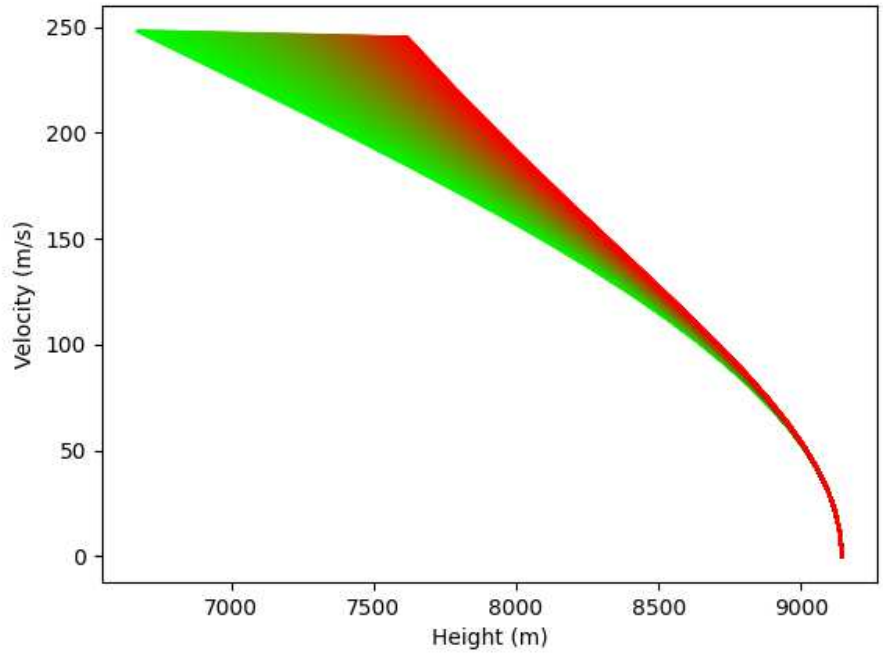


Fig. 63 Set of Trajectory Curves Generated by RIPTIDE

During flight, the algorithm runs on a Sirin flight computer in the separate Airbrakes electronics bay. Sirin connects to a motor controller, which controls the Airbrakes DC motor, as well as the motor's encoder via General Purpose Input/Output (GPIO) pins. The motor is driven by the motor driver, which is controlled with Pulse Width Modulation (PWM).

The onboard algorithm has a lockout function to prevent Airbrakes actuation above 0.8 Mach, ensuring that barometric data is the most accurate and that the Airbrakes system can withstand drag forces. Once Helios slows to below the transonic region, the Airbrakes algorithm accesses Sirin's current state estimate vector, specifically its altitude and velocity estimates. It then inputs these values into the trajectory equation generated before flight, which outputs a flap angle. This flap angle is then converted to encoder counts, and a PID controller is used to ensure that the motor actuates to the specified encoder target. This process is carried out at 5 Hz, dynamically adjusting the angle of the flaps, and ensuring that the rocket's altitude converges to the target apogee.

6. Manufacturing

Most of the Airbrakes components were CNC machined, due to the complex geometries required by the working area and weight removal efforts. All reamed holes were also done on the CNC mill to ensure accuracy. After the CNC operations, parts were deburred manually and had any cross holes drilled and tapped on a manual mill. As the mechanism is built around the motor tube, that was also cut to length and the ends sanded square. The manufacturing of the flaps was much more complex than the other components, and is detailed in the Section III.E.7.

7. Flap Creation

Mold Design and Preparation The first requirement of the forged carbon project was designing a mold. The flap was initially designed in SolidWorks. The flap geometry was then used to design a five-part compression mold, also in SolidWorks. Images of the mold in CAD are shown in Figures 64, 65, 66, 67, 68, 69, and 70.The mold was composed of a base, cap/plug, and three middle pieces to be bolted together for casting. These design choices were made in order to prevent the final part from getting stuck in the mold due to possible mold-release failure, avoiding destructive part removal and conserving material. Additionally, all pieces included a chamfer to fit a screwdriver for easier removal. The cap piece featured two conical extrusions to mark and pre-center drill the holes eventually needed for flap attachment.

The base and three middle pieces formed a female mold part while the cap was the male part. The mold was printed at 45% gyroid infill using PETG and three wall loops in order to maximize strength of the mold and prevent failure while under compression in the curing stage, as shown in Figure 71. Following printing, all relevant surfaces on all mold parts were sanded to 2000 grit to remove layer lines and provide a smooth surface finish on the final casted part. The next element of the process design was selecting a mold sealant and release method.



Fig. 64 Total Flap Mold in CAD

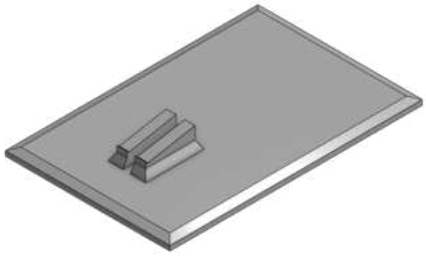


Fig. 65 Bottom of Flap Mold in CAD



Fig. 66 Cap of Flap Mold in CAD

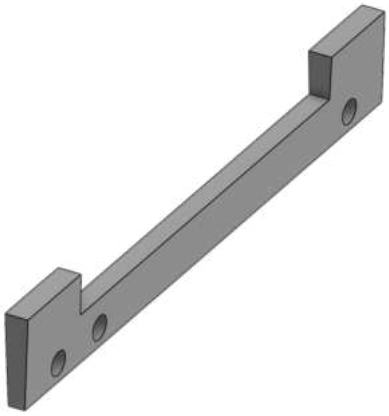


Fig. 67 Middle of Flap Mold in CAD

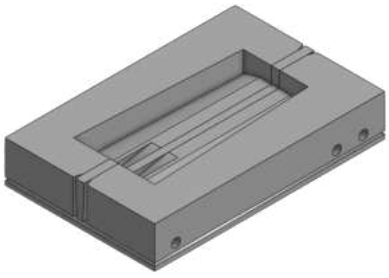


Fig. 68 Cavity of Flap Mold in CAD

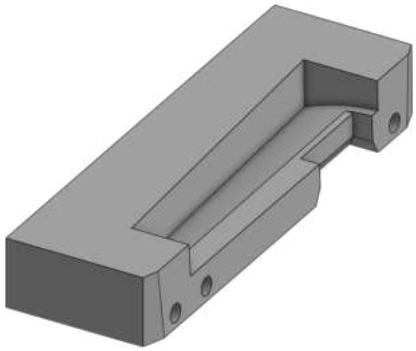


Fig. 69 Right Part of Flap Mold in CAD

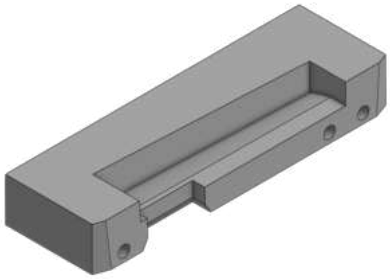


Fig. 70 Left Part of Flap Mold in CAD



Fig. 71 3D-Printed and Surface Prepared Flap Mold

Mold Release Testing For the sake of maintaining a low project cost, two sealant and release pairs were tested. The first was Partall Paste #2 and Universal Mold Release (UMR) while the second was Loctite's Frekote FMS Sealant (FMS) and 770-NC AERO Release (770-NC) system. In order to compare the methods, two molds were printed and sanded as identically as possible. First, four coats of Partall Paste #2 were applied and one coat of UMR was sprayed, both according to their respective package instructions. It is worth noting that the Partall Paste/UMR system was a longer, more involved process than the Frekote system. The Partall Paste/UMR system was loaded first according to the method outlined by Easy Composites. Laminating epoxy and chopped carbon fiber tow were distributed across the entirety of the female part of the mold. The male part was brushed with a small amount of epoxy and had a single layer of chopped fiber. The mold was then closed and placed under compression in a table vice with two pieces of wood to evenly distribute the compression force. After being compressed over the course of five to ten minutes, the mold was left to cure. The same process was subsequently followed for the mold treated with the FMS and 770-NC.

Part Removal and Final Applications Once the parts were cured, the mold was opened using screwdrivers and mallets. For the mold treated with Partall Paste and UMR, removal was much easier than anticipated. The chamfers

on all parts proved successful as they were easily separated by a screwdriver. The flap was removed from the final element of the mold by using a mallet. There were a few visible voids on the top and bottom of the part, but no epoxy or fibers were found stuck to the mold itself, so it is likely that these voids were due to loading error as it was the very first part made with this method. The FMS/770-NC mold also came apart without having to break any parts, but there was a significant amount of fiber and epoxy stuck to the surfaces of the mold. These results indicated that the FMS/770-NC system was not a reliable method for sealing the mold and preparing it for part release. As such, Partall Paste #2 and Universal Mold Release were utilized in the production of all four Airbrakes flaps. While the initial mold was mechanically fit for reuse, measurement of the final part found dimensional errors due to the draft angles of the mold cavity. Thus, a third and final mold was printed, sanded, and treated with Partall Paste and UMR.

The same mold loading method was employed in the manufacturing of all four final flaps, with additional care to evenly distribute the epoxy laterally to prevent additional voids and dry spots. This was successful for three out of four flaps. It was found that the voids on the fourth flap were easily filled and treated by applying a layer of laminating epoxy. Between part castings, any excess epoxy was cleaned off of the mold and two to three coats of Partall Paste and one coat of UMR were reapplied. The same mold was able to be used for the entirety of manufacturing, with only one part needing reprinted after damage from a screwdriver. This part, though, was the smallest and thinnest, making it the most likely to crack but easiest to reprint and sand.

Post Processing Upon removal from the molds, parts were processed to address voids, dimensional accuracy and surface finish. Initial inspection of the parts revealed excess flashing at the edges, which was manually removed using files. This and all subsequent sanding was done outdoors while wearing a respirator to mitigate particulate inhalation. A spray bottle of water was used to minimize airborne dust during this process.

After flashing removal, any remaining excess material was smoothed using 120 grit sandpaper. This stage also served to eliminate minor surface imperfections introduced during curing. Particular attention was paid to regions where part dimensions were important, such as the slot interfaces for linkage attachment–these areas often required re-sanding to bring them within specification. Maintaining tight tolerances proved difficult as material removal due to sanding and common dimensional tolerance problems with 3D-printing were somewhat unpredictable.

Following sanding, holes were drilled at predetermined locations using either a mill or hand drill, depending on the ease of fixturing for the part. In some cases, dry spots in the carbon layup led to small surface voids. These voids were filled using a thin, brushed-on layer of laminating epoxy. A fine bristle brush was used to distribute the epoxy evenly and minimize pooling. Once cured, any holes that had been previously drilled were re-drilled.

The final surface finishing process involved successive sanding steps, progressing from 120 grit to as fine as 2000 grit, to achieve a smooth and uniform finish. This level of surface refinement was necessary to meet aerodynamic performance requirements.

8. Assembly

Assembly of the Airbrakes mechanism is broken down into three main sections: upper mechanism, lower mechanism, and superstructure. Each section can be assembled largely independently from the others, allowing some parallelization of work.

The upper mechanism has the most complex assembly process, as it has components between press fit parts. The motor mount is assembled and bolted to the main bulkhead, and the limit switches are bolted on as well. The moving plate is then assembled, the linear rails are pressed into the upper plate, then the moving plate is slid onto the linear rails. The main bulkhead can then be pressed onto the linear rails. The motor retention threaded rod is then secured to the motor retention bulkhead by two sets of jam nuts. The structural rails are then pressed into the upper bulkhead, and the motor retention bulkhead is pressed onto the structural rails. Further details can be found in the assembly drawing in Appendix F.

The lower mechanism is much simpler, beginning with the actuation tube screw and linkage connectors being epoxied into the actuation tubes with ES6029 Aeropoxy Structural Epoxy. The linkages and pins are then press fit together. Further details can be found in the assembly drawing in Appendix F.

The superstructure consists of the tube interface bulkhead, centering rings, motor retention bulkhead, actuation mount bulkhead, and set screw holder affixed to the motor tube. The bulkheads and centering rings are slid to the proper position on the motor tube, and aligned such that the actuation tubes can slide freely within the bushings. The parts are then tacked in place with cyanoacrylate glue, ensuring the parts do not move during the following steps. Low viscosity PRO-SET LAM-135 Epoxy Resin and 224 Hardener is then used to fill the small gap between the parts and the

motor tube. After that cures, ES6029 Aeropoxy Structural Epoxy is then used to create fillets between the parts and the motor tube, increasing bond strength. The set screw holder is epoxied in the correct location using ES6029 Aeropoxy Structural Epoxy. Once the epoxy cures, the hole is drilled into the motor tube, then a heat set insert is melted into the part. Finally, the actuation tubes are pushed through the bushings and affixed to the upper mechanism moving plate, and the flap mounts are bolted to the actuation mount bulkhead. The Airbrakes electronics bay can then be bolted to the upper mechanism upper plate.

F. Sirin (Custom Flight Computer)

1. Architecture

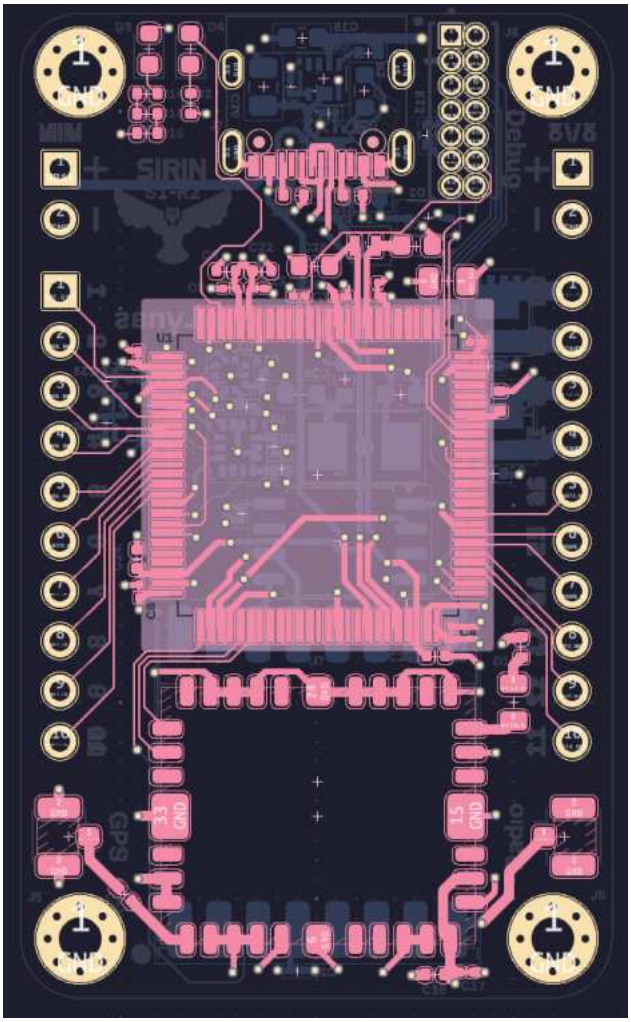


Fig. 72 Front of Sirin

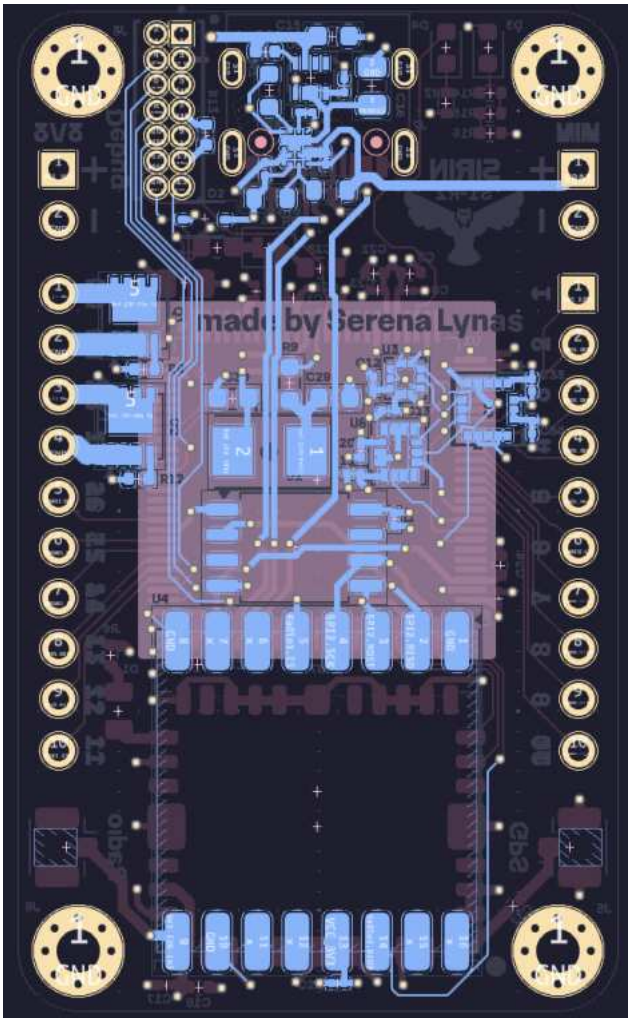


Fig. 73 Back of Sirin

Sirin is a 4-layer PCB featuring an STM32H753 processor connected to the following peripherals:

Name	Part	Bus	Type	Role
Barometer	BMP388	SPI1	Instrument	Measure barometric pressure and temperature
IMU	LSM6DSO32	SPI1	Instrument	Measure 6-axis acceleration up to 32 G
High-G IMU	H3LIS100DL	SPI1	Instrument	Measure acceleration up to 100 G
GPS	S1315F8	USART3	Instrument	Receive GPS data
Flash	W25Q32	SPI2	I/O	Save flight data
Radio	RFM9xW	SPI2	I/O	Broadcast data
USB	N/A	USB OTG FS	I/O	Communicate with desktop computer

The peripherals are split across two buses, SPI1 and SPI2. Splitting across two buses means that Sirin can write to both buses simultaneously; it also makes routing the PCB easier as they are located in physically different locations.

The code for Sirin is written in Rust, a memory-safe alternative to C. Sirin uses the Embassy library (short for "embedded async") to manage its asynchronous runtime. Embassy includes implementations for many of the STM32's built-in peripherals, such as USB, which the team has taken full advantage of. Rust's type system also allows us to express the concept of exclusive ownership over peripherals; the team has used this type system to ensure, at compile time, safe sharing of peripherals across multiple asynchronous tasks without the overhead of using mutexes.

The code for Sirin is open-source and can be fine-tuned by the end user for their use case. The ‘examples/‘ folder contains a multitude of examples which implement different functionality; the process for creating a new project is to copy an example (‘main‘ is typically recommended) into a new folder and update the ‘Cargo.toml‘.

The loop specified in the ‘main‘ example is as follows:

1. Take updated measurements of the IMU, barometer, and high-g IMU.
2. Progress the flight computer’s estimate of the state by applying the kinematics equations to these measurements.
3. Perform application-specific code, e.g. actuating a motor.
4. Dispatch an ‘OutPacket‘ to all loggers.

Typically, the loop iterates faster than the data can be logged, so the logging code is only called for one in ten iterations. The ‘OutPacket‘ format is specified in the [Data Format](data-format.md) section. If the log queue gets too backed up, the oldest packets will be dropped.

Although Sirin uses asynchronous programming techniques, it runs on a single-core, single-threaded chip, though that could change in future iterations. As a result, tasks run concurrently but not in parallel, so any blocking code will pause the entire system. To prevent this, long-lasting computationally intensive code can yield to other tasks using ‘yield_now!()‘ so that other tasks, e.g. I/O, can run. I/O tasks can either await a future event on a peripheral by repeatedly polling the peripheral and yielding when it is not ready, or they may put the task to sleep and use an interrupt triggered by the peripheral to wake it. The interrupt method is preferred for longer tasks because if all processor tasks are sleeping, the processor itself will go to sleep and save power. By contras, polling loops keep the CPU active.

Despite the fact that the processor is single-threaded, concurrency issues still arise due to interrupts. For example, shared peripherals like SPI1 and SPI2 are protected by mutexes to prevent conflicts between tasks. Other devices avoid this by using ownership rules, though mutexes can still be used should the user so desire.

The code also uses no global memory allocator; all data is stored on the stack. Memory allocators are nondeterministic and slow, and the we has found no compelling reason to include one, though the user may add one themselves.

2. Data Format

Sirin uses an SRAD serialization/deserialization protocol that loosely corresponds to ‘#[repr(packed)]‘. ‘#[repr(packed)]‘ has various safety and optimization issues [7] which make it undesirable to use. The team was looking for a format that is safe, simple, and memory efficient without dictating any specific memory layout (which would cause a loss in important optimizations), so CRT has decided to use a different format instead, which has been called ‘song‘. This is implemented by a set of custom derive macros which can be used on any struct or enum.

Serialization and deserialization use three traits which are easily extensible: ‘ToSong‘, ‘FromSong‘, and ‘SongSize‘. A new data type can be added to Sirin by simply implementing these traits, often through an automatic derive macro. Sirin does not encode knowledge of the type itself (it is not self-describing); instead the code must use ’a priori’ knowledge of the type to decode it. This allows CRT to store more on the flash. If a user needs to store multiple types, they can use an enum with a variant for each type they must store (see ‘OutPacket‘ for an example).

Integers are encoded in little endian; since the processor is little endian this is solely a simple memcpy. Floats are likewise encoded as-is (IEEE 754). Structs, enum fields, and arrays are encoded recursively; every member is encoded one after the other into the buffer with no space between. Enums are serialized so that the first byte(s) are the discriminant and then the following are the contents of the enum.

Data may be dynamically sized (without encoding their size). All ‘song‘ serializable/deserializable items must implement ‘SongSize‘ which indicates how many bytes the item is when serialized. ‘song_size()‘ called on the result of ‘from_song(...)‘ should give the exact number of bytes read so that the cursor can be advanced.

The ‘song‘ and ‘state‘ code is placed in the ‘sirin-shared‘ crate which is hardware-agnostic: it can be used as a dependency in both Sirin-side and desktop-side code. This reuses the same code across both sides and ensures they are lockstep.

3. ’OutPacket’

Data is transmitted from Sirin using the ‘OutPacket‘ enum, which includes Sirin’s state data. All I/O – flash, USB, radio – uses the same packet format, meaning that the team only has to worry about programming to one common interface between the three modes. (Radio uses a wrapper to encode HAM callsign and identification). Flash is simply a log of all packets, so by reading the flash, one can see a full transmission history.

4. Error-State Kalman Filter

Sirin performs its state estimates with an Error-State Kalman Filter. Kalman filters are only designed to work on linear objects, such as vectors; however, rotations are SO(3) group objects, and the Sirin needs to track its rotation in order to interpret the linear acceleration readings. There are various methods of dealing with this issue, but they all hinge on the fact that rotations can be linearized for a small range around a rotation, as the group properties of rotations only become evident for larger rotations.

Our approach is based on a paper written by Joan Solá [8]. Essentially, the filter breaks up the state into a nominal state and an error state. The nominal state is treated nonlinearly and the error state is treated linearly. Since the error should be relatively small, it can be treated linearly without incurring significant penalty. The nominal state is updated directly using integrated measurements from the IMU, and then it is corrected with the knowledge of absolute position gained from GPS measurements. If GPS measurements are not available, it will solely use integrated acceleration.

G. Base Station

The team will utilize an additional support system called Base Station to aid in the recovery and operation of all separating components after a nominal flight. Base Station is a ground-based radio and computer system that supports centralized radio communications. Base Station will be able to communicate with the electronic bay of Helios. Base Station has a HackRF software defined radio to transmit and receive on the 440 MHz and 915 MHz LoRa bands. It will also utilize a KrakenSDR for Doppler direction finding for incoming signals. Base Station will be deployed with an antenna tower at the team tent.

The central unit of Base Station consists of a protective case, modified to secure and protect the electronics within. This has been achieved by securing all components to panels that are bolted to the case itself. All openings have seals around them to prevent dust and dirt from entering the internal compartment. The only components accessible from the outside are monitors, a keyboard, and a mouse. The base station uses Windows operating system to communicate and provide a user interface with the SDRs. The HackRF will receive APRS packets from the GPS modules and altimeters in the electronics bay of Helios to collect data. The Kraken will be used to directionally identify where the incoming signals are strongest. This will ensure an efficient recovery process for the team.

The KrakenSDR uses five 440 MHz dipole antennas for Doppler direction finding. The antennas will be mounted on a 25 ft tall tripod to establish a clear line of sight once the rocket has landed. Once a direction and coordinates have been obtained, the antenna will be taken off the tripod and taken in the car during recovery to optimize its capabilities further.

Figures 74 and 75 present the system block diagram and connection diagram for Base Station, respectively.

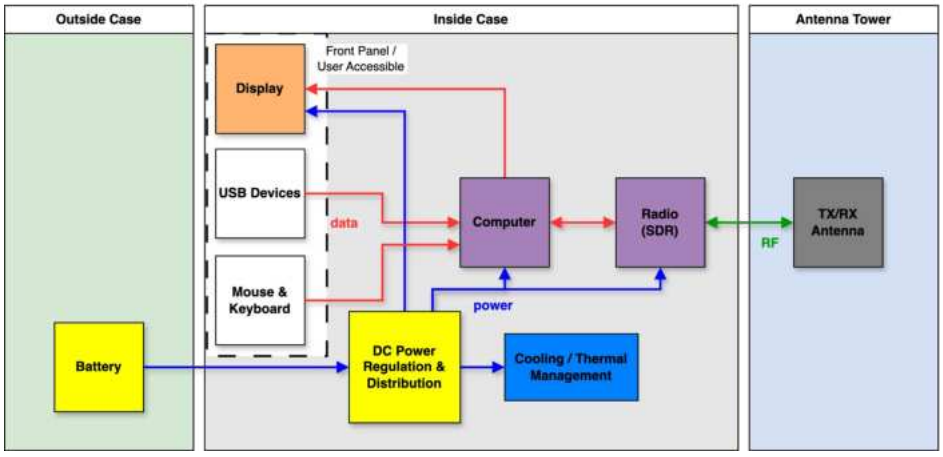


Fig. 74 System Block Diagram for Base Station

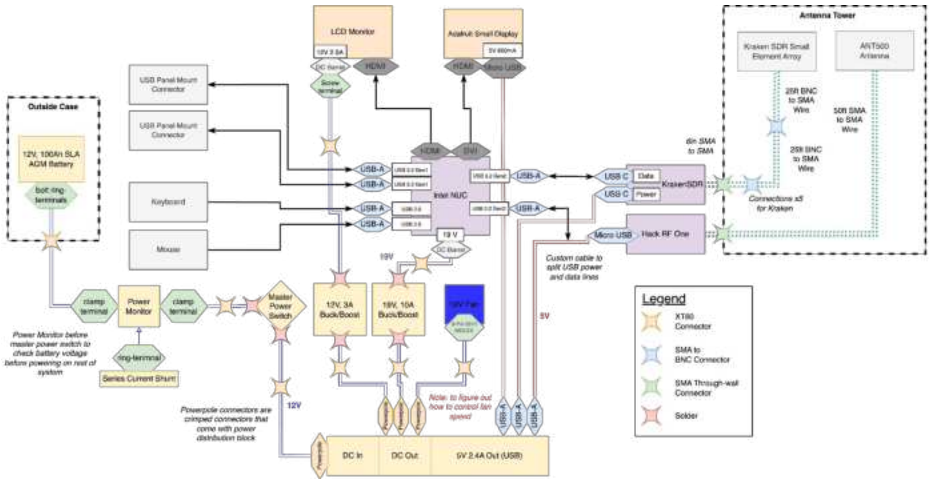


Fig. 75 Connection Diagram for Base Station

IV. Mission Concept of Operations Overview

A. Helios Concept of Operations

Integration Prior to launch, the rocket is assembled and the payload is integrated following an assembly checklist, as shown in Appendix E. First, the electronics bay is assembled with the flight computers, GPS, and batteries. Wired connections are made prior to further integration, and tested via tug tests and continuity checks. The electronics bay is then taken to an energetics table to load the charge wells. With the electronics bay fully completed, it is then clocked and installed into the nose cone, anchored in place with the nose cone tip. Simultaneously, the Airbrakes electronics bay is assembled with its controller and camera. Next, the recovery equipment is packed into the recovery section of the upper body tube. The upper body tube is then anchored to the nose cone with bolts. The payload is integrated into the rocket's payload coupler following its own assembly procedures as detailed in Section IV.B. The payload coupler is then bolted into the lower body tube, and the upper body tube and lower body tube coupler are connected in place with shear pins. The fin can is mounted to the Airbrakes superstructure via the tube interface bulkhead. The motor is then installed inside the motor tube of the Airbrakes superstructure, and the set screw on the motor tube is tightened, locking rotation. The Airbrakes superstructure is then integrated into the lower body tube and fin can via the tube interface bulkhead, finishing the integration process. To ensure quality of work and completeness, the assembly checklist has written verification by both whomever completed the task and a supervising lead.

Arming Arming begins once the rocket is set up at the launch pad. When the rocket is horizontal on the launch pad, Sirin, the FeatherWeight GPS, and the ElvinBeacon are armed via their individual screw switches. To confirm the ElvinBeacon has been activated, it will send an RF pulse which can be picked up with a handheld radio. Before the rocket is oriented vertically, Base Station will ensure that each of the components are transmitting information over radio and that the team is receiving the information.

The rocket will then be oriented vertically on the rail. Selene will be armed, as described in IV.B. Next, the Raven4 Altimeter and EasyMini will be armed, listening for beep codes and visually looking for LEDs to confirm that the flight computers are activated.

After all electronics are confirmed to be switched on and transmitting, the igniter will be installed in to the bottom of the motor, completing the arming process.

Ignition Once all personnel are a safe distance away from the rocket, as dictated in Tripoli Safety Information [9], the rocket is checked for continuity. After confirming continuity, ignition starts when a signal is sent to the igniter, causing the motor to ignite.

Liftoff Liftoff starts following ignition and constitutes the time during which the rocket is leaving the launch rail. During this period, accelerometers switch into flight mode to collect flight data, and the experiment within Selene, as described in IV.B, will begin.

Powered Ascent After the rocket exits the launch rail at 129.91 ft/s, barometric devices start taking data as the rocket begins its powered ascent. Powered ascent includes the flight time during which the motor is burning out and ends once the burnout has ceased. Burnout occurs at about 5100 ft AGL.

Unpowered Ascent Unpowered ascent begins once the motor has burnt out completely and continues until the rocket reaches apogee. When the rocket decelerates to 0.8 Mach, which occurs at about 24,000 ft AGL, the Airbrakes mechanism starts deploying the flaps to increase drag. Until apogee is reached, the Airbrakes flaps dynamically change their actuation angle in order to reach a desired apogee of 30,000 ft AGL.

Apogee Apogee occurs once the rocket has stopped its ascent, estimated to be about 38 seconds after liftoff. Flight computers detect apogee and cause separation and ejection events to occur. Once apogee is detected, the primary flight computer, the EasyMini, ignites the separation ejection charge. One second later, the secondary flight computer, the Raven4, ignites the redundant ejection charge. The shear pins between the upper body tube and the payload coupler are severed, allowing for separation to occur. This releases the drogue parachute. Airbrakes flaps retract.

Descent With Drogue Following the separation at apogee, Helios falls at 133.4 ft/s. Descent under drogue continues until main deployment.

Main Deployment Once the primary or secondary flight computer in the electronics bay detects an altitude of 1500 ft AGL, the main recovery deployment event is triggered: the Tendie Descendie Duo charges fire, releasing the main parachute from the deployment bag.

Main Descent Descent under main begins once the main parachute has opened, and it continues until Helios reaches the ground. Helios falls at a rate of 25.1 ft/s.

Ground Operations Once the rocket has landed, the rocket is located via GPS data from Sirin and the FeatherWeight GPS, as well as RF transmission from the ElvinBeacon. The KrakenSDR from Base Station will be used to identify the direction of the RF signals and inform the recovery processes. The recovery and retrieval team will take the antenna with them during recovery to optimize determination of the exact location of the rocket.

Once the recovery team has located the rocket, they will take photos of the landing conditions and listen for beep codes from the flight computers. Electronics will then be disarmed via screw switches, and the recovery team will return the rocket to the recovery tent, where the flight and recovery processes will be judged.

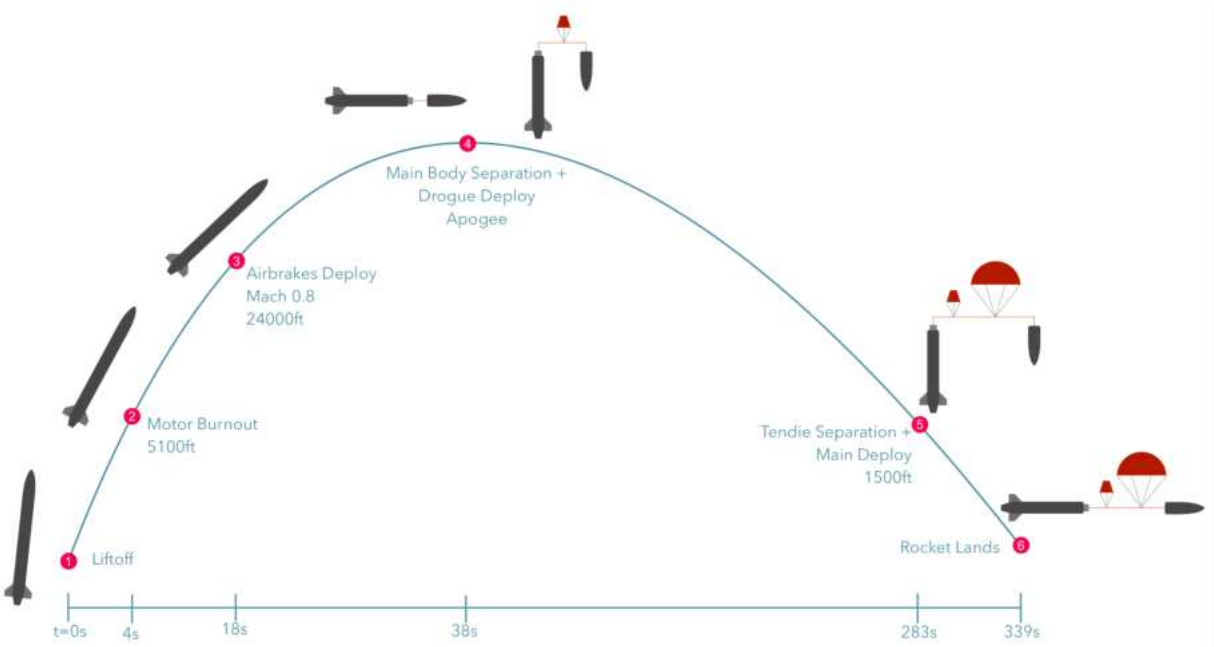


Fig. 76 Helios Mission Concept of Operations Diagram

B. Selene Concept of Operations

Integration The electronics of Selene, including Sirin, two RunCams, an LED, two micro-servos, the PDB, and seven piezoelectric sensors are placed in their locations on the electronics sled. The LiFePO4 battery packs are placed in their specified locations as well. Wires are connected between the components and their corresponding batteries. The glass strip is coiled and pre-loaded into a printed track system but remains stationary until flight conditions trigger deployment. The piezoelectric sensors are placed at their specified locations on the control and experimental glass pieces, with their wires hanging in a way that does not cause tangling. Once the electronics and glass are fully secured, the frame plates and bulkheads are added, bolting the frame of Selene together.

Once the payload is fully assembled, it is secured onto the payload retention bulkhead of the rocket, prior to final vehicle integration, as described in IV.A.

Arming Once the rocket is on the rail and oriented vertically, the payload system will be activated via screw switch. To verify the circuit has been closed, the LED which is illuminating the experiment will also be visible through the screw switch hole.

Ignition With rocket ignition, Selene continues passive monitoring until Sirin records acceleration; however, no active components are triggered until a predefined threshold for acceleration is surpassed.

Liftoff and Powered Ascent Once sustained acceleration is detected by the onboard accelerometer of Sirin, Selene transitions from standby to experiment mode. Cameras begin recording, and the servos are activated, unrolling the thin glass sheet along the guided track. Piezoelectric sensors on the glass immediately begin logging voltage responses that correspond to mechanical strain, while the control sensors record background vibrations.

Unpowered Ascent and Apogee During the coast to apogee, Selene continues uninterrupted data logging. No further actions are taken by the payload, and all video and sensor data continues to be collected for later analysis.

Descent Following apogee and separation, the payload exterior frame is exposed to the environment, although the experiment is contained within the interior of the frame. The payload remains secured to the payload retention bulkhead throughout descent. Impact events are not expected to affect internal systems due to the low descent rate and enclosed design of the payload.

Ground Operations The payload will be recovered via the methods described in Section IV.A. Upon recovery of Helios and Selene, the payload is manually powered down. Once the payload is returned from the recovery tent, the payload will be disassembled. The SD cards from each of the RunCams will be removed to retrieve camera footage, and sensor data from Sirin will be downloaded. Analysis into the differences between the data collected by the piezoelectric sensors on the experiment glass and the control glass will be done to assess stress behavior of the glass during flight during high loading.

V. Conclusions and Lessons Learned

The design and manufacturing of Helios and Selene was a challenging process that led Case Rocket Team to improve and innovate on many of its previously utilized methods. The design goals of integrating and incorporating both the Airbrakes system and Sirin into the primary operation of Helios caused many difficulties, especially when also needing to work with design constraints imposed by the desired apogee of 30,000 ft. This led to many changes in the design and engineering process for all the systems of the 2025 IREC rocket.

One of the initial changes to the design process and schedule for this project was the addition of an initial System Requirements Review (SRR). One aspect of the design process that the team has failed to complete in previous years is setting and evaluating the requirements for all the subsystems of the rocket and payload. Previously, the team had defined requirements primarily based on the DTEG and RRD. These requirements, although specific, are not always both quantifiable and informative for the design. They also do not take into account the information and experience learned from previous launches by CRT, which could inform potential additional requirements that the team should impose on itself. Additionally, there are very few requirements regarding the Airbrakes system or any other SRAD components, so creating self-imposed explicit requirements for each function and sub-function of the rocket allowed the team, during design reviews after the SRR, to more accurately measure the progress of the work. The team intends to continue in future years holding SRRs and creating additional requirements based on launch reports from the coming years of IREC launches and other tests.

Another change that the team implemented in the design process was presenting multiple different designs during the Conceptual Design Review. This was especially important for the payload, as multiple different experiment ideas were developed and conceptualized. Both the aerostructure and Airbrakes systems presented multiple concepts as well. The team analysis of these individual concepts resulted in a better final design that combined different aspects of each of the initial presented designs for the aerostructure. The team intends to continue initially creating multiple concepts for each subsystem, especially for the payload and aerostructure, which are more likely to change every year due to differing design goals.

The team learned much from the failures in time management for the manufacturing of Event Horizon, the competition rocket from CRT in IREC 2024. These failures arose from the fact that it was the team's first time manufacturing a rocket with custom composite tubes. The team had done testing during the manufacturing section of the year for the 2024 competition, slowing down the overall manufacturing process for the rocket. Because of this, the team did extensive composite testing, detailed in Section B.G, during the design phase of this year. This allowed for airframe tube manufacturing to occur in about two weeks, compared to multiple months during 2024. In future years, the team will continue to do composite testing during the fall semester, before manufacturing of the IREC rocket starts, in order to better inform the design decisions and streamline the manufacturing process.

One of the pitfalls of the manufacturing timeline from this year was the reliance on CNC machining parts. There were sixteen unique parts which required CNC operations, which was a large portion of the total number of parts, and many of them required manual machining operations after being machined on a CNC. Due to unforeseen circumstances out of the control of CRT, the CNC machine to which the team had access was inoperable for about two weeks. Due to this, the CNC operations, and thus all machining and assembly operations, were delayed. Because of these reasons, as well as stock and other material supply issues, the team was unable to perform a test launch. In future years, CRT will look into decreasing the number of parts which must be CNC machined, as access to the CNC machine became a large bottleneck in the manufacturing process.

This was the first year in the last five years that the payload experiment for the SDL competition was not related to guided parafoil descent. The decision to not continue with the parafoil experiment was due to the failure in recovery for Event Horizon, the 2024 IREC rocket, leading to many components falling ballistically. Having an experiment that did not involve a payload recovery system simplified the recovery system of the rocket greatly, going from three separately recovered sections to one separately recovered section. The team intends to continue performing experiments in the payload that simplify the recovery process for the rocket, as the lower complexity of the recovery system mitigates the number of possible failure points for the rocket.

A. System Weights, Measures, and Performance Data Appendix

A. System Weights

Configuration	Weight (lbs)
Vehicle Weight	38.75
Launch Weight	75.75
Descent Weight	54.53

Table 6 Overall Rocket Weights

Subsystem	Weight (lbs)	Notes
Airframe	14.9	Includes nose cone tip
Electronics Bay	5.82	
Airbrakes	10.4	Includes electronics and mechanism
Main Recovery	2.8	
Payload	5.25	
Motor	37.34	

Table 7 Subsystem Weights

B. Measures

Characteristic	Measurement	Units	Notes
Airframe Length	116	in	
Airframe Diameter	5.982	in	
Number of Fins	4	–	
Fin Span	16.982	in	
Fin Root Chord	12	in	
Fin Tip Chord	3	in	
Fin Sweep Length	9	in	
Number of Stages	1	–	
Center of Gravity	72.57	in	At ignition, from tip
Center of Pressure	88.94	in	At ignition, from tip, ORK

Table 8 Overall Rocket Measures

C. Performance Data

Flight simulations for Helios were done both in OpenRocket and RASAero. RASAero was utilized in altitude and velocity analysis, as it is more accurate when passing through the transonic region. OpenRocket was used for stability, recovery, and CG calculations due to the greater customization ability. Figures **??**, **??** and **??** through **??** show the flight path with the O5500X in OpenRocket and RASAero respectively. The flight parameters used in the simulations are summarized in Tables 9 and 11.

1. OpenRocket Simulation Information

Parameter	Value	Units
Latitude	-103.54731	E
Longitude	31.04981	N
Altitude	2917	ft
Wind Speed	11.4	mph
Turbulence Intensity	10	%
Launch Rail Length	164	in
Temperature	97	°F
Pressure	0.92584	Bar
Launch Angle	4	°, from vertical

Table 9 OpenRocket Simulation Parameters

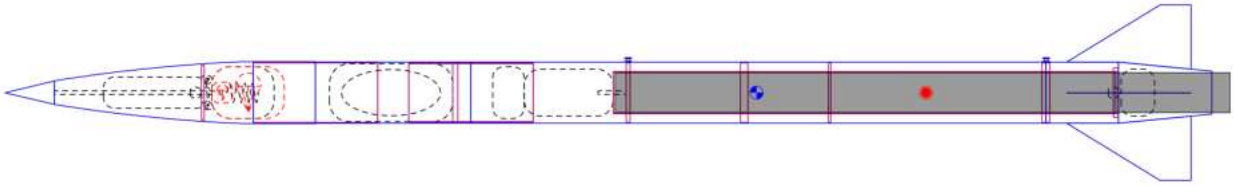


Fig. 77 Helios OpenRocket Model

2. OpenRocket Simulation Results

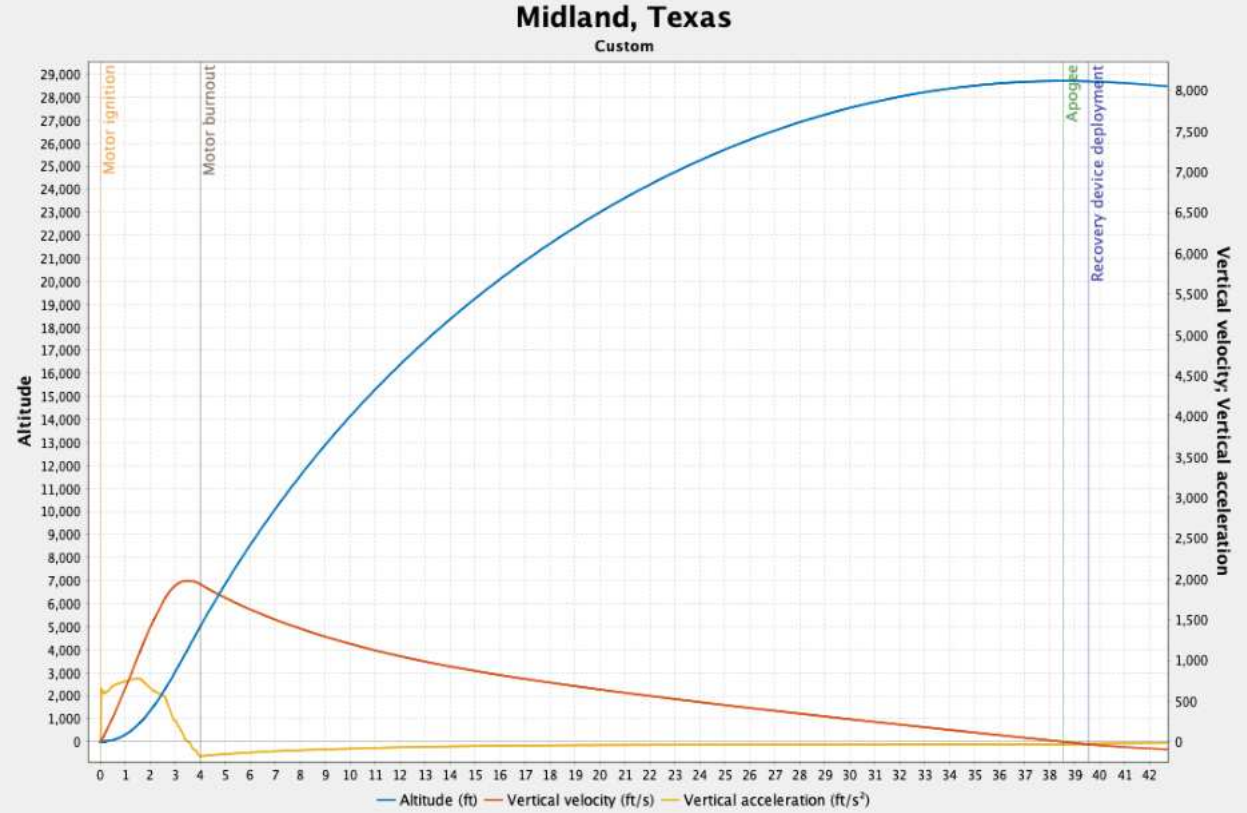


Fig. 78 Helios OpenRocket Flight Path

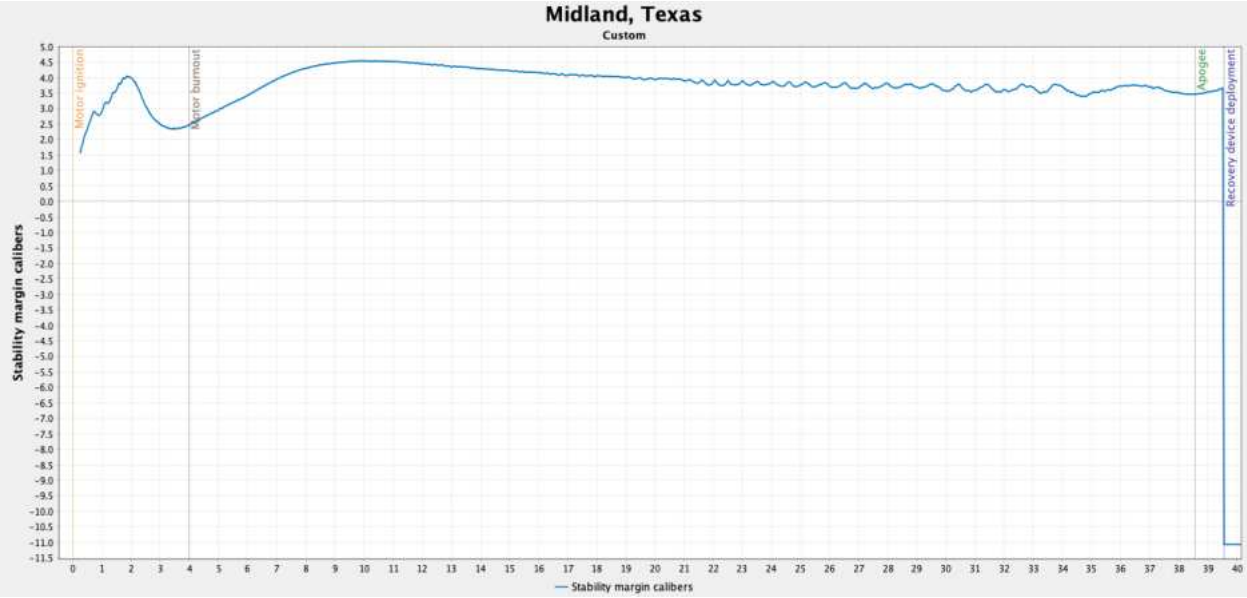


Fig. 79 Helios OpenRocket Stability Profile

Characteristic	Value	Units
Apogee	28,736	ft
Maximum Velocity	1996	ft/s
Maximum Velocity	1.759	Mach
Maximum Acceleration	786	ft/s^2
Maximum Acceleration	24.4	G
Time to Apogee	38.6	s
Flight Time	344	s
Ground Hit Velocity	29.9	ft/s
Velocity at Main Deployment	94.7	ft/s
Rail Departure Velocity	133	ft/s
Rail Departure Stability	1.73	cal

Table 10 OpenRocket Simulation Results

3. RASAero Simulation Information

Parameter	Value	Units
Altitude	2917	ft
Wind Speed	11.4	mph
Launch Rail Length	13.6	ft
Temperature	97	°F
Pressure	27.34	in-hg
Launch Angle	4	°, from vertical

Table 11 RasAero Simulation Parameters

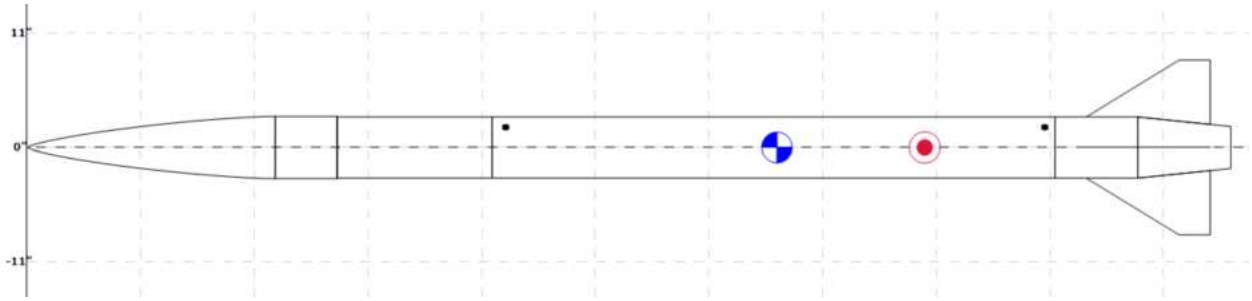


Fig. 80 Helios RASAero II Model

4. RASAero II Simulation Results

Characteristic	Value	Units
Apogee	31,768	ft
Maximum Velocity	2056	ft/s
Maximum Velocity	1.80	Mach
Maximum Acceleration	799.8	ft/s^2
Maximum Acceleration	24.86	G
Time to Apogee	40.80	s
Maximum Stability	3.88	cal
Stability at Mach 0.8	3.34	cal

Table 12 RASAero II Simulation Results

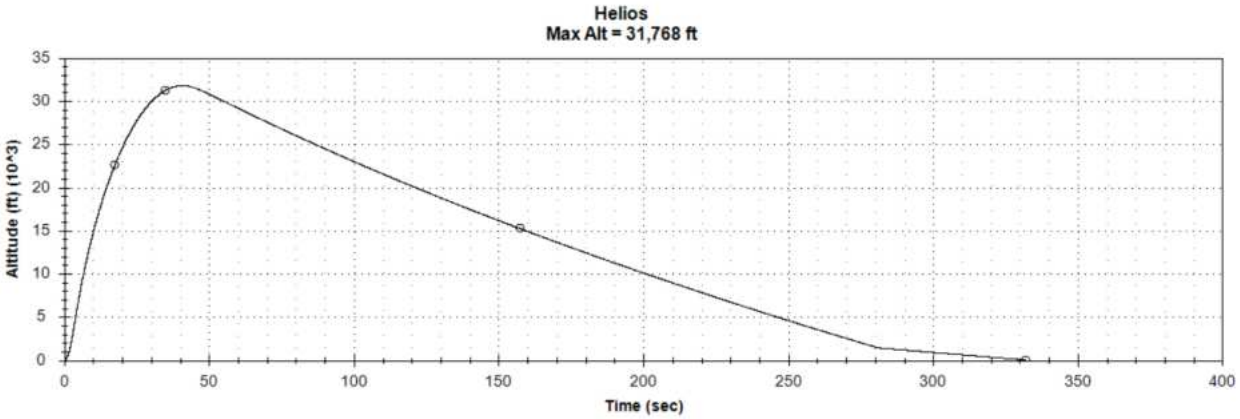


Fig. 81 Helios RASAero II Altitude Graph

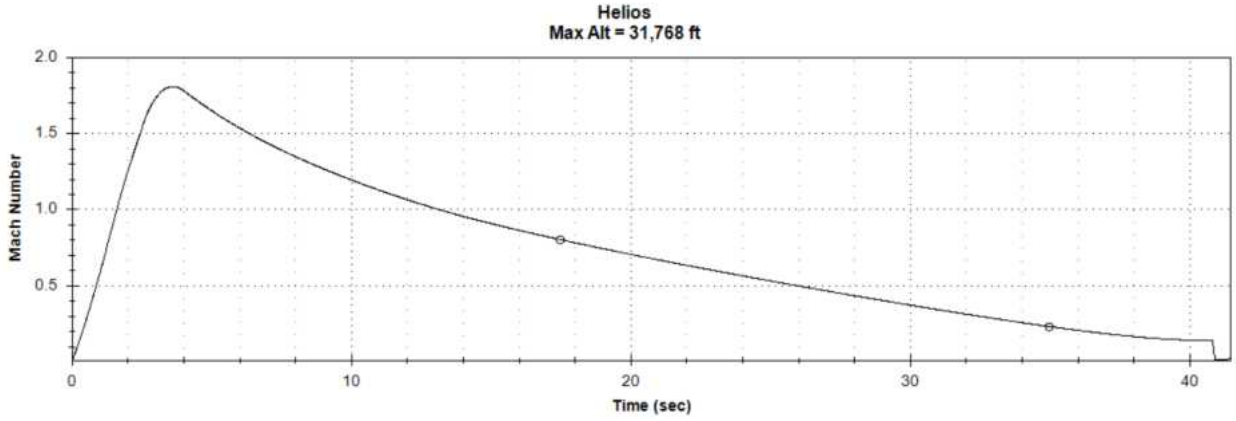


Fig. 82 Helios RASAero II Velocity Graph

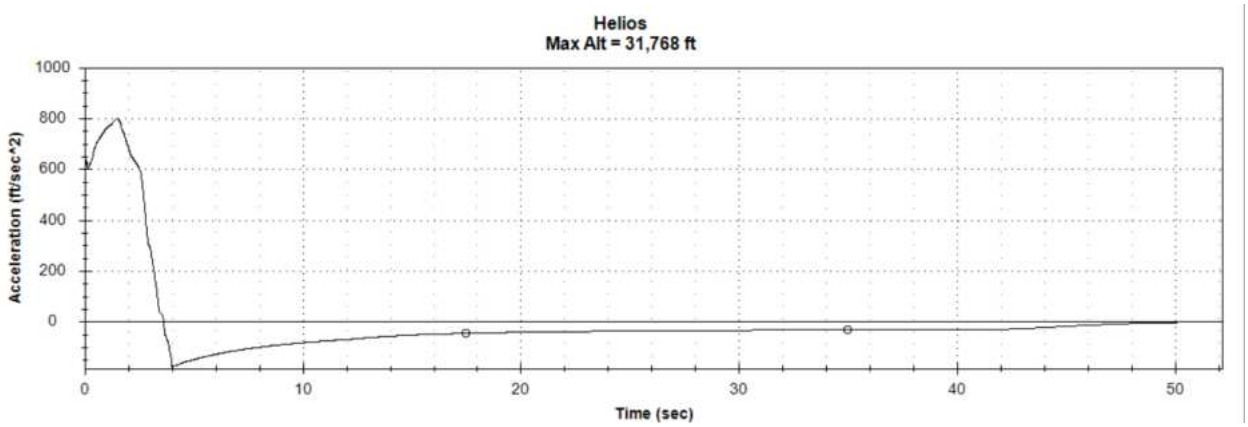


Fig. 83 Helios RASAero II Acceleration Graph

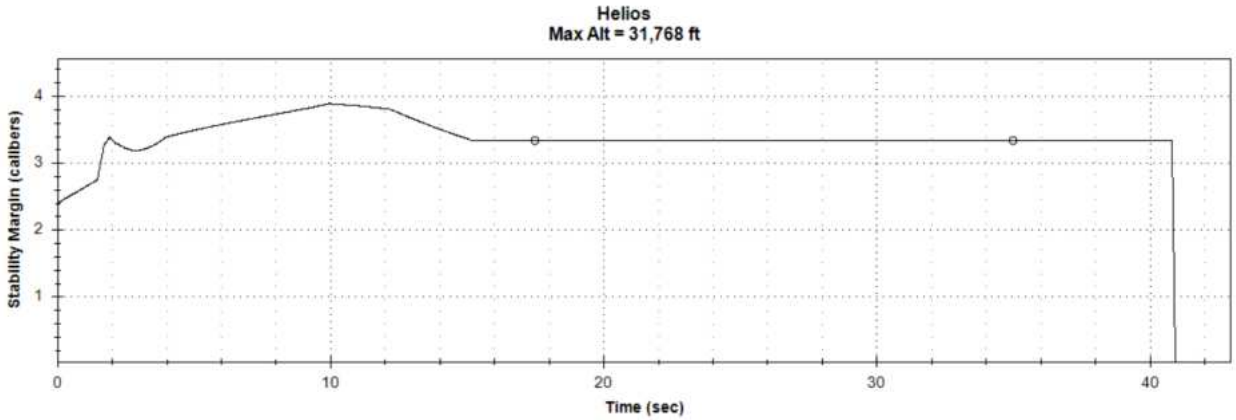


Fig. 84 Helios RASAero II Stability Graph

B. Project Test Reports Appendix

A. Recovery System Testing

1. Main Body Ejection Testing

Test 1	**Main Body Ejection Testing**		
The upper and lower body tubes need to separate to allow recovery to deploy. This test was performed on the upper half of the airframe while Helios was on the ground, with both the payload, Selene, and recovery systems in the volume to be separated. Ejection testing confirmed that the in-flight ejection would successfully separate the lower body tube and upper body tube, shearing the nylon shear pins and allowing the parachute to deploy without tangling. The initial estimate of the calculations for black powder sizing was 5.5g. The first test done was with 4g of black powder, and ejection was successful.			
Event	**Success Criteria**	**Result**	
Detonation	Successful detonation of charge	PASS	4/27/2025
Tube Separation	Upper body tube separates completely from lower body tube and shears all pins	PASS	4/27/2025
Drogue Deployment	Drogue parachute exits the recovery section and is not tangled	PASS	4/27/2025
Main Chute Stowed	Main parachute is still inside the recovery section	PASS	4/27/2025
	System Analysis	PASS	4/27/2025
Testing Notes			
Used less black powder than calculated in initial test, as 5.5g was deemed to be a large amount of black powder by the Flyer of Record. This led to the first test using 4g of black powder, which was successful. The main parachute line was not fully under tension due to the 4g ejection. Because the combustion reaction of black powder is weaker at higher altitudes, the primary ejection charge will use 5g of black powder, and the redundant charge will use 6g.			



Fig. 85 Configuration for Main Body Ejection Testing



Fig. 86 Main Body Ejection Testing After Ejection

2. Tendie Descendie Ejection Testing

Test 2	**Tendie Descendie Ejection Testing**		
The SRAD Tendie Descendie used in Helios controls the deployment of the main parachute. To verify that the pins from the Tendie Descendie would separate, a test with one of the Tendie plates attached to the electronics bay was done. About 0.1g of black powder was poured into the delrin charge well, filling it fully.			
Event	**Success Criteria**	**Result**	
Detonation	Successful detonation of the charge	FAIL	4/27/2025
Tendie Descendie Separation	Pins from the Tendie Descendie separated from Tendie body	FAIL	4/27/2025
	System Analysis	FAIL	4/27/2025
Testing Notes			
The e-match failed to light. It was found that the space where the electric match head was supposed to fit was too small, crushing the head of the e-match. After the test, the size of the hole in the delrin Tendie Descendie was drilled to slightly larger diameter.			

Test 3	**Tendie Descendie Ejection Testing**		
The SRAD Tendie Descendie used in Helios controls the deployment of the main parachute. To verify that the pins from the Tendie Descendie would separate, a test with one of the Tendie plates attached to the electronics bay was done. About 0.1g of black powder was poured into the delrin charge well, filling it fully.			
Event	**Success Criteria**	**Result**	
Detonation	Successful detonation of the charge	PASS	4/27/2025
Tendie Descendie Separation	Pins from the Tendie Descendie separated from Tendie body	PASS	4/27/2025
	System Analysis	PASS	4/27/2025
Testing Notes			
The larger cavity for the black powder and e-match head allowed for e-match to detonate, causing the pins to separate from the Tendie body.			



Fig. 87 Configuration for Tendie Descendie Ejection Testing

3. Main Parachute Deployment Testing

Test 4	**Main Parachute Deployment Testing**		
In order to confirm the construction and packing method of the main parachute in the deployment bag, a test simulating the deployment conditions was done. The packed parachute was tied to one person, while another held the deployment bag. The person attached to the parachute ran to simulate deployment.			
Event	**Success Criteria**	**Result**	
Parachute Exits Deployment Bag	The parachute exits the deployment bag without damaging the bag or the parachute.	PASS	4/18/2025
Parachute Inflates	The parachute fully inflates within 3 seconds of deployment.	FAIL	4/18/2025
	System Analysis	FAIL	4/18/2025
Testing Notes			
The parachute remained folded after deployment. This was due in part by a piece of tape that had stuck to the parachute, keeping the gores from separating. The shroud lines also tangled near the canopy, preventing the full inflation of the parachute. The tape was removed and all subsequent tests used a different method of folding the parachute that reduced the risk of tangling.			

Test 5	**Main Parachute Deployment Testing**		
In order to confirm the construction and packing method of the main parachute in the deployment bag, a test simulating the deployment conditions was done. The packed parachute was tied to one person, while another held the deployment bag. The person attached to the parachute ran up wind to simulate deployment.			
Event			
Parachute Exits Deployment Bag	The parachute exits the deployment bag without damaging the bag or the parachute.	PASS	4/29/2025
Parachute Inflates	The parachute fully inflates within 3 seconds of deployment.	PASS	4/292025
	System Analysis	PASS	4/29/2025
Testing Notes			
The parachute inflated one second after fully exiting the deployment bag. Neither the parachute nor the deployment bag sustained any damage.			



Fig. 88 Start of Main Deployment Test



Fig. 89 Main Deployment Test

4. Recovery Line Strength Testing

Test 6	**Recovery Line Strength Testing**		
Where components of the recovery system interacted with the kevlar recovery line, attachment points were to be sewn onto the kevlar line instead of using knots. The seams of the attachment points were tested using a tensile tester to verify the maximum load the attachment points could withstand.			
Event			
Configuration 1 Tensile Test	Configuration 1 withstands at least 3000 lbf before the seams fail.	FAIL	4/23/2025
Configuration 2 Tensile Test	Configuration 2 withstands at least 3000 lbf before the seams fail.	FAIL	4/23/2025
Configuration 3 Tensile Test	Configuration 3 withstands at least 3000 lbf before the seams fail.	FAIL	4/23/2025
	System Analysis	FAIL	4/23/2025
Testing Notes			
The quicklinks used to transfer force to the test articles did not fit in the jaws of the tensile tester. C clamps were used instead. The moment imparted onto the C clamp by the test article during tensile testing was great enough to rip the C clamp out of the jaws of the tensile tester at loads far below the target load. No relevant data was able to be collected. Knots were used instead of seams to attach components to the recovery line.			



Fig. 90 First Recovery Tensile Testing Configuration



Fig. 91 Second Recovery Tensile Testing Configuration

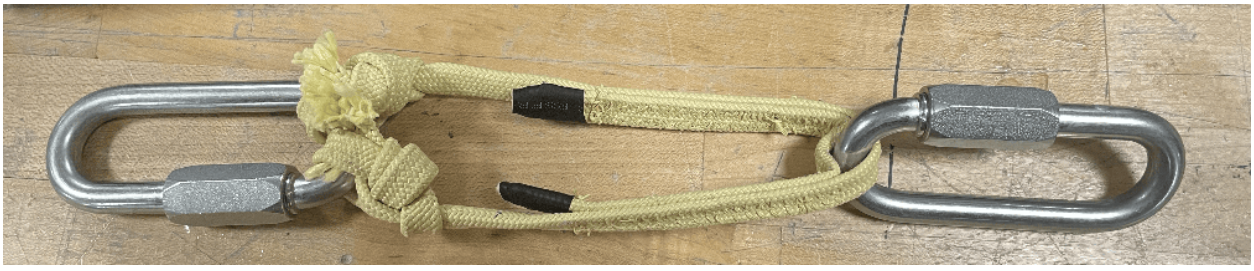


Fig. 92 Third Recovery Tensile Testing Configuration

B. SRAD Propulsion System Testing

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C. SRAD Pressure Vessel Testing

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D. SRAD GPS Testing

1. GPS Tube Testing

Test 7	**GPS in Tube Testing**		
This test was performed to determine the effect a carbon fiber tube has on the tracking signal strength of the GPS. A Featherweight GPS was mounted inside an upper body tube of a rocket. This tube was composed of varying degrees of carbon fiber, with complete carbon fiber, a carbon fiber upper body tube and fiberglass switch band and coupler, and complete fiberglass. The test was performed on a farm with line of sight from 0 to 1.5 miles in intervals of 0.5 miles, and the TRK RSSI was measured each time.			
Event	**Success Criteria**	**Result**	
All CF Test	Usable RSSI strength up to 1.5mi	FAIL	9/28/2024
Partial CF Test	Usable RSSI strength up to 1.5mi	PASS	9/28/2024
No CF Test	Usable RSSI strength up to 1.5mi	PASS	9/28/2024
	System Analysis	PASS	9/28/2024
Testing Notes			
The complete carbon fiber tube was only barely able to receive a signal at close range, with no detection at range. The attenuation of partial carbon fiber coverage was significant, yet still within acceptable range. There was less attenuation with the full fiberglass tube, with it having the strongest signal strength.			

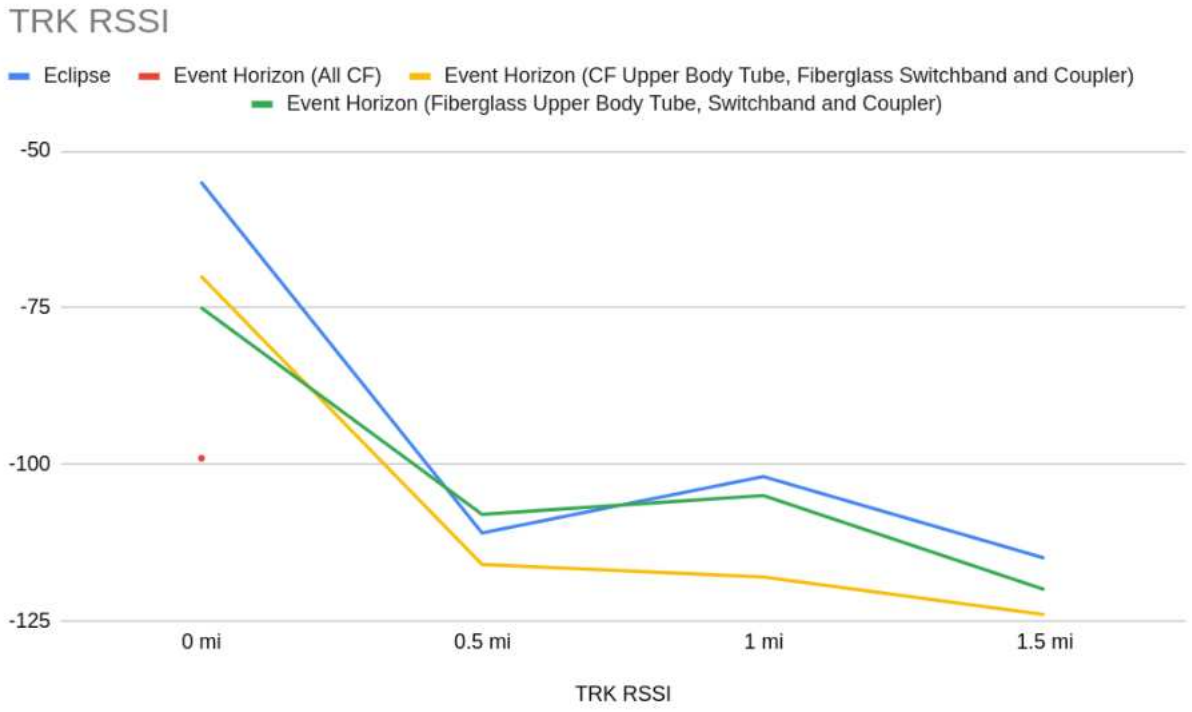


Fig. 93 Results of GPS Tube Testing

E. Payload Recovery System Testing

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F. Airbrakes Test Launch

Test 8	**Airbrakes Test Rocket Launch**		
The team developed a smaller scale rocket to test our Airbrakes system. It was launched on a J760 motor. The Airbrakes system on board was controlled by an Arduino Mega, and the physical system itself was very similar to the one developed for Helios. The system was programmed to deploy the flaps 1 second after motor burnout, wait at full flap extension for 1 second, and then retract the flaps.			
Event	**Success Criteria**	**Result**	
Launch	Rocket has a nominal launch off the rail	PASS	12/14/2024
Recovery	Rocket is successfully recovered intact, with all systems nominal	FAIL	12/14/2024
Data Recovery	Useful flight data is recovered from the rocket, allowing analysis of Airbrakes performance	PARTIAL PASS	12/14/2024
Airbrakes Deployment	Airbrakes successfully deploy	PASS	12/14/2024
Drag Increased	Airbrakes cause clear increase in C_dA (coefficient of drag times cross sectional area)	PASS	12/14/2024
	System Analysis	PARTIAL PASS	12/14/2024
Testing Notes			
Due to a failure in the recovery system that was unrelated to the Airbrakes, the rocket impacted the ground at terminal velocity, causing extensive damage to the airframe and internal components. This led to the loss of all data gathered by the dedicated Airbrakes computer. However, data from the Raven4 flight computer controlling recovery events was unaffected, and from this, we were able to confirm that the Airbrakes deployed nominally and had a clear effect on the rocket's drag.			

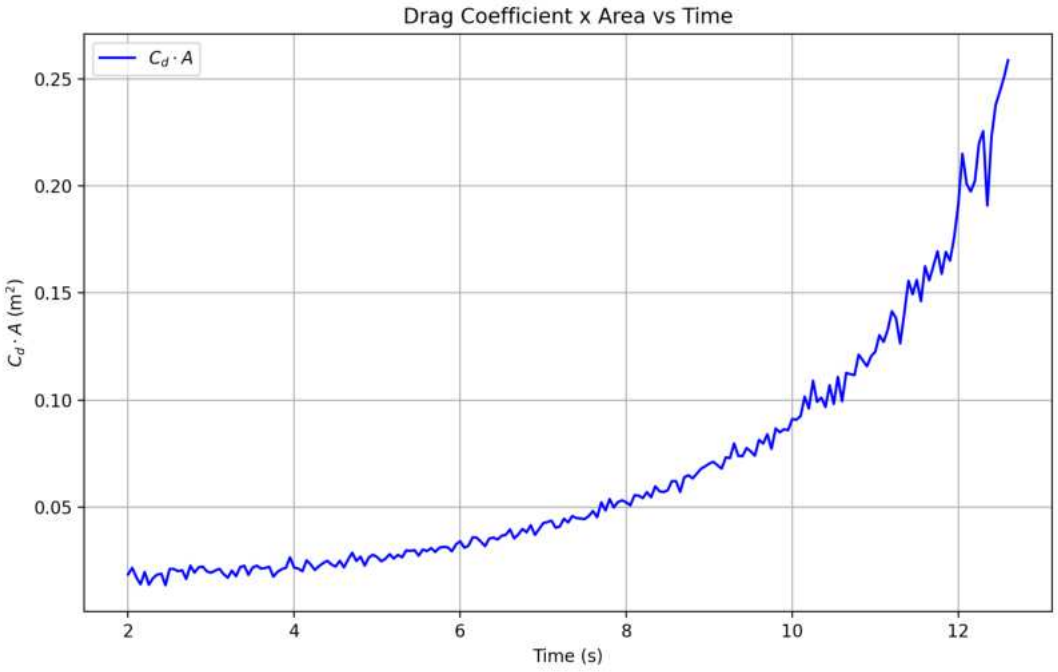


Fig. 94 Coefficient of Drag $\times Area Results for Airbrakes Test Launch$



Fig. 95 Airbrakes Test Rocket on Rail Before Launch



Fig. 96 Damaged Fin of Airbrakes Test Rocket

G. Tube Strength Testing

Manufacturing Prior to beginning manufacturing for the competition, CRT wanted to gain a better understanding of how composite tube manufacturing methods influenced the strength of the resulting tube and develop a higher standard for tube strength testing. The testing was done on tubes with two different variables: layer amount and degree compression. For the first set, carbon fiber tubes with three, four, five, and six layers were produced. The second set was composed of three-layer carbon fiber tubes made with compression during the layup process. The three-layer uncompressed tube made for the first set was treated as an uncompressed control for the compression tests. The other two tubes were made with 1.45 lbs/ft and 2.9 lbs/ft compression respectively. Two Wildman glass fiber tubes were also tested to compare carbon fiber composites to glass fiber composites. In order to ensure consistent results, three of each type were manufactured, resulting in a total of 24 tubes.

All tubes were made using a standard hand layup method utilizing a low carbon steel tube with an outer diameter of

5.5 in. The mandrel was long enough to simultaneously carry out the layups of three tubes with lengths roughly 17 in. Prior to the layup, the steel tube was sealed with Partall Paste #2, coated with a graphite lubricant, and wrapped in a protective layer of Mylar. Once prepared, the mandrel was pre-wet with epoxy, and fiber weave was wrapped around the tube, becoming more saturated with epoxy throughout the process. For the compressed tubes, one end of the carbon fiber weave was attached to another tube in order to apply weight to the fibers throughout the entire layup process. When the weight was at risk of coming into contact with the layup, it was cut off and the remaining weave was placed without compression. As this final part of the weave was only about a third of a total layer, the majority of each tube was made under compression. After curing, all tubes were cut to a length of 15 in to fit into the testing machine. Each tube was labeled with its number, layer count, and/or compression weight.

Testing Procedures In order to test the hoop stiffness, flexural stiffness, and flexural strength of different tubes, a Universal Testing Machine (UTM) was used with a three point bending jig equipped. Inside the tubes being tested, a wooden shim was placed in order to prevent horizontal compression and to more accurately test bending. When the tubes were being placed into the machine, measurements were taken with a ruler in order to ensure that the tubes were centered properly. Two programs were run on the UTM, the first being one that tested the hoop stiffness and the flexural stiffness, and the second one bending to failure to test the ultimate flexural strengths of the tubes. Program 1 ran until a displacement of 2.500 mm was recorded. (Some of the tests ran to 1.000 mm of displacement, but that was not enough to test for the desired values). The second program ran until either the tube broke, or the tube bottomed out with the bending jig. Videos were taken of each test were saved in a shared folder. Files were exported to an external hard drive in .csv and .pdf files. For the first set of tubes tested, there was a malfunction with the UTM so only .pdf files of the graphs were exported.

Analysis One of the main problems encountered when analyzing the data was the fact that, for the first set of tubes, only .pdf images of the graphs were exported. Due to this, an online graph reader was used in order to convert the pictures of the graphs into .csv files. Once .csv files were obtained for all tests, the built-in google sheets slope function was used to analyze the slope of the graphs. Since different sections of the graphs had different slopes, the .csv files were split up into 15 equal portions according to the amount of cells in each. The slope was then taken for each of these sections. For the .csv files exported from Program 1, the first section of the graph denotes the hoop stiffness, the stiffness of the tube without the shim engaged, and then the slope after that is the flexural stiffness. For Program 2, the slopes that were analyzed were the middle section before the tube bottomed out (sharp increase in force at the end of the graph) and after a period of the shim fully engaging (a less steep slope at the start of the graph). This was taken as the more accurate flexural stiffness and failure stiffness (in the case of breakage instead of bottoming out) due to the fact that there was more data here when compared to Program 1. Many of the .csv files had many sections that corresponded to the flexural stiffness so an average was taken of these differing slopes and that final value was the flexural stiffness of a specific tube.

Compression Testing After completing the series of tests for each of the compression tubes and acquiring the desired information, the team compared the results between the different levels of compression to analyze the effect that it had on strength. As expected, the uncompressed tube had a greater total deflection with a lower maximum force, indicating a lower stiffness than the compressed tubes. Additionally, the wall thickness of the tubes decreased by approximately 0.030 in with a compression of 1.45 lb/ft, and approximately 0.040 in with 2.9 lb/ft compression. It is also important to note that the difference between the 1.45 lb/ft and the 2.9 lb/ft compression is minuscule, with some instances where the tubes with 1.45 lb/ft compression performed better than the other tubes. With these results, the conclusion was reached that a light-medium compression was ideal for performance, while still minimizing the wall thickness. However, the compressed tubes did not have any significant effect on the actual performance of the tubes, and therefore IREC opted to not use compression since the small reduction in wall thickness was not justified by the additional work needed to add the compression factor.

			Values Per Sample		
			Hoop stiffness (N/mm)	Flexural stiffness (N/mm)	Flexural Strength (N)
Manufacturing Tests (ST)	0lb/ft	1	23.171	135.352	793.451
		2	0.000	0.000	0.000
		3	39.913	142.258	779.067
	1.45 lb/ft	1	84.813	139.341	725.566
		2	0.000	123.036	701.163
		3	96.864	146.098	737.864
	2.9 lb/ft	1	0.000	124.049	691.013
		2	68.234	90.265	499.507
		3	63.465	131.246	734.332

Table 13 Results of Compression Testing

Thickness Testing The goal of the thickness testing was to optimize the number of layers for the tube and determine the best layer to strength ratio. First, the average wall thickness was 0.0533 inches for a four layer tube, 0.0559 inches for five layers, and 0.0720 in for six layers. Analyzing the test results, the six layer tube has a noticeably higher stiffness and total strength compared to the other two. However, upon further analysis, it was determined that the stiffness and strength exhibited by the five layer tube was strong enough for the IREC rocket, and an additional layer, given the extra thickness, would serve as unnecessary weight. The final decision going into the manufacturing process was determined to proceed with five layers.

			Values Per Sample		
			Hoop stiffness (N/mm)	Flexural stiffness (N/mm)	Flexural Strength (N)
Thickness Tests (TT)	4 layer	1	45.306	251.434	1531.375
		2	59.612	219.887	1666.042
		3	65.399	273.378	1627.523
	5 layer	1	70.936	312.610	2057.599
		2	51.938	326.247	2221.325
		3	72.193	277.308	1816.603
	6 layer	1	116.715	512.656	3384.714
		2	99.472	499.859	3224.128
		3	108.762	425.000	3761.826

Table 14 Results of Thickness Testing

Glass Fiber and Carbon Fiber When comparing the performance of the two fiber materials, the carbon fiber tubes were notably stronger with more stiffness than the glass fiber tubes. Although the glass fiber tubes had a slightly smaller wall thickness than carbon fiber tubes, the difference was not significant enough to justify the gap in performance, and therefore IREC decided that they would proceed with carbon fiber as the reinforcing fiber.

			Values Per Sample		
			Hoop stiffness (N/mm)	**Flexural stiffness (N/mm)**	**Flexural Strength (N)**
		1	45.306	251.434	1531.375
	4 layer	**2**	59.612	219.887	1666.042
		3	65.399	273.378	1627.523
		1	70.936	312.610	2057.599
Thickness Tests (TT)	**5 layer**	**2**	51.938	326.247	2221.325
		3	72.193	277.308	1816.603
		1	116.715	512.656	3384.714
	6 layer	**2**	99.472	499.859	3224.128
		3	108.762	425.000	3761.826

Table 15 Results of Material Testing

C. Hazard Analysis Appendix

Explosives and Energetics Helios is powered by an AeroTech O5500X-PS solid motor. This motor is powered by non-toxic propellant making it safe to be handled without any need for a breathing apparatus. The team will ensure that the motor is handled only under the supervision of those with a TRA or NAR L3 certification. The motor will be properly stored around room temperature and kept away from sources of ignition.

Throughout flight, various events are initiated with black powder charges. During rocket assembly, all black powder is handled on a specific table isolating it from potential sources of ignition such as power tools and electronics. As the rocket is assembled and integrated, any pieces of the rocket containing black powder will be moved to a designated black powder table and remain there. All members who work on black powder packing are required to wear eye-protection and participate in a black powder training. Any unused black powder is treated as waste and disposed of by dumping it into the soil. The Safety Data Sheet for the black powder is available to members at all times and is included in Appendix C.

Composites Manufacturing Two main composite materials were used in the manufacturing of the airframe. Carbon fiber was used for the majority of the airframe construction, including the main body tubes, coupler tubes, boat tail, fin layups, and tip-to-tip layups on the fin can assembly. Fiberglass was also used, where fiberglass sleeves were used to manufacture the nose cone, a G12 fiberglass tube was used for the motor tube, and G10 fiberglass sheets were used as the core layer of the fins.

When carrying out composite surface preparation tasks, wet sanding, half-face respirators, and open-air spaces were used to minimize exposure to composite dusts. When laminating composites during hand layups, a well ventilated, large area and double-layered nitrile gloves were used to prevent risk of epoxy poisoning. Epoxy resin and hardener were also measured out and mixed in small batches amounting to no more than 50 g total, in order to minimize the risk of smoking resulting from an exothermic reaction. When the laminated fins were cut using a water-jet, higher water levels were used so as to avoid aerosolizing G10 fiberglass or carbon fiber particulates.

Launch Hazards While preparing for launch, all guidelines outlined by TRA [9], NAR [10], and NFPA 1127 [11] will be followed strictly. Only select members will go out to the launch pad to prepare for launch. Each member will be made aware of the necessary safety protocols. The rocket will be driven out to the pad with no electronics armed and when at the pad, a specific launch checklist will be followed to ensure every procedure is carried out correctly and safely. While at the launch site, all guidelines and decisions made by the Range Safety Officer will be adhered to.

SAFETY DATA SHEET
4011 REDUCER

1. Identification of the Preparation and of The Company

1.1 Product Name and/or code:	4011 Reducer
Effective Date:	12/22/2022
1.2 Manufacturer:	Color Craft Ltd / Createx Colors 14 Airport Park Road, PO Box 120 East Granby, CT 06026
Information Contact:	860-563-5505
1.3 Emergency Contact:	800-255-3924 813-248-0573
Emergency Response Service:	ChemTel Inc. 1305 North Florida Avenue Tampa, FL 33602 USA 813-248-0573 www.chemtelinc.com
Contact Number:	MIS4120068
Within the United States, Canada, Puerto Rico, and the U.S. Virgin Islands:	1-800-255-3924
Outside the United States, Canada, Puerto Rico, and the U.S. Virgin Islands:	+01-813-248-0585
	China: 400-120-0751 Brazil: 0-800-591-6042 India: 000-800-100-4086 Mexico: 01-800-099-0731
For Health Emergencies:	Contact your local Poison Control Center.
For Health Emergencies:	Contact your local Poison Control Center.
1.4 Product Use:	Art Material – Consumer Product

2. Hazards Identification

Emergency Overview

CAUTION. MAY CAUSE IRRITATION.

2.1 Classification of the Product:

Label Elements	Conforms to ASTM D-4236
Hazard Pictograms	 GHS07
Signal Word	CAUTION!
Hazard Statement	May cause eye, skin, nose and throat irritation. May be harmful if inhaled.

Precaution Statement:	Avoid breathing vapor. Use with adequate ventilation. Avoid contact with eyes, skin and clothing. Do not eat, drink or smoke when using this product. Ensure fresh air entry during application and drying. If you experience eye watering, headache or dizziness, wear an appropriate, properly fitted respirator (NIOSH approved) or leave the area. Avoid release to the environment.
Children's Statement	**KEEP OUT OF REACH OF CHILDREN.**
2.2 Other hazards	
NFPA	Health: 1 Flammability: 0 Reactivity: 0
HMIS	Health: 1 Flammability: 0 Reactivity: 0
2.3 Regulation (EC) No. 1272/2008	**Classification for the mixture under CLP Labelling:**
Signal Word Code (CLP Labelling)	Warning (Category 5)
H- Statements	H333 May be harmful if inhaled
P-Statements	P304 + P312 IF INHALED: Call a POISON CENTER or doctor... if you feel unwell. *Additional p-statements: Wash thoroughly after handling (P264); Wear eye protection. (P280); IF IN EYES: rinse cautiously with water for several minutes. (P305, P351); Remove contact lenses, if present and easy to do. Continue rinsing. (P338); If eye irritation persists: Get medical attention. (P337, P313).*
Substances of very high concern (SVHC)	No classification for the hazardous ingredient.

3.Composition/Information on Ingredients:

3.1 Substances:

Mixture of the following chemicals: 1-methoxy-2-propanol (CAS # 107-98-2) <30.0%

The remainder of the formulation is composed of non-hazardous ingredients.

Regulation (EC) No. 1272/2008 (CLP)

Ingredients are marked according to CLP Regulation (CLP-Regulation (EC) No 1272/2008) and no workplace-related occupational exposure limits are specified for any of the listed ingredients. These ingredients are regarded as trade secrets.

4. First Aid Measures

4.1 Description of first aid measures

Inhalation	If affected, remove to fresh air.
Skin Contact	Wash the affected area thoroughly with plenty of soap and water.

Eye Contact	Carefully flush with water for 15 minutes. If irritation occurs, contact a physician immediately.
Ingestion	If swallowed, do not induce vomiting. Contact a physician immediately.

5. Firefighting Measures

5.1 Extinguishing Media	Water, foam, carbon dioxide or dry chemical equipment.
5.2 Fire/Explosion Hazards	This product is not known to present any fire hazard.
5.3 Flashpoint/Flammability	Not flammable

6. Accidental Release Measures

6.1 Methods and Materials for Containment and Cleaning up	Contain spill. Recover as much as possible. Absorb remainder with an inert material. Place into closed container and store in a safe location to await disposal. Wash the spill area with soap and water.

7. Handling and Storage

7.1 Safe Handling	Use under ventilated conditions. Avoid eye and skin contact. For personal protection, we recommend that employees wash thoroughly after handling product. Always wash before eating, smoking or using toilet facilities. Keep container closed when not in use. Keep container upright to prevent leakage.
7.2 Environmental precautions	No product should be released to the environment. Keep container closed when not in use. Keep container upright to prevent leakage.
7.3 Storage	Store containers in a cool, dry, well ventilated area.

8. Exposure Controls/Personal Protection

8.1 Personal Protective Equipment	Wear goggles where spills or splashing may occur. Wear water resistant impervious gloves if handling bulk amounts.

8.2 Exposure Limits (USA)

Substance	OSHA PEL	NIOSH REL	ACGHI TLV
	8 hr TWA	Up to 10-hour TWA	8-hour TWA
	(ST) STEL (c)Ceiling(IHL) Inhalable		
1-Methoxy -2-Propanol	100 PPM	100 PPM	50 PPM

8.3 Respiratory and Ventilation	Wear approved NIOSH/MSHA respirator if exposure to mist or vapor exceed applicable PEL/TLV limits. Use in accordance with manufacturer's use limitations and OSHA STANDARD 1910-34. Local ventilation may be used to prevent routine inhalation.

Skin Protection	Wear water resistant impervious gloves if handling bulk amounts.
Eye Protection	Wear goggles where spills or splashing may occur.

9. Physical and Chemical Properties

9.1 Information on basic physical and chemical properties

Appearance	Clear liquid
Physical State	Liquid
Color	Cloudy
Odor	Ether-like odor
Boiling Point	Not determined
Freezing Point	Not determined
State (pH)	Not determined
Specific Gravity	No data available
Viscosity	No data available
Flashpoint	> 200° F (> 93.33° c)
Vapor Pressure	Not determined
Vapor Density	Not determined
Solubility in water	Miscible

10. Stability and Reactivity

10.1 Reactivity	No dangerous reaction known under conditions of normal use.
10.2 Chemical Stability	Stable under recommended storage conditions.
10.3 Conditions to Avoid	Avoid all sources of ignition.
10.4 Incompatible materials	Strong oxidizing agents, strong acids, strong bases, amines, ammonia, halogenated compounds.
10.5 Hazardous Decomposition Products	Carbon monoxide, carbon dioxide.

11. Toxicological Information

11.1 Information on toxicological effects

Health Effects	None known for the usual and ordinary uses of this product.
Acute Toxicity	None known for this mixture.

**Studies have not been performed on this particular mixture. The information below is based on data on the individual ingredients.*

1-methoxy-2-propanol: (literature value) : LD50 Oral - 4,016 mg/kg (Rat); LD50 Dermal - 2,000 mg/kg (Rat); LC50 Inhalation - 25.8 mg/l - 4 hrs. (Rat).

Eye Effects	May cause eye irritation
Skin Effects	May cause skin irritation on sensitive individuals.
Inhalation	May cause respiratory irritation if inhaled.
Sensitization	No effects are likely to occur during the foreseeable and reasonable use of the product.
Ingestion	No effects are likely to occur during the foreseeable and reasonable use of the product.

Chronic Effects	No effects are likely to occur during the foreseeable and reasonable use of the product.
Additional toxicological information:	When used and handled according to specifications, the product does not have any harmful effects according to past experience and the information provided.

12. Ecological Information

12.1 Toxicity:	Not expected to be harmful to the environment. No product should be released to the environment.
Aquatic toxicity	Non- hazardous to water.
12.2 Persistence and degradability	Not persistent. Biodegradable. *Not relevant to this mixture.*
12.3 Bio accumulative potential	Does not occur. *Not relevant to this mixture.*
12.4 Mobility in soil	Mixture is similar to water. *Not relevant to this mixture.*
12.5 PBT and vPvB	This mixture is not PBT/vPvB
12.6 Additional ecological information	As a general rule, no product should be released to the environment.

13. Disposal Considerations

13.1 Dispose of all waste material in accordance with all applicable federal, state and local regulations.

14. Transport Information

14.1 The following transportation categories do not apply to this mixture sold as a consumer use product (non-bulk).

DOT	This regulation does not apply to the non-bulk material.
IMDG	This regulation does not apply to the non-bulk material.
ICAO/IATA	This regulation does not apply to the non-bulk material.

This information is not intended to convey all specific regulatory or operational requirements/information relating to this product. It is the responsibility of the transporting organization to follow all applicable laws, regulations and rules relating to the transportation of the materials.

15. Regulatory Information

15.1 Safety, health and environmental regulations/legislation specific for the substance or mixture.

SARA	Not applicable to this mixture.
Section 355 (extremely hazardous substances)	Not applicable to this mixture.
Section 313 (specific toxic chemical listing)	Not applicable to this mixture.
TSCA (Toxic Substance Control Act)	All ingredients are listed.
California Proposition 65	As of December 22, 2022, this product contains no listed substances known to the State of California to cause cancer, birth defects or other reproductive harm, at concentrations which would require a warning under the statue.
Carcinogenicity categories	Not applicable to this mixture.
EPA (Environmental Protection Agency)	Not applicable to this mixture.

TLV (Threshold Limit Value established by ACGIH)	Not applicable to this mixture. Refer to section 8 for further information on individual substances of this mixture.
NIOSH (National Institute for Occupational Safety & Health)	Not applicable to this mixture.
OSHA (Occupational Safety & Health Administration)	Not applicable to this mixture.
MAK (German Maximum Workplace Concentration)	Not applicable to this mixture.

16. Other Information

Prepared by: ENVIRONMENTAL MEDICINE, INC.
778 Carver Avenue
WESTWOOD, NJ 07675
jaegerr@envmed.com
201-666-7929 x13

The information contained in this Safety Data Sheet was compiled using the latest and most reliable information available to the preparer from the manufacturer. The information is provided without any warranty, express or implied regarding its correctness or accuracy nor will the manufacturer assume any liability for any loss or damage arising out of the use of this information including without limitation direct or indirect losses or expenses. To the extent permitted by law, no warranty expressed or implied regarding the product described herein shall be created by or inferred from any state or omission for this SDS. It is solely the responsibility of the user to determine safe conditions for use of this product and to assume liability for any loss, damage or expense whatsoever arising out of the product's improper use.

Abbreviations and acronyms:

NFPA (SCALE 0-4) National Fire Protection Association (USA)

Health:	1 - Caution. May be irritating.
Fire:	0 - Not combustible.
Reactivity:	0 - Stable. Not reactive when mixed with water.

HMIS (SCALE 0-4) Hazardous Materials Identification System (USA)

Health:	1 - Slight hazard: Irritation or minor reversible injury possible.
Fire:	0 - Minimal hazard: Materials that will not burn.
Physical Hazard:	0 - Minimal hazard: This material is normally stable, even under fire conditions and will not react with water, polymerize, decompose, condense, or self-react. Non-Explosives.

Exposure Limits

TWA - Time Weighted Average (8 hr.)
STEL - Short Time Exposure Limit (15 min.)
REL - Recommended Exposure Limit
PEL - Permissible Exposure Limit
IDLH - Immediately Dangerous to Life or Health

ACGIH - Association Advancing Occupational and Environmental Health
EPA - Environmental Protection Agency

SAFETY DATA SHEET
AUTOBORNE SEALERS
10/05/15

Manufacturer or Distributor:	**Color Craft, Ltd./Createx Colors** **14 Airport Park Road** **East Granby, Connecticut 06026** **Phone: 800-509-6563** **Fax: 1-860-653-0643**
Information Telephone Number:	**800-243-2712**
Emergency Telephone Number:	**800-243-2712**
For Health Emergencies:	**Poison Control Center: 1-888-516-2502**

SECTION I – PRODUCT IDENTIFICATION

Product Name:	AutoBorne Sealers
Product Number:	AutoBorne
Product Sizes:	NA
Brand Name:	AutoBorne
Product Class:	Acrylic/Polymer Sealers

SECTION II – HAZARDS IDENTIFICATION

Classification in accordance with paragraph (d) of 29 CFR 1910.1200.

Acute Toxicity Oral:	Category 4
Skin Irritation:	Category 2
Eye Irritation:	Category 2
Label elements:	



GHS07

Signal Word:	Danger
Hazard Statement:	Harmful if swallowed
Precautionary Statements:	**Prevention:** Wash hands thoroughly after handling. Do not eat, drink or smoke when using this product. Wear protective gloves/protective clothing/eye protection/face protection. **Response:** Call a POISON CENTER/doctor if you feel unwell. Get medical advice/attention. Specific treatment (see label). Rinse mouth. Remove contact lenses, if present and easy to do. Continue rinsing. Rinse cautiously with water for several minutes. Take off contaminated clothing. *IF SWALLOWED:* Immediately call a POISON CENTER/doctor. *IF ON SKIN:* Wash with plenty of water. *If skin irritation occurs:* Get medical advice/attention.

SAFETY DATA SHEET
AUTOBORNE SEALERS
10/05/15

SECTION III – COMPOSITION / INFORMATION ON INGREDIENTS

Ingredient:	2-Butoxy Ethanol
CAS#:	111-76-2
PEL/TLV (MG/M#):	N/A
Max % Weight:	4.0
NTP:	N
IARC:	N

SECTION IV – FIRST AID MEASURES

First Aid Measures:	If eye contact occurs, rinse with tap water for 5-10 minutes. If irritation persists, seek medical care. If skin contact occurs, wash with soap and water for 5 minutes. If swallowed, get prompt medical attention.

SECTION V – FIRE FIGHTING MEASURES

Flash Point (Method):	N/A
Autoignition Temperature:	N/A
Explosion Limits in Air (% by Volume):	Not Explosive
Extinguishing Media:	No special media required.
Required Fire Fighting Procedures:	No special firefighting procedures required.
Unusual Fire & Explosion Hazards:	Not Combustible

SECTION VI – ACCIDENTAL RELEASE MEASURES

Steps to be taken in case a material is spilled:	Clean up in accordance with all applicable regulations. Absorb spillage with non-combustible, absorbent material. For waste disposal, see Section XIII

SECTION VII – HANDLING AND STORAGE

Precautions to be taken during storage and handling:	Good industrial hygiene practice requires that exposure be maintained below the TLV. This is preferably achieved through the provision of adequate ventilation. When exposure cannot be adequately controlled in this way, personal respiratory protection should be employed.

SECTION VIII - EXPOSURE CONTROLS / PERSONAL PROTECTION

Respiratory Protection and Special Ventilation Requirements:	Use only with adequate ventilation. Wear a NIOSH / MSHA approved respirator
Other Protective Equipment (Gloves, Goggles, etc):	When using wear impermeable protective gloves.
Work / Hygiene Practices:	Avoid prolonged contact with skin. Wash hands immediately after use. Keep away from eyes.
Engineering Controls:	**KEEP OUT OF REACH OF CHILDREN**

SAFETY DATA SHEET
AUTOBORNE SEALERS
10/05/15

SECTION IX – PHYSICAL AND CHEMICAL PROPERTIES

Appearance:	Colored paint
Physical State:	Liquid
VOC Content:	63.54 g/L Regulatory
Solids percentage:	43.61
Boiling Point:	N/A
Melting Point:	N/A
Vapor Pressure:	N/A
Specific Vapor Density (Air=1):	N/A
Specific Gravity:	N/A
Solubility In Water:	N/A
Reactivity In Water:	Non-Reactive

SECTION X – STABILITY AND REACTIVITY

Hazardous Polymerization Products:	None
Stability: Stable Conditions to Avoid:	None
Incompatibility (Materials to Avoid):	None
Hazardous Decomposition Products:	None

SECTION XI – TOXICOLOGICAL INFORMATION

Acute Effects Associated with Use of this Material:	Skin irritant. Eye irritant. May be harmful if swallowed, by skin contact or by breathing vapors. May be harmful if swallowed. May be harmful by skin contact. Contact may result in irritation of the skin. Contact may result in redness or pain of the eyes.

The summated LD50 is 1228.6 mg/kg.
The summated LC50 is 914.0 mg/cubic meter.
This product is not considered to be a known or suspected human carcinogen by NTP, IARC or OSHA (see section III)

SECTION XII – ECOLOGICAL INFORMATION

No harmful effects known other than those associated with suspended inert solids in water.

SECTION XIII – DISPOSAL CONSIDERATIONS

RCRA Hazard Class (40 CFR 261):	This product is not classified as a hazardous waste.
Waste Disposal Method:	Dispose of in accordance with federal, state and local regulations.

SECTION XIV – TRANSPORTATION INFORMATION

The following transportation categories do not apply to this mixture sold as a consumer use product (non-bulk).

DOT Non-Bulk	
Shipping Name	Not regulated.
Technical Shipping Name	Not regulated.
Hazard Class	Not regulated.
UN Number	Not regulated.
Packing Group	Not regulated.
IMDG	
Shipping Name	Not regulated.
Technical Shipping Name	Not regulated.
Hazard Class	Not regulated.
UN Number	Not regulated.
Packing Group	Not regulated.
EmS Number	Not regulated.
Marine Pollutant	Not regulated.
ICAO/IATA	
Shipping Name	Not regulated.
Technical Shipping Name	Not regulated.
Hazard Class	Not regulated.
UN Number	Not regulated.
Packing Group	Not regulated.
Marine Pollutant	Not regulated.

This information is not intended to convey all specific regulatory or operational requirements/information relating to this product. It is the responsibility of the transporting organization to follow all applicable laws, regulations and rules relating to the transportation of the materials.

SECTION XV – REGULATORY INFORMATION

Contents of this SDS comply with Osha Hazard Communication Standard 29 CFR 1910.1200EPA

SARA Title III Chemical Listings: None

Section 302.4 Extremely Hazardous Substances (40 CFR 355): None

Section 313 Toxic Chemicals (40 CFR 372): None

International Regulations

Canadian WHMIS:

This product is a controlled product under Canada's workplace hazardous materials information system.

It contains the following toxic or highly toxic materials: 1-Methoxy-2-Propanol
2-Butoxy Ethanol

Supplemental State Compliance Information:

This product contains the following chemical(s) listed in the state of California under their Safe Drinking Water and Toxic Enforcement Act of 1986 (Proposition 65) as being known to cause cancer, birth defects or other reproductive harm: None

This product contains the following chemical(s) listed under New Jersey's Right to Know Program: 1-Methoxy-2-Propanol
2-Butoxy Ethanol

This product contains the following chemical(s) requiring notification to the state of Washington under their Children's Safe Products Act:	None
Under CPSC's consumer product regulations (16CFR1500.3 and 150014), this product has the following required acute and chronic hazard labeling:	Warning: May be harmful if swallowed, or by skin contact. Skin irritant. Eye Irritant. Contains: 2-Butoxy Ethanol Precautions: Keep away from eyes. Keep out of reach of children. First Aid Treatment: If eye contact occurs, rinse with tap water for 5-10 minutes. If irritation persists, seek medical care. For acutely hazardous products, the name and place of business of the manufacturer, packer, distributor or seller must appear on the label. A US telephone # to obtain more information is recommended but not required.

SECTION XVI – OTHER INFORMATION

Last Revision Date: 10/05/2015

Prepared by Duke OEM Toxicology

COLOR INFORMATION

This SDS applies to the following colors which are associated with hazardous and /or non-hazardous ingredients.

Product Color	SKU	Hazardous Ingredient
6000 Transparent		(None)
6001 White		(None)
6002 Black		(None)
6003 Gray		(None)
6004 Yellow		(None)
6005 Orange		(None)
6006 Red		(None)
6007 Lilac		(None)
6008 Blue		(None)
6009 Process Blue		(None)
6010 Green		(None)
6011 Tan		(None)
6012 Burgundy		(None)
6013 Silver		(None)

Brand Names

This SDS applies to the following brand names: Autoborne Sealers
Auto Air Colors

SAFETY DATA SHEET
Klean-Strip Acetone

Revision: 06/26/2019
Supersedes Revision: 05/24/2017

1. PRODUCT AND COMPANY IDENTIFICATION

Product Name: Klean-Strip Acetone

Company Name: W. M. Barr
2105 Channel Avenue
Memphis, TN 38113

Phone Number: (901)775-0100

Web site address: www.wmbarr.com

Emergency Contact: 3E 24 Hour Emergency Contact (800)451-8346

Information: W.M. Barr Customer Service (800)398-3892

Intended Use: Paint, stain, and varnish thinning.

Product Code: CAC18, DAC18, GAC18, GAC182, QAC18, QAC184, PA12270, GAC18HDQP, GAC18HDWS, GAC18P, PAC181

2. HAZARDS IDENTIFICATION

Flammable Liquids, Category 2
Serious Eye Damage/Eye Irritation, Category 2
Specific Target Organ Toxicity (single exposure), Category 3



GHS Signal Word: **Danger**

GHS Hazard Phrases:
H225: Highly flammable liquid and vapor.
H319: Causes serious eye irritation.
H335: May cause respiratory irritation.
H336: May cause drowsiness or dizziness.

GHS Precautionary Phrases:
P233: Keep container tightly closed.
P210: Keep away from heat/sparks/open flames/hot surfaces. - No smoking.
P280: Wear protective gloves/protective clothing/eye protection/face protection.
P240: Ground/bond container and receiving equipment.
P241: Use explosion-proof electrical/ventilating/lighting equipment.
P243: Take precautionary measures against static discharge.
P242: Use only non-sparking tools.
P264: Wash hands thoroughly after handling.
P261: Avoid breathing gas/mist/vapours/spray.
P271: Use only outdoors or in a well-ventilated area.

GHS Response Phrases:
P370+378: In case of fire, use dry chemical to extinguish.
P303+361+353: IF ON SKIN (or hair): Remove/take off immediately all contaminated clothing. Rinse skin with water/shower.
P305+351+338: IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P337+313: If eye irritation persists, get medical advice/attention.
P304+340: IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing.
P312: Call a POISON CENTER/doctor if you feel unwell.

GHS Storage and Disposal Phrases:
P403+235: Store in cool/well-ventilated place.
P501: Dispose of contents/container according to local, state and federal regulations.
P403+233: Store container tightly closed in well-ventilated place - if product is as volatile as to generate hazardous atmosphere.
P405: Store locked up.

OSHA Regulatory Status: This material is classified as hazardous under OSHA regulations.

Potential Health Effects (Acute and Chronic):

Inhalation Acute Exposure Effects:
Vapor harmful. May cause dizziness, headache, watering of eyes, irritation of respiratory tract, drowsiness, nausea, and numbness in fingers, arms and legs. Inhalation of high vapor concentrations can cause central nervous system depression and narcosis. May lead to unconsciousness.

Skin Contact Acute Exposure Effects:
May cause skin irritation. Liquid is absorbed readily and can transport other toxins into the body. Prolonged or repeated skin contact with liquid may cause defatting resulting in drying, redness and possible blistering.

Eye Contact Acute Exposure Effects:
This material is an eye irritant. Causes itching, burning, redness and tearing. May cause corneal injury.

Ingestion Acute Exposure Effects:
Harmful if swallowed. Aspiration hazard if swallowed - can enter lungs and cause damage. May cause irritation of the gastrointestinal tract. May cause systemic poisoning with symptoms paralleling those of inhalation.

Chronic Exposure Effects:
Reports have associated repeated and prolonged overexposure to solvents with neurological and other physiological damage. May cause weakness, fatigue, skin irritation, and numbness in hands and feet.

May cause target organ or system damage to the respiratory system, nervous system, kidney, blood system, and liver.

Target Organs:
Eyes, skin, respiratory system, central nervous system, heart

Medical Conditions Generally Aggravated By Exposure: Skin, eye, respiratory and asthma, cardiac irregularities

3. COMPOSITION/INFORMATION ON INGREDIENTS

CAS #	Hazardous Components (Chemical Name)	Concentration
67-64-1	Acetone {2-Propanone}	100.0 %

4. FIRST AID MEASURES

Emergency and First Aid Procedures:

Skin:
Immediately begin washing the skin thoroughly with large amounts of water and mild soap, if available, while removing contaminated clothing. Seek medical attention if irritation persists.

Eyes:
Immediately begin to flush eyes with water, remove any contact lens. Continue to flush the eyes for at least 15 minutes, then seek immediate medical attention.

Inhalation:
Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get immediate medical attention.

Ingestion:
If swallowed, do NOT induce vomiting. Seek immediate medical attention. Call a physician, hospital emergency room, or poison control center immediately. Never give anything by mouth to an unconscious person.

Signs and Symptoms Of Exposure:

Primary Routes of Exposure:
Inhalation, ingestion, and dermal.

Note to Physician:

Treatment of overexposure should be directed at the control of symptoms and the clinical condition of the patient.

5. FIRE FIGHTING MEASURES

Class IB

Flash Pt: 0.00 F Method Used: TAG Closed Cup

Explosive Limits: LEL: 2.5 % at 77.0 F UEL: 13.0 % at 77.0 F

Autoignition Pt: 869.00 F

Suitable Extinguishing Media: Use carbon dioxide, dry powder, or alcohol-resistant foam.

Fire Fighting Instructions: Self-contained respiratory protection should be provided for fire fighters fighting fires in buildings or confined areas. Storage containers exposed to fire should be kept cool with water spray to prevent pressure build-up. Stay away from heads of containers that have been exposed to intense heat or flame.

Flammable Properties and Hazards:

Extremely Flammable! Vapors are heavier than air and may spread along floors. Forms or accumulates static electricity, may cause fire or explosion.

Acetone/water solutions that contain more than 2.5% acetone have flash points. When the acetone concentration is greater than 8% by weight in a closed container, it would be within the flammable range and cause fire or explosion if a source of ignition were introduced.

Do not spread this product over a large surface area because the fire and health safety risks will increase dramatically.

Hazardous Combustion Products:

carbon monoxide, carbon dioxide

6. ACCIDENTAL RELEASE MEASURES

Steps To Be Taken In Case Material Is Released Or Spilled:

Vapors may cause flash fire or ignite explosively.

Clean up: Keep unnecessary people away; isolate hazard area and deny entry. Stay upwind, out of low areas, and ventilate closed spaces before entering. Shut off ignition sources; keep flares, smoking or flames out of hazard area. Use non-sparking tools. Use proper bonding and grounding methods for all equipment and processes. Keep out of waterways and bodies of water. Be cautious of vapors collecting in small enclosed spaces, sewers, low lying areas, confined spaces, etc.

Small spills: Take up with sand, earth or other noncombustible absorbent material and place in a plastic container where applicable.

Large spills: Dike far ahead of spill for later disposal.

Waste Disposal: Dispose in accordance with applicable local, state and federal regulations.

7. HANDLING AND STORAGE

Precautions To Be Taken in Handling:

Read carefully all cautions and directions on product label before use. Since empty container retains residue, follow all label warnings even after container is empty. Dispose of empty container according to all regulations. Do not reuse this container.

Do not use this product near any source of heat or open flame, furnace areas, pilot lights, stoves, etc.

Do not use in small enclosed spaces, such as basements and bathrooms. Vapors can accumulate and explode if ignited.

Do not spread this product over large surface areas because fire and health safety risks will increase dramatically.

Precautions To Be Taken in Storing:

Keep container tightly closed when not in use. Store in a cool, dry place. Do not store near any source of heat or flame, furnace areas, pilot lights, stoves, etc. Do not reuse this container. Use product within one year of purchasing.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

CAS #	Chemical Name	Jurisdiction	Recommended Exposure Limits	Notations
67-64-1	Acetone {2-Propanone}	ACGIH TLV	TLV: 500 ppm STEL: 750 ppm	
		OSHA PELs	PEL: 1000 ppm	

Respiratory Equipment (Specify Type):	For use in areas with inadequate ventilation or fresh air, wear a properly maintained and properly fitted NIOSH approved respirator for organic solvent vapors. For OSHA controlled work places and other regular users - Use only with adequate ventilation under engineered air control systems designed to prevent exceeding the appropriate TLV. A dust mask does not provide protection against vapors.
Eye Protection:	Splash goggles.
Protective Gloves:	Wear gloves with as much resistance to the chemical ingredients as possible. Glove materials such as nitrile rubber, natural rubber, and neoprene may provide protection. Glove selection should be based on chemicals being used and conditions of use. Consult your glove supplier for additional information. Gloves contaminated with product should be discarded and not reused.
Other Protective Clothing:	Various application methods can dictate use of additional protective safety equipment, such as impermeable aprons, etc., to minimize exposure.
Engineering Controls (Ventilation etc.):	Use process enclosures, local exhaust ventilation, or other engineering controls to control airborne levels below recommended exposure limits. Use only with adequate ventilation to prevent buildup of vapors. Do not use in areas where vapors can accumulate and concentrate, such as basements, bathrooms or small enclosed areas. Whenever possible, use outdoors in an open air area. If using indoors open all windows and doors and maintain a cross ventilation of moving fresh air across the work area. If strong odor is noticed or you experience slight dizziness, headache, nausea or eye-watering -- STOP -- ventilation is inadequate. Leave area immediately and move to fresh air.
Work/Hygienic/Maintenance Practices:	Wash hands thoroughly after use and before eating, drinking, smoking, or using the restroom. Do not eat, drink, or smoke in the work area. Discard any clothing or other protective equipment that cannot be decontaminated. Facilities storing or handling this material should be equipped with an emergency eyewash and safety shower.

9. PHYSICAL AND CHEMICAL PROPERTIES

Physical States:	[ ] Gas [X] Liquid [ ] Solid
Appearance and Odor:	Clear colorless liquid with a characteristic ketone odor. Odor may be described as a sweet pungent odor.
pH:	N.D.
Melting Point:	N.D.
Boiling Point:	133.00 F
Flash Pt:	0.00 F Method Used: TAG Closed Cup
Evaporation Rate:	N.D.
Flammability (solid, gas):	No data available.
Explosive Limits:	LEL: 2.5 % at 77.0 F UEL: 13.0 % at 77.0 F
Vapor Pressure (vs. Air or mm Hg):	213 MM HG at 77.0 F
Vapor Density (vs. Air = 1):	N.D.

Specific Gravity (Water = 1):	0.789
Density:	6.572 LB/GA at 77.0 F
Solubility in Water:	Complete
Saturated Vapor Concentration:	N.D.
Octanol/Water Partition Coefficient:	N.D.
Percent Volatile:	100.0 % by weight.
Autoignition Pt:	869.00 F
Decomposition Temperature:	N.D.
Viscosity:	N.D.
Additional Physical Information	N.D. = Not Determined.

10. STABILITY AND REACTIVITY

Stability:	Unstable [ ] Stable [X]
Conditions To Avoid - Instability:	No data available.
Incompatibility - Materials To Avoid:	Avoid contact with acids, aldehydes, alkalies, amines, ammonia, oxidizing agents, reducing agents, chlorine compounds. May form explosive mixtures with chromic anhydride, chromyl alcohol, hexachloromelamine, hydrogen peroxide, permonosulfuric acid, potassium tertbutoxide, and thioglycol. Strong oxidizers.
Hazardous Decomposition or Byproducts:	Decomposition may produce carbon monoxide, carbon dioxide, and other asphyxiants.
Possibility of Hazardous Reactions:	Will occur [ ] Will not occur [X]
Conditions To Avoid - Hazardous Reactions:	No data available.

11. TOXICOLOGICAL INFORMATION

Toxicological Information:	NEUROTOXICITY: Clinical studies and case reports suggest slight neurological effects, mostly of the subjective type, in individuals exposed to varying concentrations of acetone. In most studies the subjects report discomfort, irritation of the eyes and respiratory passages, mood swings, and nausea following exposure to acetone vapor at concentrations of 500 ppm or higher. The fact that the effects subside following termination of exposure indicates that acetone may be the active compound, rather than a metabolite. Case reports of accidental poisoning also indicate that the effects (e.g., lethargy and drowsiness) are short-lived. CAS# 67-64-1: Standard Draize Test, Eyes, Species: Rabbit, 20.00 MG, Severe. Result: Behavioral: Change in motor activity (specific assay). Behavioral: Alteration of classical conditioning. - American Journal of Ophthalmology., Ophthalmic Pub. Co., 435 N. Michigan Ave., Suite 1415, Chicago, IL 60611, Vol/p/yr: 29,1363, 1946
Carcinogenicity/Other Information:	ACGIH A4 - Not Classifiable as a Human Carcinogen.

CAS #	Hazardous Components (Chemical Name)	NTP	IARC	ACGIH	OSHA
67-64-1	Acetone {2-Propanone}	n.a.	n.a.	A4	n.a.

12. ECOLOGICAL INFORMATION

No data available.

13. DISPOSAL CONSIDERATIONS

Waste Disposal Method: Dispose of in accordance with all applicable local, state, and federal regulations.

14. TRANSPORT INFORMATION

LAND TRANSPORT (US DOT):

DOT Proper Shipping Name: Acetone

DOT Hazard Class: 3 FLAMMABLE LIQUID

UN/NA Number: UN1090 **Packing Group:** II



Additional Transport Information: The shipper/supplier may apply one of the following exceptions: Combustible Liquid, Consumer Commodity, Limited Quantity, Viscous Liquid, Does Not Sustain Combustion, or others, as allowed under 49CFR Hazmat Regulations. Please consult 49CFR Subchapter C to ensure that subsequent shipments comply with these exceptions.

15. REGULATORY INFORMATION

EPA SARA (Superfund Amendments and Reauthorization Act of 1986) Lists

CAS #	Hazardous Components (Chemical Name)	S. 302 (EHS)	S. 304 RQ	S. 313 (TRI)
67-64-1	Acetone {2-Propanone}	No	Yes 5000 LB	No

CAS #	Hazardous Components (Chemical Name)	Other US EPA or State Lists
67-64-1	Acetone {2-Propanone}	CAA HAP,ODC: No; CWA NPDES: No; TSCA: Yes - Inventory; CA PROP.65: No

Regulatory Information: This product is regulated by the United States Consumer Product Safety Commission and is subject to certain labeling requirements under the Federal Hazardous Substances Act. These requirements differ from the classification criteria and hazard information required for safety data sheets (SDS). The product label also includes other important information, including directions for use, and should always be read in its entirety prior to using the product.

16. OTHER INFORMATION

Revision Date: 06/26/2019

Preparer Name: W.M. Barr EHS Department (901)775-0100

Additional Information About This Product: No data available.

Company Policy or Disclaimer: The information contained herein is presented in good faith and believed to be accurate as of the effective date shown above. This information is furnished without warranty of any kind. Employers should use this information only as a supplement to other information gathered by them and must make independent determination of suitability and completeness of information from all sources to assure proper use of these materials and the safety and health of employees. Any use of this data and information must be determined by the user to be in accordance with applicable federal, state and local laws and regulations.

GHS SAFETY DATA SHEET (SDS)

SECTION 1 — PRODUCT AND COMPANY IDENTIFICATION

Product: AEROPOXY ES6209A

PTM & W INDUSTRIES, INC. **PHONE NUMBER: (562) 946-4511**
10640 S. PAINTER AVE. *CHEMICAL TRANSPORTATION EMERGENCY:*
SANTA FE SPRINGS, CA. 90670-4092 **CHEMTREC (800) 424-9300**

DATE OF PREPARATION: 01/01/2018 SUPERSEDES: 3/31/2017

Product Type: **Epoxy Resin**

Product Use: **Industrial Epoxy Resin supplied exclusively for workplace use.**

SECTION 2 — HAZARD(S) IDENTIFICATION

Signal Word: **Warning**

Hazard Label(s):

Irritant



Hazard statement(s):
H320: Causes eye irritation. (Eye Irrit. 2B)
H302: May be harmful if swallowed. (Acute Tox. 5 Oral)
H315: Causes skin irritation. (Skin Irrit. 2)
H317: May cause an allergic skin reaction. (Skin Sens. 1)
H335: May cause respiratory irritation. (STOT SE3)

Precautionary statement(s):
P202: Do not handle until all safety precautions have been read and understood
P231: Avoid breathing dust/fume/gas/mist/vapours/spray.
P270: Do not eat, drink or smoke when using this product.
P281: Use personal protective equipment as required.
P285: In case of inadequate ventilation wear respiratory protection.
P273: Avoid release to the environment.

NO.	CANCER	REPRO-TOX	TARGET ORGANS	ACGIH/TLV	OSHA/PEL
P	NO	NO	UNKNOWN	N.A.mg/M³	N.A.mg/M³

NOTE: CONTAINS MATERIAL(S) REGULATED AS DUST HAZARDS, DISPERSED IN A NON-HAZARDOUS FORM. IF DUST IS RECREATED, APPROPRIATE RESPIRATORY AND/OR EXPLOSION PRECAUTIONS MUST STILL BE USED.

SECTION 3 — COMPOSITION / INFORMATION ON INGREDIENTS

UNDER GHS-OSHA §4.11 THE PRECISE COMPOSITION OF THIS PRODUCT IS WITHHELD AS CONFIDENTIAL BUSINESS INFORMATION (CBI). A MORE COMPLETE DISCLOSURE CAN BE PROVIDED TO A HEALTH, OR SAFETY PROFESSIONAL WHEN NECESSARY.

Substance/Mixture: Mixture

NO.	COMPONENT	CAS. NO.	PERCENT
P	EPOXY RESIN BASED MIXTURE	N.A.	< 100%

SECTION 4 — FIRST-AID MEASURES

EMERGENCY AND FIRST AID PROCEDURES:

- **EYES:** IMMEDIATELY FLUSH EYES WITH LARGE AMOUNTS OF WATER FOR 15 MINUTES. GET MEDICAL ATTENTION.
- **SKIN:** WASH AFFECTED AREA IMMEDIATELY WITH LARGE AMOUNTS OF SOAP AND WATER. REMOVE AND WASH CONTAMINATED CLOTHING BEFORE REUSE. CONTACT A PHYSICIAN IF IRRITATION OCCURS.
- **INHALATION:** REMOVE VICTIM TO FRESH AIR AND PROVIDE OXYGEN IF BREATHING IS DIFFICULT. GET MEDICAL ATTENTION.
- **INGESTION:** DO NOT INDUCE VOMITING. GIVE LARGE QUANTITIES OF WATER. CALL A PHYSICIAN IMMEDIATELY. NEVER GIVE ANYTHING BY MOUTH TO AN UNCONSCIOUS PERSON.

SECTION 5 — FIRE-FIGHTING MEASURES

FLASH POINT: ≥ 350°F (FOR PRODUCT OR LOWEST FLASH POINT INGREDIENT)
FLAMMABILITY CLASSIFICATION: COMBUSTIBLE CLASS (IIIB)
EXTINGUISHING MEDIA: WATER FOG, DRY CHEMICAL, CARBON DIOXIDE, OR FOAM.
NOTE: EITHER ATMOSPHERE-SUPPLY OR AIR-PURIFYING RESPIRATORS SHOULD BE AVAILABLE FOR FIRE FIGHTERS (20 CFR 1910.134).

SECTION 6 — ACCIDENTAL RELEASE MEASURES

- **IF MATERIAL IS SPILLED:** AVOID CONTACT WITH MATERIAL. PERSONS NOT WEARING PROPER PROTECTIVE EQUIPMENT (SEE BELOW) SHOULD BE EXCLUDED FROM THE AREA UNTIL CLEAN UP IS COMPLETE. DIKE AREA TO PREVENT SPILL SPREADING AND SCOOP UP EXCESS TO RECOVERY CONTAINERS. ABSORB REMNANT ON NONCOMBUSTIBLE MATERIAL SUCH AS CLAY AND SHOVEL INTO CONTAINERS FOR DISPOSAL.
- **WASTE DISPOSAL METHOD:** DISPOSE OF ANY WASTE(S) GENERATED ABOVE IN ACCORDANCE WITH FEDERAL, STATE, AND LOCAL REGULATIONS.

SECTION 7 — HANDLING AND STORAGE

- AVOID SKIN AND EYE CONTACT.
- AVOID BREATHING VAPOR, MIST OR FUMES.
- ENSURE THAT ALL CONTAINERS ARE PROPERLY LABELED TO PREVENT ACCIDENTAL INGESTION OR IMPROPER DISPOSAL.
- RESEAL PARTLY USED CONTAINERS.
- WASH WITH SOAP AND WATER BEFORE EATING, DRINKING OR USING TOILET FACILITIES.
- STORE UNDER COOL, DRY CONDITIONS AND AWAY FROM OPEN FLAMES AND HIGH TEMPERATURES.
- OBSERVE CONDITIONS OF GOOD INDUSTRIAL HYGIENE AND SAFE WORKING PRACTICE.

SECTION 8 — EXPOSURE CONTROLS/ PERSONAL PROTECTION

- **RESPIRATORY PROTECTION:** NOT NORMALLY NECESSARY UNLESS THE MATERIAL IS BEING USED IN SUCH A WAY AS TO PRODUCE DUST, MIST, VAPOR, FUMES, OR SMOKE, IN WHICH CASE NIOSH APPROVED RESPIRATORY PROTECTION SHOULD BE USED.
- **VENTILATION:** SHOULD BE SUFFICIENT TO CONTROL ANY DUST, MIST, VAPOR OR FUMES PRODUCED BY PROCESSING OR HANDLING METHOD. BREATHING OF VAPOR MUST BE AVOIDED.
- **HAND PROTECTION:** IMPERVIOUS GLOVES, NEOPRENE OR NILRILE RUBBER GLOVES.
- **EYE PROTECTION:** SPLASH PROOF GOGGLES OR SAFETY GLASSES WITH SIDE SHIELDS.
- **OTHER PROTECTIVE EQUIPMENT:** CLEAN, BODY COVERING CLOTHING AND FOOTWEAR.

SECTION 9 — PHYSICAL AND CHEMICAL PROPERTIES

PHYSICAL STATE.....	LIQUID
ODOR.....	BLAND
COLOR	CLOUDY AMBER
pH	NEUTRAL
SP. GR.....	1.17
DENSITY	9.7 lbs. / gal.
VAPOR PRESSURE.....	NEGLIGIBLE

NOTE: OTHER PROPERTIES ARE EITHER NOT AVAILABLE, OR DO NOT APPLY.

SECTION 10 — STABILITY AND REACTIVITY

- STABILITY: STABLE UNDER NORMAL STORAGE CONDITIONS. UNSTABLE AT ELEVATED TEMPERATURES.
- **INCOMPATIBILITY:** STRONG OXIDIZING AGENTS, STRONG LEWIS OR MINERAL ACIDS, AND STRONG MINERAL AND ORGANIC BASES / ESPECIALLY ALIPHATIC AMINES.
- **HAZARDOUS DECOMPOSITION PRODUCTS:** CARBON OXIDES, ALDEHYDES, ACIDS, PHENOLICS, AND OTHER UNKNOWN COMPOUNDS.

SECTION 11 — TOXICOLOGICAL INFORMATION

EFFECTS OF OVEREXPOSURE:

ACUTE:

- **EYES:** PRODUCT IS MODERATELY IRRITATING TO THE EYES.
- **SKIN:** PRODUCT IS MODERATELY IRRITATING TO THE SKIN AND MAY CAUSE SKIN SENSITIZATION.
- **INHALATION:** BECAUSE OF ITS LOW VOLATILITY THIS PRODUCT IS NOT LIKELY TO BE AN INHALATION HAZARD.
- **INGESTION:** PRODUCT IS CONSIDERED TO HAVE A LOW ORDER OF ACUTE ORAL TOXICITY.

CHRONIC:

- NO SPECIFIC HAZARDS KNOWN TO PTM & W. PREXISTING EYE, SKIN OR LUNG DISORDERS MAY BE AGGRAVATED BY EXPOSURE TO THIS PRODUCT.

SECTION 12 — ECOLOGICAL INFORMATION

ECOTOXICITY EFFECTS:

- **AQUATIC TOXICITY:** NO DATA IS AVAILABLE ON THE PRODUCT ITSELF.
- **TOXICITY TO OTHER ORGANISMS:** NO DATA AVAILABLE.

PERSISTANCE AND DEGRADABILITY:

- **MOBILITY:** NO DATA IS AVAILABLE ON THE PRODUCT ITSELF.
- **BIOACCUMULATION:** NO DATA IS AVAILABLE ON THE PRODUCT ITSELF.

SECTION 13 — DISPOSAL CONSIDERATIONS

- **WASTE DISPOSAL METHOD:** DISPOSE OF WASTE IN ACCORDANCE WITH ALL FEDERAL, STATE, AND LOCAL REGULATIONS.
- **CONTAINER DISPOSAL:** SINCE EMPTIED CONTAINERS RETAIN PRODUCT RESIDUE, ALL LABELED HAZARD PRECAUTIONS MUST BE OBSERVED. CONSULT WITH FEDERAL, STATE, AND LOCAL AUTHORITIES FOR DEFINITIONS OF "EMPTY" AND PROPER DISPOSAL PRACTICES.

SECTION 14 — TRANSPORT INFORMATION

- **U.S. Department of Transportation Ground (49 CFR)**

UN NUMBER.....	N.A.
PROPER SHIPPING NAME.....	PLASTIC MATERIAL LIQUID, N.O.I.
CONTAINS.....	NOT REGULATED*
HAZARD CLASS.....	N.A.
PACKAGING GROUP.....	N.A.

- **International Air Transportation (ICAO/IATA)**

UN NUMBER.....	N.A.
PROPER SHIPPING NAME.....	PLASTIC MATERIAL LIQUID, N.O.I.
CONTAINS.....	NOT REGULATED*
HAZARD CLASS.....	N.A.
PACKAGING GROUP.....	N.A.

- **Water Transportation (IMO/IMDG)**

UN NUMBER.....	N.A.
PROPER SHIPPING NAME.....	PLASTIC MATERIAL LIQUID, N.O.I.
CONTAINS.....	NOT REGULATED*
HAZARD CLASS.....	N.A.
PACKAGING GROUP.....	N.A.
MARINE POLLUTANT	NO

*Non-Bulk Packages may be shipped as Non-Regulated under §49 CFR 173.150(f).

SECTION 15 — REGULATORY INFORMATION

A. CAL SAFE DRINKING WATER & TOXIC ENFORCEMENT ACT OF 1986

(GO TO WWW.P65WARNINGS.CA.GOV FOR THE COMPLETE LIST OF PROP.65 CHEMICALS.)

NO.	CHEMICAL NAME	CAS. NO.	CANCER/REPRC.TOX	QUANTITY

THIS PRODUCT MAY CONTAIN TRACES OF PROP. 65 LISTED CHEMICALS AS IMPURITIES. HOWEVER, ANY USED AS INGREDIENTS ARE LISTED ABOVE.

B. CERCLA — §40 CFR 302.4

RELEASES EXCEEDING THE REPORTABLE QUANTITY (RQ) MUST BE REPORTED TO THE NATIONAL RESPONSE CENTER. (800)424-8802

RQ NOT ESTABLISHED OR REQUIRED FOR THIS PRODUCT.

C. RCRA — §40 CFR 261.33

NOT A HAZARDOUS WASTE BY RCRA CRITERIA (40CFR261.20-24).

D. SARA TITLE III — §52 CFR 13378, §52 CFR 21152

NO.	RQ (lbs.)	TPQ (lbs.)	SEC.312	313 CAT.	311/312
	(•1)	(•2)	(•3)	(•4)	(•5)
P	NONE	NOT LISTED	NOT LISTED	NONE	H1

•1 = REPORTABLE QUANTITY OF EXTREMELY HAZARDOUS SUBSTANCE, SEC. 302
•2 = THRESHOLD PLANNING QUANTITY, EXTREMELY HAZARDOUS SUBSTANCE, SEC. 302
•3 = TOXIC CHEMICAL, SEC. 313 (INDIVIDUAL CHEMICAL LISTED)
•4 = TOXIC RELEASE INVENTORY FORM CATEGORY SEC. 313 (40 CFR 372.65 C)
•5 = HAZARD CATEGORY FOR SARA SEC. 311/312 REPORTING
H1 = IMMED. (ACUTE) HEALTH HAZARD H2 = DELAYED (CHRONIC) HEALTH HAZARD
P3 = FIRE HAZARD P4 = SUDDEN PRESSURE RELEASE HAZARD P5 = REACTIVE HAZ.

E. VOC — SCAQMD RULES

NO.	CHEMICAL	QUANTITY	VP mm Hg	gms./l. @ 20°C
NP.				

NOTE: THIS PRODUCT DOES NOT CONTAIN SOLVENTS, BUT MAY CONTAIN INGREDIENTS WITH VP'S LOW ENOUGH TO BE EMITTED IF HEATED ALONE. WHEN 2 PART RESINS AND HARDENERS ARE PROPERLY MIXED TOGETHER THESE INGREDIENTS REACT TOGETHER AND ARE CONSUMED WITHOUT SIGNIFICANT ATMOSPHERIC EMISSIONS.

F. INTERNATIONAL CHEMICAL INVENTORY STATUS:

EINECS-EU	Listed, Exempted, Polymer substance, or as no longer polymer.
AICS-AUSTRALIA	All components are listed or exempted.
ENCS-JAPAN	All components are listed or exempted.
ISPL-JAPAN	All components are listed or exempted.
KECI/ECL-KOREA	All components are listed or exempted.
IECSC/SEPA-CHINA	All components are listed or exempted.
PICCS-PHILIPPINES	All components are listed or exempted.
DSL-CANADA	All components are listed or exempted.
TSCA-USA	All components are listed or exempted.

G. WHMIS (CANADA):

- WHMIS: D2B Materials Causing Other Toxic Effects --Toxic Material

SECTION 16 — OTHER INFORMATION

HMIS III CODES:		RATINGS:	
HEALTH	= **2**	0 = MINIMAL	3 = SERIOUS
FLAMMABILITY	= **1**	1 = SLIGHT	4 = SEVERE
REACTIVITY	= **0**	2 = MODERATE	

⇒ PERSONAL PROTECTION RATING TO BE SUPPLIED BY USER DEPENDING ON CONDITIONS OF USE.

DATE OF PREPARATION: 01/01/2019 SUPERSEDES: 3/31/2017

We believe that the information contained herein is correct as of the date of this Safety Data Sheet. Since the use of this information and these opinions and the conditions of use of this product are not within the control of PTM & W, it is the user's obligation to determine the conditions of safe use of the product.

PTM & W makes no warranty, expressed or implied regarding the accuracy of these data. PTM & W assumes no responsibility for injury from the use of the product described herein. Further, there are many international, federal, state, and local laws and regulations governing chemical products and as it is beyond the scope of this SDS to determine which of these apply, it is the responsibility of the user to determine how these affect their use of the product.

PTM&W assumes no obligation or liability for the information given, or results obtained, all such being given and accepted at users' risk.

Alteration of this document is strictly prohibited.

— END OF SDS —

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01-0047

GHS SAFETY DATA SHEET (SDS)

SECTION 1 — PRODUCT AND COMPANY IDENTIFICATION

Product: AEROPOXY ES6209B

PTM & W INDUSTRIES, INC. — PHONE NUMBER: (562) 946-4511
10940 S. PAINTER AVE. — *CHEMICAL TRANSPORTATION EMERGENCY:*
SANTA FE SPRINGS, CA. 90670-4092 — CHEMTREC (800) 424-9300
DATE OF PREPARATION: 01/01/2018 SUPERSEDES: 3/31/2017

Product Type: **Modified Amine Mixture**

Product Use: **Industrial Curing Agent supplied exclusively for workplace use.**

SECTION 2 — HAZARD(S) IDENTIFICATION

Signal Word: **Danger**

Hazard Label(s):

Corrosive



Irritant



Hazard statement(s):
H318: Causes serious eye damage. (Eye Dam. 1)
H302: Harmful if swallowed. (Acute Tox. 4 Oral)
H332: Harmful if inhaled. (Acute Tox. 4 Inhalation)
H317: May cause an allergic skin reaction. (Skin Sens. 1)

Precautionary statement(s):
P202: Do not handle until all safety precautions have been read and understood
P261: Avoid breathing dust/fume/gas/mist/vapours/spray.
P270: Do not eat, drink or smoke when using this product.
P281: Use personal protective equipment as required.
P285: In case of inadequate ventilation wear respiratory protection.
P273: Avoid release to the environment.

NO.	CANCER	REPRO-TOX	TARGET ORGANS	ACGIH/TLV	OSHA/PEL
P	NO	NO	UNKNOWN	N.A.mg/M³	N.A.mg/M³
2	NO	NO	EYES, SKIN	N.A.mg/M³	N.A.mg/M³

SECTION 3 — COMPOSITION / INFORMATION ON INGREDIENTS

UNDER GHS-OSHA §4.11 THE PRECISE COMPOSITION OF THIS PRODUCT IS WITHHELD AS CONFIDENTIAL BUSINESS INFORMATION (CBI). A MORE COMPLETE DISCLOSURE CAN BE PROVIDED TO A HEALTH, OR SAFETY PROFESSIONAL WHEN NECESSARY.

Substance/Mixture: Mixture

NO.	COMPONENT	CAS. NO.	PERCENT
P	FATTY ACIDS, C18-UNSATD., DIMERS, POLYMERS WITH POLYETHYLENEPOLYAMINES	68410-23-1	< 100%
2	TRIETHYLENETETRAMINE OR, TETRAETHYLENEPENTAMINE	112-57-2, 112-24-3	< 10%

SECTION 4 — FIRST-AID MEASURES

EMERGENCY AND FIRST AID PROCEDURES:

- **EYES:** IMMEDIATELY FLUSH EYES WITH LARGE AMOUNTS OF WATER FOR 15 MINUTES. GET MEDICAL ATTENTION.
- **SKIN:** WASH AFFECTED AREA IMMEDIATELY WITH LARGE AMOUNTS OF SOAP AND WATER. REMOVE AND WASH CONTAMINATED CLOTHING BEFORE REUSE. CONTACT A PHYSICIAN IF IRRITATION OCCURS.
- **INHALATION:** REMOVE VICTIM TO FRESH AIR AND PROVIDE OXYGEN IF BREATHING IS DIFFICULT. GET MEDICAL ATTENTION.
- **INGESTION:** DO NOT INDUCE VOMITING. GIVE LARGE QUANITIES OF WATER. CALL A PHYSICIAN IMMEDIATELY. NEVER GIVE ANYTHING BY MOUTH TO AN UNCONSCIOUS PERSON.

SECTION 5 — FIRE-FIGHTING MEASURES

FLASH POINT: ≥ 250°F (FOR PRODUCT OR LOWEST FLASH POINT INGREDIENT)
FLAMMABILITY CLASSIFICATION: COMBUSTIBLE CLASS (IIIB)
EXTINGUISHING MEDIA: WATER FOG, DRY CHEMICAL, CARBON DIOXIDE, OR FOAM.
NOTE: EITHER ATMOSPHERE-SUPPLY OR AIR-PURIFYING RESPIRATORS SHOULD BE AVAILABLE FOR FIRE FIGHTERS (20 CFR 1910.134).

SECTION 6 — ACCIDENTAL RELEASE MEASURES

- **IF MATERIAL IS SPILLED:** AVOID CONTACT WITH MATERIAL. PERSONS NOT WEARING PROPER PROTECTIVE EQUIPMENT (SEE BELOW) SHOULD BE EXCLUDED FROM THE AREA UNTIL CLEAN UP IS COMPLETE. DIKE AREA TO PREVENT SPILL SPREADING AND SCOOP UP EXCESS TO RECOVERY CONTAINERS. ABSORB REMNANT ON NONCOMBUSTIBLE MATERIAL SUCH AS CLAY AND SHOVEL INTO CONTAINERS FOR DISPOSAL.
- **WASTE DISPOSAL METHOD:** DISPOSE OF ANY WASTE(S) GENERATED ABOVE IN ACCORDANCE WITH FEDERAL, STATE, AND LOCAL REGULATIONS.

SECTION 7 — HANDLING AND STORAGE

- AVOID SKIN AND EYE CONTACT.
- AVOID BREATHING VAPOR, MIST OR FUMES.
- ENSURE THAT ALL CONTAINERS ARE PROPERLY LABELED TO PREVENT ACCIDENTAL INGESTION OR IMPROPER DISPOSAL.
- RESEAL PARTLY USED CONTAINERS.
- WASH WITH SOAP AND WATER BEFORE EATING, DRINKING OR USING TOILET FACILITIES.
- STORE UNDER COOL, DRY CONDITIONS AND AWAY FROM OPEN FLAMES AND HIGH TEMPERATURES.
- OBSERVE CONDITIONS OF GOOD INDUSTRIAL HYGIENE AND SAFE WORKING PRACTICE.

SECTION 8 — EXPOSURE CONTROLS/ PERSONAL PROTECTION

- **RESPIRATORY PROTECTION:** NOT NORMALLY NECESSARY UNLESS THE MATERIAL IS BEING USED IN SUCH A WAY AS TO PRODUCE DUST, MIST, VAPOR, FUMES, OR SMOKE, IN WHICH CASE NIOSH APPROVED RESPIRATORY PROTECTION SHOULD BE USED.
- **VENTILATION:** SHOULD BE SUFFICIENT TO CONTROL ANY DUST, MIST, VAPOR OR FUMES PRODUCED BY PROCESSING OR HANDLING METHOD. BREATHING OF VAPOR MUST BE AVOIDED.
- **HAND PROTECTION:** IMPERVIOUS GLOVES, NEOPRENE OR NITRILE RUBBER GLOVES.
- **EYE PROTECTION:** SPLASH PROOF GOGGLES OR SAFETY GLASSES WITH SIDE SHIELDS.
- **OTHER PROTECTIVE EQUIPMENT:** CLEAN, BODY COVERING CLOTHING AND FOOTWEAR.

SECTION 9 — PHYSICAL AND CHEMICAL PROPERTIES

PHYSICAL STATE.....	LIQUID
ODOR.....	AMMONIA LIKE
COLOR.....	AMBER
pH.....	ALKALINE
SP. GR.....	0.97
DENSITY.....	8.1 lbs. / gal.
VAPOR PRESSURE.....	NEGLIGIBLE

NOTE: OTHER PROPERTIES ARE EITHER NOT AVAILABLE, OR DO NOT APPLY.

SECTION 10 — STABILITY AND REACTIVITY

- **STABILITY:** STABLE UNDER NORMAL STORAGE CONDITIONS. UNSTABLE AT ELEVATED TEMPERATURES. SLOWLY CORRODES COPPER, ALUMINUM, ZINC AND GALVANIZED SURFACES.
- **INCOMPATIBILITY:** STRONG OXIDIZING AGENTS, ORGANIC, LEWIS, OR MINERAL ACIDS, NITROUS ACID, SODIUM HYPOCHLORITE, AND PEROXIDES.
- **HAZARDOUS DECOMPOSITION PRODUCTS:** OXIDES OF CARBON AND NITROGEN, NITRIC ACID, NITROSOAMINE, AND OTHER UNKNOWN ORGANIC COMPOUNDS.

SECTION 11 — TOXICOLOGICAL INFORMATION

EFFECTS OF OVEREXPOSURE:

ACUTE:

- EYES: CAUSES SEVERE CONJUNCTIVAL IRRITATION, CORNEAL INJURY AND IRITIS.
- **SKIN:** MAY CAUSE IRRITATION, BURNS, ULCERATION, OR SKIN SENSITIZATION.
- **INHALATION:** VAPORS ARE IRRITATING AND MAY CAUSE TEARS, BURNING OF NOSE AND THROAT, COUGHING, WHEEZING, NAUSEA, AND VOMITING.
- **INGESTION:** MODERATELY TOXIC, MAY CAUSE MOUTH AND THROAT BURNS, ABDOMINAL PAIN, NAUSEA, VOMITING, WEAKNESS, THIRST, AND COMA.

CHRONIC:

- AMINE VAPORS MAY CAUSE LIVER & KIDNEY INJURY. EYE, SKIN OR LUNG DISORDERS MAY DEVELOP OR BE AGGRAVATED BY AMINES.

SECTION 12 — ECOLOGICAL INFORMATION

ECOTOXICITY EFFECTS:

- **AQUATIC TOXICITY:** NO DATA IS AVAILABLE ON THE PRODUCT ITSELF.
- **TOXICITY TO OTHER ORGANISMS:** NO DATA AVAILABLE.

PERSISTANCE AND DEGRADABILITY:

- **MOBILITY:** NO DATA IS AVAILABLE ON THE PRODUCT ITSELF.
- **BIOACCUMULATION:** NO DATA IS AVAILABLE ON THE PRODUCT ITSELF.

SECTION 13 — DISPOSAL CONSIDERATIONS

- **WASTE DISPOSAL METHOD:** DISPOSE OF WASTE IN ACCORDANCE WITH ALL FEDERAL, STATE, AND LOCAL REGULATIONS.
- **CONTAINER DISPOSAL:** SINCE EMPTIED CONTAINERS RETAIN PRODUCT RESIDUE, ALL LABELED HAZARD PRECAUTIONS MUST BE OBSERVED. CONSULT WITH FEDERAL, STATE, AND LOCAL AUTHORITIES FOR DEFINITIONS OF "EMPTY" AND PROPER DISPOSAL PRACTICES.

SECTION 14 — TRANSPORT INFORMATION

- **U.S. Department of Transportation Ground (49 CFR)**

UN NUMBER.....	UN 1760
PROPER SHIPPING NAME.....	CORROSIVE LIQUID, N.O.S.
CONTAINS.....	MODIFIED AMINE MIXTURE
HAZARD CLASS.....	8
PACKAGING GROUP.....	III

- **International Air Transportation (ICAO/IATA)**

UN NUMBER.....	UN 1760
PROPER SHIPPING NAME.....	CORROSIVE LIQUID, N.O.S.
CONTAINS.....	MODIFIED AMINE MIXTURE
HAZARD CLASS.....	8
PACKAGING GROUP.....	III

- **Water Transportation (IMO/IMDG)**

UN NUMBER.....	UN 1760
PROPER SHIPPING NAME.....	CORROSIVE LIQUID, N.O.S.
CONTAINS.....	MODIFIED AMINE MIXTURE
HAZARD CLASS.....	8
PACKAGING GROUP.....	III
MARINE POLLUTANT.....	NO

SECTION 15 — REGULATORY INFORMATION

A. CAL SAFE DRINKING WATER & TOXIC ENFORCEMENT ACT OF 1986

NO.	CHEMICAL NAME	CAS. NO.	CANCER/REPRO.TOX	QUANTITY

THIS PRODUCT MAY CONTAIN TRACES OF PROP. 65 LISTED CHEMICALS AS IMPURITIES. HOWEVER, ANY USED AS INGREDIENTS ARE LISTED ABOVE.

B. CERCLA — §40 CFR 302.4

RELEASES EXCEEDING THE REPORTABLE QUANTITY (RQ) MUST BE REPORTED TO THE NATIONAL RESPONSE CENTER. (800)424-8802

RQ = 100 lbs. (UNLISTED HAZARDOUS WASTE — CHARACTERISTIC OF CORROSIVITY)

C. RCRA — §40 CFR 261.33

RQ = 1000 lbs. (UNLISTED CORROSIVE CONTENT > 10%)

D. SARA TITLE III — §62 CFR 13378, §62 CFR 21152

NO.	RQ (lbs.) (•1)	TPQ(lbs.) (•2)	SEC.313 (•3)	313 CAT. (•4)	311/312 (•5)
1	NONE	NOT LISTED	NOT LISTED	NONE	H1
2	NONE	NOT LISTED	NOT LISTED	NONE	H1, H2

•1 = REPORTABLE QUANTITY OF EXTREMELY HAZARDOUS SUBSTANCE, SEC. 302
•2 = THRESHOLD PLANNING QUANTITY, EXTREMELY HAZARDOUS SUBSTANCE, SEC. 302
•3 = TOXIC CHEMICAL, SEC. 313 (INDIVIDUAL CHEMICAL LISTED)
•4 = TOXIC RELEASE INVENTORY FORM CATEGORY SEC. 313 (40 CFR 372.65 C)
•5 – HAZARD CATEGORY FOR SARA SEC. 311/312 REPORTING
H1 = IMMED. (ACUTE) HEALTH HAZARD H2 = DELAYED (CHRONIC) HEALTH HAZARD
F2 = FIRE HAZARD P4 = SUDDEN PRESSURE RELEASE HAZARD R5 = REACTIVE HAZ.

E. VOC — SCAQMD RULES

NO.	CHEMICAL	QUANTITY	VP mm Hg	gms./l. @ 20°C
N/E				

NOTE: THIS PRODUCT DOES NOT CONTAIN SOLVENTS, BUT MAY CONTAIN INGREDIENTS WITH VP'S LOW ENOUGH TO BE EMITTED IF HEATED ALONE. WHEN 2 PART RESINS AND HARDENERS ARE PROPERLY MIXED TOGETHER THESE INGREDIENTS REACT TOGETHER AND ARE CONSUMED WITHOUT SIGNIFICANT ATMOSPHERIC EMISSIONS.

F. INTERNATIONAL CHEMICAL INVENTORY STATUS:

EINECS-EU	Listed, Exempted, Polymer substance, or as no longer polymer.
AICS-AUSTRALIA	All components are listed or exempted.
ENCS-JAPAN	All components are listed or exempted.
ISHL-JAPAN	All components are listed or exempted.
KECI/ECL-KOREA	All components are listed or exempted.
IECSC/SEPA-CHINA	All components are listed or exempted.
PICCS-PHILIPPINES	All components are listed or exempted.
DSL-CANADA	All components are listed or exempted.
TSCA-USA	All components are listed or exempted.

G. WHMIS (CANADA):

- WHMIS: D2B Materials Causing Other Toxic Effects –Toxic Material
- WHMIS: E — Corrosive Material

SECTION 16 — OTHER INFORMATION

HMIS III CODES:		RATINGS:	
HEALTH	= 2	0 = MINIMAL	3 = SERIOUS
FLAMMABILITY	= 1	1 = SLIGHT	4 = SEVERE
REACTIVITY	= 0	2 = MODERATE	

⇒ PERSONAL PROTECTION RATING TO BE SUPPLIED BY USER DEPENDING ON CONDITIONS OF USE.

DATE OF PREPARATION: 01/01/2019 SUPERSEDES: 3/31/2017

We believe that the information contained herein is correct as of the date of this Safety Data Sheet. Since the use of this information and these opinions and the conditions of use of this product are not within the control of PTM & W, it is the user's obligation to determine the conditions of safe use of the product.

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— END OF SDS —

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SAFETY DATA SHEET-BLACK POWDER

Section 1: Identification

Product Identifier: Black Powder (includes all grades)

Manufacturer's Name: GOEX Powder, Inc.

Informational Telephone Number:1-(318) 382-9300

Address: P.O. Box 659
Doyline, LA 71023-0659

Emerg. Phone Number: 1-(800) 255-3924 (Chem Tel)

Recommended Use: for use in competitive and recreational shooting, muzzleloading hunting and the U.S. Military .

Section 2: Hazard(s) Identification

Hazard category:	Signal Word	Hazard statement	Pictogram
Division 1.1	Danger	Explosive; mass explosion hazard	

Target Organ Warning: Above OSHA levels, chronic exposure may cause skin irritation and damage to the respiratory system, and acute exposure can cause skin, eye, and respiratory irritation.

Section 3: Composition/information on ingredients

Component	CAS-Number	Weight %
Charcoal	16291-96-6	8-18%
Sulfur	7704-34-9	9-20%
Potassium Nitrate	7757-79-1	70-76%
Graphite (note: not contained in all grades of black powder)	7782-42-5	<1%

Section 4: First-aid measures

Ingestion: * Not a likely route of exposure. If ingested, dilute by giving two glasses of water and induce vomiting. Avoid, when possible and contact a Poison control center for advice on treatment, if unsure.

Eye Contact: * Not a likely route of exposure. Flush eyes with water.

Inhalation: * Remove patient from area to fresh air. If not breathing, give artificial respiration, preferably by mouth to mouth. If breathing is difficult, give oxygen. Seek prompt medical attention. Avoid when possible.

Skin Contact: * wash the affected area with copious amounts of water. Some persons may be sensitive to product.

Injury from detonation: * Seek prompt medical attention immediately.

Note to Physician: * Treat symptomatically.

Section 5: Fire-fighting measures

Extinguishing media: * Water may be used as the extinguishing method. DO NOT FIGHT EXPLOSIVES FIRES. Evacuate the area according to Emergency Response Guide 112 guidelines. Isolate the area and guard against any intruders.

Special Procedures: * Black Powder is extremely flammable and may deflagrate. Get away and evacuate the area.

Unusual Hazards: * As with any pyrotechnic, if under confinement or piled in slight confinement, Black Powder can explode. No known toxic fumes are emitted, but good ventilation should still be present.

Flash Point: not applicable.

Auto ignition Temp: Approximate range: 392^{o} -867^{0}F /(200^{o}-464^{o}C)

NFPA Ratings: **Health=1** **Flammability=3** **Reactivity=1**

Advice and PPE for Firefighters: * Fires involving Black Powder should not be fought unless extinguishing media can be applied from a well protected and distant location from the point of fire. Self-contained breathing apparatus (SCBA) and protective clothing must be worn. Follow Emergency Response Guide 112. Wash all clothes prior to reuse.

Section 6: Accidental release measures

Personal precautions, protective equipment and emergency procedures:

* Non-flammable or flame retardant clothing should be worn when cleaning up spilled material. Material is sensitive to ignition from sources such as heat, flame, impact, friction or sparks. Therefore, non-sparking utensils should be used.

Spill/leak response: * Use appropriate personal protective equipment. Isolate area and remove sources of friction, impact, heat, low level electrical current, electrostatic or RF energy. Only competent, experienced persons should be involved in cleanup procedures.

Environmental precautions:

* Clean up spills immediately using non-sparking utensils Do not dispose of in the ground.

* Spill residues may be disposed of per guidelines under Section 13: Disposal Considerations.

Section 7: Handling and storage

Storage Conditions: * Store in a cool, dry place in accordance with requirements of 27CFR555.201-555.219 (ATF Subpart K)

* Avoid heat, impact, friction and static. Protect against heat effects. Keep away from heat, open flame and ignition sources.

* Absolutely no smoking around open powder or packages. Keep away from combustibles. Avoid electrostatic charges.

* Store in a cool, dry place Do not store in the same area with highly combustible materials.

* Keep containers closed at all times when not being used. Keep out of reach of children. Open and handle container with care.

* Follow all local, state and federal laws when storing this product.

Section 8: Exposure controls/personal protection

Personal protection for routine use:

* Respiratory protection is not normally needed. If significant dusting occurs, a NIOSH approved dust mask should be worn. Good ventilation is recommended when working with Black Powder. Gloves may be worn to protect skin. Safety glasses with side shields are recommended for eye protection. Flame retardant outerwear such as coveralls or lab coat may be worn.

Health Hazards (Acute or chronic): * TLV is unknown for ingestion of dust.

Signs/Symptoms of Exposure: * Burning or itching of the eyes, nose or skin; shortness of breath.

First Aid Procedures: * Remove the patient from exposure and if skin contact, wash the affected area with water

Section 9: Physical and chemical properties

Physical State:	Granular powder	**Solubility:**	Good in water
pH:	6.0-8.0	**Vapor Pressure/Density:**	not applicable
Appearance:	Black in color	**Auto-ignition Temp.:**	392° -867° F /200° -464° C
Odor:	No odor detectable	**Boiling Point:**	Not applicable

Section 10: Stability and reactivity

General Information: * Loading data and the instructions for loading must be observed.

Hazardous decomposition: * Detonation produces hazardous overpressures and fragments (if confined). Gases produced may be toxic if exposed in areas with inadequate ventilation.

Conditions to Avoid: Avoid heat, impact, friction or static. Protect against heat effects. Keep away from heat, open flame and ignition sources. A violent burn or deflagration could occur by above mentioned items.

Substances to Avoid: Avoid contact with alkaline substances or strong acids.

Section 11: Toxicological information

* LD_{50} Values: unknown

* TLV unknown for ingestion of dust. Some persons may be unusually sensitive to the product.

* None of the components of Black Powder are listed as a carcinogen by NTP, IARC or OSHA.

* Routes of entry include Skin, Inhalation and Ingestion. (Acute Toxicity=Category 4) per Table A.1.1 of 29CFR1910.1200

Section 12: Ecological information

* Do not dispose of powder or residues into any water streams or bodies of water. Avoid spilling powders onto any soils. Clean up any spills promptly.

* No known adverse effects on marine or other aquatic organisms.

Section 13: Disposal considerations

* Care must be taken to prevent environmental contamination from the use of this material. The user has the responsibility to dispose of unused material, residues and containers in compliance with all relevant laws and regulations regarding treatment, storage and disposal for hazardous and non-hazardous waste. Powder can be burned in very small quantities and in very thin layer and must only be ignited from a safe distance.

Waste Disposal: * Desensitize by diluting in water. Open train burning, by qualified personnel, may be used for disposal of small unconfined quantities. Dispose of in compliance with Federal Regulations under the authority of RCRA (40CFR Parts 260-271).

* Do not dispose of the black powder container into a fire.

Section 14: Transport information

Label required: Explosive



Highway:

Class or division: 1.1D or 4.1 Flam Solid-(if <100 pounds).

UN Number: UN0027 (NA0027 for 4.1 Flam Solid)

Shipping Name: Black Powder

Air Transport: **Forbidden!**

Maritime IMDG

Class or division: 1.1D

UN Number: UN0027

Shipping Name: Black Powder

Section 15: Regulatory information

* All products related to Black Powder are reported annually as per Community Right-to Know (Tier II). Black Powder has been approved by PHMSA and copies of the approvals are on file with Environmental, Health and Safety Manager.

Section 16: Other information

Prepared By: Mark Wendt, Environmental, Health and Safety Manager email: mwendt@hodgdon.com

SDS Creation Date: April 1, 2014

SDS Print Date: April 1, 2014

Disclaimer:

The information provided on this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guide for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered as a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other material or in any process, unless specified in the text.

Safety Data Sheet

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Document Group:	24-2442-2	**Version Number:**	3.06
Issue Date:	02/14/23	**Supercedes Date:**	03/23/22

Product identifier
3M™ Bondo Glass Reinforced Filler 271, 272, 272M, 272C, 272E, 272ES, 272K, 272T, 272W, 274, 274C, 277, 31272

ID Number	UPC	ID Number	UPC
60-4550-5656-8	00076308002725	60-4550-5661-8	00076308002749
60-4550-5817-6	00076308002725	60-4550-6594-0	00076308002725
60-4550-6601-3	00076308002749	60-4550-7263-1	00051131002777
60-4550-8124-4	00051131312722	60-4551-0303-0	

7010362873, 7010300367, 7010309210, 7000120081, 7000120082, 7010363040, 7100176181

Recommended use
Automotive, Body Repair

Supplier's details

MANUFACTURER:	3M
DIVISION:	Construction and Home Improvement Markets
ADDRESS:	3M Center, St. Paul, MN 55144-1000, USA
Telephone:	1-888-3M HELPS (1-888-364-3577)

Emergency telephone number
1-800-364-3577 or (651) 737-6501 (24 hours)

This product is a kit or a multipart product which consists of multiple, independently packaged components. A Safety Data Sheet (SDS), Article Information Sheet (AIS), or Article Information Letter (AIL) for each of these components is included. Please do not separate the component documents from this cover page. The document numbers for components of this product are:

29-5993-0, 24-2443-0

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Document Group:	29-5993-0	**Version Number:**	6.00
Issue Date:	02/24/22	**Supercedes Date:**	12/07/21

SECTION 1: Identification

1.1. Product identifier
3M™ Cream Hardener (Red, White & Blue)

Product Identification Numbers
LB-K100-0965-7, LB-K100-0965-8, LB-K100-0965-9, LB-K100-0966-0, LB-K100-0966-1, LB-K100-0966-2, LB-K100-0966-3, LB-K100-1035-6, LB-K100-1045-4, LB-K100-1286-7, 41-0003-6674-4, 41-0003-6682-7, 41-0003-6685-0, 41-0003-6686-8, 41-0003-6687-6, 41-0003-7901-0, 41-0003-7903-6, 41-0003-7904-4, 41-0003-7922-6, 41-0003-7928-3, 41-0003-7930-9, 41-0003-7931-7, 41-0003-7932-5, 41-0003-7933-3, 41-0003-7935-8, 41-0003-7987-9, 41-0003-8059-6, 41-0003-8072-9, 41-0003-8073-7, 41-0003-8074-5, 41-0003-8146-1, 60-4550-6617-9, 60-4550-6830-8, 60-4550-6981-9, 60-4550-6982-7, 60-4550-8123-6, 60-4551-0388-1
7000120090, 7010327931, 7000120133, 7100191003

1.2. Recommended use and restrictions on use

Recommended use
Automotive, hardener for body fillers & glazes

1.3. Supplier's details

MANUFACTURER:	3M
DIVISION:	Automotive Aftermarket
ADDRESS:	3M Center, St. Paul, MN 55144-1000, USA
Telephone:	1-888-3M HELPS (1-888-364-3577)

1.4. Emergency telephone number
1-800-364-3577 or (651) 737-6501 (24 hours)

SECTION 2: Hazard identification

The label elements below were prepared in accordance with OSHA Hazard Communication Standard, 29 CFR 1910.1200. This information may be different from the actual product label information for labels regulated by other agencies.

2.1. Hazard classification
Organic Peroxide: Type E.
Serious Eye Damage/Irritation: Category 2A.
Skin Sensitizer: Category 1B.
Specific Target Organ Toxicity (single exposure): Category 1.

2.2. Label elements

Signal word
Danger

Symbols
Flame | Exclamation mark | Health Hazard |

Pictograms



Hazard Statements
Heating may cause a fire.

Causes serious eye irritation.
May cause an allergic skin reaction.

Causes damage to organs:
cardiovascular system |
nervous system |
kidney/urinary tract |
respiratory system |

Precautionary Statements
General:
Keep out of reach of children.

Prevention:
Keep away from heat/sparks/open flames/hot surfaces. - No smoking.
Keep away from clothing and other combustible materials.
Keep only in original container.
Do not breathe dust/fume/gas/mist/vapors/spray.
Wear protective gloves and eye/face protection.
Do not eat, drink or smoke when using this product.
Wash thoroughly after handling.
Contaminated work clothing must not be allowed out of the workplace.

Response:
IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do.
Continue rinsing.
If eye irritation persists: Get medical advice/attention.
IF ON SKIN: Wash with plenty of soap and water.
If skin irritation or rash occurs: Get medical advice/attention.
Wash contaminated clothing before reuse.
IF exposed: Call a POISON CENTER or doctor/physician.
Specific treatment (see Notes to Physician on this label).

Storage:
Protect from sunlight.
Store at temperatures not exceeding 32C/90F. Keep cool.
Store locked up.
Store away from other materials.

Disposal:
Dispose of contents/container in accordance with applicable local/regional/national/international regulations.

Notes to Physician:
This product contains ethylene glycol. If there is reasonable suspicion of ethylene glycol poisoning, intravenous (IV) administration with either fomepizole (preferred) or ethanol (if fomepizole is unavailable) should be considered as part of the medical management.

SECTION 3: Composition/information on ingredients

Ingredient	C.A.S. No.	% by Wt
Benzoyl Peroxide	94-36-0	30 - 60 Trade Secret *
Benzoic Acid, C9-11-Branched Alkyl Esters	131298-44-7	10 - 30 Trade Secret *
Water	7732-18-5	10 - 30 Trade Secret *
Calcium Sulfate	7778-18-9	1 - 10 Trade Secret *
Zinc Stearate	557-05-1	1 - 10 Trade Secret *
Ethylene Glycol	107-21-1	<= 7.5 Trade Secret *
Iron Oxide (FE2O3)	1309-37-1	<= 5 Trade Secret *
Oxirane, Polymer with Methyloxirane, Monobutyl Ether	9038-95-3	<= 5 Trade Secret *
Ferric Ammonium Ferrocyanide	25869-00-5	<= 1 Trade Secret *
Ferric Ferrocyanide	14038-43-8	<= 1 Trade Secret *

*The specific chemical identity and/or exact percentage (concentration) of this composition has been withheld as a trade secret.

SECTION 4: First aid measures

4.1. Description of first aid measures

Inhalation:
Remove person to fresh air. If you feel unwell, get medical attention.

Skin Contact:
Immediately wash with soap and water. Remove contaminated clothing and wash before reuse. If signs/symptoms develop, get medical attention.

Eye Contact:
Immediately flush with large amounts of water. Remove contact lenses if easy to do. Continue rinsing. Get medical attention.

If Swallowed:
Rinse mouth. If you feel unwell, get medical attention.

4.2. Most important symptoms and effects, both acute and delayed

Allergic skin reaction (redness, swelling, blistering, and itching). Target organ effects. See Section 11 for additional details.

4.3. Indication of any immediate medical attention and special treatment required
This product contains ethylene glycol. If there is reasonable suspicion of ethylene glycol poisoning, intravenous (IV) administration with either fomepizole (preferred) or ethanol (if fomepizole is unavailable) should be considered as part of the medical management.

SECTION 5: Fire-fighting measures

5.1. Suitable extinguishing media
In case of fire: Use a fire fighting agent suitable for ordinary combustible material such as water or foam to extinguish.

5.2. Special hazards arising from the substance or mixture

Closed containers exposed to heat from fire may build pressure and explode. Part of the oxygen for combustion is supplied by the peroxide itself.

5.3. Special protective actions for fire-fighters
Wear full protective clothing, including helmet, self-contained, positive pressure or pressure demand breathing apparatus, bunker coat and pants, bands around arms, waist and legs, face mask, and protective covering for exposed areas of the head.

SECTION 6: Accidental release measures

6.1. Personal precautions, protective equipment and emergency procedures
Evacuate area. Eliminate all ignition sources if safe to do so. Keep away from heat/sparks/open flames/hot surfaces. - No smoking. Use only non-sparking tools. Ventilate the area with fresh air. For large spill, or spills in confined spaces, provide mechanical ventilation to disperse or exhaust vapors, in accordance with good industrial hygiene practice. Warning! A motor could be an ignition source and could cause flammable gases or vapors in the spill area to burn or explode. Refer to other sections of this SDS for information regarding physical and health hazards, respiratory protection, ventilation, and personal protective equipment.

6.2. Environmental precautions
Avoid release to the environment. For larger spills, cover drains and build dikes to prevent entry into sewer systems or bodies of water.

6.3. Methods and material for containment and cleaning up
Collect as much of the spilled material as possible using non-sparking tools. Place in a closed container approved for transportation by appropriate authorities. Clean up residue. Seal the container. Dispose of collected material as soon as possible in accordance with applicable local/regional/national/international regulations.

SECTION 7: Handling and storage

7.1. Precautions for safe handling
Do not use in a confined area with minimal air exchange. Keep out of reach of children. Keep away from heat/sparks/open flames/hot surfaces. - No smoking. Do not breathe dust/fume/gas/mist/vapors/spray. Do not get in eyes, on skin, or on clothing. Do not eat, drink or smoke when using this product. Wash thoroughly after handling. Contaminated work clothing should not be allowed out of the workplace. Avoid release to the environment. Wash contaminated clothing before reuse.

7.2. Conditions for safe storage including any incompatibilities
Keep container tightly closed. Protect from sunlight. Store away from heat. Store at temperatures not exceeding 32C/90F. Keep cool. Keep only in original container. Store away from other materials. Keep/store away from clothing and other combustible materials.

SECTION 8: Exposure controls/personal protection

8.1. Control parameters

Occupational exposure limits
If a component is disclosed in section 3 but does not appear in the table below, an occupational exposure limit is not available for the component.

Ingredient	C.A.S. No.	Agency	Limit type	Additional Comments
Ethylene Glycol	107-21-1	ACGIH	TWA(Vapor fraction):25 ppm;STEL(Vapor fraction):50 ppm;STEL(Inhalable aerosol):10 mg/m3	A4: Not class. as human carcin
Iron Oxide (FE2O3)	1309-37-1	ACGIH	TWA(respirable fraction):5 mg/m3	A4: Not class. as human carcin

Iron Oxide (FE2O3)	1309-37-1	OSHA	TWA(as fume):10 mg/m3	
CYANIDES	14038-43-8	OSHA	TWA(as CN):5 mg/m3	SKIN
Zinc Stearate	557-05-1	OSHA	TWA(as total dust):15 mg/m3;TWA(respirable fraction):5 mg/m3	
Calcium Sulfate	7778-18-9	ACGIH	TWA(inhalable fraction):10 mg/m3	
Calcium Sulfate	7778-18-9	OSHA	TWA(as total dust):15 mg/m3;TWA(respirable fraction):5 mg/m3	
Benzoyl Peroxide	94-36-0	ACGIH	TWA:5 mg/m3	A4: Not class. as human carcin
Benzoyl Peroxide	94-36-0	OSHA	TWA:5 mg/m3	

ACGIH : American Conference of Governmental Industrial Hygienists
AIHA : American Industrial Hygiene Association
CMRG : Chemical Manufacturer's Recommended Guidelines
OSHA : United States Department of Labor - Occupational Safety and Health Administration
TWA: Time-Weighted-Average
STEL: Short Term Exposure Limit
CEIL: Ceiling

8.2. Exposure controls

8.2.1. Engineering controls
Provide ventilation adequate to maintain dust concentration below minimum explosive concentrations. Use general dilution ventilation and/or local exhaust ventilation to control airborne exposures to below relevant Exposure Limits and/or control dust/fume/gas/mist/vapors/spray. If ventilation is not adequate, use respiratory protection equipment.

8.2.2. Personal protective equipment (PPE)

Eye/face protection

Select and use eye/face protection to prevent contact based on the results of an exposure assessment. The following eye/face protection(s) are recommended:
Indirect Vented Goggles

Skin/hand protection
Select and use gloves and/or protective clothing approved to relevant local standards to prevent skin contact based on the results of an exposure assessment. Selection should be based on use factors such as exposure levels, concentration of the substance or mixture, frequency and duration, physical challenges such as temperature extremes, and other use conditions. Consult with your glove and/or protective clothing manufacturer for selection of appropriate compatible gloves/protective clothing. Note: Nitrile gloves may be worn over polymer laminate gloves to improve dexterity.
Gloves made from the following material(s) are recommended: Polymer laminate

If this product is used in a manner that presents a higher potential for exposure (eg. spraying, high splash potential etc.), then use of protective coveralls may be necessary. Select and use body protection to prevent contact based on the results of an exposure assessment. The following protective clothing material(s) are recommended: Apron - polymer laminate

Respiratory protection

An exposure assessment may be needed to decide if a respirator is required. If a respirator is needed, use respirators as part of a full respiratory protection program. Based on the results of the exposure assessment, select from the following respirator type(s) to reduce inhalation exposure:
Half facepiece or full facepiece air-purifying respirator suitable for organic vapors and particulates

For questions about suitability for a specific application, consult with your respirator manufacturer.

SECTION 9: Physical and chemical properties

9.1. Information on basic physical and chemical properties

Appearance	
Physical state	Solid
Color	Red
Specific Physical Form:	Paste
Odor	Slight Ester
Odor threshold	*No Data Available*
pH	*No Data Available*
Melting point	*No Data Available*
Boiling Point	*No Data Available*
Flash Point	111 ºC [*Test Method:*Estimated]
Evaporation rate	*No Data Available*
Flammability (solid, gas)	Organic Peroxide: Type E.
Flammable Limits(LEL)	*Not Applicable*
Flammable Limits(UEL)	*Not Applicable*
Vapor Pressure	*Not Applicable*
Vapor Density	*Not Applicable*
Density	1.2 g/cm3
Specific Gravity	1.2 [@ 25 ºC] [*Ref Std:*WATER=1]
Solubility in Water	Negligible
Solubility- non-water	*No Data Available*
Partition coefficient: n-octanol/ water	*No Data Available*
Autoignition temperature	*No Data Available*
Decomposition temperature	*No Data Available*
Viscosity	*No Data Available*
Hazardous Air Pollutants	0 - 0.1209 lb HAPS/lb solids [*Test Method:*Calculated]
Molecular weight	*Not Applicable*
Volatile Organic Compounds	0 - 90 g/l [*Test Method:*calculated SCAQMD rule 443.1]
Volatile Organic Compounds	0 % weight [*Test Method:*calculated per CARB title 2]
Percent volatile	21 - 28.5 %
VOC Less H2O & Exempt Solvents	0 - 121 g/l [*Test Method:*calculated SCAQMD rule 443.1]

SECTION 10: Stability and reactivity

10.1. Reactivity
This material may be reactive with certain agents under certain conditions - see the remaining headings in this section.

10.2. Chemical stability
Stable. Stable unless exposed to heat, flames and drying conditions.

10.3. Possibility of hazardous reactions
Hazardous polymerization will not occur.

10.4. Conditions to avoid
Heat

10.5. Incompatible materials
Accelerators

10.6. Hazardous decomposition products

Substance	Condition
Carbon monoxide	Not Specified

Carbon dioxide	Not Specified
Toxic Vapor, Gas, Particulate	Not Specified

SECTION 11: Toxicological information

The information below may not be consistent with the material classification in Section 2 if specific ingredient classifications are mandated by a competent authority. In addition, toxicological data on ingredients may not be reflected in the material classification and/or the signs and symptoms of exposure, because an ingredient may be present below the threshold for labeling, an ingredient may not be available for exposure, or the data may not be relevant to the material as a whole.

11.1. Information on Toxicological effects

Signs and Symptoms of Exposure

Based on test data and/or information on the components, this material may produce the following health effects:

Inhalation:
Respiratory Tract Irritation: Signs/symptoms may include cough, sneezing, nasal discharge, headache, hoarseness, and nose and throat pain.

Skin Contact:
May be harmful in contact with skin.
Allergic Skin Reaction (non-photo induced): Signs/symptoms may include redness, swelling, blistering, and itching.

Eye Contact:
Severe Eye Irritation: Signs/symptoms may include significant redness, swelling, pain, tearing, cloudy appearance of the cornea, and impaired vision.

Ingestion:
Gastrointestinal Irritation: Signs/symptoms may include abdominal pain, stomach upset, nausea, vomiting and diarrhea.

May cause additional health effects (see below).

Additional Health Effects:

Single exposure may cause target organ effects:
Cardiac Effects: Signs/symptoms may include irregular heartbeat (arrhythmia), changes in heart rate, damage to heart muscle, heart attack, and may be fatal.

Neurological Effects: Signs/symptoms may include personality changes, lack of coordination, sensory loss, tingling or numbness of the extremities, weakness, tremors, and/or changes in blood pressure and heart rate.

Respiratory Effects: Signs/symptoms may include cough, shortness of breath, chest tightness, wheezing, increased heart rate, bluish colored skin (cyanosis), sputum production, changes in lung function tests, and/or respiratory failure.

Kidney/Bladder Effects: Signs/symptoms may include changes in urine production, abdominal or lower back pain, increased protein in urine, increased blood urea nitrogen (BUN), blood in urine, and painful urination.

Toxicological Data
If a component is disclosed in section 3 but does not appear in a table below, either no data are available for that endpoint or the data are not sufficient for classification.

Acute Toxicity

Name	Route	Species	Value

Overall product	Dermal		No data available; calculated ATE >2,000 - ≤5,000 mg/kg
Overall product	Inhalation-Dust/Mist(4 hr)		No data available; calculated ATE >12.5 mg/l
Overall product	Ingestion		No data available; calculated ATE >5,000 mg/kg
Benzoyl Peroxide	Dermal		LD50 estimated to be 2,000 - 5,000 mg/kg
Benzoyl Peroxide	Inhalation-Dust/Mist (4 hours)	Rat	LC50 > 24.3 mg/l
Benzoyl Peroxide	Ingestion	Rat	LD50 > 5,000 mg/kg
Benzoic Acid, C9-11-Branched Alkyl Esters	Dermal	Rabbit	LD50 > 2,000 mg/kg
Benzoic Acid, C9-11-Branched Alkyl Esters	Inhalation-Dust/Mist (4 hours)	Rat	LC50 > 5 mg/l
Benzoic Acid, C9-11-Branched Alkyl Esters	Ingestion	Rat	LD50 > 5,000 mg/kg
Calcium Sulfate	Dermal	Professional judgement	LD50 estimated to be > 5,000 mg/kg
Calcium Sulfate	Ingestion	Rat	LD50 > 5,000 mg/kg
Zinc Stearate	Dermal	Rabbit	LD50 > 2,000 mg/kg
Zinc Stearate	Inhalation-Dust/Mist (4 hours)	Rat	LC50 > 50 mg/l
Zinc Stearate	Ingestion	Rat	LD50 > 5,000 mg/kg
Ethylene Glycol	Ingestion	Human	LD50 1,600 mg/kg
Ethylene Glycol	Inhalation-Dust/Mist (4 hours)	Other	LC50 estimated to be 5 - 12.5 mg/l
Ethylene Glycol	Dermal	Rabbit	9,530 mg/kg
Iron Oxide (FE2O3)	Dermal	Not available	LD50 3,100 mg/kg
Iron Oxide (FE2O3)	Ingestion	Not available	LD50 3,700 mg/kg
Oxirane, Polymer with Methyloxirane, Monobutyl Ether	Dermal	Rabbit	LD50 > 16,960 mg/kg
Oxirane, Polymer with Methyloxirane, Monobutyl Ether	Inhalation-Dust/Mist (4 hours)	Rat	LC50 > 5 mg/l
Oxirane, Polymer with Methyloxirane, Monobutyl Ether	Ingestion	Rat	LD50 4,240 mg/kg
Ferric Ammonium Ferrocyanide	Dermal		LD50 estimated to be > 5,000 mg/kg
Ferric Ferrocyanide	Dermal		LD50 estimated to be > 5,000 mg/kg
Ferric Ammonium Ferrocyanide	Ingestion	Rat	LD50 > 5,110 mg/kg
Ferric Ferrocyanide	Ingestion	Rat	LD50 > 8,000 mg/kg

ATE = acute toxicity estimate

Skin Corrosion/Irritation

Name	Species	Value
Benzoyl Peroxide	Rabbit	Minimal irritation
Zinc Stearate	Rabbit	No significant irritation
Ethylene Glycol	Rabbit	Minimal irritation
Iron Oxide (FE2O3)	Rabbit	No significant irritation
Oxirane, Polymer with Methyloxirane, Monobutyl Ether	Rabbit	Minimal irritation

Serious Eye Damage/Irritation

Name	Species	Value
Benzoyl Peroxide	Rabbit	Severe irritant
Zinc Stearate	Rabbit	No significant irritation
Ethylene Glycol	Rabbit	Mild irritant
Iron Oxide (FE2O3)	Rabbit	No significant irritation
Oxirane, Polymer with Methyloxirane, Monobutyl Ether	Rabbit	No significant irritation

Skin Sensitization

Name	Species	Value
Benzoyl Peroxide	Guinea pig	Sensitizing
Ethylene Glycol	Human	Not classified
Iron Oxide (FE2O3)	Human	Not classified

Respiratory Sensitization

For the component/components, either no data are currently available or the data are not sufficient for classification.

Germ Cell Mutagenicity

Name	Route	Value
Benzoyl Peroxide	In Vitro	Not mutagenic
Benzoyl Peroxide	In vivo	Not mutagenic
Ethylene Glycol	In Vitro	Not mutagenic
Ethylene Glycol	In vivo	Not mutagenic
Iron Oxide (FE2O3)	In Vitro	Not mutagenic

Carcinogenicity

Name	Route	Species	Value
Benzoyl Peroxide	Ingestion	Multiple animal species	Not carcinogenic
Benzoyl Peroxide	Dermal	Mouse	Some positive data exist, but the data are not sufficient for classification
Ethylene Glycol	Ingestion	Multiple animal species	Not carcinogenic
Iron Oxide (FE2O3)	Inhalation	Human	Some positive data exist, but the data are not sufficient for classification
Oxirane, Polymer with Methyloxirane, Monobutyl Ether	Ingestion	Rat	Not carcinogenic

Reproductive Toxicity

Reproductive and/or Developmental Effects

Name	Route	Value	Species	Test Result	Exposure Duration
Benzoyl Peroxide	Ingestion	Not classified for female reproduction	Rat	NOAEL 1,000 mg/kg/day	premating & during gestation
Benzoyl Peroxide	Ingestion	Not classified for male reproduction	Rat	NOAEL 500 mg/kg/day	premating & during gestation
Benzoyl Peroxide	Ingestion	Not classified for development	Rat	NOAEL 500 mg/kg/day	premating & during gestation
Ethylene Glycol	Dermal	Not classified for development	Mouse	NOAEL 3,549 mg/kg/day	during organogenesis
Ethylene Glycol	Ingestion	Not classified for development	Mouse	LOAEL 750 mg/kg/day	during organogenesis
Ethylene Glycol	Inhalation	Not classified for development	Mouse	NOAEL 1,000 mg/kg/day	during organogenesis
Oxirane, Polymer with Methyloxirane, Monobutyl Ether	Inhalation	Not classified for male reproduction	Rat	NOAEL 1 mg/l	2 weeks

Target Organ(s)

Specific Target Organ Toxicity - single exposure

Name	Route	Target Organ(s)	Value	Species	Test Result	Exposure Duration
Ethylene Glycol	Ingestion	heart | nervous system | kidney and/or bladder | respiratory system	Causes damage to organs	Human	NOAEL Not available	poisoning and/or abuse
Ethylene Glycol	Ingestion	central nervous system depression	May cause drowsiness or dizziness	Human	NOAEL Not available	poisoning and/or abuse
Ethylene Glycol	Ingestion	liver	Not classified	Human	NOAEL Not available	poisoning and/or abuse
Oxirane, Polymer with Methyloxirane, Monobutyl Ether	Ingestion	nervous system	Not classified	Rat	NOAEL Not available	

Specific Target Organ Toxicity - repeated exposure

Name	Route	Target Organ(s)	Value	Species	Test Result	Exposure Duration
Ethylene Glycol	Ingestion	kidney and/or bladder	Some positive data exist, but the data are not sufficient for classification	Rat	NOAEL 200 mg/kg/day	2 years
Ethylene Glycol	Ingestion	vascular system	Not classified	Rat	NOAEL 200 mg/kg/day	2 years
Ethylene Glycol	Ingestion	heart | hematopoietic system | liver | immune system | muscles	Not classified	Rat	NOAEL 1,000 mg/kg/day	2 years
Ethylene Glycol	Ingestion	respiratory system	Not classified	Mouse	NOAEL 12,000 mg/kg/day	2 years
Ethylene Glycol	Ingestion	skin | endocrine system | bone, teeth, nails, and/or hair | nervous system | eyes	Not classified	Multiple animal species	NOAEL 1,000 mg/kg/day	2 years
Iron Oxide (FE2O3)	Inhalation	pulmonary fibrosis | pneumoconiosis	Not classified	Human	NOAEL Not available	occupational exposure
Oxirane, Polymer with Methyloxirane, Monobutyl Ether	Inhalation	endocrine system | hematopoietic system | liver | nervous system	Not classified	Rat	NOAEL 1 mg/l	2 weeks
Oxirane, Polymer with Methyloxirane, Monobutyl Ether	Inhalation	kidney and/or bladder	Not classified	Rat	NOAEL 0.005 mg/l	2 weeks
Oxirane, Polymer with Methyloxirane, Monobutyl Ether	Inhalation	respiratory system	Not classified	Rat	LOAEL 0.001 mg/l	2 weeks
Oxirane, Polymer with Methyloxirane, Monobutyl Ether	Inhalation	heart	Not classified	Rat	NOAEL 0.5 mg/l	2 weeks
Oxirane, Polymer with Methyloxirane, Monobutyl Ether	Ingestion	liver | kidney and/or bladder	Some positive data exist, but the data are not sufficient for classification	Rat	NOAEL 145 mg/kg/day	90 days
Oxirane, Polymer with Methyloxirane, Monobutyl Ether	Ingestion	hematopoietic system	Not classified	Rat	NOAEL 500 mg/kg/day	2 years
Oxirane, Polymer with Methyloxirane, Monobutyl Ether	Ingestion	heart | endocrine system | respiratory system	Not classified	Rat	NOAEL 3,770 mg/kg/day	90 days

Aspiration Hazard

For the component/components, either no data are currently available or the data are not sufficient for classification.

Please contact the address or phone number listed on the first page of the SDS for additional toxicological information on this material and/or its components.

SECTION 12: Ecological information

Ecotoxicological information

Please contact the address or phone number listed on the first page of the SDS for additional ecotoxicological information on this material and/or its components.

Chemical fate information

Please contact the address or phone number listed on the first page of the SDS for additional chemical fate information on this material and/or its components.

SECTION 13: Disposal considerations

13.1. Disposal methods

Dispose of contents/ container in accordance with the local/regional/national/international regulations.

Dispose of waste product in a permitted industrial waste facility. As a disposal alternative, incinerate in a permitted waste incineration facility. Proper destruction may require the use of additional fuel during incineration processes. Empty drums/barrels/containers used for transporting and handling hazardous chemicals (chemical substances/mixtures/preparations classified as Hazardous as per applicable regulations) shall be considered, stored, treated & disposed of as hazardous wastes unless otherwise defined by applicable waste regulations. Consult with the respective regulating authorities to determine the available treatment and disposal facilities.

SECTION 14: Transport Information

For Transport Information, please visit http://3M.com/Transportinfo or call 1-800-364-3577 or 651-737-6501.

SECTION 15: Regulatory information

15.1. US Federal Regulations

Contact 3M for more information.

EPCRA 311/312 Hazard Classifications:

Physical Hazards
Organic peroxide

Health Hazards
Respiratory or Skin Sensitization
Serious eye damage or eye irritation
Specific target organ toxicity (single or repeated exposure)

Section 313 Toxic Chemicals subject to the reporting requirements of that section and 40 CFR part 372 (EPCRA):

Ingredient	C.A.S. No	% by Wt
Ethylene Glycol	107-21-1	Trade Secret <= 7.5
Zinc Stearate (ZINC COMPOUNDS)	557-05-1	Trade Secret 1 - 10
Benzoyl Peroxide	94-36-0	Trade Secret 30 - 60
Ferric Ferrocyanide (CYANIDES)	14038-43-8	Trade Secret <= 1

15.2. State Regulations

Contact 3M for more information.

15.3. Chemical Inventories
The components of this product are in compliance with the chemical notification requirements of TSCA. All required components of this product are listed on the active portion of the TSCA Inventory.

Contact 3M for more information.

15.4. International Regulations
Contact 3M for more information.

This SDS has been prepared to meet the U.S. OSHA Hazard Communication Standard, 29 CFR 1910.1200.

SECTION 16: Other information

NFPA Hazard Classification
Health: 2 **Flammability:** 1 **Instability:** 0 **Special Hazards:** Oxidizer

National Fire Protection Association (NFPA) hazard ratings are designed for use by emergency response personnel to address the hazards that are presented by short-term, acute exposure to a material under conditions of fire, spill, or similar emergencies. Hazard ratings are primarily based on the inherent physical and toxic properties of the material but also include the toxic properties of combustion or decomposition products that are known to be generated in significant quantities.

HMIS Hazard Classification
Health: 4 **Flammability:** 1 **Physical Hazard:** 0 **Personal Protection:** X - See PPE section.

Hazardous Material Identification System (HMIS® IV) hazard ratings are designed to inform employees of chemical hazards in the workplace. These ratings are based on the inherent properties of the material under expected conditions of normal use and are not intended for use in emergency situations. HMIS® IV ratings are to be used with a fully implemented HMIS® IV program. HMIS® is a registered mark of the American Coatings Association (ACA).

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Safety Data Sheet

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Document Group:	24-2443-0	**Version Number:**	10.00
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SECTION 1: Identification

1.1. Product identifier
3M™ Bondo Glass Reinforced Filler, P.N. 270, 271, 272, 272C, 272E, 272ES, 272K, 272T, 272W, 274, 274C, 277

Product Identification Numbers

ID Number	UPC	ID Number	UPC
LB-K100-0411-5		LB-K100-0411-6	
LB-K100-0525-3		LB-K100-0525-4	
LB-K100-0525-6		LB-K100-1045-3	
LB-K100-1380-6		41-3701-1515-0	

1.2. Recommended use and restrictions on use

Recommended use
Automotive, Repairing autobody

1.3. Supplier's details

MANUFACTURER:	3M
DIVISION:	Construction and Home Improvement Markets
ADDRESS:	3M Center, St. Paul, MN 55144-1000, USA
Telephone:	1-888-3M HELPS (1-888-364-3577)

1.4. Emergency telephone number
1-800-364-3577 or (651) 737-6501 (24 hours)

SECTION 2: Hazard identification

The label elements below were prepared in accordance with OSHA Hazard Communication Standard, 29 CFR 1910.1200. This information may be different from the actual product label information for labels regulated by other agencies.

2.1. Hazard classification
Flammable Liquid: Category 3.
Serious Eye Damage/Irritation: Category 2B.
Carcinogenicity: Category 1A.
Specific Target Organ Toxicity (single exposure): Category 1.
Specific Target Organ Toxicity (repeated exposure): Category 1.

2.2. Label elements
Signal word

Danger

Symbols
Flame | Health Hazard |

Pictograms



Hazard Statements
Flammable liquid and vapor.

Causes eye irritation.
May cause cancer.

Causes damage to organs:
liver |
sensory organs |

Causes damage to organs through prolonged or repeated exposure:
respiratory system |
sensory organs |

May cause damage to organs through prolonged or repeated exposure:
liver |

Precautionary Statements
General:
Keep out of reach of children.

Prevention:
Obtain special instructions before use.
Do not handle until all safety precautions have been read and understood.
Keep away from heat/sparks/open flames/hot surfaces. - No smoking.
Ground/bond container and receiving equipment.
Use only non-sparking tools.
Take precautionary measures against static discharge.
Keep container tightly closed.
Use explosion-proof electrical/ventilating/lighting equipment.
Do not breathe dust/fume/gas/mist/vapors/spray.
Wear protective gloves and eye/face protection.
Do not eat, drink or smoke when using this product.
Wash thoroughly after handling.

Response:
IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower.
IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
If eye irritation persists: Get medical advice/attention.
IF exposed or concerned: Get medical advice/attention.
In case of fire: Use a fire fighting agent suitable for flammable liquids such as dry chemical or carbon dioxide to extinguish.

Storage:
Store in a well-ventilated place. Keep cool.
Store locked up.

Disposal:
Dispose of contents/container in accordance with applicable local/regional/national/international regulations.

30% of the mixture consists of ingredients of unknown acute oral toxicity.
30% of the mixture consists of ingredients of unknown acute dermal toxicity.
30% of the mixture consists of ingredients of unknown acute inhalation toxicity.

SECTION 3: Composition/information on ingredients

Ingredient	C.A.S. No.	% by Wt
Polyester Resin	Trade Secret*	15 - 40 Trade Secret *
Talc	14807-96-6	< 35 Trade Secret *
Magnesium Carbonate	546-93-0	< 20 Trade Secret *
Styrene Monomer	100-42-5	< 20 Trade Secret *
Limestone	1317-65-3	< 6 Trade Secret *
Oxide Glass Chemicals	65997-17-3	1 - 5 Trade Secret *
Synthetic Crystalline-Free Silica Gel	112926-00-8	1 - 5 Trade Secret *
Wollastonite	13983-17-0	1 - 5 Trade Secret *
Chlorite	1318-59-8	< 3 Trade Secret *
Dolomite	16389-88-1	< 3 Trade Secret *
Quartz Silica	14808-60-7	< 1 Trade Secret *
Dimethylaniline	121-69-7	< 0.5 Trade Secret *
N,N-Diethylaniline	91-66-7	< 0.5 Trade Secret *

*The specific chemical identity and/or exact percentage (concentration) of this composition has been withheld as a trade secret.

SECTION 4: First aid measures

4.1. Description of first aid measures

Inhalation:
Remove person to fresh air. If you feel unwell, get medical attention.

Skin Contact:
Immediately wash with soap and water. Remove contaminated clothing and wash before reuse. If signs/symptoms develop, get medical attention.

Eye Contact:
Immediately flush with large amounts of water for at least 15 minutes. Remove contact lenses if easy to do. Continue rinsing. Immediately get medical attention.

If Swallowed:
Rinse mouth. If you feel unwell, get medical attention.

4.2. Most important symptoms and effects, both acute and delayed

Target organ effects. See Section 11 for additional details. Target organ effects following prolonged or repeated exposure. See Section 11 for additional details.

4.3. Indication of any immediate medical attention and special treatment required

Not applicable

SECTION 5: Fire-fighting measures

5.1. Suitable extinguishing media
In case of fire: Use a fire fighting agent suitable for flammable liquids such as dry chemical or carbon dioxide to extinguish.

5.2. Special hazards arising from the substance or mixture
Closed containers exposed to heat from fire may build pressure and explode.

Hazardous Decomposition or By-Products

Substance	Condition
Carbon monoxide	During Combustion
Carbon dioxide	During Combustion
Toxic Vapor, Gas, Particulate	During Combustion

5.3. Special protective actions for fire-fighters
Water may not effectively extinguish fire; however, it should be used to keep fire-exposed containers and surfaces cool and prevent explosive rupture. Wear full protective clothing, including helmet, self-contained, positive pressure or pressure demand breathing apparatus, bunker coat and pants, bands around arms, waist and legs, face mask, and protective covering for exposed areas of the head.

SECTION 6: Accidental release measures

6.1. Personal precautions, protective equipment and emergency procedures
Evacuate area. Keep away from heat/sparks/open flames/hot surfaces. - No smoking. Use only non-sparking tools. Ventilate the area with fresh air. For large spill, or spills in confined spaces, provide mechanical ventilation to disperse or exhaust vapors, in accordance with good industrial hygiene practice. Warning! A motor could be an ignition source and could cause flammable gases or vapors in the spill area to burn or explode. Refer to other sections of this SDS for information regarding physical and health hazards, respiratory protection, ventilation, and personal protective equipment.

6.2. Environmental precautions
Avoid release to the environment. For larger spills, cover drains and build dikes to prevent entry into sewer systems or bodies of water.

6.3. Methods and material for containment and cleaning up
Cover spill area with a fire-extinguishing foam. Working from around the edges of the spill inward, cover with bentonite, vermiculite, or commercially available inorganic absorbent material. Mix in sufficient absorbent until it appears dry. Remember, adding an absorbent material does not remove a physical, health, or environmental hazard. Collect as much of the spilled material as possible using non-sparking tools. Place in a metal container approved for transportation by appropriate authorities. Clean up residue with an appropriate solvent selected by a qualified and authorized person. Ventilate the area with fresh air. Read and follow safety precautions on the solvent label and SDS. Seal the container. Dispose of collected material as soon as possible in accordance with applicable local/regional/national/international regulations.

SECTION 7: Handling and storage

7.1. Precautions for safe handling
Keep out of reach of children. Do not handle until all safety precautions have been read and understood. Keep away from heat/sparks/open flames/hot surfaces. - No smoking. Use only non-sparking tools. Take precautionary measures against static discharge. Do not breathe dust/fume/gas/mist/vapors/spray. Do not get in eyes, on skin, or on clothing. Do not eat, drink or smoke when using this product. Wash thoroughly after handling. Avoid release to the environment. Avoid contact with oxidizing agents (eg. chlorine, chromic acid etc.) Wear low static or properly grounded shoes. Use personal protective equipment (gloves, respirators, etc.) as required. To minimize the risk of ignition, determine applicable electrical

classifications for the process using this product and select specific local exhaust ventilation equipment to avoid flammable vapor accumulation. Ground/bond container and receiving equipment if there is potential for static electricity accumulation during transfer.

7.2. Conditions for safe storage including any incompatibilities
Store in a well-ventilated place. Keep cool. Keep container tightly closed. Store away from heat. Store away from acids. Store away from strong bases. Store away from oxidizing agents.

SECTION 8: Exposure controls/personal protection

8.1. Control parameters

Occupational exposure limits
If a component is disclosed in section 3 but does not appear in the table below, an occupational exposure limit is not available for the component.

Ingredient	C.A.S. No.	Agency	Limit type	Additional Comments
Styrene Monomer	100-42-5	ACGIH	TWA:10 ppm;STEL:20 ppm	A3: Confirmed animal carcin., Ototoxicant
Styrene Monomer	100-42-5	OSHA	TWA:100 ppm;CEIL:200 ppm	
SILICA, AMORPHOUS	112926-00-8	OSHA	TWA:20 millions of particles/cu. ft.;TWA concentration:0.8 mg/m3	
Dimethylaniline	121-69-7	ACGIH	TWA:5 ppm;STEL:10 ppm	A4: Not class. as human carcin, Danger of cutaneous absorption
Dimethylaniline	121-69-7	OSHA	TWA:25 mg/m3(5 ppm)	SKIN
Limestone	1317-65-3	OSHA	TWA(as total dust):15 mg/m3;TWA(respirable fraction):5 mg/m3	
Wollastonite	13983-17-0	ACGIH	TWA(inhalable fraction):1 mg/m3	A4: Not class. as human carcin
Talc	14807-96-6	ACGIH	TWA(respirable fraction):2 mg/m3	A4: Not class. as human carcin
Talc	14807-96-6	OSHA	TWA concentration(respirable):0.1 mg/m3(2.4 millions of particles/cu. ft.);TWA:20 millions of particles/cu. ft.	
Quartz Silica	14808-60-7	ACGIH	TWA(respirable fraction):0.025 mg/m3	A2: Suspected human carcin.
Quartz Silica	14808-60-7	OSHA	TWA Table Z-1(respirable):0.05 mg/m3;TWA Table Z-3(respirable):0.1 mg/m3;TWA concentration(respirable):0.1 mg/m3(2.4 millions of particles/cu. ft.)	
DUST, INERT OR NUISANCE	16389-88-1	OSHA	TWA(as total dust):15 mg/m3;TWA(as total dust):50 millions of particles/cu. ft.(15 mg/m3);TWA(respirable fraction):5 mg/m3;TWA(respirable fraction):15 millions of	

			particles/cu. ft.(5 mg/m3)	
Magnesium Carbonate	546-93-0	OSHA	TWA(as total dust):15 mg/m3;TWA(respirable fraction):5 mg/m3	
CONTINUOUS FILAMENT GLASS FIBERS	65997-17-3	ACGIH	TWA(as fiber):1 fiber/cc	A4: Not class. as human carcin
CONTINUOUS FILAMENT GLASS FIBERS, INHALABLE FRACTION	65997-17-3	ACGIH	TWA(inhalable fraction):5 mg/m3	A4: Not class. as human carcin
Oxide Glass Chemicals	65997-17-3	Manufacturer determined	TWA(as non-fibrous, respirable)(8 hours):3 mg/m3;TWA(as non-fibrous, inhalable fraction)(8 hours):10 mg/m3	

ACGIH : American Conference of Governmental Industrial Hygienists
AIHA : American Industrial Hygiene Association
CMRG : Chemical Manufacturer's Recommended Guidelines
OSHA : United States Department of Labor - Occupational Safety and Health Administration
TWA: Time-Weighted-Average
STEL: Short Term Exposure Limit
CEIL: Ceiling

8.2. Exposure controls

8.2.1. Engineering controls
Use general dilution ventilation and/or local exhaust ventilation to control airborne exposures to below relevant Exposure Limits and/or control dust/fume/gas/mist/vapors/spray. If ventilation is not adequate, use respiratory protection equipment. Use explosion-proof ventilation equipment.

8.2.2. Personal protective equipment (PPE)

Eye/face protection

Select and use eye/face protection to prevent contact based on the results of an exposure assessment. The following eye/face protection(s) are recommended:
Safety Glasses with side shields
Indirect Vented Goggles

Skin/hand protection
Select and use gloves and/or protective clothing approved to relevant local standards to prevent skin contact based on the results of an exposure assessment. Selection should be based on use factors such as exposure levels, concentration of the substance or mixture, frequency and duration, physical challenges such as temperature extremes, and other use conditions. Consult with your glove and/or protective clothing manufacturer for selection of appropriate compatible gloves/protective clothing. Note: Nitrile gloves may be worn over polymer laminate gloves to improve dexterity.
Gloves made from the following material(s) are recommended: Fluoroelastomer
Polyvinyl Alcohol (PVA)
Polymer laminate

Respiratory protection

An exposure assessment may be needed to decide if a respirator is required. If a respirator is needed, use respirators as part of a full respiratory protection program. Based on the results of the exposure assessment, select from the following respirator type(s) to reduce inhalation exposure:
Half facepiece or full facepiece air-purifying respirator suitable for organic vapors and particulates

For questions about suitability for a specific application, consult with your respirator manufacturer.

SECTION 9: Physical and chemical properties

9.1. Information on basic physical and chemical properties

Appearance	
Physical state	Liquid
Color	Green
Specific Physical Form:	Paste
Odor	Pungent Organic solvent
Odor threshold	*No Data Available*
pH	*No Data Available*
Melting point	*No Data Available*
Boiling Point	293 ºF
Flash Point	88 ºF [*Test Method:*Closed Cup]
Evaporation rate	*No Data Available*
Flammability (solid, gas)	Not Applicable
Flammable Limits(LEL)	1.1 %
Flammable Limits(UEL)	*No Data Available*
Vapor Pressure	4.5 mmHg
Vapor Density	3.6 [*Ref Std:*AIR=1]
Density	1.638 g/ml
Specific Gravity	1.638 [*Ref Std:*WATER=1]
Solubility in Water	Negligible
Solubility- non-water	*No Data Available*
Partition coefficient: n-octanol/ water	*No Data Available*
Autoignition temperature	*No Data Available*
Decomposition temperature	*No Data Available*
Viscosity	100,000 centipoise [*Test Method:*Estimated]
Hazardous Air Pollutants	0.27 lb HAPS/lb solids [*Test Method:*Calculated]
Volatile Organic Compounds	247 g/l [*Test Method:*calculated SCAQMD rule 443.1]
Volatile Organic Compounds	15.1 % weight [*Test Method:*calculated per CARB title 2]
Percent volatile	15.1 % weight
VOC Less H2O & Exempt Solvents	247 g/l [*Test Method:*calculated SCAQMD rule 443.1]

SECTION 10: Stability and reactivity

10.1. Reactivity
This material may be reactive with certain agents under certain conditions - see the remaining headings in this section.

10.2. Chemical stability
Stable.

10.3. Possibility of hazardous reactions
Hazardous polymerization will not occur.

10.4. Conditions to avoid
Heat
Sparks and/or flames

10.5. Incompatible materials
Strong acids
Strong bases
Strong oxidizing agents
Alkali and alkaline earth metals

10.6. Hazardous decomposition products

Substance	Condition
None known.	

Refer to section 5.2 for hazardous decomposition products during combustion.

SECTION 11: Toxicological information

The information below may not be consistent with the material classification in Section 2 if specific ingredient classifications are mandated by a competent authority. In addition, toxicological data on ingredients may not be reflected in the material classification and/or the signs and symptoms of exposure, because an ingredient may be present below the threshold for labeling, an ingredient may not be available for exposure, or the data may not be relevant to the material as a whole.

11.1. Information on Toxicological effects

Signs and Symptoms of Exposure

Based on test data and/or information on the components, this material may produce the following health effects:

Inhalation:
Respiratory Tract Irritation: Signs/symptoms may include cough, sneezing, nasal discharge, headache, hoarseness, and nose and throat pain.

May cause additional health effects (see below).

Skin Contact:
Mild Skin Irritation: Signs/symptoms may include localized redness, swelling, itching, and dryness. May cause additional health effects (see below).

Eye Contact:
Moderate Eye Irritation: Signs/symptoms may include redness, swelling, pain, tearing, and blurred or hazy vision.

Ingestion:
May be harmful if swallowed.
Gastrointestinal Irritation: Signs/symptoms may include abdominal pain, stomach upset, nausea, vomiting and diarrhea.

May cause additional health effects (see below).

Additional Health Effects:

Single exposure may cause target organ effects:
Auditory Effects: Signs/symptoms may include hearing impairment, balance dysfunction and ringing in the ears.

Liver Effects: Signs/symptoms may include loss of appetite, weight loss, fatigue, weakness, abdominal tenderness and jaundice.

Prolonged or repeated exposure may cause target organ effects:
Pneumoconiosis: Sign/symptoms may include persistent cough, breathlessness, chest pain, increased amounts of sputum, and changes in lung function tests.

Ocular Effects: Signs/symptoms may include blurred or significantly impaired vision.

Auditory Effects: Signs/symptoms may include hearing impairment, balance dysfunction and ringing in the ears.

Liver Effects: Signs/symptoms may include loss of appetite, weight loss, fatigue, weakness, abdominal tenderness and jaundice.

Carcinogenicity:
Contains a chemical or chemicals which can cause cancer.

Ingredient	CAS No.	Class Description	Regulation
Silica, Crystalline (Respirable Size)	14808-60-7	Known To Be Human Carcinogen.	National Toxicology Program Carcinogens
Talc-based body powder (perineal use of)	14807-96-6	Grp. 2B: Possible human carc.	International Agency for Research on Cancer
Special-purpose fibres such as E-glass and '475' glass fibres	65997-17-3	Grp. 2B: Possible human carc.	International Agency for Research on Cancer
Ceramic Fibers (Respirable Size)	65997-17-3	Anticipated human carcinogen	National Toxicology Program Carcinogens
Refractory ceramic fibres	65997-17-3	Grp. 2B: Possible human carc.	International Agency for Research on Cancer
GLASS WOOL FIBERS (INHALABLE), CERTAIN	65997-17-3	Anticipated human carcinogen	National Toxicology Program Carcinogens
Talc containing asbestiform fibres	14807-96-6	Grp. 1: Carcinogenic to humans	International Agency for Research on Cancer
Silica dust, crystalline, in the form of quartz or cristobalite	14808-60-7	Grp. 1: Carcinogenic to humans	International Agency for Research on Cancer
Styrene	100-42-5	Grp. 2A: Probable human carc.	International Agency for Research on Cancer
Styrene	100-42-5	Anticipated human carcinogen	National Toxicology Program Carcinogens

Toxicological Data
If a component is disclosed in section 3 but does not appear in a table below, either no data are available for that endpoint or the data are not sufficient for classification.

Acute Toxicity

Name	Route	Species	Value
Overall product	Dermal		No data available; calculated ATE >5,000 mg/kg
Overall product	Inhalation-Vapor(4 hr)		No data available; calculated ATE >50 mg/l
Overall product	Ingestion		No data available; calculated ATE >2,000 - =5,000 mg/kg
Talc	Dermal		LD50 estimated to be > 5,000 mg/kg
Talc	Ingestion		LD50 estimated to be > 5,000 mg/kg
Magnesium Carbonate	Dermal	Professional judgement	LD50 estimated to be 2,000 - 5,000 mg/kg
Magnesium Carbonate	Ingestion	Rat	LD50 > 2,000 mg/kg
Styrene Monomer	Dermal	Rat	LD50 > 2,000 mg/kg
Styrene Monomer	Inhalation-Vapor (4 hours)	Rat	LC50 11.8 mg/l
Styrene Monomer	Ingestion	Rat	LD50 5,000 mg/kg
Limestone	Dermal	Rat	LD50 > 2,000 mg/kg
Limestone	Inhalation-Dust/Mist (4 hours)	Rat	LC50 3 mg/l
Limestone	Ingestion	Rat	LD50 6,450 mg/kg
Oxide Glass Chemicals	Dermal		LD50 estimated to be > 5,000 mg/kg
Oxide Glass Chemicals	Ingestion		LD50 estimated to be 2,000 - 5,000 mg/kg
Chlorite	Dermal		LD50 estimated to be > 5,000 mg/kg
Chlorite	Ingestion		LD50 estimated to be > 5,000 mg/kg
Dolomite	Dermal		LD50 estimated to be 2,000 - 5,000 mg/kg
Dolomite	Ingestion	Rat	LD50 > 2,000 mg/kg
Synthetic Crystalline-Free Silica Gel	Dermal	Rabbit	LD50 > 5,000 mg/kg
Synthetic Crystalline-Free Silica Gel	Inhalation-Dust/Mist (4 hours)	Rat	LC50 > 0.691 mg/l
Synthetic Crystalline-Free Silica Gel	Ingestion	Rat	LD50 > 5,110 mg/kg
Wollastonite	Dermal		LD50 estimated to be > 5,000 mg/kg

Wollastonite	Ingestion		LD50 estimated to be 2,000 - 5,000 mg/kg
Quartz Silica	Dermal		LD50 estimated to be > 5,000 mg/kg
Quartz Silica	Ingestion		LD50 estimated to be > 5,000 mg/kg
Dimethylaniline	Dermal		estimated to be 200 - 1,000 mg/kg
Dimethylaniline	Inhalation-Dust/Mist		estimated to be > 12.5 mg/l
Dimethylaniline	Inhalation-Vapor		estimated to be 2 - 10 mg/l
Dimethylaniline	Ingestion		estimated to be 50 - 300 mg/kg
N,N-Diethylaniline	Dermal	Rabbit	LD50 > 468 mg/kg
N,N-Diethylaniline	Inhalation-Vapor (4 hours)	Rat	LC50 1.9 mg/l
N,N-Diethylaniline	Ingestion	Rat	LD50 606 mg/kg

ATE = acute toxicity estimate

Skin Corrosion/Irritation

Name	Species	Value
Talc	Rabbit	No significant irritation
Magnesium Carbonate	In vitro data	No significant irritation
Styrene Monomer	Professional judgement	Mild irritant
Limestone	Rabbit	No significant irritation
Oxide Glass Chemicals	Professional judgement	No significant irritation
Chlorite	Professional judgement	No significant irritation
Dolomite	Professional judgement	No significant irritation
Synthetic Crystalline-Free Silica Gel	Rabbit	No significant irritation
Quartz Silica	Professional judgement	No significant irritation
N,N-Diethylaniline	Rabbit	Mild irritant

Serious Eye Damage/Irritation

Name	Species	Value
Talc	Rabbit	No significant irritation
Magnesium Carbonate	Rabbit	Mild irritant
Styrene Monomer	Professional judgement	Moderate irritant
Limestone	Rabbit	No significant irritation
Oxide Glass Chemicals	Professional judgement	No significant irritation
Chlorite	Professional judgement	No significant irritation

Dolomite	Professional judgement	No significant irritation
Synthetic Crystalline-Free Silica Gel	Rabbit	No significant irritation
N,N-Diethylaniline	Rabbit	Mild irritant

Skin Sensitization

Name	Species	Value
Styrene Monomer	Guinea pig	Not classified
Synthetic Crystalline-Free Silica Gel	Human and animal	Not classified
N,N-Diethylaniline	Guinea pig	Not classified

Respiratory Sensitization

Name	Species	Value
Talc	Human	Not classified

Germ Cell Mutagenicity

Name	Route	Value
Talc	In Vitro	Not mutagenic
Talc	In vivo	Not mutagenic
Styrene Monomer	In Vitro	Some positive data exist, but the data are not sufficient for classification
Styrene Monomer	In vivo	Some positive data exist, but the data are not sufficient for classification
Oxide Glass Chemicals	In Vitro	Some positive data exist, but the data are not sufficient for classification
Synthetic Crystalline-Free Silica Gel	In Vitro	Not mutagenic
Wollastonite	In Vitro	Not mutagenic
Quartz Silica	In Vitro	Some positive data exist, but the data are not sufficient for classification
Quartz Silica	In vivo	Some positive data exist, but the data are not sufficient for classification
N,N-Diethylaniline	In vivo	Not mutagenic
N,N-Diethylaniline	In Vitro	Some positive data exist, but the data are not sufficient for classification

Carcinogenicity

Name	Route	Species	Value
Talc	Inhalation	Rat	Some positive data exist, but the data are not sufficient for classification
Styrene Monomer	Ingestion	Mouse	Carcinogenic
Styrene Monomer	Inhalation	Human and animal	Carcinogenic
Oxide Glass Chemicals	Inhalation	Multiple animal species	Some positive data exist, but the data are not sufficient for classification
Synthetic Crystalline-Free Silica Gel	Not Specified	Mouse	Some positive data exist, but the data are not sufficient for classification
Quartz Silica	Inhalation	Human and animal	Carcinogenic

Reproductive Toxicity

Reproductive and/or Developmental Effects

Name	Route	Value	Species	Test Result	Exposure Duration
Talc	Ingestion	Not classified for development	Rat	NOAEL 1,600 mg/kg	during organogenesis
Styrene Monomer	Ingestion	Not classified for female reproduction	Rat	NOAEL 21 mg/kg/day	3 generation
Styrene Monomer	Inhalation	Not classified for female reproduction	Rat	NOAEL 2.1 mg/l	2 generation
Styrene Monomer	Inhalation	Not classified for male reproduction	Rat	NOAEL 2.1 mg/l	2 generation
Styrene Monomer	Ingestion	Not classified for male reproduction	Rat	NOAEL 400 mg/kg/day	60 days
Styrene Monomer	Ingestion	Not classified for development	Rat	NOAEL 400 mg/kg/day	during gestation
Styrene Monomer	Inhalation	Not classified for development	Multiple animal species	NOAEL 2.1 mg/l	during gestation
Limestone	Ingestion	Not classified for development	Rat	NOAEL 625 mg/kg/day	premating & during gestation
Synthetic Crystalline-Free Silica Gel	Ingestion	Not classified for female reproduction	Rat	NOAEL 509 mg/kg/day	1 generation
Synthetic Crystalline-Free Silica Gel	Ingestion	Not classified for male reproduction	Rat	NOAEL 497 mg/kg/day	1 generation
Synthetic Crystalline-Free Silica Gel	Ingestion	Not classified for development	Rat	NOAEL 1,350 mg/kg/day	during organogenesis
N,N-Diethylaniline	Ingestion	Not classified for development	Rat	NOAEL 250 mg/kg/day	during organogenesis

Target Organ(s)

Specific Target Organ Toxicity - single exposure

Name	Route	Target Organ(s)	Value	Species	Test Result	Exposure Duration
Styrene Monomer	Inhalation	auditory system	Causes damage to organs	Multiple animal species	LOAEL 4.3 mg/l	not available
Styrene Monomer	Inhalation	liver	Causes damage to organs	Mouse	LOAEL 2.1 mg/l	not available
Styrene Monomer	Inhalation	central nervous system depression	May cause drowsiness or dizziness	Human	NOAEL Not available	occupational exposure
Styrene Monomer	Inhalation	respiratory irritation	May cause respiratory irritation	Human and animal	NOAEL Not available	
Styrene Monomer	Inhalation	endocrine system	Not classified	Rat	NOAEL Not available	not available
Styrene Monomer	Inhalation	kidney and/or bladder	Not classified	Multiple animal species	NOAEL 2.1 mg/l	not available
Limestone	Inhalation	respiratory system	Not classified	Rat	NOAEL 0.812 mg/l	90 minutes
N,N-Diethylaniline	Inhalation	respiratory irritation	Some positive data exist, but the data are not sufficient for classification	similar health hazards	NOAEL Not available	

Specific Target Organ Toxicity - repeated exposure

Name	Route	Target Organ(s)	Value	Species	Test Result	Exposure Duration
Talc	Inhalation	pneumoconiosis	Causes damage to organs through prolonged or repeated exposure	Human	NOAEL Not available	occupational exposure
Talc	Inhalation	pulmonary fibrosis | respiratory system	Not classified	Rat	NOAEL 18 mg/m3	113 weeks

Styrene Monomer	Inhalation	auditory system	Causes damage to organs through prolonged or repeated exposure	Human	NOAEL not available	occupational exposure
Styrene Monomer	Inhalation	eyes	Causes damage to organs through prolonged or repeated exposure	Human	NOAEL Not available	occupational exposure
Styrene Monomer	Inhalation	liver	May cause damage to organs though prolonged or repeated exposure	Mouse	LOAEL 0.85 mg/l	13 weeks
Styrene Monomer	Inhalation	nervous system	Some positive data exist, but the data are not sufficient for classification	Multiple animal species	LOAEL 1.1 mg/l	not available
Styrene Monomer	Inhalation	hematopoietic system	Not classified	Rat	NOAEL 0.85 mg/l	7 days
Styrene Monomer	Inhalation	endocrine system	Not classified	Rat	NOAEL 0.6 mg/l	10 days
Styrene Monomer	Inhalation	respiratory system	Not classified	Multiple animal species	LOAEL 0.09 mg/l	not available
Styrene Monomer	Inhalation	heart | gastrointestinal tract | bone, teeth, nails, and/or hair | muscles | kidney and/or bladder	Not classified	Multiple animal species	NOAEL 4.3 mg/l	2 years
Styrene Monomer	Ingestion	nervous system	Some positive data exist, but the data are not sufficient for classification	Rat	LOAEL 500 mg/kg/day	8 weeks
Styrene Monomer	Ingestion	immune system	Some positive data exist, but the data are not sufficient for classification	Multiple animal species	NOAEL Not available	not available
Styrene Monomer	Ingestion	liver | kidney and/or bladder	Not classified	Rat	NOAEL 677 mg/kg/day	6 months
Styrene Monomer	Ingestion	hematopoietic system	Not classified	Dog	NOAEL 600 mg/kg/day	470 days
Styrene Monomer	Ingestion	heart | respiratory system	Not classified	Rat	NOAEL 35 mg/kg/day	105 weeks
Limestone	Inhalation	respiratory system	Not classified	Human	NOAEL Not available	occupational exposure
Oxide Glass Chemicals	Inhalation	respiratory system	Not classified	Human	NOAEL not available	occupational exposure
Synthetic Crystalline-Free Silica Gel	Inhalation	respiratory system | silicosis	Not classified	Human	NOAEL Not available	occupational exposure
Wollastonite	Inhalation	respiratory system	Not classified	Human	NOAEL Not available	occupational exposure
Wollastonite	Inhalation	pulmonary fibrosis	Not classified	Human and animal	NOAEL Not available	
Quartz Silica	Inhalation	silicosis	Causes damage to organs through prolonged or repeated exposure	Human	NOAEL Not available	occupational exposure
N,N-Diethylaniline	Ingestion	hematopoietic system	Causes damage to organs through prolonged or repeated exposure	Rat	LOAEL 10 mg/kg/day	28 days
N,N-Diethylaniline	Ingestion	liver | kidney and/or bladder	Not classified	Rat	NOAEL 250 mg/kg/day	28 days

Aspiration Hazard

Name	Value
Styrene Monomer	Aspiration hazard

Please contact the address or phone number listed on the first page of the SDS for additional toxicological information on this material and/or its components.

SECTION 12: Ecological information

Ecotoxicological information

Please contact the address or phone number listed on the first page of the SDS for additional ecotoxicological information on this material and/or its components.

Chemical fate information

Please contact the address or phone number listed on the first page of the SDS for additional chemical fate information on this material and/or its components.

SECTION 13: Disposal considerations

13.1. Disposal methods
Dispose of contents/ container in accordance with the local/regional/national/international regulations.

Dispose of completely cured (or polymerized) material in a permitted industrial waste facility. As a disposal alternative, incinerate uncured product in a permitted waste incineration facility. Empty drums/barrels/containers used for transporting and handling hazardous chemicals (chemical substances/mixtures/preparations classified as Hazardous as per applicable regulations) shall be considered, stored, treated & disposed of as hazardous wastes unless otherwise defined by applicable waste regulations. Consult with the respective regulating authorities to determine the available treatment and disposal facilities.

SECTION 14: Transport Information

For Transport Information, please visit http://3M.com/Transportinfo or call 1-800-364-3577 or 651-737-6501.

SECTION 15: Regulatory information

15.1. US Federal Regulations
Contact 3M for more information.

EPCRA 311/312 Hazard Classifications:

Physical Hazards
Flammable (gases, aerosols, liquids, or solids)

Health Hazards
Carcinogenicity
Serious eye damage or eye irritation
Specific target organ toxicity (single or repeated exposure)

Section 313 Toxic Chemicals subject to the reporting requirements of that section and 40 CFR part 372 (EPCRA):

Ingredient	C.A.S. No	% by Wt
Styrene Monomer	100-42-5	Trade Secret < 20

15.2. State Regulations
Contact 3M for more information.

15.3. Chemical Inventories
The components of this product are in compliance with the chemical notification requirements of TSCA. All required components of this product are listed on the active portion of the TSCA Inventory.

Contact 3M for more information.

15.4. International Regulations

Contact 3M for more information.

This SDS has been prepared to meet the U.S. OSHA Hazard Communication Standard, 29 CFR 1910.1200.

SECTION 16: Other information

NFPA Hazard Classification
Health: 1 **Flammability:** 3 **Instability:** 0 **Special Hazards:** None

National Fire Protection Association (NFPA) hazard ratings are designed for use by emergency response personnel to address the hazards that are presented by short-term, acute exposure to a material under conditions of fire, spill, or similar emergencies. Hazard ratings are primarily based on the inherent physical and toxic properties of the material but also include the toxic properties of combustion or decomposition products that are known to be generated in significant quantities.

Document Group:	24-2443-0	**Version Number:**	10.00
Issue Date:	03/01/23	**Supercedes Date:**	03/15/22

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3M USA SDSs are available at www.3M.com

SAFETY DATA SHEET
Candy2o Colors

1. Identification of the Preparation and of The Company	
1.1 Product Name and/or code:	Candy2o Colors
Effective Date:	5/17/2023
1.2 Manufacturer:	Color Craft Ltd / Createx Colors 14 Airport Park Road, PO Box 120 East Granby, CT 06026
Information Contact:	860-563-5505
1.3 Emergency Contact:	800-255-3924 813-248-0573
Emergency Response Service:	ChemTel Inc. 1305 North Florida Avenue Tampa, FL 33602 USA 813-248-0573 www.chemtelinc.com
Contact Number:	MIS4120068
Within the United States, Canada, Puerto Rico, and the U.S. Virgin Islands:	1-800-255-3924
Outside the United States, Canada, Puerto Rico, and the U.S. Virgin Islands:	+01-813-248-0585
	China: 400-120-0751 Brazil: 0-800-591-6042 India: 000-800-100-4086 Mexico: 01-800-099-0731
For Health Emergencies:	Contact your local Poison Control Center.
1.4 Product Use:	Art Material – Consumer Product

2. Hazards Identification

Emergency Overview

WARNING! MAY CAUSE EYE AND SKIN IRRITATION. MAY CAUSE AN ALLERGIC SKIN REACTION.

2.1 Classification of the Product:

Label Elements	Conforms to ASTM D-4236
Hazard Pictograms	  GHS07 GHS09
Signal Word	WARNING!
Hazard Statement	May cause respiratory irritation if inhaled.

Precaution Statement:	Avoid contact with eyes, skin and clothing. Avoid breathing vapors or mist. Wash thoroughly after handling. Use with adequate ventilation. To avoid breathing vapors and mist, open windows and doors or use other means to ensure fresh air entry during application and drying. Ensure fresh air entry during application and drying. If you experience eye watering, headache or dizziness, wear an appropriate, properly fitted respirator (NIOSH approved) or leave the area. Do not eat, drink or smoke when using this product. Avoid release to the environment. Do not ingest.
Children's Statement	**KEEP OUT OF REACH OF CHILDREN.**
2.2 Other hazards	
NFPA	Health: 1 *Health: 2* (If sprayed applied)* Flammability: 0 Reactivity: 0
HMIS	Health: 1 *Health: 2* (If sprayed applied)* Flammability: 0 Reactivity: 0

3.Composition/Information on Ingredients:

3.1 Substances:

Mixture of the following chemicals:	Acid Yellow dye complex (Proprietary) <7.0% Glycol Ether blend (Proprietary) < 5.0 % Surfactants dispersants < 1.0 % Proprietary Pigment (Mixture) ***The remainder of the formulation is composed of non-hazardous ingredients.***

4. First Aid Measures

4.1 Description of first aid measures

Inhalation	If affected, remove to fresh air.
Skin Contact	Wash the affected area thoroughly with plenty of soap and water. If irritation occurs, contact a physician immediately.
Eye Contact	Carefully flush with water for 15 minutes. If irritation occurs, contact a physician immediately.
Ingestion	If swallowed, do not induce vomiting. Contact a physician immediately.

5. Firefighting Measures

5.1 Extinguishing Media	Water, foam, carbon dioxide or dry chemical equipment.

5.2 Fire/Explosion Hazards	This product is not known to present any fire hazard.
5.3 Flashpoint/Flammability	Not flammable

6. Accidental Release Measures

6.1 Methods and Materials for Containment and Cleaning up	Contain spill. Recover as much as possible. Absorb remainder with an inert material. Place into closed container and store in a safe location to await disposal. Wash the spill area with soap and water.

7. Handling and Storage

7.1 Safe Handling	Use under ventilated conditions. Avoid eye and skin contact. For personal protection, we recommend that employees wash thoroughly after handling product. Always wash before eating, smoking or using toilet facilities. Keep container closed when not in use. Keep container upright to prevent leakage.
7.2 Environmental precautions	No product should be released to the environment. Keep container closed when not in use. Keep container upright to prevent leakage.
7.3 Storage	Store containers in a cool, dry, well ventilated area.

8. Exposure Controls/Personal Protection

8.1 Personal Protective Equipment	Wear goggles where spills or splashing may occur. Wear water resistant impervious gloves if handling bulk amounts.
8.2 Exposure Limits (USA)	None known for this mixture. Not applicable.
8.3 Respiratory and Ventilation	Wear approved NIOSH/MSHA respirator if exposure to mist or vapor exceed applicable PEL/TLV limits. Use in accordance with manufacturer's use limitations and OSHA STANDARD 1910-34. Local ventilation may be used to prevent routine inhalation.
Skin Protection	Wear water resistant impervious gloves if handling bulk amounts.
Eye Protection	Wear goggles where spills or splashing may occur.

9. Physical and Chemical Properties

9.1 Information on basic physical and chemical properties

Appearance	Clear liquid
Physical State	Liquid
Color	Various
Odor	Ether-like odor
Boiling Point	Not determined
Freezing Point	Not determined
State (pH)	Not determined
Specific Gravity	No data available
Viscosity	No data available
Flashpoint	Not Flammable
Vapor Pressure	Not determined

Vapor Density	Not determined
Solubility in water	Miscible

10. Stability and Reactivity

10.1 Reactivity	No dangerous reaction known under conditions of normal use.
10.2 Chemical Stability	Stable under recommended storage conditions.
10.3 Conditions to Avoid	Avoid all sources of ignition.
10.4 Incompatible materials	Strong oxidizing agents, strong acids, strong bases, amines, ammonia, halogenated compounds.
10.5 Hazardous Decomposition Products	Carbon monoxide, carbon dioxide.

11. Toxicological Information

11.1 Information on toxicological effects	
Health Effects	None known for the usual and ordinary uses of this product.
Acute Toxicity	May cause eye and skin irritation. May cause an allergic skin reaction.

**Studies have not been performed on this particular mixture. The information below is based on data on the individual ingredients.*

Eye Effects	May cause eye irritation
Skin Effects	May cause an allergic skin reaction. May cause skin irritation.
Inhalation	May cause respiratory irritation if inhaled.
Sensitization	No effects are likely to occur during the foreseeable and reasonable use of the product.
Ingestion	No effects are likely to occur during the foreseeable and reasonable use of the product.
Chronic Effects	No effects are likely to occur during the foreseeable and reasonable use of the product.
Additional toxicological information:	When used and handled according to specifications, the product does not have any harmful effects according to past experience and the information provided.

12. Ecological Information

12.1 Toxicity:	Not expected to be harmful to the environment when used as directed by the manufacturer. No product should be released to the environment.

**Studies have not been performed on this particular mixture. The information below is based on data on the individual ingredients.*

Aquatic toxicity	Very Toxic to aquatic life. Very toxic to aquatic life with long lasting effects.
12.2 Persistence and degradability	Not persistent. Biodegradable. *Not relevant to this mixture.*
12.3 Bio accumulative potential	Does not occur. *Not relevant to this mixture.*
12.4 Mobility in soil	Mixture is similar to water. *Not relevant to this mixture.*

12.5 Additional ecological information	As a general rule, no product should be released to the environment.

13. Disposal Considerations

13.1 Dispose of all waste material in accordance with all applicable federal, state and local regulations.

14. Transport Information

14.1 The following transportation categories do not apply to this mixture sold as a consumer use product (non-bulk).

DOT	This regulation does not apply to the non-bulk material.
IMDG	This regulation does not apply to the non-bulk material.
ICAO/IATA	This regulation does not apply to the non-bulk material.

This information is not intended to convey all specific regulatory or operational requirements/information relating to this product. It is the responsibility of the transporting organization to follow all applicable laws, regulations and rules relating to the transportation of the materials.

15. Regulatory Information

15.1 Safety, health and environmental regulations/legislation specific for the substance or mixture.

SARA	Not applicable to this mixture.
Section 355 (extremely hazardous substances)	Not applicable to this mixture.
Section 313 (specific toxic chemical listing)	Not applicable to this mixture.
TSCA (Toxic Substance Control Act)	All ingredients are listed.
California Proposition 65	⚠ WARNING: This product can expose you to chemicals including trace amounts of cobalt which are known to the State of California to cause cancer, and birth defects or other reproductive harm. For more information go to www.P65Warnings.ca.gov.
Carcinogenicity categories	Not applicable to this mixture.
EPA (Environmental Protection Agency)	Not applicable to this mixture.
TLV (Threshold Limit Value established by ACGIH)	Not applicable to this mixture. Refer to section 8 for further information on individual substances of this mixture.
NIOSH (National Institute for Occupational Safety & Health)	Not applicable to this mixture.
OSHA (Occupational Safety & Health Administration)	Not applicable to this mixture.
MAK (German Maximum Workplace Concentration)	Not applicable to this mixture.

16. Other Information

Color List

PRODUCT CODE	***PRODUCT NAME***

4652 Tequila Yellow
4661 Emerald Green
4662 Dirt Track Brown
4663 Red Oxide
4666 Tealiscious

Prepared by: ENVIRONMENTAL MEDICINE, INC.
778 Carver Avenue
WESTWOOD, NJ 07675
jaegerr@envmed.com
201-666-7929 x13

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Abbreviations and acronyms:

NFPA (SCALE 0-4) National Fire Protection Association (USA)

Health:	1 - Caution. May be irritating. 2 - Warning. May be harmful if inhaled or absorbed. *
Fire:	0 - Not combustible.
Reactivity:	0 - Stable. Not reactive when mixed with water.

HMIS (SCALE 0-4) Hazardous Materials Identification System (USA)

Health:	1 - Slight hazard: Irritation or minor reversible injury possible. 2 - Moderate hazard: Temporary or minor injury may occur.*
Fire:	0 - Minimal hazard: Materials that will not burn.
Physical Hazard:	0 - Minimal hazard: This material is normally stable, even under fire conditions and will not react with water, polymerize, decompose, condense, or self-react. Non-Explosives.

Exposure Limits
TWA - Time Weighted Average (8 hr.)
STEL - Short Time Exposure Limit (15 min.)
REL - Recommended Exposure Limit
PEL - Permissible Exposure Limit
IDLH - Immediately Dangerous to Life or Health

ACGIH - Association Advancing Occupational and Environmental Health
EPA - Environmental Protection Agency

CLEAR HI-GLOSS ADDITIVE

Safety Data Sheet

according to the Hazardous Products Regulation (February 11, 2015)

Distributed By
Freeman Manufacturing & Supply Co.
www.freemansupply.com 800-321-8511 FREEMAN

SECTION 1: Identification

1.1. Product identifier

Product form	:	Mixture
Trade name	:	CLEAR HI-GLOSS ADDITIVE
Type of product	:	Coating
CAS-No.	:	mixture
Product code	:	904-001
Formula	:	na
Product group	:	Trade product

Become a member!

1.2. Recommended use and restrictions on use

No additional information available

1.3. Supplier

Dura Technologies, Inc.
2720 South Willow Avenue #A
Bloomington, CA 92316

909-546-1162
ChemTrec US: 800.424.9300
ChemTrec Int: +1 70 3527 3887

1.4. Emergency telephone number

Emergency number : ChemTrec US: 800.424.9300 Int: +1 70 3527 3887

SECTION 2: Hazard identification

2.1. Classification of the substance or mixture

Classification (GHS CA)

Flammable liquids Category 2 H225 Highly flammable liquid and vapour

Full text of H statements : see section 16

2.2. GHS Label elements, including precautionary statements

GHS CA labeling

Hazard pictograms (GHS CA) :



Signal word (GHS CA) : Danger

Hazard statements (GHS CA) : H225 - Highly flammable liquid and vapour

Precautionary statements (GHS CA) : P210 - Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking.
P233 - Keep container tightly closed.
P240 - Ground/bond container and receiving equipment.
P241 - Use explosion-proof electrical/ventilating/lighting equipment
P242 - Use only non-sparking tools.
P243 - Take action to prevent static discharges.
P280 - Wear protective gloves/protective clothing/eye protection/face protection.
P303+P361+P353 - IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water .
P370+P378 - In case of fire: Use media other than water to extinguish.
P403+P235 - Store in a well-ventilated place. Keep cool
P501 - Dispose of contents/container to hazardous or special waste collection point, in accordance with local, regional, national and/or international regulation

2.3. Other hazards

No additional information available

2.4. Unknown acute toxicity (GHS CA)

No data available

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SECTION 3: Composition/Information on ingredients

3.1. Substances

Not applicable

3.2. Mixtures

Name	Chemical name / Synonyms	Product identifier	%	Classification (GHS CA)
Proprietary Resin	POLYMER	(CAS-No.) TRADE SECRET	<= 55	Not classified
styrene, inhibited	benzene, ethenyl- / cinnamene / phenylethylene / styrene / styrene, monomer / styrol / vinylbenzene	(CAS-No.) 100-42-5	<= 36	Flam. Liq. 3, H226
methyl ethyl ketone	2-butanone / 2-oxobutane / 3-butanone / acetone, methyl- / AI3-07540 / butan-2-one / butanone / Caswell NO 569 / ethyl methyl ketone / EXXON methylethyl ketone / FEMA N°. 2170 / ketone, ethyl methyl- / meetco / MEK (= methyl ethyl ketone) / methyl 2-propanone / methyl acetone	(CAS-No.) 78-93-3	<= 18	Flam. Liq. 2, H225
cobalt(II) 2-ethylhexanoate	2-ethylhexanoic acid cobalt salt / CO 12 / cobalt 2-ethylhexoate / cobalt bis(2-ethylhexanoate) / cobalt octoate / cobaltous 2-ethylhexanoate / cobaltous octoate / Environmentally hazardous substance, solid, n.o.s. / hexanoic acid, 2-ethyl-, cobalt(2+) salt / NL 49P / NL 51P / NL 51S	(CAS-No.) 136-52-7	<= 0.9	Not classified

Full text of hazard classes and H-statements : see section 16

SECTION 4: First-aid measures

4.1. Description of first aid measures

First-aid measures after inhalation : Remove person to fresh air and keep comfortable for breathing. Remove victim to fresh air and keep at rest in a position comfortable for breathing. Call a POISON CENTER or doctor/physician if you feel unwell. Allow affected person to breathe fresh air. Allow the victim to rest.

First-aid measures after skin contact : Wash with plenty of soap and water. Wash contaminated clothing before reuse. If skin irritation occurs: wash throughly for five minutes. seek medical attention. Get medical advice/attention. Specific treatment (see seek medical attention. on this label). Rinse skin with water/shower. Remove/Take off immediately all contaminated clothing.

First-aid measures after eye contact : Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If eye irritation persists: SEEK IMMEDIATE MEDICAL ATTENTION. Get medical advice/attention.

First-aid measures after ingestion : Rinse mouth. Do NOT induce vomiting. Obtain emergency medical attention. Call a poison center/doctor/physician if you feel unwell.

First-aid measures general : Never give anything by mouth to an unconscious person. Suspected of causing cancer. IF exposed or concerned: Get medical advice/attention.

4.2. Most important symptoms and effects (acute and delayed)

Symptoms/effects : Suspected of damaging fertility or the unborn child. Causes damage to organs through prolonged or repeated exposure. May cause genetic defects. Causes damage to organs.

Symptoms/effects after inhalation : May cause respiratory irritation. Danger of serious damage to health by prolonged exposure through inhalation. Harmful if inhaled.

Symptoms/effects after skin contact : Causes skin irritation.

Symptoms/effects after eye contact : Causes serious eye irritation.

Potential Adverse human health effects and symptoms : Harmful if inhaled.

4.3. Immediate medical attention and special treatment, if necessary

Other medical advice or treatment : Treat symptomatically.

SECTION 5: Fire-fighting measures

5.1. Suitable extinguishing media

Suitable extinguishing media : Sand. Water spray. Dry powder. Foam. Carbon dioxide.

5.2. Unsuitable extinguishing media

Unsuitable extinguishing media : Do not use a heavy water stream.

5.3. Specific hazards arising from the hazardous product

Fire hazard : Highly flammable liquid and vapour.

Explosion hazard	:	May form flammable/explosive vapor-air mixture.
Reactivity in case of fire	:	No reactivity hazard other than the effects described in sub-sections below.

5.4. Special protective equipment and precautions for fire-fighters

Firefighting instructions	:	Use water spray or fog for cooling exposed containers. Exercise caution when fighting any chemical fire. Prevent fire-fighting water from entering environment.
Protection during firefighting	:	Do not enter fire area without proper protective equipment, including respiratory protection. Do not attempt to take action without suitable protective equipment. Self-contained breathing apparatus. Complete protective clothing.

SECTION 6: Accidental release measures

6.1. Personal precautions, protective equipment and emergency procedures

General measures	:	Remove ignition sources. Use special care to avoid static electric charges. No open flames. No smoking.

6.2. Methods and materials for containment and cleaning up

For containment	:	Dam up the liquid spill. Contain released product, pump into suitable containers.
Methods for cleaning up	:	Take up liquid spill into absorbent material. Soak up spills with inert solids, such as clay or diatomaceous earth as soon as possible. Collect spillage. Store away from other materials. Notify authorities if product enters sewers or public waters.
Other information	:	Dispose of materials or solid residues at an authorized site.

6.3. Reference to other sections

For further information refer to section 8: "Exposure controls/personal protection"

SECTION 7: Handling and storage

7.1. Precautions for safe handling

Precautions for safe handling	:	Wash hands and other exposed areas with mild soap and water before eating, drinking or smoking and when leaving work. Provide good ventilation in process area to prevent formation of vapor. No open flames. No smoking. Use only outdoors or in a well-ventilated area. Avoid breathing DUST, FUMES, MIST, OR VAPORS. Obtain special instructions before use. Do not handle until all safety precautions have been read and understood. Do not breathe dust/fume/gas/mist/vapors/spray. Eliminate all ignition sources if safe to do so. Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking. Ground/bond container and receiving equipment. Use only non-sparking tools. Take precautionary measures against static discharge. Flammable vapors may accumulate in the container. Use explosion-proof equipment. Wear personal protective equipment.
Hygiene measures	:	Wash HANDS thoroughly after handling. Do not eat, drink or smoke when using this product. Always wash hands after handling the product.
Additional hazards when processed	:	Handle empty containers with care because residual vapors are flammable.

7.2. Conditions for safe storage, including any incompatibilities

Technical measures	:	Proper grounding procedures to avoid static electricity should be followed. Use explosion-proof electrical, ventilating and lighting equipment. equipment. Ground/bond container and receiving equipment.
Storage conditions	:	Keep only in the original container in a cool, well ventilated place away from : HEAT SPARKS OR OPEN FLAMES. Keep in fireproof place. Store in a well-ventilated place. Keep cool. Keep container tightly closed.
Incompatible products	:	Strong bases. Strong acids.
Incompatible materials	:	Sources of ignition. Direct sunlight. Heat sources.

SECTION 8: Exposure controls/personal protection

8.1. Control parameters

styrene, inhibited (100-42-5)		
USA - ACGIH	ACGIH TWA (ppm)	20 ppm
USA - ACGIH	ACGIH STEL (ppm)	40 ppm
Ontario	OEL STEL (ppm)	100 ppm
Ontario	OEL TWA (ppm)	35 ppm
Ontario	Regulatory reference	Ontario Occuational Exposure Limits under Regulation 833
Saskatchewan	OEL STEL (ppm)	40 ppm
Saskatchewan	OEL TWA (ppm)	20 ppm
Saskatchewan	Notations and remarks	T20

methyl ethyl ketone (78-93-3)		
USA - ACGIH	ACGIH TWA (ppm)	200 ppm
USA - ACGIH	ACGIH STEL (ppm)	300 ppm
Alberta	OEL STEL (ppm)	300 ppm
Alberta	OEL TWA (ppm)	200 ppm
Alberta	Notations and remarks	URT irr; CNS & PNS impair
Manitoba	OEL STEL (ppm)	300 ppm
Manitoba	OEL TWA (ppm)	200 ppm
Manitoba	Notations and remarks	URT irr; CNS & PNS impair
New Brunswick	OEL STEL (ppm)	300 ppm
New Brunswick	OEL TWA (ppm)	200 ppm
New Brunswick	Notations and remarks	URT irr; CNS & PNS impair
Newfoundland & Labrador	OEL STEL (ppm)	300 ppm
Newfoundland & Labrador	OEL TWA (ppm)	200 ppm
Newfoundland & Labrador	Notations and remarks	URT irr; CNS & PNS impair
Nova Scotia	OEL STEL (ppm)	300 ppm
Nova Scotia	OEL TWA (ppm)	200 ppm
Nova Scotia	Notations and remarks	URT irr; CNS & PNS impair
Nunavut	OEL STEL (ppm)	300 ppm
Nunavut	OEL TWA (ppm)	200 ppm
Nunavut	Notations and remarks	URT irr; CNS & PNS impair
Northwest Territories	OEL STEL (ppm)	300 ppm
Northwest Territories	OEL TWA (ppm)	200 ppm
Northwest Territories	Notations and remarks	URT irr; CNS & PNS impair
Ontario	OEL STEL (ppm)	300 ppm
Ontario	OEL TWA (ppm)	200 ppm
Ontario	Regulatory reference	Ontario Occuational Exposure Limits under Regulation 833
Prince Edward Island	OEL STEL (ppm)	300 ppm
Prince Edward Island	OEL TWA (ppm)	200 ppm
Prince Edward Island	Notations and remarks	URT irr; CNS & PNS impair
Saskatchewan	OEL STEL (ppm)	300 ppm
Saskatchewan	OEL TWA (ppm)	200 ppm

8.2. Appropriate engineering controls

Appropriate engineering controls : Ensure exposure is below occupational exposure limits (where available). Ensure good ventilation of the work station.

Environmental exposure controls : Avoid release to the environment.

8.3. Individual protection measures/Personal protective equipment

Personal protective equipment:

Avoid all unnecessary exposure.

Hand protection:

Wear protective gloves.

Eye protection:

Chemical goggles or safety glasses. Safety glasses

Skin and body protection:

Wear suitable protective clothing

Respiratory protection:

Wear appropriate mask

Other information:

Do not eat, drink or smoke during use.

SECTION 9: Physical and chemical properties

9.1. Information on basic physical and chemical properties

Physical state	:	Liquid
Appearance	:	No data available
Color	:	clear
Odor	:	characteristic
Odor threshold	:	No data available
pH	:	No data available
Relative evaporation rate (butyl acetate=1)	:	No data available
Relative evaporation rate (ether=1)	:	No data available
Melting point	:	>= °C
Freezing point	:	No data available
Boiling point	:	>= 79.4 °C
Flash point	:	>= 7 - 10 °C
Auto-ignition temperature	:	No data available
Decomposition temperature	:	No data available
Flammability (solid, gas)	:	Highly flammable liquid and vapour
Vapor pressure	:	No data available
Vapor pressure at 50 °C	:	No data available
Relative density	:	<=
Specific gravity / density	:	<= 1.05
Solubility	:	No data available
Log Pow	:	No data available
Explosion limits	:	No data available

9.2. Other information

No additional information available

SECTION 10: Stability and reactivity

10.1. Reactivity

Reactivity	:	No reactivity hazard other than the effects described in sub-sections below. Highly flammable liquid and vapour.
Chemical stability	:	Polymerization can result in formation of solid deposits, even in vapour space. Highly flammable liquid and vapour. May form flammable/explosive vapor-air mixture.
Possibility of hazardous reactions	:	Not established.
Conditions to avoid	:	Direct sunlight. Extremely high or low temperatures. Open flame. Avoid contact with hot surfaces. Heat. No flames, no sparks. Eliminate all sources of ignition.
Incompatible materials	:	Strong acids. Strong bases.
Hazardous decomposition products	:	fume. Carbon monoxide. Carbon dioxide. May release flammable gases.

SECTION 11: Toxicological information

11.1. Information on toxicological effects

Acute toxicity (oral)	:	Not classified
Acute toxicity (dermal)	:	Not classified
Acute toxicity (inhalation)	:	Not classified

styrene, inhibited (100-42-5)	
LD50 oral rat	5000 mg/kg (Rat; Literature study; >6000 mg/kg bodyweight; Rat; Weight of evidence)
LD50 oral	> 6000 mg/kg body weight (Hamster, Male, Weight of evidence, Oral)
LD50 dermal rat	> 2000 mg/kg body weight (OECD 402: Acute Dermal Toxicity, 24 h, Rat, Male / female, Experimental value, Dermal)
LD50 dermal rabbit	5010 mg/kg (Rabbit; Literature study)
LC50 inhalation rat (mg/l)	11.8 mg/l air (4 h, Rat, Inconclusive, insufficient data, Inhalation (vapours))
LC50 inhalation rat (ppm)	2770 ppm/4h (Rat; Literature study)
ATE CA (oral)	5000 mg/kg body weight

styrene, inhibited (100-42-5)	
ATE CA (Dermal)	5010 mg/kg body weight
ATE CA (Gases)	2770 ppmV/4h

cobalt(II) 2-ethylhexanoate (136-52-7)	
LD50 oral rat	3129 mg/kg body weight (Rat; OECD 425: Acute Oral Toxicity: Up-and-Down Procedure; Experimental value)
LD50 dermal rat	> 2000 mg/kg body weight (Rat; Weight of evidence; OECD 402: Acute Dermal Toxicity)
ATE CA (oral)	3129 mg/kg body weight

methyl ethyl ketone (78-93-3)	
LD50 oral rat	2193 mg/kg body weight (Equivalent or similar to OECD 423, Rat, Male / female, Read-across, Oral)
LD50 dermal rabbit	> 10 ml/kg (Equivalent or similar to OECD 402, 24 h, Rabbit, Male, Experimental value, Dermal)
ATE CA (oral)	2193 mg/kg body weight

Skin corrosion/irritation : Not classified
Serious eye damage/irritation : Not classified
Respiratory or skin sensitization : Not classified
Germ cell mutagenicity : Not classified
Carcinogenicity : Not classified
Reproductive toxicity : Not classified
STOT-single exposure : Not classified
STOT-repeated exposure : Not classified
Aspiration hazard : Not classified
Potential Adverse human health effects and symptoms : Harmful if inhaled.
Symptoms/effects : Suspected of damaging fertility or the unborn child. Causes damage to organs through prolonged or repeated exposure. May cause genetic defects. Causes damage to organs.
Symptoms/effects after inhalation : May cause respiratory irritation. Danger of serious damage to health by prolonged exposure through inhalation. Harmful if inhaled.
Symptoms/effects after skin contact : Causes skin irritation.
Symptoms/effects after eye contact : Causes serious eye irritation.

SECTION 12: Ecological information

12.1. Toxicity

Ecology - general : The product is not considered harmful to aquatic organisms or to cause long-term adverse effects in the environment.
Aquatic acute : Not classified
Aquatic chronic : Not classified

styrene, inhibited (100-42-5)	
LC50 fish 1	10 mg/l (OECD 203: Fish, Acute Toxicity Test, 96 h, Pimephales promelas, Flow-through system, Fresh water, Experimental value, GLP)
EC50 Daphnia 1	4.7 mg/l (OECD 202: Daphnia sp. Acute Immobilisation Test, 48 h, Daphnia magna, Flow-through system, Fresh water, Experimental value, GLP)
ErC50 (algae)	4.9 mg/l (EPA OTS 797.1050, 72 h, Pseudokirchneriella subcapitata, Static system, Fresh water, Experimental value, GLP)
BCF fish 1	35.5 (Carassius auratus, Literature study)
Log Pow	2.96 (Experimental value, OECD 107: Partition Coefficient (n-octanol/water): Shake Flask Method, 25 °C)
Log Koc	2.55 (log Koc, Estimated value)

cobalt(II) 2-ethylhexanoate (136-52-7)	
LC50 fish 1	46.51 mg/l (LOEC; ASTM; 96 h; Pimephales promelas; Flow-through system; Fresh water; Read-across)
LC50 fish 2	54.1 mg/l (LC50; ASTM; 96 h; Pimephales promelas; Flow-through system; Fresh water; Read-across)

cobalt(II) 2-ethylhexanoate (136-52-7)	
EC50 Daphnia 1	0.212 mg/l (NOEC; ASTM; 48 h; Ceriodaphnia dubia; Static system; Salt water; Read-across)
EC50 Daphnia 2	0.605 mg/l (LC50; ASTM; 48 h; Ceriodaphnia dubia; Static system; Salt water; Read-across)
BCF fish 1	1.2 (BCF; 131 days; Seriola quinqueradiata; Static system; Salt water; Read-across)
Threshold limit algae 1	144 µg/l (ErC50; OECD 201: Alga, Growth Inhibition Test; 72 h; Pseudokirchneriella subcapitata; Static system; Fresh water; Read-across)
Threshold limit algae 2	32.2 µg/l (NOEC; OECD 201: Alga, Growth Inhibition Test; 72 h; Pseudokirchneriella subcapitata; Static system; Fresh water; Read-across)

methyl ethyl ketone (78-93-3)	
LC50 fish 1	2993 mg/l (OECD 203: Fish, Acute Toxicity Test, 96 h, Pimephales promelas, Static system, Fresh water, Experimental value, GLP)
EC50 Daphnia 1	308 mg/l (OECD 202: Daphnia sp. Acute Immobilisation Test, 48 h, Daphnia magna, Static system, Fresh water, Experimental value, GLP)
ErC50 (algae)	1972 mg/l (OECD 201: Alga, Growth Inhibition Test, 72 h, Pseudokirchneriella subcapitata, Static system, Fresh water, Experimental value, GLP)
Log Pow	0.3 (Experimental value, OECD 117: Partition Coefficient (n-octanol/water), HPLC method, 40 °C)
Log Koc	1.53 (log Koc, Calculated value)

12.2. Persistence and degradability

CLEAR HI-GLOSS ADDITIVE (mixture)	
Persistence and degradability	Not established.

styrene, inhibited (100-42-5)	
Persistence and degradability	Biodegradable in the soil. Readily biodegradable in water.
Chemical oxygen demand (COD)	2.8 g O_2/g substance
ThOD	3.07 g O_2/g substance
BOD (% of ThOD)	0.42 (Literature study)

Proprietary Resin (TRADE SECRET)	
Persistence and degradability	Not established.

cobalt(II) 2-ethylhexanoate (136-52-7)	
Persistence and degradability	Readily biodegradable in water. No (test)data on mobility of the substance available.

methyl ethyl ketone (78-93-3)	
Persistence and degradability	Readily biodegradable in water. Biodegradable in the soil. Biodegradable in the soil under anaerobic conditions. Not established.
Biochemical oxygen demand (BOD)	2.03 g O_2/g substance
Chemical oxygen demand (COD)	2.31 g O_2/g substance
ThOD	2.44 g O_2/g substance

12.3. Bioaccumulative potential

CLEAR HI-GLOSS ADDITIVE (mixture)	
Bioaccumulative potential	Not established.

styrene, inhibited (100-42-5)	
Bioaccumulative potential	Low potential for bioaccumulation (Log Kow < 4).
BCF fish 1	35.5 (Carassius auratus, Literature study)
Log Pow	2.96 (Experimental value, OECD 107: Partition Coefficient (n-octanol/water): Shake Flask Method, 25 °C)
Log Koc	2.55 (log Koc, Estimated value)

Proprietary Resin (TRADE SECRET)	
Bioaccumulative potential	Not established.

cobalt(II) 2-ethylhexanoate (136-52-7)	
Bioaccumulative potential	Low potential for bioaccumulation (BCF < 500).
BCF fish 1	1.2 (BCF; 131 days; Seriola quinqueradiata; Static system; Salt water; Read-across)

methyl ethyl ketone (78-93-3)	
Bioaccumulative potential	Low potential for bioaccumulation (Log Kow < 4). Not established.
Log Pow	0.3 (Experimental value, OECD 117: Partition Coefficient (n-octanol/water), HPLC method, 40 °C)
Log Koc	1.53 (log Koc, Calculated value)

12.4. Mobility in soil

styrene, inhibited (100-42-5)	
Surface tension	0.032 N/m (20 °C)
Ecology - soil	Low potential for adsorption in soil.
Log Koc	2.55 (log Koc, Estimated value)
Log Pow	2.96 (Experimental value, OECD 107: Partition Coefficient (n-octanol/water): Shake Flask Method, 25 °C)

cobalt(II) 2-ethylhexanoate (136-52-7)	
Surface tension	0.064 N/m (20 °C; 1 g/l)

methyl ethyl ketone (78-93-3)	
Surface tension	0.024 N/m (20 °C)
Ecology - soil	Highly mobile in soil. Slightly harmful to plants.
Log Koc	1.53 (log Koc, Calculated value)
Log Pow	0.3 (Experimental value, OECD 117: Partition Coefficient (n-octanol/water), HPLC method, 40 °C)

12.5. Other adverse effects

Ozone : Not classified

Other information : Avoid release to the environment.

SECTION 13: Disposal considerations

13.1. Disposal methods

Waste treatment methods : Dispose of contents/container in accordance with licensed collector's sorting instructions.

Product/Packaging disposal recommendations : Dispose in a safe manner in accordance with local/national regulations. Dispose of contents/container to approved disposal site.

Additional information : Handle empty containers with care because residual vapors are flammable. Flammable vapors may accumulate in the container.

Ecology - waste materials : Avoid release to the environment.

SECTION 14: Transport information

14.1. Basic shipping description

In accordance with TDG

Transportation of Dangerous Goods

Not regulated for transport

14.2. Transport information/DOT

Department of Transport

DOT NA No : UN1866

UN-No.(DOT) : 1866

Packing group (DOT) : II - Medium Danger

Transport document description : UN1866 Resin solution, 3, II

Proper Shipping Name (DOT) : Resin solution

Contains Statement Field Selection (DOT) :

Class (DOT) : 3 - Class 3 - Flammable and combustible liquid 49 CFR 173.120

Division (DOT) : 3

Hazard labels (DOT) : 3 - Flammable liquid



Dangerous for the environment : No

DOT Special Provisions (49 CFR 172.102)	:	149 - When transported as a limited quantity or a consumer commodity, the maximum net capacity specified in 173.150(b)(2) of this subchapter for inner packaging may be increased to 5 L (1.3 gallons). 383 - Packages containing toy plastic or paper caps for toy pistols described as "UN0349, Articles, explosive, n.o.s. (Toy caps), 1.4S" or "NA0337, Toy caps, 1.4S" are not subject to the subpart E (labeling) requirements of this part when offered for transportation by motor vehicle, rail freight, cargo vessel, and cargo aircraft and, notwithstanding the packing method assigned in §173.62 of this subchapter, in conformance with the following conditions: B52 - Notwithstanding the provisions of 173.24b of this subchapter, non-reclosing pressure relief devices are authorized on DOT 57 portable tanks. IB2 - Authorized IBCs: Metal (31A, 31B and 31N); Rigid plastics (31H1 and 31H2); Composite (31HZ1). Additional Requirement: Only liquids with a vapor pressure less than or equal to 110 kPa at 50 C (1.1 bar at 122 F), or 130 kPa at 55 C (1.3 bar at 131 F) are authorized. T4 - 2.65 178.274(d)(2) Normal..... 178.275(d)(3) TP1 - The maximum degree of filling must not exceed the degree of filling determined by the following: Degree of filling = 97 / 1 + a (tr - tf) Where: tr is the maximum mean bulk temperature during transport, and tf is the temperature in degrees celsius of the liquid during filling. TP8 - A portable tank having a minimum test pressure of 1.5 bar (150 kPa) may be used when the flash point of the hazardous material transported is greater than 0 C (32 F).
DOT Packaging Exceptions (49 CFR 173.xxx)	:	150
DOT Packaging Non Bulk (49 CFR 173.xxx)	:	173
DOT Packaging Bulk (49 CFR 173.xxx)	:	242
DOT Quantity Limitations Passenger aircraft/rail (49 CFR 173.27)	:	5 L
DOT Quantity Limitations Cargo aircraft only (49 CFR 175.75)	:	60 L
DOT Vessel Stowage Location	:	B - (i) The material may be stowed "on deck" or "under deck" on a cargo vessel and on a passenger vessel carrying a number of passengers limited to not more than the larger of 25 passengers, or one passenger per each 3 m of overall vessel length; and (ii) "On deck only" on passenger vessels in which the number of passengers specified in paragraph (k)(2)(i) of this section is exceeded.
Emergency Response Guide (ERG) Number	:	127
Other information	:	No supplementary information available.

14.3. Air and sea transport

IMDG

UN-No. (IMDG)	:	1866
Proper Shipping Name (IMDG)	:	RESIN SOLUTION
Transport document description (IMDG)	:	UN 1866 RESIN SOLUTION, 3, II
Class (IMDG)	:	3 - Flammable liquids
Packing group (IMDG)	:	II - substances presenting medium danger

IATA

UN-No. (IATA)	:	1866
Proper Shipping Name (IATA)	:	Resin solution
Transport document description (IATA)	:	UN 1866 Resin solution, 3, II
Class (IATA)	:	3 - Flammable Liquids
Packing group (IATA)	:	II - Medium Danger

SECTION 15: Regulatory information

15.1. National regulations

styrene, inhibited (100-42-5)
Listed on the Canadian DSL (Domestic Substances List)

Proprietary Resin (TRADE SECRET)
Not listed on the Canadian DSL (Domestic Substances List)/NDSL (Non-Domestic Substances List)

cobalt(II) 2-ethylhexanoate (136-52-7)
Listed on the Canadian DSL (Domestic Substances List)

methyl ethyl ketone (78-93-3)
Listed on the Canadian DSL (Domestic Substances List)

15.2. International regulations

styrene, inhibited (100-42-5)
Listed on the United States TSCA (Toxic Substances Control Act) inventory

Proprietary Resin (TRADE SECRET)
Not listed on the United States TSCA (Toxic Substances Control Act) inventory

cobalt(II) 2-ethylhexanoate (136-52-7)
Listed on the United States TSCA (Toxic Substances Control Act) inventory

methyl ethyl ketone (78-93-3)
Listed on the United States TSCA (Toxic Substances Control Act) inventory

SECTION 16: Other information

Data sources : REGULATION (EC) No 1272/2008 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 16 December 2008 on classification, labeling and packaging of substances and mixtures, amending and repealing Directives 67/548/EEC and 1999/45/EC, and amending Regulation (EC) No 1907/2006.

Other information : None.

Full text of H-phrases:

H225	Highly flammable liquid and vapour
H226	Flammable liquid and vapour

SDS Canada (GHS)

To the best of our knowledge this SDS is accurate. The the extent allowed by law, this statement is made in lieu of an other warranties, expressed or implied including but not limited to any implied warranty of merchantability or fitness for a particular purpose and is in lieu of any other obligations or liability on the part of Dura Technoligies, Inc.

GHS SAFETY DATA SHEET (SDS)

SECTION 1 - PRODUCT AND COMPANY IDENTIFICATION

PRODUCT NAME: PART #683 Maxguard™ WG-LEI-5555 WHITE GELCOAT

FIBRE GLAST DEVELOPMENTS CORP.
385 Carr Drive
BROOKVILLE, OH 45309

TELEPHONE: (937) 833-5200
FAX: (937) 833-6555
FOR CHEMICAL EMERGENCY CALL (801) 629-0667 24 HRS.

RECOMMENDED USE: Industrial Chemical

SECTION 2 – HAZARDS IDENTIFICATION

GHS Classification

Flammable liquids	:	Category 3
Combustible Dust	:	
Skin irritation	:	Category 2
Eye irritation	:	Category 2A
Skin sensitization	:	Category 1
Specific target organ toxicity - single exposure	:	Category 3 (Respiratory system)
Specific target organ toxicity - repeated exposure (Inhalation)	:	Category 1 (Auditory system)

GHS label elements

Hazard pictograms :



Signal Word	:	Danger
Hazard Statements	:	Flammable liquid and vapor. May form combustible dust concentrations in air. Causes skin irritation. May cause an allergic skin reaction. Causes serious eye irritation. May cause respiratory irritation. Causes damage to organs (Auditory system) through prolonged or repeated exposure if inhaled.
Precautionary Statements	:	**Prevention:** Keep away from heat/ sparks/ open flames/ hot surfaces. No smoking. Keep container tightly closed. Ground/bond container and receiving equipment. Use explosion-proof electrical/ ventilating/ lighting/ equipment. Use only non-sparking tools. Take precautionary measures against static discharge. Do not breathe mist or vapors. Wash skin thoroughly after handling. Do not eat, drink or smoke when using this product. Use only outdoors or in a well-ventilated area. Contaminated work clothing must not be allowed out of the workplace. Wear protective gloves/ eye protection/ face protection. Keep dust/air mixtures away from ignition sources. Hazardous polymerization can occur under certain conditions. Avoid excessive heat, direct sunlight, peroxides, and other polymerization catalysts. Store in a cool place and maintain proper concentrations of inhibitor and oxygen. **Response:** IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water/ shower. IF INHALED: Remove person to fresh air and keep comfortable for breathing. Call a POISON CENTER/ doctor if you feel unwell. IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Get medical advice/ attention if you feel unwell. If skin irritation or rash occurs: Get medical advice/ attention. If eye irritation persists: Get medical advice/ attention. Take off contaminated clothing and wash before reuse. In case of fire: Use dry sand, dry chemical or alcohol-resistant foam to extinguish.

Storage:
Store in a well-ventilated place. Keep container tightly closed. Store in a well-ventilated place. Keep cool. Store locked up.
Disposal:
Dispose of contents/ container to an approved waste disposal plant.

Other hazards

Static Accumulating liquid
Hazardous polymerization may occur.

SECTION 3 – COMPOSITION/INFORMATION ON INGREDIENTS

Substance / Mixture : Mixture

Chemical nature : Static Accumulator

Chemical nature : Defatter

Hazardous components

Chemical name	CAS-No.	Classification	Concentration (%)
Styrene	100-42-5	Flam. Liq. 3; H226 Acute Tox. 4; H332 Skin Irrit. 2; H315 Eye Irrit. 2A; H319 STOT SE 3; H335 STOT RE 1; H372 Asp. Tox. 1; H304	25.3162
TITANIUM DIOXIDE (TIO2)	13463-67-7	This material is not considered hazardous under the OSHA Hazard Communication Standard (HazCom 2012).	17.82

TALC	14807-96-6	This material is not considered hazardous under the OSHA Hazard Communication Standard (HazCom 2012).	6.00
ALUMINUM HYDROXIDE	21645-51-2	This material is not considered hazardous under the OSHA Hazard Communication Standard (HazCom 2012).	5.0851
METHYLMETHACRYLATE	80-62-6	Flam. Liq. 2; H225 Skin Irrit. 2; H315 Skin Sens. 1B; H317 STOT SE 3; H335	3.00
SILICA AMORPHOUS (SIO2)	7631-86-9	This material is not considered hazardous under the OSHA Hazard Communication Standard (HazCom 2012)	1.5007
SILICA COLLOIDAL AMORPHOUS	112945-52-5	This material is not considered hazardous under the OSHA Hazard Communication Standard (HazCom 2012).	1.50
FATTY ACIDS, C14-18 AND C16- 18 UNSATD., MALEATED	85711-46-2	Skin Irrit. 2; H315 Skin Sens. 1; H317	0.1999

SECTION 4 – FIRST AID MEASURES

General advice	:	Move out of dangerous area. Call a POISON CENTRE or doctor/physician if exposed or you feel unwell. Show this safety data sheet to the doctor in attendance. Do not leave the victim unattended.
If inhaled	:	Move to fresh air. If unconscious, place in recovery position and seek medical advice. If symptoms persist, call a physician.
In case of skin contact	:	Remove contaminated clothing. If irritation develops, get medical attention. If on skin, rinse well with water. Wash contaminated clothing before re-use. If on clothes, remove clothes.
In case of eye contact	:	Immediately flush eye(s) with plenty of water. Remove contact lenses. Protect unharmed eye.
If swallowed	:	Obtain medical attention. Do not give milk or alcoholic beverages. Never give anything by mouth to an unconscious person. If symptoms persist, call a physician.
Most important symptoms and effects, both acute and delayed	:	Signs and symptoms of exposure to this material through breathing, swallowing, and/or passage of the material through the skin may include: stomach or intestinal upset (nausea, vomiting, diarrhea) irritation (nose, throat, airways) Cough Headache effects on memory loss of appetite Shortness of breath confusion pain in the hands and feet Difficulty in breathing Causes skin irritation. May cause an allergic skin reaction. Causes serious eye irritation. May cause respiratory irritation. Causes damage to organs through prolonged or repeated exposure if inhaled.
Notes to physician	:	No hazards which require special first aid measures.

SECTION 5 – FIRE-FIGHTING MEASURES

Suitable extinguishing media	:	Use extinguishing measures that are appropriate to local circumstances and the surrounding environment. Water spray Foam Alcohol-resistant foam Carbon dioxide (CO2) Dry chemical
Unsuitable extinguishing media	:	High volume water jet
Specific hazards during firefighting	:	Organic dusts at sufficient concentration can form explosive mixtures in air. Never use welding or cutting torch on or near drum (even empty) because product (even just residue) can ignite explosively. Beware of vapours accumulating to form explosive concentrations. Vapours can accumulate in low areas. Do not allow run-off from fire fighting to enter drains or water courses.
Hazardous combustion products	:	Carbon dioxide (CO2) Carbon monoxide Hydrocarbons Metal oxides Burning produces noxious and toxic fumes.
Specific extinguishing methods	:	Product is compatible with standard fire-fighting agents.
Further information	:	Do not use a solid water stream as it may scatter and spread fire. Fire residues and contaminated fire extinguishing water must be disposed of in accordance with local regulations. Use a water spray to cool fully closed containers. Polymerization will take place under fire conditions. If polymerization occurs in a closed container, there is a possibility it will rupture violently. Cool storage container with water, if exposed to fire.

Special protective equipment for firefighters	:	In the event of fire, wear self-contained breathing apparatus.

SECTION 6 – ACCIDENTAL RELEASE MEASURES

Personal precautions, protective equipment and emergency procedures	:	Evacuate personnel to safe areas. Remove all sources of ignition. Use personal protective equipment. Ensure adequate ventilation. Beware of vapours accumulating to form explosive concentrations. Vapours can accumulate in low areas. Persons not wearing protective equipment should be excluded from area of spill until clean-up has been completed.
Environmental precautions	:	Prevent product from entering drains. Prevent further leakage or spillage if safe to do so. If the product contaminates rivers and lakes or drains inform respective authorities.
Methods and materials for containment and cleaning up	:	Contain spillage, and then collect with non-combustible absorbent material, (e.g. sand, earth, diatomaceous earth, vermiculite) and place in container for disposal according to local / national regulations (see section 13).
Other information	:	Comply with all applicable federal, state, and local regulations. Suppress (knock down) gases/vapours/mists with a water spray jet.

SECTION 7 - HANDLING AND STORAGE

Advice on protection against fire and explosion	:	Take necessary action to avoid static electricity discharge (which might cause ignition of organic vapours). No sparking tools should be used. Keep away from open flames, hot surfaces and sources of ignition. Use only explosion-proof equipment.

		Static ignition hazard can result from handling and use. Electrically bond and ground all containers, personnel and equipment before transfer or use of material. Special precautions may be necessary to dissipate static electricity for non-conductive containers. Use proper bonding and grounding during product transfer as described in National Fire Protection Association document NFPA 77.
Advice on safe handling	:	Open drum carefully as content may be under pressure. Avoid formation of aerosol. Provide sufficient air exchange and/or exhaust in work rooms. Do not breathe vapours/dust. Do not smoke. Persons susceptible to skin sensitisation problems or asthma, allergies, chronic or recurrent respiratory disease should not be employed in any process in which this mixture is being used. Container hazardous when empty. Take precautionary measures against static discharges. Avoid exposure - obtain special instructions before use. Avoid contact with skin and eyes. Smoking, eating and drinking should be prohibited in the application area. For personal protection see section 8. Dispose of rinse water in accordance with local and national regulations. Secondary operations, such as grinding and sanding, may produce dust. Maintain good housekeeping. Do not permit dust layers to accumulate, for example, on floors, ledges, and equipment, in order to avoid any potential for dust explosion hazards. For further guidance on prevention of dust explosions, refer to National Fire Protection Association (NFPA) 654: "Standard for the Prevention of Fire and Dust Explosions, from the Manufacturing, Processing and Handling of Combustible Particulate Solids".
Conditions for safe storage	:	Keep container tightly closed in a dry and well-ventilated place. Containers which are opened must be carefully resealed and kept upright to prevent leakage. Observe label precautions. No smoking.
Further information on storage stability	:	No decomposition if stored and applied as directed.

SECTION 8 – EXPOSURE CONTROLS / PERSONAL PROTECTION

Components with workplace control parameters

Components	CAS-No.	Value type (Form of exposure)	Control parameters / Permissible concentration	Basis
Styrene	100-42-5	TWA	50 ppm 215 mg/m3	NIOSH REL
		ST	100 ppm 425 mg/m3	NIOSH REL
		TWA	100 ppm	OSHA Z-2
		CEIL	200 ppm	OSHA Z-2
		Peak	600 ppm	OSHA Z-2
		TWA	50 ppm 215 mg/m3	OSHA P0
		STEL	100 ppm 425 mg/m3	OSHA P0
		C	500 ppm	CAL PEL
		PEL	50 ppm 215 mg/m3	CAL PEL
		STEL	100 ppm 425 mg/m3	CAL PEL
		TWA	10 ppm	ACGIH
		STEL	20 ppm	ACGIH
TITANIUM DIOXIDE (TIO2)	13463-67-7	TWA	15 mg/m3 total dust	OSHA Z-1
		TWA	10 mg/m3 Total dust	OSHA P0
		PEL	10 mg/m3 Total dust (Titanium)	CAL PEL
		PEL	5 mg/m3 respirable dust fraction (Titanium)	CAL PEL
		TWA	10 mg/m3 (Titanium dioxide)	ACGIH

TALC	14807-96-6	TWA	20 Million particles per cubic foot Dust	OSHA Z-3
		TWA	2 mg/m3 respirable dust fraction	OSHA P0
		TWA	2 mg/m3 Respirable	NIOSH REL
		PEL	2 mg/m3 Respirable dust	CAL PEL
		TWA	0.1 fibres per cubic centimeter	ACGIH
		TWA	2 mg/m3 Respirable particulate matter	ACGIH
ALUMINUM HYDROXIDE	21645-51-2	TWA	1 mg/m3 Respirable particulate matter (Aluminium)	ACGIH
METHYLMETHACRYLATE	80-62-6	TWA	50 ppm	ACGIH
		STEL	100 ppm	ACGIH
		TWA	100 ppm 410 mg/m3	NIOSH REL
		TWA	100 ppm 410 mg/m3	OSHA Z-1
		TWA	100 ppm 410 mg/m3	OSHA P0
		PEL	50 ppm 205 mg/m3	CAL PEL
		STEL	100 ppm 410 mg/m3	CAL PEL
SILICA AMORPHOUS (SIO2)	7631-86-9	TWA	20 Million particles per cubic foot Dust (Silica)	OSHA Z-3
		TWA	80 mg/m3 / %SiO2 Dust (Silica)	OSHA Z-3
		TWA	6 mg/m3 (Silica)	NIOSH REL

		PEL	6 mg/m3	CAL PEL
SILICA COLLOIDAL AMORPHOUS	112945-52-5	TWA	20 Million particles per cubic foot Dust (Silica)	OSHA Z-3
		TWA	80 mg/m3 / %SiO2 Dust (Silica)	OSHA Z-3
		TWA	6 mg/m3 (Silica)	NIOSH REL
		PEL	6 mg/m3	CAL PEL
ETHYL BENZENE	100-41-4	TWA	20 ppm	ACGIH
		TWA	100 ppm 435 mg/m3	NIOSH REL
		ST	125 ppm 545 mg/m3	NIOSH REL
		TWA	100 ppm 435 mg/m3	OSHA Z-1
		TWA	100 ppm 435 mg/m3	OSHA P0

		STEL	125 ppm 545 mg/m3	OSHA P0
		PEL	5 ppm 22 mg/m3	CAL PEL
		STEL	30 ppm 130 mg/m3	CAL PEL

Hazardous components without workplace control parameters

Components	CAS-No.
FATTY ACIDS, C14-18 AND C16-18 UNSATD., MALEATED	85711-46-2

Biological occupational exposure limits

Components	CAS-No.	Control parameters	Biological specimen	Sampling time	Permissible concentration	Basis
Styrene	100-42-5	Mandelic acid plus phenylglyoxylic acid	Urine	End of shift (As soon as possible after exposure ceases)	400 mg/g Creatinine	ZUS_A CGIHB
Remarks:	Nonspecific					
		Styrene	Urine	End of shift (As soon as possible after exposure ceases)	40 µg/l	ZUS_A CGIHB

Engineering measures : Provide sufficient mechanical (general and/or local exhaust) ventilation to maintain exposure below exposure guidelines (if applicable) or below levels that cause known, suspected or apparent adverse effects.
Provide appropriate exhaust ventilation at places where dust is formed.

Personal protective equipment

Respiratory protection	:	In the case of vapour formation use a respirator with an approved filter.
Filter type	:	Organic vapour type

Hand protection

Material	:	Laminate (AlphaTec® 02-100 (formerly Barrier®) or Silvershield®)
Break through time	:	480 min
Glove thickness	:	> 0.5 mm
Remarks	:	The exact break through time can be obtained from the protective glove producer and this has to be observed. Gloves should be discarded and replaced if there is any indication of degradation or chemical breakthrough.
Eye protection	:	Wear chemical splash goggles when there is the potential for exposure of the eyes to liquid, vapor or mist.
Skin and body protection	:	Wear as appropriate: Impervious clothing Safety shoes Flame-resistant clothing Choose body protection according to the amount and concentration of the dangerous substance at the work place. Discard gloves that show tears, pinholes, or signs of wear. Wear resistant gloves (consult your safety equipment supplier).
Hygiene measures	:	Wash hands before breaks and at the end of workday. When using do not eat or drink. When using do not smoke.

SECTION 9 – PHYSICAL AND CHEMICAL PROPERTIES

Physical state	:	liquid
Colour	:	white
Odour	:	solvent-like
Odour Threshold	:	No data available
pH	:	No data available
Melting point/freezing point	:	No data available

Relative vapour density	:	No data available
Relative density	:	No data available
Density	:	1.078 g/cm3 (25 °C)
Solubility(ies)		
Water solubitliy	:	insoluble
Solubility in other solvents	:	No data available
Partition coefficient: n-octanol/water	:	No data available
Thermal decomposition	:	No data available
Viscosity		
Viscosity, dynamic	:	No data available
Viscosity, kinematic	:	> 20.5 mm2/s (40 °C)
Oxidizing properties	:	No data available

SECTION 10 – STABILITY AND REACTIVITY

Reactivity	:	No decomposition if stored and applied as directed.
Chemical stability	:	Stable under recommended storage conditions.
Possibility of hazardous reactions	:	Hazardous polymerisation may occur. Vapours may form explosive mixture with air. This product does not present a dust explosion hazard as delivered. However, fine dust dispersed in air in sufficient concentrations, and in the presence of an ignition source, is a potential dust explosion hazard.
Conditions to avoid	:	Exposure to air. Exposure to sunlight. Exposure to moisture

Heat, flames and sparks.

Incompatible materials	:	Acids aluminum aluminum chloride Amines Bases Copper Copper alloys fluorides halogens iron chloride metal salts nitrates reducing agents strong bases Strong oxidizing agents UV light. Peroxides
Hazardous decomposition products		Carbon monoxide Carbon dioxide (CO2) Hydrocarbons Acetone aluminum oxides

SECTION 11 – TOXICOLOGY INFORMATION

Information on likely routes of exposure	:	Inhalation Skin contact Eye Contact Ingestion

Acute toxicity

Not classified based on available information.

Components:

Styrene:

Acute oral toxicity	:	LD50 (Rat): > 2,000 mg/kg
Acute inhalation toxicity	:	LC50 (Rat): 11.8 mg/l, 2770 ppm Exposure time: 4 h Test atmosphere: vapour

No observed adverse effect level (Humans): 100 ppm
Exposure time: 7 h
Test atmosphere: vapour

Acute dermal toxicity	:	LD50 (Rat): > 2,000 mg/kg Method: OECD Test Guideline 402 Assessment: No adverse effect has been observed in acute dermal toxicity tests.

TITANIUM DIOXIDE (TIO2):

Acute oral toxicity	:	LD50 (Rat): > 24,000 mg/kg
Acute inhalation toxicity	:	LC50 (Rat): > 6.82 mg/l Exposure time: 4 h Test atmosphere: dust/mist Assessment: Not classified as acutely toxic by inhalation under GHS.
Acute dermal toxicity	:	LD50 (Rabbit): > 10,000 mg/kg

TALC:

Acute oral toxicity	:	LD50 (Rat): > 5,000 mg/kg Method: OECD Test Guideline 423

ALUMINUM HYDROXIDE:

Acute oral toxicity	:	LD50 (Rat): > 5,000 mg/kg LD50 (Rat, female): > 2,000 mg/kg Method: OECD Test Guideline 423 GLP: yes Assessment: No adverse effect has been observed in acute oral toxicity tests.
Acute inhalation toxicity	:	LC50 (Rat): > 2.3 mg/l Exposure time: 4 h Test atmosphere: dust/mist Assessment: Not classified as acutely toxic by inhalation under GHS. Remarks: Information given is based on data obtained from similar substances.

METHYLMETHACRYLATE:

Acute oral toxicity	:	LD50 (Rat): 7,800 mg/kg
Acute inhalation toxicity	:	LC50 (Rat): 29.8 mg/l Exposure time: 4 h Test atmosphere: vapour
Acute dermal toxicity	:	LD50 (Rabbit): > 5,000

mg/kg

SILICA AMORPHOUS (SIO2)**:**

Acute oral toxicity	:	LD50 (Rat): > 5,000 mg/kg Method: OECD Test Guideline 401 GLP: yes
Acute inhalation toxicity	:	LC50 (Rat): > 2.08 mg/l Exposure time: 4 h Test atmosphere: dust/mist Method: OECD Test Guideline 403 GLP: yes Assessment: No adverse effect has been observed in acute inhalation toxicity tests.
Acute dermal toxicity	:	LD50 (Rabbit): > 5,000 mg/kg

SILICA COLLOIDAL AMORPHOUS**:**

Acute oral toxicity	:	LD50 (Rat): > 5,000 mg/kg
Acute dermal toxicity	:	LD50 (Rabbit): > 2,000 mg/kg Assessment: Not classified as acutely toxic by dermal absorption under GHS.

FATTY ACIDS, C14-18 AND C16-18 UNSATD., MALEATED**:**

Acute oral toxicity	:	LD50 (Rat): > 2,000 mg/kg Method: OECD Test Guideline 401

Skin corrosion/irritation

Causes skin irritation.

Product:

Result: Repeated exposure may cause skin dryness or cracking.

Remarks: Individuals with direct skin contact with methyl methacrylate have experienced temporary loss of feeling and mild nerve damage in the fingers.

Remarks: May cause skin irritation and/or dermatitis.

Components:

Styrene**:**

Species:

Rabbit

Result: Irritating to skin.

Species: human skin

Result: No skin irritation

TITANIUM DIOXIDE (TIO2)**:**

Result: Slight, transient irritation

TALC:
Species: reconstructed human epidermis (RhE)
Result: No skin irritation

ALUMINUM HYDROXIDE:
Species: Rabbit
Method: OECD Test Guideline 404
Result: No skin irritation
GLP: yes

METHYLMETHACRYLATE:
Result: Irritating to skin.

SILICA AMORPHOUS (SIO2):
Result: Slight, transient irritation

SILICA COLLOIDAL AMORPHOUS:
Result: No skin irritation

FATTY ACIDS, C14-18 AND C16-18 UNSATD., MALEATED:
Species: reconstructed human epidermis (RhE)
Method: OECD Test Guideline 439
Result: Irritating to skin.

Serious eye damage/eye irritation

Causes serious eye irritation.

Product:

Remarks: Vapours may cause irritation to the eyes, respiratory system and the skin., Causes serious eye irritation.

Components:

Styrene:
Result: Irritating to eyes.
Remarks: Vapour during processing may be irritating to the respiratory tract and to the eyes.

TITANIUM DIOXIDE (TIO2):
Result: Slight, transient irritation

TALC:
Species: Rabbit
Result: Slight, transient irritation
Method: OECD Test Guideline 405

ALUMINUM HYDROXIDE:
Species: Rabbit
Result: No eye irritation
Method: OECD Test Guideline 405
GLP: yes

METHYLMETHACRYLATE:
Result: Slight, transient irritation

SILICA AMORPHOUS (SIO2):
Result: Slight, transient irritation

SILICA COLLOIDAL AMORPHOUS**:**
Result: No eye irritation

FATTY ACIDS, C14-18 AND C16-18 UNSATD., MALEATED**:**
Species: Rabbit
Result: No skin irritation
Method: OECD Test Guideline 405

Respiratory or skin sensitisation

Skin sensitisation: May cause an allergic skin reaction.
Respiratory sensitisation: Not classified based on available information.

Components:

Styrene**:**
Exposure routes: Skin contact
Species: Guinea pig
Assessment: Does not cause skin sensitisation.
Result: negative

Exposure routes: inhalation
(vapour) Species: Humans
Assessment: Does not cause respiratory sensitisation. Result: negative

TALC**:**
Test Type: Maximisation Test
Species: Guinea pig
Assessment: Did not cause sensitisation on laboratory animals. Method: OECD Test Guideline 406

ALUMINUM HYDROXIDE**:**
Test Type: Maximisation Test
Species: Guinea pig
Assessment: Did not cause sensitisation on laboratory animals. Method: OECD Test Guideline 406
GLP: yes

METHYLMETHACRYLATE**:**
Test Type: Local lymph node assay
Species: Mouse
Method: OECD Test Guideline 429
Result: The product is a skin sensitiser, sub-category 1B.

FATTY ACIDS, C14-18 AND C16-18 UNSATD., MALEATED**:**
Test Type: Local lymph node assay
Species: Mouse
Assessment: May cause sensitisation by skin contact.
Method: OECD Test Guideline 429

Germ cell mutagenicity
Not classified based on available information.

Components:

TALC**:**

Genotoxicity in vitro	:	Test Type: In vitro gene mutation study in bacteria Test species: Salmonella typhimurium Metabolic activation: with and without metabolic activation Result: negative
	:	Test Type: In vitro gene mutation study in bacteria Test species: Saccharomyces cerevisiae Metabolic activation: with and without metabolic activation Result: negative
Genotoxicity in vivo	:	Test Type: dominant lethal test Test species: Rat (male) Cell type: Bone marrow Result: negative

FATTY ACIDS, C14-18 AND C16-18 UNSATD., MALEATED**:**

Genotoxicity in vitro	:	Test Type: Ames test Metabolic activation: with and without metabolic activation Method: OECD Test Guideline 471 Result: negative

Carcinogenicity

Not classified based on available information.

Product:

Carcinogenicity - Assessment	:	Styrene has been tested for carcinogenicity in rats and mice. Styrene caused lung tumors in mice only. These tumors are not considered to be relevant to humans.

Reproductive toxicity

Not classified based on available information.

STOT - single exposure

May cause respiratory irritation.

Components:

Styrene**:**
Assessment: May cause respiratory irritation.

METHYLMETHACRYLATE**:**
Target Organs: Upper respiratory tract
Assessment: May cause respiratory irritation.

STOT - repeated exposure

Causes damage to organs (Auditory system) through prolonged or repeated exposure if inhaled.

Components:

Styrene**:**
Exposure routes: inhalation
(vapour) Target Organs: Auditory system
Assessment: Causes damage to organs through prolonged or repeated exposure.

Repeated dose toxicity

Components:

Styrene**:**
Species: Human 85 mg/m3

Application Route: inhalation (vapour)

Species: Human 615 mg/kg
Application Route: Skin contact

Aspiration toxicity
Not classified based on available information.

Components:
Styrene**:**
May be fatal if swallowed and enters airways.

Further information Product:
Remarks: Solvents may degrease the skin.

Carcinogenicity:

IARC	Group 2A: Probably carcinogenic to humans	
	Styrene	100-42-5
	Group 2B: Possibly carcinogenic to humans	
	TITANIUM DIOXIDE (TIO2)	13463-67-7
	ETHYL BENZENE	100-41-4
OSHA	No component of this product present at levels greater than or equal to 0.1% is on OSHA's list of regulated carcinogens.	
NTP	Reasonably anticipated to be a human carcinogen	
	Styrene	100-42-5

SECTION 12 – ECOLOGICAL INFORMATION

Ecotoxicity Product:

Ecotoxicology Assessment

Short-term (acute) aquatic hazard	:	Acute aquatic toxicity Category 2; Toxic to aquatic life.
Long-term (chronic) aquatic hazard	:	Chronic aquatic toxicity Category 3; Harmful to aquatic life with long lasting effects.

Components:

Styrene:

Toxicity to fish	:	LC50 (Pimephales promelas (fathead minnow)): 4.02 mg/l Exposure time: 96 h
Toxicity to daphnia and other aquatic invertebrates	:	EC50 (Daphnia magna (Water flea)): 4.7 mg/l Exposure time: 48 h
Toxicity to algae	:	ErC50 (Pseudokirchneriella subcapitata (green algae)): 4.9 mg/l Exposure time: 72 h
Toxicity to daphnia and other aquatic invertebrates (Chronic toxicity)	:	NOEC (Daphnia magna (Water flea)): 1.01 mg/l Exposure time: 21 d
Toxicity to bacteria	:	EC50 (activated sludge): ca. 500 mg/l Exposure time: 0.5 h
Toxicity to soil dwelling organisms	:	NOEC (Eisenia fetida (earthworms)): 34 mg/kg Exposure time: 14 d Method: OECD Test Guideline 207

TITANIUM DIOXIDE (TIO2):

Toxicity to daphnia and other aquatic invertebrates	:	EC50 (Daphnia magna (Water flea)): > 1,000 mg/l Exposure time: 48 h Test Type: static test

METHYLMETHACRYLATE:

Toxicity to fish	:	LC50 (Pimephales promelas (fathead minnow)): 130 mg/l Exposure time: 96 h Method: static test
		LC50 (Oncorhynchus mykiss (rainbow trout)): > 79 mg/l Exposure time: 96 h Test Type: flow-through test

Toxicity to daphnia and other aquatic invertebrates	:	EC50 (Daphnia magna (Water flea)): 69 mg/l Exposure time: 48 h Test Type: flow-through test
Toxicity to algae	:	EC50 (Pseudokirchneriella subcapitata (algae)): > 110 mg/l Exposure time: 72 h Test Type: static test
Toxicity to fish (Chronic toxicity)	:	LC50 (Danio rerio (zebra fish)): 33.7 mg/l Exposure time: 35 d Test Type: flow-through test Method: OECD Test Guideline 210
Toxicity to daphnia and other aquatic invertebrates (Chronic toxicity)	:	NOEC (Daphnia magna (Water flea)): 37 mg/l Exposure time: 21 d Test Type: flow-through test Method: OECD Test Guideline 211

SILICA AMORPHOUS (SIO2)**:**

Toxicity to fish	:	LC50 (Danio rerio (zebra fish)): > 10,000 mg/l Exposure time: 96 h Method: OECD Test Guideline 203 GLP: yes

SILICA COLLOIDAL AMORPHOUS**:**

Toxicity to fish	:	LC50 (Brachydanio rerio (zebrafish)): > 10,000 mg/l Exposure time: 96 h Method: OECD Test Guideline 203

FATTY ACIDS, C14-18 AND C16-18 UNSATD., MALEATED**:**

Toxicity to daphnia and other aquatic invertebrates	:	EL50 (Daphnia magna (Water flea)): > 100 mg/l Exposure time: 48 h Test Type: semi-static test Test substance: WAF Method: OECD Test Guideline 202
Toxicity to algae	:	EL50 (Pseudokirchneriella subcapitata (microalgae)): > 100 mg/l End point: Growth inhibition Exposure time: 72 h Test Type: static test Test substance: WAF Method: OECD Test Guideline 201

Persistence and degradability Components:

Styrene:

Biodegradability : Result: Readily biodegradable.
Biodegradation: > 60 %
Exposure time: 10 d

TALC:

Biodegradability : Result: The methods for determining biodegradability are not applicable to inorganic substances.

METHYLMETHACRYLATE:

Biodegradability : Result: Readily biodegradable.
Biodegradation: 94.3 %
Exposure time: 14 d
Method: OECD Test Guideline 301C

SILICA COLLOIDAL AMORPHOUS:

Biodegradability : Result: The methods for determining biodegradability are not applicable to inorganic substances.

FATTY ACIDS, C14-18 AND C16-18 UNSATD., MALEATED:

Biodegradability : Result: Not readily biodegradable
Biodegradation 40 %
Exposure time 28 d
Method: OECD Test Guideline 301F

:

No data available

Bioaccumulative potential

Components:

Styrene:

Bioaccumulation : Bioconcentration factor (BCF): < 100

Partition coefficient: n-octanol/water : log Pow: 2.96 (25 °C)

METHYLMETHACRYLATE:

Partition coefficient: n-octanol/water : log Pow: 1.38

FATTY ACIDS, C14-18 AND C16-18 UNSATD., MALEATED:

Partition coefficient: n-octanol/water : log Pow: < 1 (25 °C)

No data available

Mobility in soil

Components: Styrene**:**

Distribution among environmental compartments : Koc: 352

No data available **Other adverse effects**

Product:

Additional ecological information : An environmental hazard cannot be excluded in the event of unprofessional handling or disposal., Toxic to aquatic life., Harmful to aquatic life with long lasting effects.

Components:

Styrene**:**

Results of PBT and vPvB assessment : This substance is not considered to be persistent, bioaccumulating and toxic (PBT). This substance is not considered to be very persistent and very bioaccumulating (vPvB).

METHYLMETHACRYLATE**:**

Results of PBT and vPvB assessment : This substance is not considered to be persistent, bioaccumulating and toxic (PBT). This substance is not considered to be very persistent and very bioaccumulating (vPvB).

SECTION 13 – DISPOSAL CONSIDERATIONS

Disposal methods

General advice : The product should not be allowed to enter drains, water courses or the soil.
Do not contaminate ponds, waterways or ditches with chemical or used container.
Send to a licensed waste management company.

Dispose of in accordance with all applicable local, state and federal regulations.

Contaminated packaging	:	Empty remaining contents. Dispose of as unused product. Empty containers should be taken to an approved waste handling site for recycling or disposal. Do not re-use empty containers. Do not burn, or use a cutting torch on, the empty drum.

SECTION 14 - TRANSPORT INFORMATION

International transport regulations REGULATION

ID NUMBER	PROPER SHIPPING NAME	*HAZARD CLASS	SUBSIDIARY HAZARDS	PACKING GROUP	MARINE POLLUTANT / LTD. QTY.

MX_DG

UN	1866	RESIN SOLUTION	3		III

INTERNATIONAL AIR TRANSPORT ASSOCIATION - PASSENGER

UN	1866	Resin solution	3		III

INTERNATIONAL AIR TRANSPORT ASSOCIATION - CARGO

UN	1866	Resin solution	3		III

INTERNATIONAL MARITIME DANGEROUS GOODS

UN	1866	RESIN SOLUTION	3		III

TDG_INWT_C

UN	1866	RESIN SOLUTION	3		III

TDG_RAIL_C

UN	1866	RESIN SOLUTION	3		III

TDG_ROAD_C

UN	1866	RESIN SOLUTION	3		III

U.S. DOT - INLAND WATERWAYS

UN	1866	Resin solution	3		III

CFR_RAIL_C

UN	1866	Resin solution	3	III

U.S. DOT - ROAD

UN	1866	Resin solution	3	III

***ORM = ORM-D, CBL = COMBUSTIBLE LIQUID**

Marine pollutant		no

Dangerous goods descriptions (if indicated above) may not reflect quantity, end-use or region-specific exceptions that can be applied. Consult shipping documents for descriptions that are specific to the shipment.

SECTION 15 – REGULATORY INFORMATION

TSCA list
No substances are subject to a Significant New Use Rule.

No substances are subject to TSCA 12(b) export notification requirements.

EPCRA - Emergency Planning and Community

Right-to-Know Act CERCLA Reportable Quantity

Components	CAS-No.	Component	Calculated product
		(lbs)	(lbs)
Styrene	100-42-5	1000	3950

SARA 304 Extremely Hazardous Substances Reportable Quantity
This material does not contain any components with a section 304 EHS RQ.

SARA 311/312 Hazards : Flammable (gases, aerosols, liquids, or solids)
Combustible Dust
Hazard not otherwise classified (physical hazards) Skin corrosion or irritation
Serious eye damage or eye irritation
Respiratory or skin sensitisation
Specific target organ toxicity (single or repeated exposure)

SARA 302 : This material does not contain any components with a section 302 EHS TPQ.

SARA 313

The following components are subject to reporting levels established by SARA Title III, Section 313:
Styrene 100-42-5 25.31 %

METHYLMETHACRYLATE	80-62-6	3.00 %
ETHYL BENZENE	100-41-4	0.15 %

California Prop. 65

WARNING: This product can expose you to chemicals including styrene, Titanium dioxide, ethylbenzene, Quartz, cumene, benzene, 1,4-dioxane, formaldehyde, acetaldehyde, ethylene oxide, methyl isobutyl ketone, naphthalene, α-methylstyrene, which is/are known to the State of California to cause cancer, and toluene, benzene, ethylene oxide, methyl isobutyl ketone, methanol, chloromethane, which is/are known to the State of California to cause birth defects or other reproductive harm. For more information go to www.P65Warnings.ca.gov.

The components of this product are reported in the following inventories:

TCSI	:	Not in compliance with the inventory
TSCA	:	On or in compliance with the active portion of the TSCA inventory
AIIC	:	Not in compliance with the inventory
DSL	:	On the inventory, or in compliance with the inventory
ENCS	:	Not in compliance with the inventory
KECI	:	Not in compliance with the inventory
PICCS	:	Not in compliance with the inventory
IECSC	:	On the inventory, or in compliance with the inventory
NZIoC	:	Not in compliance with the inventory

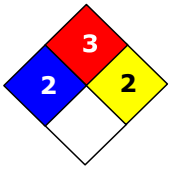
Inventories

AIIC (Australia), DSL (Canada), IECSC (China), REACH (European Union), ENCS (Japan), ISHL (Japan), KECI (Korea), NZIoC (New Zealand), PICCS (Philippines), TCSI (Taiwan), TECI (Thailand), TSCA (USA)

SECTION 16 – OTHER INFORMATION

Revision Date

2/13/2023

NFPA:	HMIS III:
Flammability  Special	HEALTH 2* FLAMMABILITY 3 PHYSICAL HAZARD 2 0 = not significant, 1 =Slight, 2 = Moderate, 3 = High 4 = Extreme, * = Chronic

NFPA Flammable and Combustible Liquids Classification

Flammable Liquid Class IC

Full text of H-Statements

H225	Highly flammable liquid and vapor
H226	Flammable liquid and vapor.
H304	May be fatal if swallowed and enters airways.
H315	Causes skin irritation.
H317	May cause an allergic skin reaction.
H319	Causes serious eye irritation.
H332	Harmful if inhaled.
H335	May cause respiratory irritation.
H372	Causes damage to organs through prolonged or repeated exposure if inhaled.

The information accumulated herein is believed to be accurate but is not warranted to be whether originating with **Fibre Glast Developments Corporation** or not. Recipients are advised to confirm in advance of need that the information is current, applicable, and suitable to their circumstances.

SAFETY DATA SHEET

FH411

Section 1. Identification

Product name : FINISH 1™ 2K HS Hardener (Part B)

Product code : FH411

Other means of identification : Not available.

Product type : Liquid.

Relevant identified uses of the substance or mixture and uses advised against

Paint or paint related material.

Manufacturer : ACME AUTOMOTIVE FINISHES
101 W. Prospect Avenue
Cleveland, OH 44115

National contact : ACME AUTOMOTIVE FINISHES
180 Brunel Road
Mississauga, Ontario L4Z 1T5 Canada

Emergency telephone number of the company : US / Canada: (800) 424-9300
Mexico: SETIQ 800-00-214-00 / 55-5559-1588 Available 24 hours and 365 days a year

Product Information Telephone Number : US / Canada: (216) 566-3031
Mexico: Not Available

Transportation Emergency Telephone Number : US / Canada: (800) 424-9300
Mexico: SETIQ 800-00-214-00 / 55-5559-1588 Available 24 hours and 365 days a year

Section 2. Hazards identification

Classification of the substance or mixture : FLAMMABLE LIQUIDS - Category 3
SKIN CORROSION/IRRITATION - Category 2
SERIOUS EYE DAMAGE/ EYE IRRITATION - Category 2A
SKIN SENSITIZATION - Category 1
CARCINOGENICITY - Category 2
SPECIFIC TARGET ORGAN TOXICITY (SINGLE EXPOSURE) (Respiratory tract irritation) - Category 3
SPECIFIC TARGET ORGAN TOXICITY (SINGLE EXPOSURE) (Narcotic effects) - Category 3
SPECIFIC TARGET ORGAN TOXICITY (REPEATED EXPOSURE) - Category 2
Percentage of the mixture consisting of ingredient(s) of unknown acute toxicity: 7.3% (dermal), 16.9% (inhalation)

GHS label elements

Hazard pictograms :



Signal word : Warning

Section 2. Hazards identification

Hazard statements : Flammable liquid and vapor.
Causes skin irritation.
May cause an allergic skin reaction.
Causes serious eye irritation.
May cause respiratory irritation.
May cause drowsiness or dizziness.
Suspected of causing cancer.
May cause damage to organs through prolonged or repeated exposure.

Precautionary statements

Prevention : Obtain special instructions before use. Do not handle until all safety precautions have been read and understood. Wear protective gloves, protective clothing and eye or face protection. Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking. Use explosion-proof electrical, ventilating or lighting equipment. Use non-sparking tools. Take action to prevent static discharges. Use only outdoors or in a well-ventilated area. Do not breathe vapor. Wash thoroughly after handling. Contaminated work clothing must not be allowed out of the workplace.

Response : IF exposed or concerned: Get medical advice or attention. IF INHALED: Remove person to fresh air and keep comfortable for breathing. Call a POISON CENTER or doctor if you feel unwell. IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water. Wash contaminated clothing before reuse. IF ON SKIN: Wash with plenty of water. If skin irritation or rash occurs: Get medical advice or attention. IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If eye irritation persists: Get medical advice or attention.

Storage : Store locked up. Store in a well-ventilated place. Keep container tightly closed. Keep cool.

Disposal : Dispose of contents and container in accordance with all local, regional, national and international regulations.

Supplemental label elements

DELAYED EFFECTS FROM LONG TERM OVEREXPOSURE. Contains solvents which can cause permanent brain and nervous system damage. Intentional misuse by deliberately concentrating and inhaling the contents can be harmful or fatal. WARNING: This product contains chemicals known to the State of California to cause cancer and birth defects or other reproductive harm. FOR PROFESSIONAL USE ONLY. This product must be mixed with other components before use. Before opening the packages, READ AND FOLLOW WARNING LABELS ON ALL COMPONENTS. VAPOR AND SPRAY MIST HARMFUL. Gives off harmful vapor of solvents and isocyanates. DO NOT USE IF YOU HAVE CHRONIC (LONG-TERM) LUNG OR BREATHING PROBLEMS, OR IF YOU HAVE EVER HAD A REACTION TO ISOCYANATES. USE ONLY WITH ADEQUATE VENTILATION. WHERE OVERSPRAY IS PRESENT, A POSITIVE PRESSURE AIR SUPPLIED RESPIRATOR (NIOSH approved) SHOULD BE WORN TO PREVENT EXPOSURE. IF UNAVAILABLE, AN APPROPRIATE PROPERLY FITTED APPROVED NIOSH VAPOR/PARTICULATE RESPIRATOR MAY BE EFFECTIVE. Follow directions for respirator use. Wear the respirator for the whole time of spraying and until all vapors and mists are gone. If you have any breathing problems during use, LEAVE THE AREA and get fresh air. If problems remain or happen later, IMMEDIATELY call a doctor - If not available get emergency medical treatment. Have this label with you. Reacts with water in closed container to produce pressure which may cause container to burst.

Please refer to the SDS for additional information. Keep out of reach of children. Do not transfer contents to other containers for storage.

Hazards not otherwise classified : None known.

Section 3. Composition/information on ingredients

Substance/mixture : Mixture

Other means of identification : Not available.

CAS number/other identifiers

Ingredient name	% by weight	CAS number
Hexamethylene Diisocyanate Polymer	41.14	28182-81-2
n-Butyl Acetate	19.26	123-86-4
Methyl Ethyl Ketone	9.7	78-93-3
Methyl n-Propyl Ketone	9.61	107-87-9
Ethyl 3-Ethoxypropionate	7.27	763-69-9
Xylene, mixed isomers	4.92	1330-20-7
Methyl n-Amyl Ketone	4.85	110-43-0
Light Aromatic Hydrocarbons	1.09	64742-95-6
Ethylbenzene	0.88	100-41-4
trimethylbenzene	0.53	25551-13-7
1,3,5-Trimethylbenzene	0.22	108-67-8
1,2,4-Trimethylbenzene	0.22	95-63-6

Any concentration shown as a range is to protect confidentiality or is due to batch variation.

There are no additional ingredients present which, within the current knowledge of the supplier and in the concentrations applicable, are classified and hence require reporting in this section.

Occupational exposure limits, if available, are listed in Section 8.

Section 4. First aid measures

Description of necessary first aid measures

Eye contact : Immediately flush eyes with plenty of water, occasionally lifting the upper and lower eyelids. Check for and remove any contact lenses. Continue to rinse for at least 10 minutes. Get medical attention.

Inhalation : Remove victim to fresh air and keep at rest in a position comfortable for breathing. If it is suspected that fumes are still present, the rescuer should wear an appropriate mask or self-contained breathing apparatus. If not breathing, if breathing is irregular or if respiratory arrest occurs, provide artificial respiration or oxygen by trained personnel. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation. Get medical attention. If necessary, call a poison center or physician. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway. Loosen tight clothing such as a collar, tie, belt or waistband. In case of inhalation of decomposition products in a fire, symptoms may be delayed. The exposed person may need to be kept under medical surveillance for 48 hours.

Skin contact : Wash with plenty of soap and water. Remove contaminated clothing and shoes. Wash contaminated clothing thoroughly with water before removing it, or wear gloves. Continue to rinse for at least 10 minutes. Get medical attention. In the event of any complaints or symptoms, avoid further exposure. Wash clothing before reuse. Clean shoes thoroughly before reuse.

Ingestion : Wash out mouth with water. Remove dentures if any. If material has been swallowed and the exposed person is conscious, give small quantities of water to drink. Stop if the exposed person feels sick as vomiting may be dangerous. Do not induce vomiting unless directed to do so by medical personnel. If vomiting occurs, the head should be kept low so that vomit does not enter the lungs. Get medical attention. If necessary, call a poison center or physician. Never give anything by mouth to an unconscious person. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway. Loosen tight clothing such as a collar, tie, belt or waistband.

Section 4. First aid measures

Most important symptoms/effects, acute and delayed

Potential acute health effects

Eye contact : Causes serious eye irritation.

Inhalation : Can cause central nervous system (CNS) depression. May cause drowsiness or dizziness. May cause respiratory irritation.

Skin contact : Causes skin irritation. May cause an allergic skin reaction.

Ingestion : Can cause central nervous system (CNS) depression.

Over-exposure signs/symptoms

Eye contact : Adverse symptoms may include the following:
pain or irritation
watering
redness

Inhalation : Adverse symptoms may include the following:
respiratory tract irritation
coughing
nausea or vomiting
headache
drowsiness/fatigue
dizziness/vertigo
unconsciousness

Skin contact : Adverse symptoms may include the following:
irritation
redness

Ingestion : No specific data.

Indication of immediate medical attention and special treatment needed, if necessary

Notes to physician : In case of inhalation of decomposition products in a fire, symptoms may be delayed. The exposed person may need to be kept under medical surveillance for 48 hours.

Specific treatments : No specific treatment.

Protection of first-aiders : No action shall be taken involving any personal risk or without suitable training. If it is suspected that fumes are still present, the rescuer should wear an appropriate mask or self-contained breathing apparatus. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation. Wash contaminated clothing thoroughly with water before removing it, or wear gloves.

See toxicological information (Section 11)

Section 5. Fire-fighting measures

Extinguishing media

Suitable extinguishing media : Use dry chemical, CO_2, water spray (fog) or foam.

Unsuitable extinguishing media : Do not use water jet.

Specific hazards arising from the chemical : Flammable liquid and vapor. Runoff to sewer may create fire or explosion hazard. In a fire or if heated, a pressure increase will occur and the container may burst, with the risk of a subsequent explosion. The vapor/gas is heavier than air and will spread along the ground. Vapors may accumulate in low or confined areas or travel a considerable distance to a source of ignition and flash back.

Section 5. Fire-fighting measures

Hazardous thermal decomposition products : Decomposition products may include the following materials:
carbon dioxide
carbon monoxide
nitrogen oxides

Special protective actions for fire-fighters : Promptly isolate the scene by removing all persons from the vicinity of the incident if there is a fire. No action shall be taken involving any personal risk or without suitable training. Move containers from fire area if this can be done without risk. Use water spray to keep fire-exposed containers cool.

Special protective equipment for fire-fighters : Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.

Remark : Flammable liquid.

Section 6. Accidental release measures

Personal precautions, protective equipment and emergency procedures

For non-emergency personnel : No action shall be taken involving any personal risk or without suitable training. Evacuate surrounding areas. Keep unnecessary and unprotected personnel from entering. Do not touch or walk through spilled material. Shut off all ignition sources. No flares, smoking or flames in hazard area. Avoid breathing vapor or mist. Provide adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Put on appropriate personal protective equipment.

For emergency responders : If specialized clothing is required to deal with the spillage, take note of any information in Section 8 on suitable and unsuitable materials. See also the information in "For non-emergency personnel".

Environmental precautions : Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers. Inform the relevant authorities if the product has caused environmental pollution (sewers, waterways, soil or air).

Methods and materials for containment and cleaning up

Small spill : Stop leak if without risk. Move containers from spill area. Use spark-proof tools and explosion-proof equipment. Dilute with water and mop up if water-soluble. Alternatively, or if water-insoluble, absorb with an inert dry material and place in an appropriate waste disposal container. Dispose of via a licensed waste disposal contractor.

Large spill : Stop leak if without risk. Move containers from spill area. Use spark-proof tools and explosion-proof equipment. Approach release from upwind. Prevent entry into sewers, water courses, basements or confined areas. Wash spillages into an effluent treatment plant or proceed as follows. Contain and collect spillage with non-combustible, absorbent material e.g. sand, earth, vermiculite or diatomaceous earth and place in container for disposal according to local regulations (see Section 13). Dispose of via a licensed waste disposal contractor. Contaminated absorbent material may pose the same hazard as the spilled product. Note: see Section 1 for emergency contact information and Section 13 for waste disposal.

Section 7. Handling and storage

Precautions for safe handling

Protective measures : Put on appropriate personal protective equipment (see Section 8). Persons with a history of skin sensitization problems should not be employed in any process in which this product is used. Avoid exposure - obtain special instructions before use. Do not handle until all safety precautions have been read and understood. Do not get in eyes or on skin or clothing. Do not breathe vapor or mist. Do not ingest. Use only with adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Do not enter storage areas and confined spaces unless adequately ventilated. Keep in the original container or an approved alternative made from a compatible material, kept

Section 7. Handling and storage

tightly closed when not in use. Store and use away from heat, sparks, open flame or any other ignition source. Use explosion-proof electrical (ventilating, lighting and material handling) equipment. Use only non-sparking tools. Take precautionary measures against electrostatic discharges. Empty containers retain product residue and can be hazardous. Do not reuse container.

Advice on general occupational hygiene : Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking. Remove contaminated clothing and protective equipment before entering eating areas. See also Section 8 for additional information on hygiene measures.

Conditions for safe storage, including any incompatibilities : Store in accordance with local regulations. Store in a segregated and approved area. Store in original container protected from direct sunlight in a dry, cool and well-ventilated area, away from incompatible materials (see Section 10) and food and drink. Store locked up. Eliminate all ignition sources. Separate from oxidizing materials. Keep container tightly closed and sealed until ready for use. Containers that have been opened must be carefully resealed and kept upright to prevent leakage. Do not store in unlabeled containers. Use appropriate containment to avoid environmental contamination. See Section 10 for incompatible materials before handling or use.

Section 8. Exposure controls/personal protection

Control parameters

Occupational exposure limits (OSHA United States)

Ingredient name	CAS #	Exposure limits
Hexamethylene Diisocyanate Polymer	28182-81-2	None.
n-Butyl Acetate	123-86-4	**NIOSH REL (United States, 10/2020).** TWA: 150 ppm 10 hours. TWA: 710 mg/m³ 10 hours. STEL: 200 ppm 15 minutes. STEL: 950 mg/m³ 15 minutes. **OSHA PEL (United States, 5/2018).** TWA: 150 ppm 8 hours. TWA: 710 mg/m³ 8 hours. **ACGIH TLV (United States, 1/2024). [Butyl acetates]** STEL: 150 ppm 15 minutes. TWA: 50 ppm 8 hours.
Methyl Ethyl Ketone	78-93-3	**ACGIH TLV (United States, 1/2024). Absorbed through skin.** TWA: 75 ppm 8 hours. STEL: 150 ppm 15 minutes. **NIOSH REL (United States, 10/2020).** TWA: 200 ppm 10 hours. TWA: 590 mg/m³ 10 hours. STEL: 300 ppm 15 minutes. STEL: 885 mg/m³ 15 minutes. **OSHA PEL (United States, 5/2018).** TWA: 200 ppm 8 hours. TWA: 590 mg/m³ 8 hours.
Methyl n-Propyl Ketone	107-87-9	**NIOSH REL (United States, 10/2020).** TWA: 150 ppm 10 hours. TWA: 530 mg/m³ 10 hours. **OSHA PEL (United States, 5/2018).** TWA: 200 ppm 8 hours. TWA: 700 mg/m³ 8 hours.

Section 8. Exposure controls/personal protection

		ACGIH TLV (United States, 1/2024). STEL: 150 ppm 15 minutes.
Ethyl 3-Ethoxypropionate	763-69-9	None.
Xylene, mixed isomers	1330-20-7	**OSHA PEL (United States, 5/2018). [Xylenes]** TWA: 100 ppm 8 hours. TWA: 435 mg/m³ 8 hours. **ACGIH TLV (United States, 1/2024). [p-xylene and mixtures containing p-xylene] Ototoxicant.** TWA: 20 ppm 8 hours.
Methyl n-Amyl Ketone	110-43-0	**ACGIH TLV (United States, 1/2024).** TWA: 50 ppm 8 hours. TWA: 233 mg/m³ 8 hours. **NIOSH REL (United States, 10/2020).** TWA: 100 ppm 10 hours. TWA: 465 mg/m³ 10 hours. **OSHA PEL (United States, 5/2018).** TWA: 100 ppm 8 hours. TWA: 465 mg/m³ 8 hours.
Light Aromatic Hydrocarbons	64742-95-6	None.
Ethylbenzene	100-41-4	**ACGIH TLV (United States, 1/2024). Ototoxicant.** TWA: 20 ppm 8 hours. **NIOSH REL (United States, 10/2020).** TWA: 100 ppm 10 hours. TWA: 435 mg/m³ 10 hours. STEL: 125 ppm 15 minutes. STEL: 545 mg/m³ 15 minutes. **OSHA PEL (United States, 5/2018).** TWA: 100 ppm 8 hours. TWA: 435 mg/m³ 8 hours.
trimethylbenzene	25551-13-7	**ACGIH TLV (United States, 1/2024). [trimethyl benzene, isomers]** TWA: 10 ppm 8 hours.
1,3,5-Trimethylbenzene	108-67-8	**ACGIH TLV (United States, 1/2024). [trimethyl benzene, isomers]** TWA: 10 ppm 8 hours. **NIOSH REL (United States, 10/2020).** TWA: 25 ppm 10 hours. TWA: 125 mg/m³ 10 hours.
1,2,4-Trimethylbenzene	95-63-6	**NIOSH REL (United States, 10/2020).** TWA: 25 ppm 10 hours. TWA: 125 mg/m³ 10 hours. **ACGIH TLV (United States, 1/2024).** TWA: 10 ppm 8 hours.

Occupational exposure limits (Canada)

Section 8. Exposure controls/personal protection

Ingredient name	CAS #	Exposure limits
Hexamethylene Diisocyanate Polymer	28182-81-2	**CA Quebec Provincial (Canada, 2/2024). [Isocyanate oligomers] Skin sensitizer. Inhalation sensitizer.**
n-butyl acetate	123-86-4	**CA Alberta Provincial (Canada, 3/2023).** OEL: 200 ppm 15 minutes. OEL: 950 mg/m³ 15 minutes. OEL: 150 ppm 8 hours. OEL: 713 mg/m³ 8 hours. **CA Saskatchewan Provincial (Canada, 4/2021).** STEL: 200 ppm 15 minutes. TWA: 150 ppm 8 hours. **CA Ontario Provincial (Canada, 6/2019). [butyl acetates, all isomers]** STEL: 150 ppm 15 minutes. TWA: 50 ppm 8 hours. **CA British Columbia Provincial (Canada, 8/2023). [butyl acetate, all isomers]** STEL: 150 ppm 15 minutes. TWA: 50 ppm 8 hours. **CA Quebec Provincial (Canada, 2/2024). [butyl acetates]** STEV: 150 ppm 15 minutes. TWAEV: 50 ppm 8 hours.
Methyl ethyl ketone	78-93-3	**CA Alberta Provincial (Canada, 3/2023).** OEL: 300 ppm 15 minutes. OEL: 200 ppm 8 hours. OEL: 590 mg/m³ 8 hours. OEL: 885 mg/m³ 15 minutes. **CA British Columbia Provincial (Canada, 8/2023). Absorbed through skin.** TWA: 50 ppm 8 hours. STEL: 100 ppm 15 minutes. **CA Ontario Provincial (Canada, 6/2019).** TWA: 200 ppm 8 hours. STEL: 300 ppm 15 minutes. **CA Quebec Provincial (Canada, 2/2024).** TWAEV: 50 ppm 8 hours. TWAEV: 150 mg/m³ 8 hours. STEV: 100 ppm 15 minutes. STEV: 300 mg/m³ 15 minutes. **CA Saskatchewan Provincial (Canada, 4/2021).** STEL: 300 ppm 15 minutes. TWA: 200 ppm 8 hours.
Methyl propyl ketone	107-87-9	**CA Alberta Provincial (Canada, 3/2023).** OEL: 200 ppm 8 hours. OEL: 250 ppm 15 minutes. OEL: 705 mg/m³ 8 hours. OEL: 881 mg/m³ 15 minutes. **CA British Columbia Provincial (Canada, 8/2023).** TWA: 150 ppm 8 hours. STEL: 250 ppm 15 minutes. **CA Ontario Provincial (Canada, 6/2019).**

Section 8. Exposure controls/personal protection

		STEL: 150 ppm 15 minutes. **CA Saskatchewan Provincial (Canada, 4/2021).** STEL: 250 ppm 15 minutes. TWA: 200 ppm 8 hours. **CA Quebec Provincial (Canada, 2/2024).** STEV: 150 ppm 15 minutes.
Xylene	1330-20-7	**CA Alberta Provincial (Canada, 3/2023). [Dimethylbenzene]** OEL: 100 ppm 8 hours. OEL: 651 mg/m³ 15 minutes. OEL: 150 ppm 15 minutes. OEL: 434 mg/m³ 8 hours. **CA British Columbia Provincial (Canada, 8/2023). [Xylene (o, m & p isomers)]** TWA: 100 ppm 8 hours. STEL: 150 ppm 15 minutes. **CA Quebec Provincial (Canada, 2/2024). [Xylene]** TWAEV: 100 ppm 8 hours. TWAEV: 434 mg/m³ 8 hours. STEV: 150 ppm 15 minutes. STEV: 651 mg/m³ 15 minutes. **CA Ontario Provincial (Canada, 6/2019). [Xylene (o-, m-, p-isomers)]** STEL: 150 ppm 15 minutes. TWA: 100 ppm 8 hours. **CA Saskatchewan Provincial (Canada, 4/2021). [Xylene]** STEL: 150 ppm 15 minutes. TWA: 100 ppm 8 hours.
Methyl n-amyl ketone	110-43-0	**CA Alberta Provincial (Canada, 3/2023).** OEL: 233 mg/m³ 8 hours. OEL: 50 ppm 8 hours. **CA British Columbia Provincial (Canada, 8/2023).** TWA: 50 ppm 8 hours. **CA Ontario Provincial (Canada, 6/2019).** TWA: 25 ppm 8 hours. TWA: 115 mg/m³ 8 hours. **CA Quebec Provincial (Canada, 2/2024).** TWAEV: 50 ppm 8 hours. TWAEV: 233 mg/m³ 8 hours. **CA Saskatchewan Provincial (Canada, 4/2021).** STEL: 60 ppm 15 minutes. TWA: 50 ppm 8 hours.
Ethylbenzene	100-41-4	**CA Alberta Provincial (Canada, 3/2023).** OEL: 100 ppm 8 hours. OEL: 434 mg/m³ 8 hours. OEL: 543 mg/m³ 15 minutes. OEL: 125 ppm 15 minutes. **CA British Columbia Provincial (Canada, 8/2023).** TWA: 20 ppm 8 hours. **CA Ontario Provincial (Canada, 6/2019).** TWA: 20 ppm 8 hours.

Section 8. Exposure controls/personal protection

		CA Quebec Provincial (Canada, 2/2024). TWAEV: 20 ppm 8 hours. **CA Saskatchewan Provincial (Canada, 4/2021).** STEL: 125 ppm 15 minutes. TWA: 100 ppm 8 hours.

Occupational exposure limits (Mexico)

Ingredient name	CAS #	Exposure limits
n-Butyl Acetate	123-86-4	**NOM-010-STPS-2014 (Mexico, 4/2016).** TWA: 150 ppm 8 hours. STEL: 200 ppm 15 minutes.
Methyl Ethyl Ketone	78-93-3	**NOM-010-STPS-2014 (Mexico, 4/2016).** TWA: 200 ppm 8 hours. STEL: 300 ppm 15 minutes.
Methyl n-Propyl Ketone	107-87-9	**NOM-010-STPS-2014 (Mexico, 4/2016).** STEL: 150 ppm 15 minutes.
Xylene, mixed isomers	1330-20-7	**NOM-010-STPS-2014 (Mexico, 4/2016). [Xileno, mezcla]** STEL: 150 ppm 15 minutes. TWA: 100 ppm 8 hours.
Methyl n-Amyl Ketone	110-43-0	**NOM-010-STPS-2014 (Mexico, 4/2016).** TWA: 50 ppm 8 hours.

Biological exposure indices (United States)

Ingredient name	Exposure indices
Methyl Ethyl Ketone	**ACGIH BEI (United States, 1/2024)** BEI: 2 mg/l, methyl ethyl ketone [in urine]. Sampling time: end of shift.
Xylene, mixed isomers	**ACGIH BEI (United States, 1/2024) [xylenes (technical or commercial grades)]** BEI: 0.3 g/g creatinine, methylhippuric acids [in urine]. Sampling time: end of shift.
Ethylbenzene	**ACGIH BEI (United States, 1/2024)** BEI: 150 mg/g creatinine, sum of mandelic acid and phenylglyoxylic acid [in urine]. Sampling time: end of shift.

Biological exposure indices (Canada)

No exposure indices known.

Biological exposure indices (Mexico)

Ingredient name	Exposure indices
Methyl Ethyl Ketone	**Official Mexican STANDARD NOM-047-SSA1-2011, Environmental Health-Biological exposure indices for personnel occupationally exposed to chemical substances. (Mexico, 6/2012)** BEI: 2 mg/L, MEK [in urine]. Sampling time: at the end of the work shift.
Xylene, mixed isomers	**Official Mexican STANDARD NOM-047-SSA1-2011, Environmental Health-**

Section 8. Exposure controls/personal protection

	Biological exposure indices for personnel occupationally exposed to chemical substances. (Mexico, 6/2012) [xylenes (technical or commercial grade)] BEI: 1.5 g/g creatinine, methyl hippuric acids [in urine]. Sampling time: at the end of the work shift.

Appropriate engineering controls : Use only with adequate ventilation. Use process enclosures, local exhaust ventilation or other engineering controls to keep worker exposure to airborne contaminants below any recommended or statutory limits. The engineering controls also need to keep gas, vapor or dust concentrations below any lower explosive limits. Use explosion-proof ventilation equipment.

Environmental exposure controls : Emissions from ventilation or work process equipment should be checked to ensure they comply with the requirements of environmental protection legislation. In some cases, fume scrubbers, filters or engineering modifications to the process equipment will be necessary to reduce emissions to acceptable levels.

Individual protection measures

Hygiene measures : Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Appropriate techniques should be used to remove potentially contaminated clothing. Contaminated work clothing should not be allowed out of the workplace. Wash contaminated clothing before reusing. Ensure that eyewash stations and safety showers are close to the workstation location.

Eye/face protection : Safety eyewear complying with an approved standard should be used when a risk assessment indicates this is necessary to avoid exposure to liquid splashes, mists, gases or dusts. If contact is possible, the following protection should be worn, unless the assessment indicates a higher degree of protection: chemical splash goggles.

Skin protection

Hand protection : Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary. Considering the parameters specified by the glove manufacturer, check during use that the gloves are still retaining their protective properties. It should be noted that the time to breakthrough for any glove material may be different for different glove manufacturers. In the case of mixtures, consisting of several substances, the protection time of the gloves cannot be accurately estimated.

Body protection : Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product. When there is a risk of ignition from static electricity, wear anti-static protective clothing. For the greatest protection from static discharges, clothing should include anti-static overalls, boots and gloves.

Other skin protection : Appropriate footwear and any additional skin protection measures should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Respiratory protection : Based on the hazard and potential for exposure, select a respirator that meets the appropriate standard or certification. Respirators must be used according to a respiratory protection program to ensure proper fitting, training, and other important aspects of use.

Section 9. Physical and chemical properties

The conditions of measurement of all properties are at standard temperature and pressure unless otherwise indicated.

Appearance

Physical state : Liquid.

Color : Clear.

Odor : Not available.

Odor threshold : Not available.

pH : Not applicable.

Melting point/freezing point : Not available.

Boiling point, initial boiling point, and boiling range : 78°C (172.4°F)

Flash point : Closed cup: 27°C (80.6°F) [Pensky-Martens Closed Cup]

Evaporation rate : 5.6 (butyl acetate = 1)

Flammability : Flammable liquid.

Lower and upper explosion limit/flammability limit : Lower: 0.7%
Upper: 12.1%

Vapor pressure : 12.1 kPa (90.6 mm Hg)

Relative vapor density : 2.48 [Air = 1]

Relative density : 0.95

Solubility(ies) :

Media	Result
cold water	Not soluble

Partition coefficient: n-octanol/water : Not applicable.

Auto-ignition temperature : Not available.

Decomposition temperature : Not available.

Viscosity : Kinematic (40°C (104°F)): >20.5 mm^2/s (>20.5 cSt)

Molecular weight : Not applicable.

Heat of combustion : 17.983 kJ/g

Section 10. Stability and reactivity

Reactivity : No specific test data related to reactivity available for this product or its ingredients.

Chemical stability : The product is stable.

Possibility of hazardous reactions : Under normal conditions of storage and use, hazardous reactions will not occur.

Conditions to avoid : Avoid all possible sources of ignition (spark or flame). Do not pressurize, cut, weld, braze, solder, drill, grind or expose containers to heat or sources of ignition. Do not allow vapor to accumulate in low or confined areas.

Incompatible materials : Reactive or incompatible with the following materials:
oxidizing materials

Section 10. Stability and reactivity

Hazardous decomposition products : Under normal conditions of storage and use, hazardous decomposition products should not be produced.

Section 11. Toxicological information

Information on toxicological effects

Acute toxicity

Product/ingredient name	Result	Species	Dose	Exposure
Hexamethylene Diisocyanate Polymer	LC50 Inhalation Dusts and mists	Rat	18500 mg/m³	1 hours
n-Butyl Acetate	LD50 Dermal	Rabbit	>17600 mg/kg	-
	LD50 Oral	Rat	10768 mg/kg	-
Methyl Ethyl Ketone	LD50 Dermal	Rabbit	6480 mg/kg	-
	LD50 Oral	Rat	2737 mg/kg	-
Methyl n-Propyl Ketone	LD50 Dermal	Rabbit	6500 mg/kg	-
	LD50 Oral	Rat	1600 mg/kg	-
Ethyl 3-Ethoxypropionate	LD50 Oral	Rat	3200 mg/kg	-
Xylene, mixed isomers	LC50 Inhalation Gas.	Rat	6700 ppm	4 hours
	LD50 Oral	Rat	4300 mg/kg	-
Methyl n-Amyl Ketone	LD50 Oral	Rat	1600 mg/kg	-
Light Aromatic Hydrocarbons	LD50 Oral	Rat	8400 mg/kg	-
Ethylbenzene	LD50 Dermal	Rabbit	>5000 mg/kg	-
	LD50 Oral	Rat	3500 mg/kg	-
trimethylbenzene	LD50 Oral	Rat	8970 mg/kg	-
1,3,5-Trimethylbenzene	LC50 Inhalation Vapor	Rat	24000 mg/m³	4 hours
	LD50 Oral	Rat	5000 mg/kg	-
1,2,4-Trimethylbenzene	LC50 Inhalation Vapor	Rat	18000 mg/m³	4 hours
	LD50 Oral	Rat	5 g/kg	-

Irritation/Corrosion

Product/ingredient name	Result	Species	Score	Exposure	Observation
Hexamethylene Diisocyanate Polymer	Eyes - Moderate irritant	Rabbit	-	100 mg	-
	Skin - Moderate irritant	Rabbit	-	500 mg	-
n-Butyl Acetate	Eyes - Moderate irritant	Rabbit	-	100 mg	-
	Skin - Moderate irritant	Rabbit	-	24 hours 500 mg	-
Methyl Ethyl Ketone	Skin - Mild irritant	Rabbit	-	24 hours 14 mg	-
	Skin - Moderate irritant	Rabbit	-	24 hours 500 mg	-
Methyl n-Propyl Ketone	Skin - Mild irritant	Rabbit	-	405 mg	-
Ethyl 3-Ethoxypropionate	Skin - Mild irritant	Rabbit	-	24 hours 500 mg	-
Xylene, mixed isomers	Eyes - Mild irritant	Rabbit	-	87 mg	-
	Eyes - Severe irritant	Rabbit	-	24 hours 5 mg	-
	Skin - Mild irritant	Rat	-	8 hours 60 uL	-
	Skin - Moderate irritant	Rabbit	-	100 %	-
	Skin - Moderate irritant	Rabbit	-	24 hours 500 mg	-
Methyl n-Amyl Ketone	Skin - Mild irritant	Rabbit	-	24 hours 14 mg	-
Light Aromatic Hydrocarbons	Eyes - Mild irritant	Rabbit	-	24 hours 100 uL	-
Ethylbenzene	Eyes - Severe irritant	Rabbit	-	500 mg	-
	Skin - Mild irritant	Rabbit	-	24 hours 15 mg	-

Section 11. Toxicological information

trimethylbenzene	Eyes - Mild irritant	Rabbit	-	24 hours 500 mg	-
	Skin - Moderate irritant	Rabbit	-	24 hours 500 mg	-
1,3,5-Trimethylbenzene	Eyes - Mild irritant	Rabbit	-	24 hours 500 mg	-
	Skin - Moderate irritant	Rabbit	-	24 hours 20 mg	-

Sensitization

Not available.

Mutagenicity

Not available.

Carcinogenicity

Not available.

Classification

Product/ingredient name	OSHA	IARC	NTP
Xylene, mixed isomers	-	3	-
Ethylbenzene	-	2B	-

Reproductive toxicity

Not available.

Teratogenicity

Not available.

Specific target organ toxicity (single exposure)

Name	Category	Route of exposure	Target organs
Hexamethylene Diisocyanate Polymer	Category 3	-	Respiratory tract irritation
n-Butyl Acetate	Category 3	-	Narcotic effects
Methyl Ethyl Ketone	Category 3	-	Narcotic effects
Xylene, mixed isomers	Category 3	-	Respiratory tract irritation
	Category 3		Narcotic effects
Methyl n-Amyl Ketone	Category 3	-	Narcotic effects
Light Aromatic Hydrocarbons	Category 3	-	Respiratory tract irritation
	Category 3		Narcotic effects
Ethylbenzene	Category 3	-	Narcotic effects
1,3,5-Trimethylbenzene	Category 3	-	Respiratory tract irritation
1,2,4-Trimethylbenzene	Category 3	-	Respiratory tract irritation

Specific target organ toxicity (repeated exposure)

Name	Category	Route of exposure	Target organs
Xylene, mixed isomers	Category 2	-	-
Ethylbenzene	Category 2	-	-

Aspiration hazard

Section 11. Toxicological information

Name	Result
Xylene, mixed isomers	ASPIRATION HAZARD - Category 1
Light Aromatic Hydrocarbons	ASPIRATION HAZARD - Category 1
Ethylbenzene	ASPIRATION HAZARD - Category 1
trimethylbenzene	ASPIRATION HAZARD - Category 1
1,3,5-Trimethylbenzene	ASPIRATION HAZARD - Category 1
1,2,4-Trimethylbenzene	ASPIRATION HAZARD - Category 1

Information on the likely routes of exposure : Not available.

Potential acute health effects

Eye contact : Causes serious eye irritation.

Inhalation : Can cause central nervous system (CNS) depression. May cause drowsiness or dizziness. May cause respiratory irritation.

Skin contact : Causes skin irritation. May cause an allergic skin reaction.

Ingestion : Can cause central nervous system (CNS) depression.

Symptoms related to the physical, chemical and toxicological characteristics

Eye contact : Adverse symptoms may include the following:
pain or irritation
watering
redness

Inhalation : Adverse symptoms may include the following:
respiratory tract irritation
coughing
nausea or vomiting
headache
drowsiness/fatigue
dizziness/vertigo
unconsciousness

Skin contact : Adverse symptoms may include the following:
irritation
redness

Ingestion : No specific data.

Delayed and immediate effects and also chronic effects from short and long term exposure

Short term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Long term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Potential chronic health effects

Not available.

General : May cause damage to organs through prolonged or repeated exposure. Once sensitized, a severe allergic reaction may occur when subsequently exposed to very low levels.

Carcinogenicity : Suspected of causing cancer. Risk of cancer depends on duration and level of exposure.

Section 11. Toxicological information

Mutagenicity : No known significant effects or critical hazards.

Teratogenicity : No known significant effects or critical hazards.

Developmental effects : No known significant effects or critical hazards.

Fertility effects : No known significant effects or critical hazards.

Numerical measures of toxicity

Acute toxicity estimates

Route	ATE value
Oral	6252.9 mg/kg
Dermal	50860.37 mg/kg
Inhalation (vapors)	188.63 mg/l
Inhalation (dusts and mists)	9.34 mg/l

Section 12. Ecological information

Toxicity

Product/ingredient name	Result	Species	Exposure
n-Butyl Acetate	Acute LC50 32 mg/l Marine water	Crustaceans - *Artemia salina*	48 hours
	Acute LC50 18000 µg/l Fresh water	Fish - *Pimephales promelas*	96 hours
Methyl Ethyl Ketone	Acute EC50 >500000 µg/l Marine water	Algae - *Skeletonema costatum*	96 hours
	Acute EC50 5091000 µg/l Fresh water	Daphnia - *Daphnia magna* - Larvae	48 hours
	Acute LC50 3220000 µg/l Fresh water	Fish - *Pimephales promelas*	96 hours
Methyl n-Propyl Ketone	Acute LC50 1240000 µg/l Fresh water	Fish - *Pimephales promelas*	96 hours
Xylene, mixed isomers	Acute LC50 8500 µg/l Marine water	Crustaceans - *Palaemonetes pugio*	48 hours
	Acute LC50 13400 µg/l Fresh water	Fish - *Pimephales promelas*	96 hours
Methyl n-Amyl Ketone	Acute LC50 131000 µg/l Fresh water	Fish - *Pimephales promelas*	96 hours
Ethylbenzene	Acute EC50 4600 µg/l Fresh water	Algae - *Raphidocelis subcapitata*	72 hours
	Acute EC50 3600 µg/l Fresh water	Algae - *Raphidocelis subcapitata*	96 hours
	Acute EC50 6.53 mg/l Marine water	Crustaceans - *Artemia sp.* - Nauplii	48 hours
	Acute EC50 2.93 mg/l Fresh water	Daphnia - *Daphnia magna* - Neonate	48 hours
	Acute LC50 4200 µg/l Fresh water	Fish - *Oncorhynchus mykiss*	96 hours
trimethylbenzene	Acute LC50 5600 µg/l Marine water	Crustaceans - *Palaemonetes pugio*	48 hours
1,3,5-Trimethylbenzene	Acute LC50 13000 µg/l Marine water	Crustaceans - *Cancer magister* - Zoea	48 hours
	Acute LC50 12520 µg/l Fresh water	Fish - *Carassius auratus*	96 hours
	Chronic NOEC 0.4 mg/l Fresh water	Daphnia - *Daphnia magna*	21 days
1,2,4-Trimethylbenzene	Acute LC50 4910 µg/l Marine water	Crustaceans - *Elasmopus pectenicrus* - Adult	48 hours
	Acute LC50 7720 µg/l Fresh water	Fish - *Pimephales promelas*	96 hours

Persistence and degradability

Section 12. Ecological information

Product/ingredient name	Aquatic half-life	Photolysis	Biodegradability
n-Butyl Acetate	-	-	Readily
Methyl Ethyl Ketone	-	-	Readily
Xylene, mixed isomers	-	-	Readily
Methyl n-Amyl Ketone	-	-	Readily
Light Aromatic Hydrocarbons	-	-	Readily
Ethylbenzene	-	-	Readily

Bioaccumulative potential

Product/ingredient name	$LogP_{ow}$	BCF	Potential
Hexamethylene Diisocyanate Polymer	-	367.7	Low
Xylene, mixed isomers	-	8.1 to 25.9	Low
Light Aromatic Hydrocarbons	-	10 to 2500	High
1,3,5-Trimethylbenzene	-	161	Low
1,2,4-Trimethylbenzene	-	243	Low

Mobility in soil

Soil/water partition coefficient (K_{OC}) : Not available.

Other adverse effects : No known significant effects or critical hazards.

Section 13. Disposal considerations

Disposal methods : The generation of waste should be avoided or minimized wherever possible. Disposal of this product, solutions and any by-products should at all times comply with the requirements of environmental protection and waste disposal legislation and any regional local authority requirements. Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Waste should not be disposed of untreated to the sewer unless fully compliant with the requirements of all authorities with jurisdiction. Waste packaging should be recycled. Incineration or landfill should only be considered when recycling is not feasible. This material and its container must be disposed of in a safe way. Care should be taken when handling emptied containers that have not been cleaned or rinsed out. Empty containers or liners may retain some product residues. Vapor from product residues may create a highly flammable or explosive atmosphere inside the container. Do not cut, weld or grind used containers unless they have been cleaned thoroughly internally. Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers.

Section 14. Transport information

	DOT Classification	TDG Classification	Mexico Classification	IATA	IMDG
UN number	UN1263	UN1263	UN1263	UN1263	UN1263
UN proper shipping name	PAINT RELATED MATERIAL	PAINT RELATED MATERIAL	PAINT RELATED MATERIAL	PAINT RELATED MATERIAL	PAINT RELATED MATERIAL
Transport hazard class(es)	3 	3 	3 	3 	3 

Section 14. Transport information

Packing group	III	III	III	III	III
Environmental hazards	No.	No.	No.	No.	No.
Additional information	- **ERG No.** 128	Product classified as per the following sections of the Transportation of Dangerous Goods Regulations: 2.18-2.19 (Class 3). **ERG No.** 128	- **ERG No.** 128	-	**Emergency schedules** F-E, S-E

Special precautions for user : Multi-modal shipping descriptions are provided for informational purposes and do not consider container sizes. The presence of a shipping description for a particular mode of transport (sea, air, etc.), does not indicate that the product is packaged suitably for that mode of transport. All packaging must be reviewed for suitability prior to shipment, and compliance with the applicable regulations is the sole responsibility of the person offering the product for transport. People loading and unloading dangerous goods must be trained on all of the risks deriving from the substances and on all actions in case of emergency situations.

Transport in bulk according to IMO instruments : Not available.

Proper shipping name : Not available.

Section 15. Regulatory information

International regulations

Montreal Protocol

Not listed.

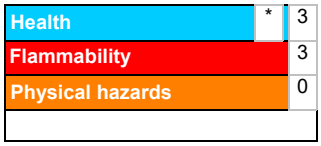
Stockholm Convention on Persistent Organic Pollutants

Not listed.

International lists : **Australia inventory (AIIC)**: Not determined.
China inventory (IECSC): Not determined.
Japan inventory (CSCL): Not determined.
Japan inventory (ISHL): Not determined.
Korea inventory (KECI): Not determined.
New Zealand Inventory of Chemicals (NZIoC): Not determined.
Philippines inventory (PICCS): Not determined.
Taiwan Chemical Substances Inventory (TCSI): Not determined.
Thailand inventory: Not determined.
Turkey inventory: Not determined.
Vietnam inventory: Not determined.

Section 16. Other information

Hazardous Material Information System (U.S.A.)



The customer is responsible for determining the PPE code for this material. For more information on HMIS® Personal Protective Equipment (PPE) codes, consult the HMIS® Implementation Manual.

Caution: HMIS® ratings are based on a 0-4 rating scale, with 0 representing minimal hazards or risks, and 4 representing significant hazards or risks. Although HMIS® ratings and the associated label are not required on SDSs or products leaving a facility under 29 CFR 1910.1200, the preparer may choose to provide them. HMIS® ratings are to be used with a fully implemented HMIS® program. HMIS® is a registered trademark and service mark of the American Coatings Association, Inc.

Procedure used to derive the classification

Classification	Justification
FLAMMABLE LIQUIDS - Category 3	On basis of test data
SKIN CORROSION/IRRITATION - Category 2	Calculation method
SERIOUS EYE DAMAGE/ EYE IRRITATION - Category 2A	Calculation method
SKIN SENSITIZATION - Category 1	Calculation method
CARCINOGENICITY - Category 2	Calculation method
SPECIFIC TARGET ORGAN TOXICITY (SINGLE EXPOSURE) (Respiratory tract irritation) - Category 3	Calculation method
SPECIFIC TARGET ORGAN TOXICITY (SINGLE EXPOSURE) (Narcotic effects) - Category 3	Calculation method
SPECIFIC TARGET ORGAN TOXICITY (REPEATED EXPOSURE) - Category 2	Calculation method

History

Date of printing : 1/25/2025

Date of issue/Date of revision : 1/25/2025

Date of previous issue : 12/12/2024

Version : 17.01

Key to abbreviations : ATE = Acute Toxicity Estimate
BCF = Bioconcentration Factor
GHS = Globally Harmonized System of Classification and Labelling of Chemicals
IATA = International Air Transport Association
IBC = Intermediate Bulk Container
IMDG = International Maritime Dangerous Goods
LogPow = logarithm of the octanol/water partition coefficient
MARPOL = International Convention for the Prevention of Pollution From Ships, 1973 as modified by the Protocol of 1978. ("Marpol" = marine pollution)
N/A = Not available
SGG = Segregation Group
UN = United Nations

Indicates information that has changed from previously issued version.

Notice to reader

It is recommended that each customer or recipient of this Safety Data Sheet (SDS) study it carefully and consult resources, as necessary or appropriate, to become aware of and understand the data contained in this SDS and any hazards associated with the product. This information is provided in good faith and believed to be accurate as of the effective date herein. However, no warranty, express or implied, is given. The information presented here applies only to the product as shipped. The addition of any material can change the composition, hazards and risks of the product. Products shall not be repackaged, modified, or tinted except as specifically instructed by the manufacturer, including but not limited to the incorporation of products not specified by the manufacturer,

Section 16. Other information

or the use or addition of products in proportions not specified by the manufacturer. Regulatory requirements are subject to change and may differ between various locations and jurisdictions. The customer/buyer/user is responsible to ensure that his activities comply with all country, federal, state, provincial or local laws. The conditions for use of the product are not under the control of the manufacturer; the customer/buyer/user is responsible to determine the conditions necessary for the safe use of this product. The customer/buyer/user should not use the product for any purpose other than the purpose shown in the applicable section of this SDS without first referring to the supplier and obtaining written handling instructions. Due to the proliferation of sources for information such as manufacturer-specific SDS, the manufacturer cannot be responsible for SDSs obtained from any other source.

SAFETY DATA SHEET

FP410

Section 1. Identification

Product name : FINISH 1™ 2K HS Urethane Primer (Part A)
Gray

Product code : FP410

Other means of identification : Not available.

Product type : Liquid.

Relevant identified uses of the substance or mixture and uses advised against

Paint or paint related material.

Manufacturer : ACME AUTOMOTIVE FINISHES
101 W. Prospect Avenue
Cleveland, OH 44115

Emergency telephone number of the company : US / Canada: (800) 424-9300
Mexico: SETIQ 800-00-214-00 / 55-5559-1588 Available 24 hours and 365 days a year

Product Information Telephone Number : US / Canada: (216) 566-3031
Mexico: Not Available

Transportation Emergency Telephone Number : US / Canada: (800) 424-9300
Mexico: SETIQ 800-00-214-00 / 55-5559-1588 Available 24 hours and 365 days a year

Section 2. Hazards identification

OSHA/HCS status : This material is considered hazardous by the OSHA Hazard Communication Standard (29 CFR 1910.1200).

Classification of the substance or mixture : FLAMMABLE LIQUIDS - Category 2
SKIN CORROSION/IRRITATION - Category 2
SERIOUS EYE DAMAGE/ EYE IRRITATION - Category 2A
CARCINOGENICITY - Category 1A
TOXIC TO REPRODUCTION - Category 1B
SPECIFIC TARGET ORGAN TOXICITY (SINGLE EXPOSURE) (Narcotic effects) - Category 3
SPECIFIC TARGET ORGAN TOXICITY (REPEATED EXPOSURE) - Category 1
ASPIRATION HAZARD - Category 1

Percentage of the mixture consisting of ingredient(s) of unknown acute toxicity: 14.6% (oral), 36% (dermal), 16.1% (inhalation)

GHS label elements

Hazard pictograms :



Signal word : Danger

Section 2. Hazards identification

Hazard statements : Highly flammable liquid and vapor.
May be fatal if swallowed and enters airways.
Causes skin irritation.
Causes serious eye irritation.
May cause drowsiness or dizziness.
May cause cancer.
May damage fertility or the unborn child.
Causes damage to organs through prolonged or repeated exposure. (lungs)

Precautionary statements

Prevention : Obtain special instructions before use. Do not handle until all safety precautions have been read and understood. Wear protective gloves, protective clothing, eye protection, face protection, or hearing protection. Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking. Use only outdoors or in a well-ventilated area. Do not breathe vapor. Do not eat, drink or smoke when using this product. Wash thoroughly after handling.

Response : IF exposed or concerned: Get medical advice or attention. IF INHALED: Remove person to fresh air and keep comfortable for breathing. Call a POISON CENTER or doctor if you feel unwell. IF SWALLOWED: Immediately call a POISON CENTER or doctor. Do NOT induce vomiting. IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water. If skin irritation occurs: Get medical advice or attention. IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If eye irritation persists: Get medical advice or attention.

Storage : Store locked up. Store in a well-ventilated place. Keep container tightly closed.

Disposal : Dispose of contents and container in accordance with all local, regional, national and international regulations.

Supplemental label elements

DELAYED EFFECTS FROM LONG TERM OVEREXPOSURE. Contains solvents which can cause permanent brain and nervous system damage. Intentional misuse by deliberately concentrating and inhaling the contents can be harmful or fatal. WARNING: This product contains chemicals known to the State of California to cause cancer and birth defects or other reproductive harm. FOR PROFESSIONAL USE ONLY. This product must be mixed with other components before use. Before opening the packages, READ AND FOLLOW WARNING LABELS ON ALL COMPONENTS. Adequate ventilation required when sanding or abrading the dried film. If Adequate ventilation cannot be provided wear an approved particulate respirator (NIOSH approved). Follow respirator manufacturer's directions for respirator use. DELAYED EFFECTS FROM LONG TERM OVEREXPOSURE. Abrading or sanding of the dry film may release Crystalline Silica which has been shown to cause lung damage and cancer under long term exposure.

Please refer to the SDS for additional information. Keep out of reach of children. Do not transfer contents to other containers for storage.

Hazards not otherwise classified : DANGER: Rags, steel wool, other waste soaked with this product, and sanding residue may spontaneously catch fire if improperly discarded. Immediately place rags, steel wool, other waste soaked with this product, and sanding residue in a sealed, water-filled, metal container. Dispose of in accordance with local fire regulations.

Section 3. Composition/information on ingredients

Substance/mixture : Mixture

Other means of identification : Not available.

CAS number/other identifiers

Section 3. Composition/information on ingredients

Ingredient name	% by weight	Identifiers
Toluene	≥10 - ≤25	108-88-3
Kaolin	≥10 - ≤25	1332-58-7
Talc	≥10 - ≤25	14807-96-6
Xylene, mixed isomers	≤10	1330-20-7
n-Butyl Acetate	≤5	123-86-4
Titanium Dioxide	≤5	13463-67-7
Methyl Ethyl Ketone	≤3	78-93-3
Methyl Isobutyl Ketone	≤3	108-10-1
Ethyl 3-Ethoxypropionate	≤3	763-69-9
Ethylbenzene	≤3	100-41-4
Med. Aliphatic Hydrocarbon Solvent	<1	64742-88-7
Light Aliphatic Hydrocarbon	<1	64742-47-8
Crystalline Silica, respirable powder	≤0.3	14808-60-7

Any concentration shown as a range is to protect confidentiality or is due to batch variation.

There are no additional ingredients present which, within the current knowledge of the supplier and in the concentrations applicable, are classified and hence require reporting in this section.

Occupational exposure limits, if available, are listed in Section 8.

Section 4. First aid measures

Description of necessary first aid measures

Eye contact : Immediately flush eyes with plenty of water, occasionally lifting the upper and lower eyelids. Check for and remove any contact lenses. Continue to rinse for at least 10 minutes. Get medical attention.

Inhalation : Remove victim to fresh air and keep at rest in a position comfortable for breathing. If it is suspected that fumes are still present, the rescuer should wear an appropriate mask or self-contained breathing apparatus. If not breathing, if breathing is irregular or if respiratory arrest occurs, provide artificial respiration or oxygen by trained personnel. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation. Get medical attention. If necessary, call a poison center or physician. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway. Loosen tight clothing such as a collar, tie, belt or waistband.

Skin contact : Flush contaminated skin with plenty of water. Remove contaminated clothing and shoes. Wash contaminated clothing thoroughly with water before removing it, or wear gloves. Continue to rinse for at least 10 minutes. Get medical attention. Wash clothing before reuse. Clean shoes thoroughly before reuse.

Ingestion : Get medical attention immediately. Call a poison center or physician. Wash out mouth with water. Remove dentures if any. If material has been swallowed and the exposed person is conscious, give small quantities of water to drink. Stop if the exposed person feels sick as vomiting may be dangerous. Aspiration hazard if swallowed. Can enter lungs and cause damage. Do not induce vomiting. If vomiting occurs, the head should be kept low so that vomit does not enter the lungs. Never give anything by mouth to an unconscious person. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway. Loosen tight clothing such as a collar, tie, belt or waistband.

Most important symptoms/effects, acute and delayed

Potential acute health effects

Eye contact : Causes serious eye irritation.

Inhalation : Can cause central nervous system (CNS) depression. May cause drowsiness or dizziness.

Skin contact : Causes skin irritation.

Section 4. First aid measures

Ingestion : Can cause central nervous system (CNS) depression. May be fatal if swallowed and enters airways.

Over-exposure signs/symptoms

Eye contact : Adverse symptoms may include the following:
pain or irritation
watering
redness

Inhalation : Adverse symptoms may include the following:
nausea or vomiting
headache
drowsiness/fatigue
dizziness/vertigo
unconsciousness
reduced fetal weight
increase in fetal deaths
skeletal malformations

Skin contact : Adverse symptoms may include the following:
irritation
redness
reduced fetal weight
increase in fetal deaths
skeletal malformations

Ingestion : Adverse symptoms may include the following:
nausea or vomiting
reduced fetal weight
increase in fetal deaths
skeletal malformations

Indication of immediate medical attention and special treatment needed, if necessary

Notes to physician : Treat symptomatically. Contact poison treatment specialist immediately if large quantities have been ingested or inhaled.

Specific treatments : No specific treatment.

Protection of first-aiders : No action shall be taken involving any personal risk or without suitable training. If it is suspected that fumes are still present, the rescuer should wear an appropriate mask or self-contained breathing apparatus. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation. Wash contaminated clothing thoroughly with water before removing it, or wear gloves.

See toxicological information (Section 11)

Section 5. Fire-fighting measures

Extinguishing media

Suitable extinguishing media : Use dry chemical, CO_2, water spray (fog) or foam.

Unsuitable extinguishing media : Do not use water jet.

Specific hazards arising from the chemical : Highly flammable liquid and vapor. Runoff to sewer may create fire or explosion hazard. In a fire or if heated, a pressure increase will occur and the container may burst, with the risk of a subsequent explosion. The vapor/gas is heavier than air and will spread along the ground. Vapors may accumulate in low or confined areas or travel a considerable distance to a source of ignition and flash back.

Section 5. Fire-fighting measures

Hazardous thermal decomposition products : Decomposition products may include the following materials:
carbon dioxide
carbon monoxide
sulfur oxides
metal oxide/oxides

Special protective actions for fire-fighters : Promptly isolate the scene by removing all persons from the vicinity of the incident if there is a fire. No action shall be taken involving any personal risk or without suitable training. Move containers from fire area if this can be done without risk. Use water spray to keep fire-exposed containers cool.

Special protective equipment for fire-fighters : Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.

Remark : Flammable liquid.

Section 6. Accidental release measures

Personal precautions, protective equipment and emergency procedures

For non-emergency personnel : No action shall be taken involving any personal risk or without suitable training. Evacuate surrounding areas. Keep unnecessary and unprotected personnel from entering. Do not touch or walk through spilled material. Shut off all ignition sources. No flares, smoking or flames in hazard area. Avoid breathing vapor or mist. Provide adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Put on appropriate personal protective equipment.

For emergency responders : If specialized clothing is required to deal with the spillage, take note of any information in Section 8 on suitable and unsuitable materials. See also the information in "For non-emergency personnel".

Environmental precautions : Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers. Inform the relevant authorities if the product has caused environmental pollution (sewers, waterways, soil or air).

Methods and materials for containment and cleaning up

Small spill : Stop leak if without risk. Move containers from spill area. Use spark-proof tools and explosion-proof equipment. Absorb with an inert material and place in an appropriate waste disposal container. Dispose of via a licensed waste disposal contractor.

Large spill : Stop leak if without risk. Move containers from spill area. Use spark-proof tools and explosion-proof equipment. Approach release from upwind. Prevent entry into sewers, water courses, basements or confined areas. Wash spillages into an effluent treatment plant or proceed as follows. Dispose of via a licensed waste disposal contractor. Contaminated absorbent material may pose the same hazard as the spilled product. Contain and collect spillage with non-combustible, absorbent material e.g. sand, earth, vermiculite or diatomaceous earth and place in container for disposal according to local regulations.

Section 7. Handling and storage

Precautions for safe handling

Protective measures : Put on appropriate personal protective equipment (see Section 8). Avoid exposure - obtain special instructions before use. Avoid exposure during pregnancy. Do not handle until all safety precautions have been read and understood. Do not get in eyes or on skin or clothing. Do not breathe vapor or mist. Do not swallow. Use only with adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Do not enter storage areas and confined spaces unless adequately ventilated. Keep in the original container or an approved alternative made from a compatible material, kept tightly closed when not in use. Store and use away from heat, sparks, open flame or any other ignition source. Use explosion-proof electrical (ventilating, lighting and

Section 7. Handling and storage

material handling) equipment. Use only non-sparking tools. Take precautionary measures against electrostatic discharges. Empty containers retain product residue and can be hazardous. Do not reuse container.

Advice on general occupational hygiene : Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking. Remove contaminated clothing and protective equipment before entering eating areas. See also Section 8 for additional information on hygiene measures.

Conditions for safe storage, including any incompatibilities : Store in accordance with local regulations. Store in a segregated and approved area. Store in original container protected from direct sunlight in a dry, cool and well-ventilated area, away from incompatible materials (see Section 10) and food and drink. Store locked up. Eliminate all ignition sources. Separate from oxidizing materials. Keep container tightly closed and sealed until ready for use. Containers that have been opened must be carefully resealed and kept upright to prevent leakage. Do not store in unlabeled containers. Use appropriate containment to avoid environmental contamination. See Section 10 for incompatible materials before handling or use.

Section 8. Exposure controls/personal protection

Control parameters

Occupational exposure limits (OSHA United States)

Ingredient name	CAS #	Exposure limits
Toluene	108-88-3	**ACGIH TLV (United States, 1/2024)** A4. Ototoxicant. TWA 8 hours: 20 ppm. **OSHA PEL Z2 (United States, 2/2013)** TWA 8 hours: 200 ppm. CEIL: 300 ppm. AMP 10 minutes: 500 ppm. **NIOSH REL (United States, 10/2020)** TWA 10 hours: 100 ppm. TWA 10 hours: 375 mg/m³. STEL 15 minutes: 150 ppm. STEL 15 minutes: 560 mg/m³.
Kaolin	1332-58-7	**ACGIH TLV (United States, 1/2024)** A4. TWA 8 hours: 2 mg/m³. Form: Respirable fraction. **NIOSH REL (United States, 10/2020)** TWA 10 hours: 10 mg/m³. Form: Total. TWA 10 hours: 5 mg/m³. Form: Respirable fraction. **OSHA PEL (United States, 5/2018)** TWA 8 hours: 15 mg/m³. Form: Total dust. TWA 8 hours: 5 mg/m³. Form: Respirable fraction.
Talc	14807-96-6	**ACGIH TLV (United States, 1/2024)** A4. TWA 8 hours: 2 mg/m³. Form: Respirable fraction. **NIOSH REL (United States, 10/2020)** TWA 10 hours: 2 mg/m³. Form: Respirable fraction.
Xylene, mixed isomers	1330-20-7	**ACGIH TLV (United States, 1/2024) [p-xylene and mixtures containing p-xylene]** A4. Ototoxicant. TWA 8 hours: 20 ppm.

Section 8. Exposure controls/personal protection

		OSHA PEL (United States, 5/2018) [Xylenes] TWA 8 hours: 100 ppm. TWA 8 hours: 435 mg/m³.
n-Butyl Acetate	123-86-4	**ACGIH TLV (United States, 1/2024) [Butyl acetates]** STEL 15 minutes: 150 ppm. TWA 8 hours: 50 ppm. **NIOSH REL (United States, 10/2020)** TWA 10 hours: 150 ppm. TWA 10 hours: 710 mg/m³. STEL 15 minutes: 200 ppm. STEL 15 minutes: 950 mg/m³. **OSHA PEL (United States, 5/2018)** TWA 8 hours: 150 ppm. TWA 8 hours: 710 mg/m³.
Titanium Dioxide	13463-67-7	**ACGIH TLV (United States, 1/2024)** A3. TWA 8 hours: 2.5 mg/m³. Form: respirable fraction, finescale particles. **NIOSH REL (United States, 10/2020)** NIA. **OSHA PEL (United States, 5/2018)** TWA 8 hours: 15 mg/m³. Form: Total dust.
Methyl Ethyl Ketone	78-93-3	**ACGIH TLV (United States, 1/2024)** Absorbed through skin. TWA 8 hours: 75 ppm. STEL 15 minutes: 150 ppm. **NIOSH REL (United States, 10/2020)** TWA 10 hours: 200 ppm. TWA 10 hours: 590 mg/m³. STEL 15 minutes: 300 ppm. STEL 15 minutes: 885 mg/m³. **OSHA PEL (United States, 5/2018)** TWA 8 hours: 200 ppm. TWA 8 hours: 590 mg/m³.
Methyl Isobutyl Ketone	108-10-1	**ACGIH TLV (United States, 1/2024)** A3. TWA 8 hours: 20 ppm. STEL 15 minutes: 75 ppm. **NIOSH REL (United States, 10/2020)** TWA 10 hours: 50 ppm. TWA 10 hours: 205 mg/m³. STEL 15 minutes: 75 ppm. STEL 15 minutes: 300 mg/m³. **OSHA PEL (United States, 5/2018)** TWA 8 hours: 100 ppm. TWA 8 hours: 410 mg/m³.
Ethyl 3-Ethoxypropionate	763-69-9	None.
Ethylbenzene	100-41-4	**ACGIH TLV (United States, 1/2024)** A3. Ototoxicant. TWA 8 hours: 20 ppm. **NIOSH REL (United States, 10/2020)** TWA 10 hours: 100 ppm. TWA 10 hours: 435 mg/m³. STEL 15 minutes: 125 ppm. STEL 15 minutes: 545 mg/m³. **OSHA PEL (United States, 5/2018)** TWA 8 hours: 100 ppm. TWA 8 hours: 435 mg/m³.

Section 8. Exposure controls/personal protection

Med. Aliphatic Hydrocarbon Solvent	64742-88-7	**OSHA PEL (United States, 5/2018) [Naphtha (Coal tar)]** TWA 8 hours: 100 ppm. TWA 8 hours: 400 mg/m³.
Light Aliphatic Hydrocarbon	64742-47-8	**ACGIH TLV (United States, 1/2024) [Kerosene]** A3. Absorbed through skin. TWA 8 hours: 200 mg/m³ (as total hydrocarbon vapor).
Crystalline Silica, respirable powder	14808-60-7	**ACGIH TLV (United States, 1/2024) [Silica, crystalline]** A2. TWA 8 hours: 0.025 mg/m³. Form: Respirable fraction. **NIOSH REL (United States, 10/2020) [SILICA, CRYSTALLINE]** NIA. TWA 10 hours: 0.05 mg/m³. Form: respirable dust. **OSHA PEL (United States, 5/2018) [Silica, crystalline]** TWA 8 hours: 50 µg/m³. Form: Respirable dust. **OSHA PEL Z3 (United States, 6/2016)** TWA 8 hours: 250 / $(\%SiO_2+5)$ mppcf. Form: Respirable. TWA 8 hours: 10 / $(\%SiO_2+2)$ mg/m³. Form: Respirable.

Occupational exposure limits (Canada)

Ingredient name	CAS #	Exposure limits
toluene	108-88-3	**CA Saskatchewan Provincial (Canada, 4/2021)** Absorbed through skin. STEL 15 minutes: 60 ppm. TWA 8 hours: 50 ppm. **CA British Columbia Provincial (Canada, 4/2024)** Repr. TWA 8 hours: 20 ppm. **CA Ontario Provincial (Canada, 6/2019)** TWA 8 hours: 20 ppm. **CA Quebec Provincial (Canada, 2/2024)** Ototoxicant. TWAEV 8 hours: 20 ppm. **CA Alberta Provincial (Canada, 3/2023)** Absorbed through skin. OEL 8 hours: 50 ppm. OEL 8 hours: 188 mg/m³.
Kaolin	1332-58-7	**CA Saskatchewan Provincial (Canada, 4/2021)** STEL 15 minutes: 4 mg/m³. Form: respirable fraction. TWA 8 hours: 2 mg/m³. Form: respirable fraction. **CA British Columbia Provincial (Canada, 4/2024)** TWA 8 hours: 2 mg/m³. Form: Respirable. Notes: the value is for particulate matter containing no asbestos and less than 1% crystalline silica.

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		CA Ontario Provincial (Canada, 6/2019) TWA 8 hours: 2 mg/m³. Form: Respirable particulate matter.. **CA Quebec Provincial (Canada, 2/2024)** TWAEV 8 hours: 2 mg/m³. Form: respirable aerosol fraction. **CA Alberta Provincial (Canada, 3/2023)** OEL 8 hours: 2 mg/m³. Form: Respirable.
talc (none asbestiform)	14807-96-6	**CA Saskatchewan Provincial (Canada, 4/2021)** TWA 8 hours: 2 mg/m³. Form: respirable fraction. **CA British Columbia Provincial (Canada, 4/2024)** TWA 8 hours: 2 mg/m³. Form: Respirable. Notes: the value is for particulate matter containing no asbestos and less than 1% crystalline silica. **CA Ontario Provincial (Canada, 6/2019)** TWA 8 hours: 2 mg/m³. Form: Respirable particulate matter.. TWA 8 hours: 2 fibers/cm³. **CA Quebec Provincial (Canada, 2/2024)** TWAEV 8 hours: 2 mg/m³. Form: respirable aerosol fraction. **CA Alberta Provincial (Canada, 3/2023)** OEL 8 hours: 2 mg/m³. Form: Respirable particulate.
Xylene	1330-20-7	**CA Saskatchewan Provincial (Canada, 4/2021) [Xylene]** STEL 15 minutes: 150 ppm. TWA 8 hours: 100 ppm. **CA British Columbia Provincial (Canada, 4/2024) [xylene (o, m & p isomers)]** TWA 8 hours: 100 ppm. STEL 15 minutes: 150 ppm. **CA Ontario Provincial (Canada, 6/2019) [Xylene (o-, m-, p-isomers)]** STEL 15 minutes: 150 ppm. TWA 8 hours: 100 ppm. **CA Quebec Provincial (Canada, 2/2024) [Xylene]** TWAEV 8 hours: 100 ppm. TWAEV 8 hours: 434 mg/m³. STEV 15 minutes: 150 ppm. STEV 15 minutes: 651 mg/m³. **CA Alberta Provincial (Canada, 3/2023) [Dimethylbenzene]** OEL 8 hours: 100 ppm. OEL 15 minutes: 651 mg/m³. OEL 15 minutes: 150 ppm. OEL 8 hours: 434 mg/m³.
n-butyl acetate	123-86-4	**CA Saskatchewan Provincial (Canada, 4/2021)** STEL 15 minutes: 200 ppm. TWA 8 hours: 150 ppm. **CA British Columbia Provincial (Canada,**

Section 8. Exposure controls/personal protection

		4/2024) [butyl acetate, all isomers] STEL 15 minutes: 150 ppm. TWA 8 hours: 50 ppm. **CA Ontario Provincial (Canada, 6/2019) [butyl acetates, all isomers]** STEL 15 minutes: 150 ppm. TWA 8 hours: 50 ppm. **CA Quebec Provincial (Canada, 2/2024) [butyl acetates]** STEV 15 minutes: 150 ppm. TWAEV 8 hours: 50 ppm. **CA Alberta Provincial (Canada, 3/2023)** OEL 15 minutes: 200 ppm. OEL 15 minutes: 950 mg/m³. OEL 8 hours: 150 ppm. OEL 8 hours: 713 mg/m³.
Methyl ethyl ketone	78-93-3	**CA Saskatchewan Provincial (Canada, 4/2021)** STEL 15 minutes: 300 ppm. TWA 8 hours: 200 ppm. **CA British Columbia Provincial (Canada, 4/2024)** Repr. Absorbed through skin. TWA 8 hours: 50 ppm. STEL 15 minutes: 100 ppm. **CA Ontario Provincial (Canada, 6/2019)** TWA 8 hours: 200 ppm. STEL 15 minutes: 300 ppm. **CA Quebec Provincial (Canada, 2/2024)** TWAEV 8 hours: 50 ppm. TWAEV 8 hours: 150 mg/m³. STEV 15 minutes: 100 ppm. STEV 15 minutes: 300 mg/m³. **CA Alberta Provincial (Canada, 3/2023)** OEL 15 minutes: 300 ppm. OEL 8 hours: 200 ppm. OEL 8 hours: 590 mg/m³. OEL 15 minutes: 885 mg/m³.
Methyl isobutyl ketone	108-10-1	**CA Saskatchewan Provincial (Canada, 4/2021)** STEL 15 minutes: 75 ppm. TWA 8 hours: 50 ppm. **CA British Columbia Provincial (Canada, 4/2024)** Carc 2B. TWA 8 hours: 20 ppm. STEL 15 minutes: 75 ppm. **CA Ontario Provincial (Canada, 6/2019)** TWA 8 hours: 20 ppm. STEL 15 minutes: 75 ppm. **CA Quebec Provincial (Canada, 2/2024)** C3. TWAEV 8 hours: 20 ppm. STEV 15 minutes: 75 ppm. **CA Alberta Provincial (Canada, 3/2023)** OEL 8 hours: 205 mg/m³. OEL 8 hours: 50 ppm. OEL 15 minutes: 75 ppm. OEL 15 minutes: 307 mg/m³.

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Ethylbenzene	100-41-4	**CA Saskatchewan Provincial (Canada, 4/2021)** STEL 15 minutes: 125 ppm. TWA 8 hours: 100 ppm. **CA British Columbia Provincial (Canada, 4/2024)** Carc 2B. TWA 8 hours: 20 ppm. **CA Ontario Provincial (Canada, 6/2019)** TWA 8 hours: 20 ppm. **CA Quebec Provincial (Canada, 2/2024)** C3. TWAEV 8 hours: 20 ppm. **CA Alberta Provincial (Canada, 3/2023)** OEL 8 hours: 100 ppm. OEL 8 hours: 434 mg/m³. OEL 15 minutes: 543 mg/m³. OEL 15 minutes: 125 ppm.
Petroleum refining, hydrotreated light distillate	64742-47-8	**CA British Columbia Provincial (Canada, 4/2024) [kerosene/jet fuels]** Absorbed through skin. TWA 8 hours: 200 mg/m³ (as total hydrocarbon vapour). Notes: Application restricted to conditions in which there are negligible aerosol exposures. **CA Ontario Provincial (Canada, 6/2019)** Absorbed through skin. TWA 8 hours: 200 mg/m³ (as total hydrocarbon vapour). **CA Quebec Provincial (Canada, 2/2024) [kerosene]** C3. Absorbed through skin. TWAEV 8 hours: 200 mg/m³. **CA Alberta Provincial (Canada, 3/2023) [Kerosene/Jet fuels]** Absorbed through skin. OEL 8 hours: 200 mg/m³ (as total hydrocarbon vapour).
2-Butoxyethanol	111-76-2	**CA Saskatchewan Provincial (Canada, 4/2021)** STEL 15 minutes: 30 ppm. TWA 8 hours: 20 ppm. **CA British Columbia Provincial (Canada, 4/2024)** TWA 8 hours: 20 ppm. **CA Ontario Provincial (Canada, 6/2019)** TWA 8 hours: 20 ppm. **CA Quebec Provincial (Canada, 2/2024)** C3. TWAEV 8 hours: 20 ppm. **CA Alberta Provincial (Canada, 3/2023)** OEL 8 hours: 97 mg/m³. OEL 8 hours: 20 ppm.
Quartz	14808-60-7	**CA Saskatchewan Provincial (Canada, 4/2021)** TWA 8 hours: 0.05 mg/m³. Form: respirable fraction. **CA British Columbia Provincial (Canada, 4/2024) [silica, crystalline - alpha quartz and cristobalite]** Carc 2A, Carc 1.

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		TWA 8 hours: 0.025 mg/m³. Form: Respirable. **CA Ontario Provincial (Canada, 6/2019) [Silica, Crystalline (Quartz/Tripoli)]** TWA 8 hours: 0.1 mg/m³. Form: Respirable particulate matter.. **CA Quebec Provincial (Canada, 2/2024) [Silica Crystalline -Quartz]** C2. TWAEV 8 hours: 0.1 mg/m³. Form: respirable aerosol fraction. **CA Alberta Provincial (Canada, 3/2023)** A2. OEL 8 hours: 0.025 mg/m³. Form: Respirable particulate.

Occupational exposure limits (Mexico)

Ingredient name	CAS #	Exposure limits
Toluene	108-88-3	**NOM-010-STPS-2014 (Mexico, 4/2016)** A4. TWA 8 hours: 20 ppm.
Xylene, mixed isomers	1330-20-7	**NOM-010-STPS-2014 (Mexico, 4/2016) [Xileno, mezcla]** A4. STEL 15 minutes: 150 ppm. TWA 8 hours: 100 ppm.
n-Butyl Acetate	123-86-4	**NOM-010-STPS-2014 (Mexico, 4/2016)** TWA 8 hours: 150 ppm. STEL 15 minutes: 200 ppm.
Methyl Ethyl Ketone	78-93-3	**NOM-010-STPS-2014 (Mexico, 4/2016)** TWA 8 hours: 200 ppm. STEL 15 minutes: 300 ppm.
Methyl Isobutyl Ketone	108-10-1	**NOM-010-STPS-2014 (Mexico, 4/2016)** A3. TWA 8 hours: 50 ppm. STEL 15 minutes: 75 ppm.
Ethylbenzene	100-41-4	**NOM-010-STPS-2014 (Mexico, 4/2016)** A3. TWA 8 hours: 20 ppm.

Biological exposure indices (United States)

Ingredient name	Exposure indices
Toluene	**ACGIH BEI (United States, 1/2024)** BEI: 0.03 mg/l, toluene [in urine]. Sampling time: end of shift. BEI: 0.3 mg/g creatinine, o-cresol [in urine]. Sampling time: end of shift. BEI: 0.02 mg/l, toluene [in blood]. Sampling time: prior to last shift of workweek.
Xylene, mixed isomers	**ACGIH BEI (United States, 1/2024) [xylenes (technical or commercial grades)]** BEI: 0.3 g/g creatinine, methylhippuric acids [in urine]. Sampling time: end of shift.
Methyl Ethyl Ketone	**ACGIH BEI (United States, 1/2024)** BEI: 2 mg/l, methyl ethyl ketone [in urine]. Sampling time: end of shift.
Methyl Isobutyl Ketone	**ACGIH BEI (United States, 1/2024)** BEI: 1 mg/l, methyl isobutyl ketone [in urine]. Sampling time: end of shift.

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Ethylbenzene	**ACGIH BEI (United States, 1/2024)** BEI: 150 mg/g creatinine, sum of mandelic acid and phenylglyoxylic acid [in urine]. Sampling time: end of shift.

Biological exposure indices (Canada)

No exposure indices known.

Biological exposure indices (Mexico)

Ingredient name	Exposure indices
Toluene	**Official Mexican STANDARD NOM-047-SSA1-2011, Environmental Health-Biological exposure indices for personnel occupationally exposed to chemical substances. (Mexico, 6/2012)** BEI: 0.05 mg/L, toluene [in blood]. Sampling time: sample time not specified. BEI: 1.6 g/g creatinine [Basal level.The determinant may be present in the biological sample obtained from subjects who have not been occupationally exposed, at a concentration that could affect the interpretation of the results. These background levels are included in the valu; non-specific.The determinant is nonspecific, since it can be found after exposure to other chemicals.], hippuric acid [in urine]. Sampling time: at the end of the work shift. BEI: 0.5 mg/L [Basal level.The determinant may be present in the biological sample obtained from subjects who have not been occupationally exposed, at a concentration that could affect the interpretation of the results. These background levels are included in the valu], o-cresol [in urine]. Sampling time: at the end of the work shift.
Xylene, mixed isomers	**Official Mexican STANDARD NOM-047-SSA1-2011, Environmental Health-Biological exposure indices for personnel occupationally exposed to chemical substances. (Mexico, 6/2012) [xylenes (technical or commercial grade)]** BEI: 1.5 g/g creatinine, methyl hippuric acids [in urine]. Sampling time: at the end of the work shift.
Methyl Ethyl Ketone	**Official Mexican STANDARD NOM-047-SSA1-2011, Environmental Health-Biological exposure indices for personnel occupationally exposed to chemical substances. (Mexico, 6/2012)** BEI: 2 mg/L, MEK [in urine]. Sampling time: at the end of the work shift.
Methyl Isobutyl Ketone	**Official Mexican STANDARD NOM-**

Section 8. Exposure controls/personal protection

	047-SSA1-2011, Environmental Health-Biological exposure indices for personnel occupationally exposed to chemical substances. (Mexico, 6/2012) BEI: 2 mg/L, MIBK [in urine]. Sampling time: at the end of the work shift.
Ethylbenzene	**Official Mexican STANDARD NOM-047-SSA1-2011, Environmental Health-Biological exposure indices for personnel occupationally exposed to chemical substances. (Mexico, 6/2012)** BEI: 0.7 g/g creatinine [non-specific.The determinant is nonspecific, since it can be found after exposure to other chemicals.; semi-quantitative.The biological determinant is an indicator of chemical exposure, but the quantitative interpretation of the measure is ambiguous. These biological determinants should be used as a screening test if a quantitative test is not possible.], Sum of mandelic acid and acid phenylglyoxylic [in urine]. Sampling time: at the end of the shift at the end of the work week. BEI: semi-quantitative.The biological determinant is an indicator of chemical exposure, but the quantitative interpretation of the measure is ambiguous. These biological determinants should be used as a screening test if a quantitative test is not possible., ethylbenzene [in exhaled air]. Sampling time: uncritical.

Appropriate engineering controls : Use only with adequate ventilation. Use process enclosures, local exhaust ventilation or other engineering controls to keep worker exposure to airborne contaminants below any recommended or statutory limits. The engineering controls also need to keep gas, vapor or dust concentrations below any lower explosive limits. Use explosion-proof ventilation equipment.

Environmental exposure controls : Emissions from ventilation or work process equipment should be checked to ensure they comply with the requirements of environmental protection legislation. In some cases, fume scrubbers, filters or engineering modifications to the process equipment will be necessary to reduce emissions to acceptable levels.

Individual protection measures

Hygiene measures : Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Appropriate techniques should be used to remove potentially contaminated clothing. Wash contaminated clothing before reusing. Ensure that eyewash stations and safety showers are close to the workstation location.

Eye/face protection : Safety eyewear complying with an approved standard should be used when a risk assessment indicates this is necessary to avoid exposure to liquid splashes, mists, gases or dusts. If contact is possible, the following protection should be worn, unless the assessment indicates a higher degree of protection: chemical splash goggles.

Skin protection

Section 8. Exposure controls/personal protection

Hand protection : Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary. Considering the parameters specified by the glove manufacturer, check during use that the gloves are still retaining their protective properties. It should be noted that the time to breakthrough for any glove material may be different for different glove manufacturers. In the case of mixtures, consisting of several substances, the protection time of the gloves cannot be accurately estimated.

Body protection : Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product. When there is a risk of ignition from static electricity, wear anti-static protective clothing. For the greatest protection from static discharges, clothing should include anti-static overalls, boots and gloves.

Other skin protection : Appropriate footwear and any additional skin protection measures should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Respiratory protection : Based on the hazard and potential for exposure, select a respirator that meets the appropriate standard or certification. Respirators must be used according to a respiratory protection program to ensure proper fitting, training, and other important aspects of use.

Section 9. Physical and chemical properties

The conditions of measurement of all properties are at standard temperature and pressure unless otherwise indicated.

Appearance

Physical state : Liquid.

Color : Gray.

Odor : Not available.

Odor threshold : Not available.

pH : Not applicable.

Melting point/freezing point : Not available.

Boiling point or initial boiling point and boiling range : 78°C (172.4°F)

Flash point : Closed cup: 9°C (48.2°F) [Pensky-Martens Closed Cup]

Evaporation rate : 5.6 (butyl acetate = 1)

Flammability : Flammable liquid.

Lower and upper explosion limit/flammability limit : Lower: 1%
Upper: 12.1%

Vapor pressure : 12.1 kPa (90.6 mm Hg)

Relative vapor density : 2.48 [Air = 1]

Relative density : 1.3

Density : 1.29 g/cm³

Solubility(ies) :

Media	Result
cold water	Not soluble

Partition coefficient: n-octanol/water : Not applicable.

Auto-ignition temperature : Not available.

Decomposition temperature : Not available.

Section 9. Physical and chemical properties

Viscosity : Dynamic (room temperature): Not available.
Kinematic (room temperature): Not available.
Kinematic (40°C (104°F)): <20.5 mm^2/s (<20.5 cSt)

Molecular weight : Not applicable.

Particle characteristics

Median particle size : Not applicable.

Heat of combustion : 11.724 kJ/g

Section 10. Stability and reactivity

Reactivity : No specific test data related to reactivity available for this product or its ingredients.

Chemical stability : The product is stable.

Possibility of hazardous reactions : Under normal conditions of storage and use, hazardous reactions will not occur.

Conditions to avoid : Avoid all possible sources of ignition (spark or flame). Do not pressurize, cut, weld, braze, solder, drill, grind or expose containers to heat or sources of ignition. Do not allow vapor to accumulate in low or confined areas.

Incompatible materials : Reactive or incompatible with the following materials:
oxidizing materials

Hazardous decomposition products : Under normal conditions of storage and use, hazardous decomposition products should not be produced.

Section 11. Toxicological information

Information on toxicological effects

Acute toxicity

Product/ingredient name	Result
Toluene	**Rat - Oral - LD50** 636 mg/kg **Rat - Inhalation - LC50 Vapor** 49 g/m^3 [4 hours]
Xylene, mixed isomers	**Rat - Oral - LD50** 4300 mg/kg Toxic effects: Liver - Other changes Kidney, Ureter, and Bladder - Other changes **Rat - Inhalation - LC50 Gas.** 6700 ppm [4 hours] Toxic effects: Behavioral - Somnolence (general depressed activity)
n-Butyl Acetate	**Rat - Oral - LD50** 10768 mg/kg Toxic effects: Behavioral - Somnolence (general depressed activity) Lung, Thorax, or Respiration - Other changes Liver - Other changes **Rabbit - Dermal - LD50** >17600 mg/kg
Methyl Ethyl Ketone	**Rabbit - Dermal - LD50** 6480 mg/kg

Section 11. Toxicological information

	Rat - Oral - LD50 2737 mg/kg
Methyl Isobutyl Ketone	**Rat - Oral - LD50** 2080 mg/kg
Ethyl 3-Ethoxypropionate	**Rat - Oral - LD50** 3200 mg/kg Toxic effects: Behavioral - Ataxia
Ethylbenzene	**Rat - Oral - LD50** 3500 mg/kg Toxic effects: Liver - Other changes Kidney, Ureter, and Bladder - Other changes **Rabbit - Dermal - LD50** >5000 mg/kg

Conclusion/Summary [Product] : Not available.

Skin corrosion/irritation

Product/ingredient name	Result
Toluene	**Pig - Skin - Mild irritant** Duration of treatment/exposure: 24 hours Amount/concentration applied: 250 uL **Rabbit - Skin - Mild irritant** Amount/concentration applied: 435 mg **Rabbit - Skin - Moderate irritant** Duration of treatment/exposure: 24 hours Amount/concentration applied: 20 mg **Rabbit - Skin - Moderate irritant** Amount/concentration applied: 500 mg
Talc	**Human - Skin - Mild irritant** Duration of treatment/exposure: 72 hours Amount/concentration applied: 300 ug I
Xylene, mixed isomers	**Rat - Skin - Mild irritant** Duration of treatment/exposure: 8 hours Amount/concentration applied: 60 uL **Rabbit - Skin - Moderate irritant** Duration of treatment/exposure: 24 hours Amount/concentration applied: 500 mg **Rabbit - Skin - Moderate irritant** Amount/concentration applied: 100 %
n-Butyl Acetate	**Rabbit - Skin - Moderate irritant** Duration of treatment/exposure: 24 hours Amount/concentration applied: 500 mg
Titanium Dioxide	**Human - Skin - Mild irritant** Duration of treatment/exposure: 72 hours Amount/concentration applied: 300 ug I
Methyl Ethyl Ketone	**Rabbit - Skin - Mild irritant** Duration of treatment/exposure: 24 hours Amount/concentration applied: 14 mg **Rabbit - Skin - Mild irritant** Duration of treatment/exposure: 24 hours Amount/concentration applied: 402 mg **Rabbit - Skin - Moderate irritant** Duration of treatment/exposure: 24 hours Amount/concentration applied: 500 mg
Methyl Isobutyl Ketone	**Rabbit - Skin - Mild irritant**

Section 11. Toxicological information

	Duration of treatment/exposure: 24 hours Amount/concentration applied: 500 mg
Ethyl 3-Ethoxypropionate	**Rabbit - Skin - Mild irritant** Duration of treatment/exposure: 24 hours Amount/concentration applied: 500 mg
Ethylbenzene	**Rabbit - Skin - Mild irritant** Duration of treatment/exposure: 24 hours Amount/concentration applied: 15 mg

Conclusion/Summary [Product] : Not available.

Serious eye damage/eye irritation

Product/ingredient name	Result
Toluene	**Rabbit - Eyes - Mild irritant** Duration of treatment/exposure: 0.5 minutes Amount/concentration applied: 100 mg **Rabbit - Eyes - Mild irritant** Amount/concentration applied: 870 ug **Rabbit - Eyes - Severe irritant** Duration of treatment/exposure: 24 hours Amount/concentration applied: 2 mg **Rabbit - Eyes - Severe irritant** Amount/concentration applied: 0.1 Ml
Xylene, mixed isomers	**Rabbit - Eyes - Mild irritant** Amount/concentration applied: 87 mg **Rabbit - Eyes - Severe irritant** Duration of treatment/exposure: 24 hours Amount/concentration applied: 5 mg
n-Butyl Acetate	**Rabbit - Eyes - Moderate irritant** Amount/concentration applied: 100 mg
Methyl Isobutyl Ketone	**Rabbit - Eyes - Moderate irritant** Duration of treatment/exposure: 24 hours Amount/concentration applied: 100 uL **Rabbit - Eyes - Severe irritant** Amount/concentration applied: 40 mg
Ethylbenzene	**Rabbit - Eyes - Severe irritant** Amount/concentration applied: 500 mg

Conclusion/Summary [Product] : Not available.

Respiratory corrosion/irritation

Not available.

Conclusion/Summary [Product] : Not available.

Respiratory or skin sensitization

Not available.

Skin

Conclusion/Summary [Product] : Not available.

Section 11. Toxicological information

Respiratory

Conclusion/Summary [Product] : Not available.

Germ cell mutagenicity

Not available.

Conclusion/Summary [Product] : Not available.

Carcinogenicity

Not available.

Conclusion/Summary [Product] : Not available.

Classification

Product/ingredient name	OSHA	IARC	NTP
Toluene	-	3	-
Talc	-	3	-
Xylene, mixed isomers	-	3	-
Titanium Dioxide	-	2B	-
Methyl Isobutyl Ketone	-	2B	-
Ethylbenzene	-	2B	-
Crystalline Silica, respirable powder	+	1	Known to be a human carcinogen.

Reproductive toxicity

Not available.

Conclusion/Summary [Product] : Not available.

Specific target organ toxicity (single exposure)

Product/ingredient name	Result
Toluene	SPECIFIC TARGET ORGAN TOXICITY (SINGLE EXPOSURE) (Narcotic effects) - Category 3
Xylene, mixed isomers	SPECIFIC TARGET ORGAN TOXICITY (SINGLE EXPOSURE) (Respiratory tract irritation) - Category 3 SPECIFIC TARGET ORGAN TOXICITY (SINGLE EXPOSURE) (Narcotic effects) - Category 3
n-Butyl Acetate	SPECIFIC TARGET ORGAN TOXICITY (SINGLE EXPOSURE) (Narcotic effects) - Category 3
Methyl Ethyl Ketone	SPECIFIC TARGET ORGAN TOXICITY (SINGLE EXPOSURE) (Narcotic effects) - Category 3
Methyl Isobutyl Ketone	SPECIFIC TARGET ORGAN TOXICITY (SINGLE EXPOSURE) (Respiratory tract irritation) - Category 3 SPECIFIC TARGET ORGAN TOXICITY (SINGLE EXPOSURE) (Narcotic effects) - Category 3
Ethylbenzene	SPECIFIC TARGET ORGAN TOXICITY (SINGLE EXPOSURE) (Narcotic effects) - Category 3
Light Aliphatic Hydrocarbon	SPECIFIC TARGET ORGAN TOXICITY (SINGLE EXPOSURE) (Narcotic effects) - Category 3

Specific target organ toxicity (repeated exposure)

Section 11. Toxicological information

Product/ingredient name	Result
Toluene	SPECIFIC TARGET ORGAN TOXICITY (REPEATED EXPOSURE) - Category 2
Kaolin	SPECIFIC TARGET ORGAN TOXICITY (REPEATED EXPOSURE) (lungs) (inhalation) - Category 1
Talc	SPECIFIC TARGET ORGAN TOXICITY (REPEATED EXPOSURE) (lungs) (inhalation) - Category 1
Xylene, mixed isomers	SPECIFIC TARGET ORGAN TOXICITY (REPEATED EXPOSURE) - Category 2
Ethylbenzene	SPECIFIC TARGET ORGAN TOXICITY (REPEATED EXPOSURE) - Category 2
Med. Aliphatic Hydrocarbon Solvent	SPECIFIC TARGET ORGAN TOXICITY (REPEATED EXPOSURE) - Category 1
Crystalline Silica, respirable powder	SPECIFIC TARGET ORGAN TOXICITY (REPEATED EXPOSURE) (inhalation) - Category 1

Aspiration hazard

Product/ingredient name	Result
Toluene	ASPIRATION HAZARD - Category 1
Xylene, mixed isomers	ASPIRATION HAZARD - Category 1
Ethylbenzene	ASPIRATION HAZARD - Category 1
Med. Aliphatic Hydrocarbon Solvent	ASPIRATION HAZARD - Category 1
Light Aliphatic Hydrocarbon	ASPIRATION HAZARD - Category 1

Information on the likely routes of exposure

Not available.

Potential acute health effects

Eye contact : Causes serious eye irritation.

Inhalation : Can cause central nervous system (CNS) depression. May cause drowsiness or dizziness.

Skin contact : Causes skin irritation.

Ingestion : Can cause central nervous system (CNS) depression. May be fatal if swallowed and enters airways.

Symptoms related to the physical, chemical and toxicological characteristics

Eye contact : Adverse symptoms may include the following:
pain or irritation
watering
redness

Inhalation : Adverse symptoms may include the following:
nausea or vomiting
headache
drowsiness/fatigue
dizziness/vertigo
unconsciousness
reduced fetal weight
increase in fetal deaths
skeletal malformations

Section 11. Toxicological information

Skin contact : Adverse symptoms may include the following:
irritation
redness
reduced fetal weight
increase in fetal deaths
skeletal malformations

Ingestion : Adverse symptoms may include the following:
nausea or vomiting
reduced fetal weight
increase in fetal deaths
skeletal malformations

Delayed and immediate effects and also chronic effects from short and long term exposure

Short term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Long term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Potential chronic health effects

Not available.

Conclusion/Summary [Product] : Not available.

General : Causes damage to organs through prolonged or repeated exposure.

Carcinogenicity : May cause cancer. Risk of cancer depends on duration and level of exposure.

Mutagenicity : No known significant effects or critical hazards.

Reproductive toxicity : May damage fertility or the unborn child.

Numerical measures of toxicity

Acute toxicity estimates

Product/ingredient name	Oral (mg/kg)	Dermal (mg/kg)	Inhalation (gases) (ppm)	Inhalation (vapors) (mg/l)	Inhalation (dusts and mists) (mg/l)
FINISH 1™ 2K HS Urethane Primer (Part A)	24013.6	20387.6	N/A	305.8	N/A
Toluene	N/A	N/A	N/A	49	N/A
Xylene, mixed isomers	4300	2500	N/A	N/A	N/A
n-Butyl Acetate	10768	N/A	N/A	N/A	N/A
Methyl Ethyl Ketone	2737	6480	N/A	N/A	N/A
Methyl Isobutyl Ketone	2080	N/A	N/A	11	N/A
Ethyl 3-Ethoxypropionate	3200	N/A	N/A	N/A	N/A
Ethylbenzene	3500	N/A	N/A	11	N/A

Section 12. Ecological information

Toxicity

Product/ingredient name	Result
Toluene	**Acute - LC50 - Fresh water** Fish - Coho salmon,silver salmon - *Oncorhynchus kisutch* - Fry Weight: 1 g 5500 µg/l [96 hours] Effect: Mortality **Acute - EC50 - Fresh water** Daphnia - Water flea - *Daphnia magna* - Juvenile (Fledgling, Hatchling, Weanling) 6000 µg/l [48 hours] Effect: Intoxication **Chronic - NOEC - Fresh water** Daphnia - Water flea - *Daphnia magna* Age: ≤24 hours 1 mg/l [21 days] Effect: Mortality **Acute - EC50 - Fresh water** Algae - Green algae - *Raphidocelis subcapitata* 12.5 mg/l [72 hours] Effect: Growth
Xylene, mixed isomers	**Acute - LC50 - Marine water** Crustaceans - Daggerblade grass shrimp - *Palaemon pugio* 8500 µg/l [48 hours] Effect: Mortality **Acute - LC50 - Fresh water** Fish - Fathead minnow - *Pimephales promelas* Age: 31 days; Size: 18.4 mm; Weight: 0.077 g 13.4 mg/l [96 hours] Effect: Mortality
n-Butyl Acetate	**Acute - LC50 - Fresh water** Fish - Fathead minnow - *Pimephales promelas* Age: 31 to 32 days; Size: 21.6 mm; Weight: 0.175 g 18 mg/l [96 hours] Effect: Mortality **Acute - LC50 - Marine water** Crustaceans - Brine shrimp - *Artemia salina* 32 mg/l [48 hours] Effect: Mortality
Titanium Dioxide	**Acute - LC50 - Marine water** Fish - Mummichog - *Fundulus heteroclitus* >1000 mg/l [96 hours] Effect: Mortality
Methyl Ethyl Ketone	**Acute - EC50 - Fresh water** Daphnia - Water flea - *Daphnia magna* - Larvae Age: <24 hours 5091 mg/l [48 hours] Effect: Intoxication **Acute - LC50 - Fresh water** Fish - Fathead minnow - *Pimephales promelas* Age: 31 days; Size: 22 mm; Weight: 0.167 g 3220 mg/l [96 hours] Effect: Mortality **Acute - EC50 - Marine water** Algae - Diatom - *Skeletonema costatum* >500 mg/l [96 hours]

Section 12. Ecological information

	Effect: Population
Methyl Isobutyl Ketone	**Acute - LC50 - Fresh water** Fish - Fathead minnow - *Pimephales promelas* Age: 29 days; Size: 21 mm; Weight: 0.141 g 505 mg/l [96 hours] Effect: Mortality **Chronic - NOEC - Fresh water** Daphnia - Water flea - *Daphnia magna* 78 mg/l [21 days] Effect: Behavior **Chronic - NOEC - Fresh water** Fish - Fathead minnow - *Pimephales promelas* - Embryo Age: <24 hours 168 mg/l [33 days] Effect: Mortality
Ethylbenzene	**Acute - LC50 - Fresh water** Fish - Rainbow trout,donaldson trout - *Oncorhynchus mykiss* 4200 µg/l [96 hours] Effect: Mortality **Acute - EC50 - Fresh water** Daphnia - Water flea - *Daphnia magna* - Neonate Age: ≤24 hours 2.93 mg/l [48 hours] Effect: Intoxication **Acute - EC50 - Fresh water** Algae - Green algae - *Raphidocelis subcapitata* 3600 µg/l [96 hours] Effect: Population
Light Aliphatic Hydrocarbon	**Acute - LC50 - Fresh water** Fish - Bluegill - *Lepomis macrochirus* Size: 35 to 75 mm 2200 µg/l [4 days] Effect: Mortality

Conclusion/Summary [Product] : Not available.

Persistence and degradability

Not available.

Conclusion/Summary [Product] : Not available.

Product/ingredient name	Aquatic half-life	Photolysis	Biodegradability
Toluene	-	-	Readily
Xylene, mixed isomers	-	-	Readily
n-Butyl Acetate	-	-	Readily
Methyl Ethyl Ketone	-	-	Readily
Methyl Isobutyl Ketone	-	-	Readily
Ethylbenzene	-	-	Readily

Bioaccumulative potential

Product/ingredient name	$LogP_{ow}$	BCF	Potential
Toluene	-	90	Low
Xylene, mixed isomers	-	8.1 to 25.9	Low

Section 12. Ecological information

Mobility in soil

Soil/Water partition coefficient : Not available.

Other adverse effects

No known significant effects or critical hazards.

Section 13. Disposal considerations

Disposal methods : The generation of waste should be avoided or minimized wherever possible. Disposal of this product, solutions and any by-products should at all times comply with the requirements of environmental protection and waste disposal legislation and any regional local authority requirements. Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Waste should not be disposed of untreated to the sewer unless fully compliant with the requirements of all authorities with jurisdiction. Waste packaging should be recycled. Incineration or landfill should only be considered when recycling is not feasible. This material and its container must be disposed of in a safe way. Care should be taken when handling emptied containers that have not been cleaned or rinsed out. Empty containers or liners may retain some product residues. Vapor from product residues may create a highly flammable or explosive atmosphere inside the container. Do not cut, weld or grind used containers unless they have been cleaned thoroughly internally. Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers.

Section 14. Transport information

	DOT Classification	TDG Classification	Mexico Classification	IATA	IMDG
UN number	UN1263	UN1263	UN1263	UN1263	UN1263
UN proper shipping name	PAINT	PAINT	PAINT	PAINT	PAINT
Transport hazard class(es)	3 	3 	3 	3 	3 
Packing group	II	II	II	II	II
Environmental hazards	No.	No.	No.	No.	No.
Additional information	- **ERG No.** 128	Product classified as per the following sections of the Transportation of Dangerous Goods Regulations: 2.18-2.19 (Class 3). **ERG No.** 128	- **ERG No.** 128	-	**Emergency schedules** F-E, S-E

Section 14. Transport information

Special precautions for user : Multi-modal shipping descriptions are provided for informational purposes and do not consider container sizes. The presence of a shipping description for a particular mode of transport (sea, air, etc.), does not indicate that the product is packaged suitably for that mode of transport. All packaging must be reviewed for suitability prior to shipment, and compliance with the applicable regulations is the sole responsibility of the person offering the product for transport. People loading and unloading dangerous goods must be trained on all of the risks deriving from the substances and on all actions in case of emergency situations.

Transport in bulk according to IMO instruments : Not available.

Proper shipping name : Not available.

Section 15. Regulatory information

U.S. Federal regulations :

SARA 313

All data given below are MAXIMUM THEORETICAL VALUES based on the product AS CURRENTLY FORMULATED and rely on information provided to us by our raw material suppliers. Our suppliers often provide an estimated value or range less than a certain upper limit. We calculate MAXIMUM THEORETICAL VALUES using defined values, if provided, or the upper limit reported by our supplier. Additionally, the suppliers' information may include amounts present in the product as unintentional byproducts or impurities. Variations may occur in individual batches due to adjustments made during production. Reporting of chemicals in this section does not necessarily indicate their presence in the final formulated product.

Ingredient name	% by weight	CAS number
Toluene	18	108-88-3
Xylene, mixed isomers	8	1330-20-7
Methyl Isobutyl Ketone	2	108-10-1
Ethylbenzene	1	100-41-4
Lead (as Pb)	0.00003	
Mercury (as Hg)	0.00001	

California Prop. 65

WARNING: This product contains chemicals known to the State of California to cause cancer and birth defects or other reproductive harm.

International regulations

Montreal Protocol

Not listed.

Stockholm Convention on Persistent Organic Pollutants

Not listed.

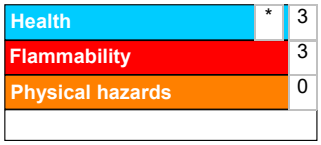
International lists : **Australia inventory (AIIC)**: Not determined.
China inventory (IECSC): Not determined.
Japan inventory (CSCL): Not determined.
Japan inventory (ISHL): Not determined.
Korea inventory (KECI): Not determined.
New Zealand Inventory of Chemicals (NZIoC): Not determined.
Philippines inventory (PICCS): Not determined.
Taiwan Chemical Substances Inventory (TCSI): Not determined.

Section 15. Regulatory information

Thailand inventory: Not determined.
Turkey inventory: Not determined.
Vietnam inventory: Not determined.

Section 16. Other information

Hazardous Material Information System (U.S.A.)



The customer is responsible for determining the PPE code for this material. For more information on HMIS® Personal Protective Equipment (PPE) codes, consult the HMIS® Implementation Manual.

Caution: HMIS® ratings are based on a 0-4 rating scale, with 0 representing minimal hazards or risks, and 4 representing significant hazards or risks. Although HMIS® ratings and the associated label are not required on SDSs or products leaving a facility under 29 CFR 1910.1200, the preparer may choose to provide them. HMIS® ratings are to be used with a fully implemented HMIS® program. HMIS® is a registered trademark and service mark of the American Coatings Association, Inc.

Procedure used to derive the classification

Classification	Justification
FLAMMABLE LIQUIDS - Category 2	On basis of test data
SKIN CORROSION/IRRITATION - Category 2	Calculation method
SERIOUS EYE DAMAGE/ EYE IRRITATION - Category 2A	Calculation method
CARCINOGENICITY - Category 1A	Calculation method
TOXIC TO REPRODUCTION - Category 1B	Calculation method
SPECIFIC TARGET ORGAN TOXICITY (SINGLE EXPOSURE) (Narcotic effects) - Category 3	Calculation method
SPECIFIC TARGET ORGAN TOXICITY (REPEATED EXPOSURE) - Category 1	Calculation method
ASPIRATION HAZARD - Category 1	Calculation method

History

Date of printing : 4/4/2025

Date of issue/Date of revision : 4/4/2025

Date of previous issue : 12/12/2024

Version : 37

Key to abbreviations : ATE = Acute Toxicity Estimate
BCF = Bioconcentration Factor
GHS = Globally Harmonized System of Classification and Labelling of Chemicals
IATA = International Air Transport Association
IBC = Intermediate Bulk Container
IMDG = International Maritime Dangerous Goods
LogPow = logarithm of the octanol/water partition coefficient
MARPOL = International Convention for the Prevention of Pollution From Ships, 1973 as modified by the Protocol of 1978. ("Marpol" = marine pollution)
N/A = Not available
SGG = Segregation Group
UN = United Nations

Indicates information that has changed from previously issued version.

Notice to reader

Section 16. Other information

It is recommended that each customer or recipient of this Safety Data Sheet (SDS) study it carefully and consult resources, as necessary or appropriate, to become aware of and understand the data contained in this SDS and any hazards associated with the product. This information is provided in good faith and believed to be accurate as of the effective date herein. However, no warranty, express or implied, is given. The information presented here applies only to the product as shipped. The addition of any material can change the composition, hazards and risks of the product. Products shall not be repackaged, modified, or tinted except as specifically instructed by the manufacturer, including but not limited to the incorporation of products not specified by the manufacturer, or the use or addition of products in proportions not specified by the manufacturer. Regulatory requirements are subject to change and may differ between various locations and jurisdictions. The customer/buyer/user is responsible to ensure that his activities comply with all country, federal, state, provincial or local laws. The conditions for use of the product are not under the control of the manufacturer; the customer/buyer/user is responsible to determine the conditions necessary for the safe use of this product. The customer/buyer/user should not use the product for any purpose other than the purpose shown in the applicable section of this SDS without first referring to the supplier and obtaining written handling instructions. Due to the proliferation of sources for information such as manufacturer-specific SDS, the manufacturer cannot be responsible for SDSs obtained from any other source.

SAFETY DATA SHEET

FC720

Section 1. Identification

Product name : FINISH 1™ Ultimate Overall Clearcoat (Part A)

Product code : FC720

Other means of identification : Not available.

Product type : Liquid.

Relevant identified uses of the substance or mixture and uses advised against

Paint or paint related material.

Manufacturer : ACME AUTOMOTIVE FINISHES
101 W. Prospect Avenue
Cleveland, OH 44115

National contact : ACME AUTOMOTIVE FINISHES
180 Brunel Road
Mississauga, Ontario L4Z 1T5 Canada

Emergency telephone number of the company : US / Canada: (800) 424-9300
Mexico: SETIQ 800-00-214-00 / 55-5559-1588 Available 24 hours and 365 days a year

Product Information Telephone Number : US / Canada: (216) 566-3031
Mexico: Not Available

Transportation Emergency Telephone Number : US / Canada: (800) 424-9300
Mexico: SETIQ 800-00-214-00 / 55-5559-1588 Available 24 hours and 365 days a year

Section 2. Hazards identification

Classification of the substance or mixture : FLAMMABLE LIQUIDS - Category 2
SKIN CORROSION/IRRITATION - Category 2
SERIOUS EYE DAMAGE/ EYE IRRITATION - Category 2A
SKIN SENSITIZATION - Category 1
TOXIC TO REPRODUCTION - Category 2
SPECIFIC TARGET ORGAN TOXICITY (SINGLE EXPOSURE) (Narcotic effects) - Category 3

Percentage of the mixture consisting of ingredient(s) of unknown acute toxicity: 6.9% (dermal), 6.9% (inhalation)

GHS label elements

Hazard pictograms :



Signal word : Danger

Hazard statements : Highly flammable liquid and vapor.
Causes skin irritation.
May cause an allergic skin reaction.
Causes serious eye irritation.
May cause drowsiness or dizziness.
Suspected of damaging fertility or the unborn child.

Section 2. Hazards identification

Precautionary statements

Prevention : Obtain special instructions before use. Do not handle until all safety precautions have been read and understood. Wear protective gloves, protective clothing and eye or face protection. Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking. Use explosion-proof electrical, ventilating or lighting equipment. Use non-sparking tools. Take action to prevent static discharges. Use only outdoors or in a well-ventilated area. Avoid breathing vapor. Wash thoroughly after handling. Contaminated work clothing must not be allowed out of the workplace.

Response : IF exposed or concerned: Get medical advice or attention. IF INHALED: Remove person to fresh air and keep comfortable for breathing. Call a POISON CENTER or doctor if you feel unwell. IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water. Wash contaminated clothing before reuse. IF ON SKIN: Wash with plenty of water. If skin irritation or rash occurs: Get medical advice or attention. IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If eye irritation persists: Get medical advice or attention.

Storage : Store locked up. Store in a well-ventilated place. Keep container tightly closed. Keep cool.

Disposal : Dispose of contents and container in accordance with all local, regional, national and international regulations.

Supplemental label elements

DELAYED EFFECTS FROM LONG TERM OVEREXPOSURE. Contains solvents which can cause permanent brain and nervous system damage. Intentional misuse by deliberately concentrating and inhaling the contents can be harmful or fatal. WARNING: This product contains chemicals known to the State of California to cause cancer and birth defects or other reproductive harm. FOR PROFESSIONAL USE ONLY. This product must be mixed with other components before use. Before opening the packages, READ AND FOLLOW WARNING LABELS ON ALL COMPONENTS.

This product contains a component that is either subject to a CEPA ministerial condition or an existing/proposed SNAC (Significant New Activity).

Please refer to the SDS for additional information. Keep out of reach of children. Do not transfer contents to other containers for storage.

Hazards not otherwise classified : None known.

Section 3. Composition/information on ingredients

Substance/mixture : Mixture

Other means of identification : Not available.

CAS number/other identifiers

Ingredient name	% by weight	CAS number
n-Butyl Acetate	22.31	123-86-4
n-Butyl Propionate	12.68	590-01-2
Acetone	12.68	67-64-1
Ethyl 3-Ethoxypropionate	6.89	763-69-9
Methyl Ethyl Ketone	4.41	78-93-3
Bis(pentamethyl-4-piperidyl)sebacate	0.21	41556-26-7

Any concentration shown as a range is to protect confidentiality or is due to batch variation.

There are no additional ingredients present which, within the current knowledge of the supplier and in the concentrations applicable, are classified and hence require reporting in this section.

Occupational exposure limits, if available, are listed in Section 8.

Section 4. First aid measures

Description of necessary first aid measures

Eye contact : Immediately flush eyes with plenty of water, occasionally lifting the upper and lower eyelids. Check for and remove any contact lenses. Continue to rinse for at least 10 minutes. Get medical attention.

Inhalation : Remove victim to fresh air and keep at rest in a position comfortable for breathing. If it is suspected that fumes are still present, the rescuer should wear an appropriate mask or self-contained breathing apparatus. If not breathing, if breathing is irregular or if respiratory arrest occurs, provide artificial respiration or oxygen by trained personnel. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation. Get medical attention. If necessary, call a poison center or physician. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway. Loosen tight clothing such as a collar, tie, belt or waistband.

Skin contact : Wash with plenty of soap and water. Remove contaminated clothing and shoes. Wash contaminated clothing thoroughly with water before removing it, or wear gloves. Continue to rinse for at least 10 minutes. Get medical attention. In the event of any complaints or symptoms, avoid further exposure. Wash clothing before reuse. Clean shoes thoroughly before reuse.

Ingestion : Wash out mouth with water. Remove dentures if any. If material has been swallowed and the exposed person is conscious, give small quantities of water to drink. Stop if the exposed person feels sick as vomiting may be dangerous. Do not induce vomiting unless directed to do so by medical personnel. If vomiting occurs, the head should be kept low so that vomit does not enter the lungs. Get medical attention. If necessary, call a poison center or physician. Never give anything by mouth to an unconscious person. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway. Loosen tight clothing such as a collar, tie, belt or waistband.

Most important symptoms/effects, acute and delayed

Potential acute health effects

Eye contact : Causes serious eye irritation.

Inhalation : Can cause central nervous system (CNS) depression. May cause drowsiness or dizziness.

Skin contact : Causes skin irritation. May cause an allergic skin reaction.

Ingestion : Can cause central nervous system (CNS) depression.

Over-exposure signs/symptoms

Eye contact : Adverse symptoms may include the following:
pain or irritation
watering
redness

Inhalation : Adverse symptoms may include the following:
nausea or vomiting
headache
drowsiness/fatigue
dizziness/vertigo
unconsciousness
reduced fetal weight
increase in fetal deaths
skeletal malformations

Skin contact : Adverse symptoms may include the following:
irritation
redness
reduced fetal weight
increase in fetal deaths
skeletal malformations

Section 4. First aid measures

Ingestion : Adverse symptoms may include the following:
reduced fetal weight
increase in fetal deaths
skeletal malformations

Indication of immediate medical attention and special treatment needed, if necessary

Notes to physician : Treat symptomatically. Contact poison treatment specialist immediately if large quantities have been ingested or inhaled.

Specific treatments : No specific treatment.

Protection of first-aiders : No action shall be taken involving any personal risk or without suitable training. If it is suspected that fumes are still present, the rescuer should wear an appropriate mask or self-contained breathing apparatus. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation. Wash contaminated clothing thoroughly with water before removing it, or wear gloves.

See toxicological information (Section 11)

Section 5. Fire-fighting measures

Extinguishing media

Suitable extinguishing media : Use dry chemical, CO_2, water spray (fog) or foam.

Unsuitable extinguishing media : Do not use water jet.

Specific hazards arising from the chemical : Highly flammable liquid and vapor. Runoff to sewer may create fire or explosion hazard. In a fire or if heated, a pressure increase will occur and the container may burst, with the risk of a subsequent explosion. The vapor/gas is heavier than air and will spread along the ground. Vapors may accumulate in low or confined areas or travel a considerable distance to a source of ignition and flash back.

Hazardous thermal decomposition products : Decomposition products may include the following materials:
carbon dioxide
carbon monoxide

Special protective actions for fire-fighters : Promptly isolate the scene by removing all persons from the vicinity of the incident if there is a fire. No action shall be taken involving any personal risk or without suitable training. Move containers from fire area if this can be done without risk. Use water spray to keep fire-exposed containers cool.

Special protective equipment for fire-fighters : Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.

Remark : Flammable liquid.

Section 6. Accidental release measures

Personal precautions, protective equipment and emergency procedures

For non-emergency personnel : No action shall be taken involving any personal risk or without suitable training. Evacuate surrounding areas. Keep unnecessary and unprotected personnel from entering. Do not touch or walk through spilled material. Shut off all ignition sources. No flares, smoking or flames in hazard area. Avoid breathing vapor or mist. Provide adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Put on appropriate personal protective equipment.

For emergency responders : If specialized clothing is required to deal with the spillage, take note of any information in Section 8 on suitable and unsuitable materials. See also the information in "For non-emergency personnel".

Section 6. Accidental release measures

Environmental precautions : **This product contains a component that is either subject to a CEPA ministerial condition or an existing/proposed SNAC (Significant New Activity).**

Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers. Inform the relevant authorities if the product has caused environmental pollution (sewers, waterways, soil or air).

Methods and materials for containment and cleaning up

Small spill : Stop leak if without risk. Move containers from spill area. Use spark-proof tools and explosion-proof equipment. Dilute with water and mop up if water-soluble. Alternatively, or if water-insoluble, absorb with an inert dry material and place in an appropriate waste disposal container. Dispose of via a licensed waste disposal contractor.

Large spill : Stop leak if without risk. Move containers from spill area. Use spark-proof tools and explosion-proof equipment. Approach release from upwind. Prevent entry into sewers, water courses, basements or confined areas. Wash spillages into an effluent treatment plant or proceed as follows. Contain and collect spillage with non-combustible, absorbent material e.g. sand, earth, vermiculite or diatomaceous earth and place in container for disposal according to local regulations (see Section 13). Dispose of via a licensed waste disposal contractor. Contaminated absorbent material may pose the same hazard as the spilled product. Note: see Section 1 for emergency contact information and Section 13 for waste disposal.

Section 7. Handling and storage

Precautions for safe handling

Protective measures : Put on appropriate personal protective equipment (see Section 8). Persons with a history of skin sensitization problems should not be employed in any process in which this product is used. Avoid exposure - obtain special instructions before use. Avoid exposure during pregnancy. Do not handle until all safety precautions have been read and understood. Do not get in eyes or on skin or clothing. Do not ingest. Avoid breathing vapor or mist. Use only with adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Do not enter storage areas and confined spaces unless adequately ventilated. Keep in the original container or an approved alternative made from a compatible material, kept tightly closed when not in use. Store and use away from heat, sparks, open flame or any other ignition source. Use explosion-proof electrical (ventilating, lighting and material handling) equipment. Use only non-sparking tools. Take precautionary measures against electrostatic discharges. Empty containers retain product residue and can be hazardous. Do not reuse container.

Advice on general occupational hygiene : Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking. Remove contaminated clothing and protective equipment before entering eating areas. See also Section 8 for additional information on hygiene measures.

Conditions for safe storage, including any incompatibilities : Store in accordance with local regulations. Store in a segregated and approved area. Store in original container protected from direct sunlight in a dry, cool and well-ventilated area, away from incompatible materials (see Section 10) and food and drink. Store locked up. Eliminate all ignition sources. Separate from oxidizing materials. Keep container tightly closed and sealed until ready for use. Containers that have been opened must be carefully resealed and kept upright to prevent leakage. Do not store in unlabeled containers. Use appropriate containment to avoid environmental contamination. See Section 10 for incompatible materials before handling or use.

Section 8. Exposure controls/personal protection

Control parameters

Occupational exposure limits (OSHA United States)

Ingredient name	CAS #	Exposure limits
n-Butyl Acetate	123-86-4	**NIOSH REL (United States, 10/2020).** TWA: 150 ppm 10 hours. TWA: 710 mg/m³ 10 hours. STEL: 200 ppm 15 minutes. STEL: 950 mg/m³ 15 minutes. **OSHA PEL (United States, 5/2018).** TWA: 150 ppm 8 hours. TWA: 710 mg/m³ 8 hours. **ACGIH TLV (United States, 1/2024). [Butyl acetates]** STEL: 150 ppm 15 minutes. TWA: 50 ppm 8 hours.
n-Butyl Propionate	590-01-2	None.
Acetone	67-64-1	**ACGIH TLV (United States, 1/2024).** TWA: 250 ppm 8 hours. STEL: 500 ppm 15 minutes. **NIOSH REL (United States, 10/2020).** TWA: 250 ppm 10 hours. TWA: 590 mg/m³ 10 hours. **OSHA PEL (United States, 5/2018).** TWA: 1000 ppm 8 hours. TWA: 2400 mg/m³ 8 hours.
Ethyl 3-Ethoxypropionate	763-69-9	None.
Methyl Ethyl Ketone	78-93-3	**ACGIH TLV (United States, 1/2024).** **Absorbed through skin.** TWA: 75 ppm 8 hours. STEL: 150 ppm 15 minutes. **NIOSH REL (United States, 10/2020).** TWA: 200 ppm 10 hours. TWA: 590 mg/m³ 10 hours. STEL: 300 ppm 15 minutes. STEL: 885 mg/m³ 15 minutes. **OSHA PEL (United States, 5/2018).** TWA: 200 ppm 8 hours. TWA: 590 mg/m³ 8 hours.
Bis(pentamethyl-4-piperidyl)sebacate	41556-26-7	None.

Occupational exposure limits (Canada)

Ingredient name	CAS #	Exposure limits
n-butyl acetate	123-86-4	**CA Alberta Provincial (Canada, 3/2023).** OEL: 200 ppm 15 minutes. OEL: 950 mg/m³ 15 minutes. OEL: 150 ppm 8 hours. OEL: 713 mg/m³ 8 hours. **CA Saskatchewan Provincial (Canada, 4/2021).** STEL: 200 ppm 15 minutes. TWA: 150 ppm 8 hours. **CA Ontario Provincial (Canada, 6/2019). [butyl acetates, all isomers]** STEL: 150 ppm 15 minutes. TWA: 50 ppm 8 hours.

Section 8. Exposure controls/personal protection

		CA British Columbia Provincial (Canada, 8/2023). [butyl acetate, all isomers] STEL: 150 ppm 15 minutes. TWA: 50 ppm 8 hours. **CA Quebec Provincial (Canada, 2/2024). [butyl acetates]** STEV: 150 ppm 15 minutes. TWAEV: 50 ppm 8 hours.
acetone	67-64-1	**CA Alberta Provincial (Canada, 3/2023).** OEL: 1200 mg/m³ 8 hours. OEL: 1800 mg/m³ 15 minutes. OEL: 500 ppm 8 hours. OEL: 750 ppm 15 minutes. **CA British Columbia Provincial (Canada, 8/2023).** TWA: 250 ppm 8 hours. STEL: 500 ppm 15 minutes. **CA Ontario Provincial (Canada, 6/2019).** TWA: 250 ppm 8 hours. STEL: 500 ppm 15 minutes. **CA Quebec Provincial (Canada, 2/2024).** TWAEV: 250 ppm 8 hours. STEV: 500 ppm 15 minutes. **CA Saskatchewan Provincial (Canada, 4/2021).** STEL: 750 ppm 15 minutes. TWA: 500 ppm 8 hours.
Methyl ethyl ketone	78-93-3	**CA Alberta Provincial (Canada, 3/2023).** OEL: 300 ppm 15 minutes. OEL: 200 ppm 8 hours. OEL: 590 mg/m³ 8 hours. OEL: 885 mg/m³ 15 minutes. **CA British Columbia Provincial (Canada, 8/2023). Absorbed through skin.** TWA: 50 ppm 8 hours. STEL: 100 ppm 15 minutes. **CA Ontario Provincial (Canada, 6/2019).** TWA: 200 ppm 8 hours. STEL: 300 ppm 15 minutes. **CA Quebec Provincial (Canada, 2/2024).** TWAEV: 50 ppm 8 hours. TWAEV: 150 mg/m³ 8 hours. STEV: 100 ppm 15 minutes. STEV: 300 mg/m³ 15 minutes. **CA Saskatchewan Provincial (Canada, 4/2021).** STEL: 300 ppm 15 minutes. TWA: 200 ppm 8 hours.
Ethylene glycol butyl ether acetate	112-07-2	**CA British Columbia Provincial (Canada, 8/2023).** TWA: 20 ppm 8 hours. **CA Ontario Provincial (Canada, 6/2019).** TWA: 20 ppm 8 hours. **CA Alberta Provincial (Canada, 3/2023).** OEL: 131 mg/m³ 8 hours. OEL: 20 ppm 8 hours.

Section 8. Exposure controls/personal protection

		CA Saskatchewan Provincial (Canada, 4/2021). STEL: 30 ppm 15 minutes. TWA: 20 ppm 8 hours. **CA Quebec Provincial (Canada, 2/2024).** TWAEV: 10 ppm 8 hours.

Occupational exposure limits (Mexico)

Ingredient name	CAS #	Exposure limits
n-Butyl Acetate	123-86-4	**NOM-010-STPS-2014 (Mexico, 4/2016).** TWA: 150 ppm 8 hours. STEL: 200 ppm 15 minutes.
Acetone	67-64-1	**NOM-010-STPS-2014 (Mexico, 4/2016).** TWA: 500 ppm 8 hours. STEL: 750 ppm 15 minutes.
Methyl Ethyl Ketone	78-93-3	**NOM-010-STPS-2014 (Mexico, 4/2016).** TWA: 200 ppm 8 hours. STEL: 300 ppm 15 minutes.

Biological exposure indices (United States)

Ingredient name	Exposure indices
Acetone	**ACGIH BEI (United States, 1/2024)** BEI: 25 mg/l, acetone [in urine]. Sampling time: end of shift.
Methyl Ethyl Ketone	**ACGIH BEI (United States, 1/2024)** BEI: 2 mg/l, methyl ethyl ketone [in urine]. Sampling time: end of shift.

Biological exposure indices (Canada)

No exposure indices known.

Biological exposure indices (Mexico)

Ingredient name	Exposure indices
Acetone	**Official Mexican STANDARD NOM-047-SSA1-2011, Environmental Health-Biological exposure indices for personnel occupationally exposed to chemical substances. (Mexico, 6/2012)** BEI: 50 mg/L [non-specific.The determinant is nonspecific, since it can be found after exposure to other chemicals.], acetone [in urine]. Sampling time: at the end of the work shift.
Methyl Ethyl Ketone	**Official Mexican STANDARD NOM-047-SSA1-2011, Environmental Health-Biological exposure indices for personnel occupationally exposed to chemical substances. (Mexico, 6/2012)** BEI: 2 mg/L, MEK [in urine]. Sampling time: at the end of the work shift.

Section 8. Exposure controls/personal protection

Appropriate engineering controls : Use only with adequate ventilation. Use process enclosures, local exhaust ventilation or other engineering controls to keep worker exposure to airborne contaminants below any recommended or statutory limits. The engineering controls also need to keep gas, vapor or dust concentrations below any lower explosive limits. Use explosion-proof ventilation equipment.

Environmental exposure controls : **This product contains a component that is either subject to a CEPA ministerial condition or an existing/proposed SNAC (Significant New Activity).**
Emissions from ventilation or work process equipment should be checked to ensure they comply with the requirements of environmental protection legislation. In some cases, fume scrubbers, filters or engineering modifications to the process equipment will be necessary to reduce emissions to acceptable levels.

Individual protection measures

Hygiene measures : Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Appropriate techniques should be used to remove potentially contaminated clothing. Contaminated work clothing should not be allowed out of the workplace. Wash contaminated clothing before reusing. Ensure that eyewash stations and safety showers are close to the workstation location.

Eye/face protection : Safety eyewear complying with an approved standard should be used when a risk assessment indicates this is necessary to avoid exposure to liquid splashes, mists, gases or dusts. If contact is possible, the following protection should be worn, unless the assessment indicates a higher degree of protection: chemical splash goggles.

Skin protection

Hand protection : Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary. Considering the parameters specified by the glove manufacturer, check during use that the gloves are still retaining their protective properties. It should be noted that the time to breakthrough for any glove material may be different for different glove manufacturers. In the case of mixtures, consisting of several substances, the protection time of the gloves cannot be accurately estimated.

Body protection : Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product. When there is a risk of ignition from static electricity, wear anti-static protective clothing. For the greatest protection from static discharges, clothing should include anti-static overalls, boots and gloves.

Other skin protection : Appropriate footwear and any additional skin protection measures should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Respiratory protection : Based on the hazard and potential for exposure, select a respirator that meets the appropriate standard or certification. Respirators must be used according to a respiratory protection program to ensure proper fitting, training, and other important aspects of use.

Section 9. Physical and chemical properties

The conditions of measurement of all properties are at standard temperature and pressure unless otherwise indicated.

Appearance

Physical state : Liquid.

Color : Clear.

Odor : Not available.

Odor threshold : Not available.

pH : Not applicable.

Melting point/freezing point : Not available.

Section 9. Physical and chemical properties

Boiling point, initial boiling point, and boiling range : 55°C (131°F)

Flash point : Closed cup: -14°C (6.8°F) [Pensky-Martens Closed Cup]

Evaporation rate : 5.6 (butyl acetate = 1)

Flammability : Flammable liquid.

Lower and upper explosion limit/flammability limit : Lower: 1.05%
Upper: 12.8%

Vapor pressure : 24 kPa (180 mm Hg)

Relative vapor density : 2 [Air = 1]

Relative density : 0.95

Solubility(ies) :

Media	Result
cold water	Not soluble

Partition coefficient: n-octanol/water : Not applicable.

Auto-ignition temperature : Not available.

Decomposition temperature : Not available.

Viscosity : Kinematic (40°C (104°F)): >20.5 mm^2/s (>20.5 cSt)

Molecular weight : Not applicable.

Heat of combustion : 17.513 kJ/g

Section 10. Stability and reactivity

Reactivity : No specific test data related to reactivity available for this product or its ingredients.

Chemical stability : The product is stable.

Possibility of hazardous reactions : Under normal conditions of storage and use, hazardous reactions will not occur.

Conditions to avoid : Avoid all possible sources of ignition (spark or flame). Do not pressurize, cut, weld, braze, solder, drill, grind or expose containers to heat or sources of ignition. Do not allow vapor to accumulate in low or confined areas.

Incompatible materials : Reactive or incompatible with the following materials:
oxidizing materials

Hazardous decomposition products : Under normal conditions of storage and use, hazardous decomposition products should not be produced.

Section 11. Toxicological information

Information on toxicological effects

Acute toxicity

Section 11. Toxicological information

Product/ingredient name	Result	Species	Dose	Exposure
n-Butyl Acetate	LD50 Dermal	Rabbit	>17600 mg/kg	-
	LD50 Oral	Rat	10768 mg/kg	-
n-Butyl Propionate	LD50 Dermal	Rabbit	>14 g/kg	-
	LD50 Oral	Rat	11031 mg/kg	-
Acetone	LD50 Oral	Rat	5800 mg/kg	-
Ethyl 3-Ethoxypropionate	LD50 Oral	Rat	3200 mg/kg	-
Methyl Ethyl Ketone	LD50 Dermal	Rabbit	6480 mg/kg	-
	LD50 Oral	Rat	2737 mg/kg	-

Irritation/Corrosion

Product/ingredient name	Result	Species	Score	Exposure	Observation
n-Butyl Acetate	Eyes - Moderate irritant	Rabbit	-	100 mg	-
	Skin - Moderate irritant	Rabbit	-	24 hours 500 mg	-
n-Butyl Propionate	Eyes - Moderate irritant	Rabbit	-	0.1 Ml	-
	Eyes - Severe irritant	Rabbit	-	100 mg	-
	Skin - Mild irritant	Guinea pig	-	0.3 Ml	-
	Skin - Mild irritant	Rabbit	-	0.5 Ml	-
	Skin - Moderate irritant	Rabbit	-	24 hours 500 mg	-
Acetone	Eyes - Mild irritant	Human	-	186300 ppm	-
	Eyes - Mild irritant	Rabbit	-	10 uL	-
	Eyes - Moderate irritant	Rabbit	-	24 hours 20 mg	-
	Eyes - Severe irritant	Rabbit	-	20 mg	-
	Skin - Mild irritant	Rabbit	-	395 mg	-
	Skin - Mild irritant	Rabbit	-	24 hours 500 mg	-
Ethyl 3-Ethoxypropionate	Skin - Mild irritant	Rabbit	-	24 hours 500 mg	-
Methyl Ethyl Ketone	Skin - Mild irritant	Rabbit	-	24 hours 14 mg	-
	Skin - Moderate irritant	Rabbit	-	24 hours 500 mg	-

Sensitization

Not available.

Mutagenicity

Not available.

Carcinogenicity

Not available.

Reproductive toxicity

Not available.

Teratogenicity

Not available.

Specific target organ toxicity (single exposure)

Name	Category	Route of exposure	Target organs
n-Butyl Acetate	Category 3	-	Narcotic effects
Acetone	Category 3	-	Narcotic effects
Methyl Ethyl Ketone	Category 3	-	Narcotic effects

Section 11. Toxicological information

Specific target organ toxicity (repeated exposure)

Not available.

Aspiration hazard

Not available.

Information on the likely routes of exposure : Not available.

Potential acute health effects

Eye contact : Causes serious eye irritation.

Inhalation : Can cause central nervous system (CNS) depression. May cause drowsiness or dizziness.

Skin contact : Causes skin irritation. May cause an allergic skin reaction.

Ingestion : Can cause central nervous system (CNS) depression.

Symptoms related to the physical, chemical and toxicological characteristics

Eye contact : Adverse symptoms may include the following:
pain or irritation
watering
redness

Inhalation : Adverse symptoms may include the following:
nausea or vomiting
headache
drowsiness/fatigue
dizziness/vertigo
unconsciousness
reduced fetal weight
increase in fetal deaths
skeletal malformations

Skin contact : Adverse symptoms may include the following:
irritation
redness
reduced fetal weight
increase in fetal deaths
skeletal malformations

Ingestion : Adverse symptoms may include the following:
reduced fetal weight
increase in fetal deaths
skeletal malformations

Delayed and immediate effects and also chronic effects from short and long term exposure

Short term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Long term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Potential chronic health effects

Not available.

Section 11. Toxicological information

General : Once sensitized, a severe allergic reaction may occur when subsequently exposed to very low levels.

Carcinogenicity : No known significant effects or critical hazards.

Mutagenicity : No known significant effects or critical hazards.

Teratogenicity : No known significant effects or critical hazards.

Developmental effects : No known significant effects or critical hazards.

Fertility effects : Suspected of damaging fertility.

Numerical measures of toxicity

Acute toxicity estimates

Route	ATE value
Oral	26557.3 mg/kg

Section 12. Ecological information

Toxicity

Product/ingredient name	Result	Species	Exposure
n-Butyl Acetate	Acute LC50 32 mg/l Marine water	Crustaceans - *Artemia salina*	48 hours
	Acute LC50 18000 µg/l Fresh water	Fish - *Pimephales promelas*	96 hours
Acetone	Acute EC50 7200000 µg/l Fresh water	Algae - *Selenastrum sp.*	96 hours
	Acute LC50 4.42589 ml/L Marine water	Crustaceans - *Acartia tonsa* - Copepodid	48 hours
	Acute LC50 7460000 µg/l Fresh water	Daphnia - *Daphnia cucullata*	48 hours
	Acute LC50 5600 ppm Fresh water	Fish - *Poecilia reticulata*	96 hours
	Chronic NOEC 4.95 mg/l Marine water	Algae - *Ulva pertusa*	96 hours
	Chronic NOEC 0.016 ml/L Fresh water	Crustaceans - *Daphniidae*	21 days
	Chronic NOEC 0.1 ml/L Fresh water	Daphnia - *Daphnia magna* - Neonate	21 days
	Chronic NOEC 5 µg/l Marine water	Fish - *Gasterosteus aculeatus* - Larvae	42 days
Methyl Ethyl Ketone	Acute EC50 >500000 µg/l Marine water	Algae - *Skeletonema costatum*	96 hours
	Acute EC50 5091000 µg/l Fresh water	Daphnia - *Daphnia magna* - Larvae	48 hours
	Acute LC50 3220000 µg/l Fresh water	Fish - *Pimephales promelas*	96 hours

Persistence and degradability

Product/ingredient name	Aquatic half-life	Photolysis	Biodegradability
n-Butyl Acetate	-	-	Readily
Acetone	-	-	Readily
Methyl Ethyl Ketone	-	-	Readily

Bioaccumulative potential

Not available.

Mobility in soil

Soil/water partition coefficient (K_{OC}) : Not available.

Section 12. Ecological information

Other adverse effects : No known significant effects or critical hazards.

Section 13. Disposal considerations

Disposal methods : **This product contains a component that is either subject to a CEPA ministerial condition or an existing/proposed SNAC (Significant New Activity).**

The generation of waste should be avoided or minimized wherever possible. Disposal of this product, solutions and any by-products should at all times comply with the requirements of environmental protection and waste disposal legislation and any regional local authority requirements. Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Waste should not be disposed of untreated to the sewer unless fully compliant with the requirements of all authorities with jurisdiction. Waste packaging should be recycled. Incineration or landfill should only be considered when recycling is not feasible. This material and its container must be disposed of in a safe way. Care should be taken when handling emptied containers that have not been cleaned or rinsed out. Empty containers or liners may retain some product residues. Vapor from product residues may create a highly flammable or explosive atmosphere inside the container. Do not cut, weld or grind used containers unless they have been cleaned thoroughly internally. Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers.

Section 14. Transport information

	DOT Classification	TDG Classification	Mexico Classification	IATA	IMDG
UN number	UN1263	UN1263	UN1263	UN1263	UN1263
UN proper shipping name	PAINT	PAINT	PAINT	PAINT	PAINT
Transport hazard class(es)	3 	3 	3 	3 	3 
Packing group	II	II	II	II	II
Environmental hazards	No.	No.	No.	No.	No.
Additional information	- **ERG No.** 128	Product classified as per the following sections of the Transportation of Dangerous Goods Regulations: 2.18-2.19 (Class 3). **ERG No.** 128	- **ERG No.** 128	-	**Emergency schedules** F-E, S-E

Section 14. Transport information

Special precautions for user : Multi-modal shipping descriptions are provided for informational purposes and do not consider container sizes. The presence of a shipping description for a particular mode of transport (sea, air, etc.), does not indicate that the product is packaged suitably for that mode of transport. All packaging must be reviewed for suitability prior to shipment, and compliance with the applicable regulations is the sole responsibility of the person offering the product for transport. People loading and unloading dangerous goods must be trained on all of the risks deriving from the substances and on all actions in case of emergency situations.

Transport in bulk according to IMO instruments : Not available.

Proper shipping name : Not available.

Section 15. Regulatory information

This product contains a component that is either subject to a CEPA ministerial condition or an existing/proposed SNAC (Significant New Activity).

International regulations

Montreal Protocol

Not listed.

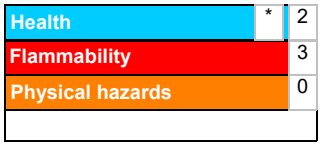
Stockholm Convention on Persistent Organic Pollutants

List name	Ingredient name	Status
Annex A - Elimination - Production	UV-328	Listed
Annex A - Elimination - Use	UV-328	Listed

International lists : **Australia inventory (AIIC)**: Not determined.
China inventory (IECSC): Not determined.
Japan inventory (CSCL): Not determined.
Japan inventory (ISHL): Not determined.
Korea inventory (KECI): Not determined.
New Zealand Inventory of Chemicals (NZIoC): Not determined.
Philippines inventory (PICCS): Not determined.
Taiwan Chemical Substances Inventory (TCSI): Not determined.
Thailand inventory: Not determined.
Turkey inventory: Not determined.
Vietnam inventory: Not determined.

Section 16. Other information

Hazardous Material Information System (U.S.A.)



The customer is responsible for determining the PPE code for this material. For more information on HMIS® Personal Protective Equipment (PPE) codes, consult the HMIS® Implementation Manual.

Section 16. Other information

Caution: HMIS® ratings are based on a 0-4 rating scale, with 0 representing minimal hazards or risks, and 4 representing significant hazards or risks. Although HMIS® ratings and the associated label are not required on SDSs or products leaving a facility under 29 CFR 1910.1200, the preparer may choose to provide them. HMIS® ratings are to be used with a fully implemented HMIS® program. HMIS® is a registered trademark and service mark of the American Coatings Association, Inc.

Procedure used to derive the classification

Classification	Justification
FLAMMABLE LIQUIDS - Category 2	On basis of test data
SKIN CORROSION/IRRITATION - Category 2	Calculation method
SERIOUS EYE DAMAGE/ EYE IRRITATION - Category 2A	Calculation method
SKIN SENSITIZATION - Category 1	Calculation method
TOXIC TO REPRODUCTION - Category 2	Calculation method
SPECIFIC TARGET ORGAN TOXICITY (SINGLE EXPOSURE) (Narcotic effects) - Category 3	Calculation method

History

Date of printing : 12/12/2024

Date of issue/Date of revision : 12/12/2024

Date of previous issue : 9/29/2024

Version : 19

Key to abbreviations : ATE = Acute Toxicity Estimate
BCF = Bioconcentration Factor
GHS = Globally Harmonized System of Classification and Labelling of Chemicals
IATA = International Air Transport Association
IBC = Intermediate Bulk Container
IMDG = International Maritime Dangerous Goods
LogPow = logarithm of the octanol/water partition coefficient
MARPOL = International Convention for the Prevention of Pollution From Ships, 1973 as modified by the Protocol of 1978. ("Marpol" = marine pollution)
N/A = Not available
SGG = Segregation Group
UN = United Nations

Indicates information that has changed from previously issued version.

Notice to reader

It is recommended that each customer or recipient of this Safety Data Sheet (SDS) study it carefully and consult resources, as necessary or appropriate, to become aware of and understand the data contained in this SDS and any hazards associated with the product. This information is provided in good faith and believed to be accurate as of the effective date herein. However, no warranty, express or implied, is given. The information presented here applies only to the product as shipped. The addition of any material can change the composition, hazards and risks of the product. Products shall not be repackaged, modified, or tinted except as specifically instructed by the manufacturer, including but not limited to the incorporation of products not specified by the manufacturer, or the use or addition of products in proportions not specified by the manufacturer. Regulatory requirements are subject to change and may differ between various locations and jurisdictions. The customer/buyer/user is responsible to ensure that his activities comply with all country, federal, state, provincial or local laws. The conditions for use of the product are not under the control of the manufacturer; the customer/buyer/user is responsible to determine the conditions necessary for the safe use of this product. The customer/buyer/user should not use the product for any purpose other than the purpose shown in the applicable section of this SDS without first referring to the supplier and obtaining written handling instructions. Due to the proliferation of sources for information such as manufacturer-specific SDS, the manufacturer cannot be responsible for SDSs obtained from any other source.

SAFETY DATA SHEET

FH613

Section 1. Identification

Product name : FINISH 1™ Hardener (Part B)
Slow

Product code : FH613

Other means of identification : Not available.

Product type : Liquid.

Relevant identified uses of the substance or mixture and uses advised against

Paint or paint related material.

Manufacturer : ACME AUTOMOTIVE FINISHES
101 W. Prospect Avenue
Cleveland, OH 44115

Emergency telephone number of the company : US / Canada: (800) 424-9300
Mexico: SETIQ 800-00-214-00 / 55-5559-1588 Available 24 hours and 365 days a year

Product Information Telephone Number : US / Canada: (216) 566-3031
Mexico: Not Available

Transportation Emergency Telephone Number : US / Canada: (800) 424-9300
Mexico: SETIQ 800-00-214-00 / 55-5559-1588 Available 24 hours and 365 days a year

Section 2. Hazards identification

OSHA/HCS status : This material is considered hazardous by the OSHA Hazard Communication Standard (29 CFR 1910.1200).

Classification of the substance or mixture : FLAMMABLE LIQUIDS - Category 3
SKIN CORROSION/IRRITATION - Category 2
SERIOUS EYE DAMAGE/ EYE IRRITATION - Category 2A
RESPIRATORY SENSITIZATION - Category 1
SKIN SENSITIZATION - Category 1
SPECIFIC TARGET ORGAN TOXICITY (SINGLE EXPOSURE) (Respiratory tract irritation) - Category 3
SPECIFIC TARGET ORGAN TOXICITY (SINGLE EXPOSURE) (Narcotic effects) - Category 3

Percentage of the mixture consisting of ingredient(s) of unknown acute toxicity: 4.4% (dermal), 4.4% (inhalation)

GHS label elements

Hazard pictograms :



Signal word : Danger

Section 2. Hazards identification

Hazard statements : Flammable liquid and vapor.
Causes skin irritation.
May cause an allergic skin reaction.
Causes serious eye irritation.
May cause allergy or asthma symptoms or breathing difficulties if inhaled.
May cause respiratory irritation.
May cause drowsiness or dizziness.

Precautionary statements

Prevention : Wear protective gloves, protective clothing and eye or face protection. Wear respiratory protection. Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking. Use explosion-proof electrical, ventilating or lighting equipment. Use non-sparking tools. Take action to prevent static discharges. Use only outdoors or in a well-ventilated area. Avoid breathing vapor. Wash thoroughly after handling. Contaminated work clothing must not be allowed out of the workplace.

Response : IF INHALED: Remove person to fresh air and keep comfortable for breathing. Call a POISON CENTER or doctor if you feel unwell. If experiencing respiratory symptoms: Call a POISON CENTER or doctor. IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water. Wash contaminated clothing before reuse. IF ON SKIN: Wash with plenty of water. If skin irritation or rash occurs: Get medical advice or attention. IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If eye irritation persists: Get medical advice or attention.

Storage : Store locked up. Store in a well-ventilated place. Keep container tightly closed. Keep cool.

Disposal : Dispose of contents and container in accordance with all local, regional, national and international regulations.

Supplemental label elements

DELAYED EFFECTS FROM LONG TERM OVEREXPOSURE. Contains solvents which can cause permanent brain and nervous system damage. Intentional misuse by deliberately concentrating and inhaling the contents can be harmful or fatal. FOR PROFESSIONAL USE ONLY. This product must be mixed with other components before use. Before opening the packages, READ AND FOLLOW WARNING LABELS ON ALL COMPONENTS. VAPOR AND SPRAY MIST HARMFUL. Gives off harmful vapor of solvents and isocyanates. DO NOT USE IF YOU HAVE CHRONIC (LONG-TERM) LUNG OR BREATHING PROBLEMS, OR IF YOU HAVE EVER HAD A REACTION TO ISOCYANATES. USE ONLY WITH ADEQUATE VENTILATION. WHERE OVERSPRAY IS PRESENT, A POSITIVE PRESSURE AIR SUPPLIED RESPIRATOR (NIOSH approved) SHOULD BE WORN TO PREVENT EXPOSURE. IF UNAVAILABLE, AN APPROPRIATE PROPERLY FITTED APPROVED NIOSH VAPOR/PARTICULATE RESPIRATOR MAY BE EFFECTIVE. Follow directions for respirator use. Wear the respirator for the whole time of spraying and until all vapors and mists are gone. If you have any breathing problems during use, LEAVE THE AREA and get fresh air. If problems remain or happen later, IMMEDIATELY call a doctor - If not available get emergency medical treatment. Have this label with you. Reacts with water in closed container to produce pressure which may cause container to burst.

Please refer to the SDS for additional information. Keep out of reach of children. Do not transfer contents to other containers for storage.

Hazards not otherwise classified : None known.

Section 3. Composition/information on ingredients

Substance/mixture : Mixture

Other means of identification : Not available.

CAS number/other identifiers

Ingredient name	% by weight	CAS number
Hexamethylene Diisocyanate Polymer	≥50 - ≤75	28182-81-2
Methyl n-Amyl Ketone	≥25 - ≤43	110-43-0
2-Butoxyethyl Acetate	≤10	112-07-2
Ethyl 3-Ethoxypropionate	≤5	763-69-9
Hexamethylene Diisocyanate (max.)	≤0.3	822-06-0

Any concentration shown as a range is to protect confidentiality or is due to batch variation.

There are no additional ingredients present which, within the current knowledge of the supplier and in the concentrations applicable, are classified and hence require reporting in this section.

Occupational exposure limits, if available, are listed in Section 8.

Section 4. First aid measures

Description of necessary first aid measures

Eye contact : Immediately flush eyes with plenty of water, occasionally lifting the upper and lower eyelids. Check for and remove any contact lenses. Continue to rinse for at least 10 minutes. Get medical attention.

Inhalation : Remove victim to fresh air and keep at rest in a position comfortable for breathing. If it is suspected that fumes are still present, the rescuer should wear an appropriate mask or self-contained breathing apparatus. If not breathing, if breathing is irregular or if respiratory arrest occurs, provide artificial respiration or oxygen by trained personnel. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation. Get medical attention. If necessary, call a poison center or physician. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway. Loosen tight clothing such as a collar, tie, belt or waistband. In case of inhalation of decomposition products in a fire, symptoms may be delayed. The exposed person may need to be kept under medical surveillance for 48 hours. In the event of any complaints or symptoms, avoid further exposure.

Skin contact : Wash with plenty of soap and water. Remove contaminated clothing and shoes. Wash contaminated clothing thoroughly with water before removing it, or wear gloves. Continue to rinse for at least 10 minutes. Get medical attention. In the event of any complaints or symptoms, avoid further exposure. Wash clothing before reuse. Clean shoes thoroughly before reuse.

Ingestion : Wash out mouth with water. Remove dentures if any. If material has been swallowed and the exposed person is conscious, give small quantities of water to drink. Stop if the exposed person feels sick as vomiting may be dangerous. Do not induce vomiting unless directed to do so by medical personnel. If vomiting occurs, the head should be kept low so that vomit does not enter the lungs. Get medical attention. If necessary, call a poison center or physician. Never give anything by mouth to an unconscious person. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway. Loosen tight clothing such as a collar, tie, belt or waistband.

Most important symptoms/effects, acute and delayed

Potential acute health effects

Eye contact : Causes serious eye irritation.

Section 4. First aid measures

Inhalation : Can cause central nervous system (CNS) depression. May cause drowsiness or dizziness. May cause respiratory irritation. May cause allergy or asthma symptoms or breathing difficulties if inhaled.

Skin contact : Causes skin irritation. May cause an allergic skin reaction.

Ingestion : Can cause central nervous system (CNS) depression.

Over-exposure signs/symptoms

Eye contact : Adverse symptoms may include the following:
pain or irritation
watering
redness

Inhalation : Adverse symptoms may include the following:
respiratory tract irritation
coughing
wheezing and breathing difficulties
asthma
nausea or vomiting
headache
drowsiness/fatigue
dizziness/vertigo
unconsciousness

Skin contact : Adverse symptoms may include the following:
irritation
redness

Ingestion : No specific data.

Indication of immediate medical attention and special treatment needed, if necessary

Notes to physician : In case of inhalation of decomposition products in a fire, symptoms may be delayed. The exposed person may need to be kept under medical surveillance for 48 hours.

Specific treatments : No specific treatment.

Protection of first-aiders : No action shall be taken involving any personal risk or without suitable training. If it is suspected that fumes are still present, the rescuer should wear an appropriate mask or self-contained breathing apparatus. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation. Wash contaminated clothing thoroughly with water before removing it, or wear gloves.

See toxicological information (Section 11)

Section 5. Fire-fighting measures

Extinguishing media

Suitable extinguishing media : Use dry chemical, CO_2, water spray (fog) or foam.

Unsuitable extinguishing media : Do not use water jet.

Specific hazards arising from the chemical : Flammable liquid and vapor. Runoff to sewer may create fire or explosion hazard. In a fire or if heated, a pressure increase will occur and the container may burst, with the risk of a subsequent explosion. The vapor/gas is heavier than air and will spread along the ground. Vapors may accumulate in low or confined areas or travel a considerable distance to a source of ignition and flash back.

Hazardous thermal decomposition products : Decomposition products may include the following materials:
carbon dioxide
carbon monoxide
nitrogen oxides

Section 5. Fire-fighting measures

Special protective actions for fire-fighters : Promptly isolate the scene by removing all persons from the vicinity of the incident if there is a fire. No action shall be taken involving any personal risk or without suitable training. Move containers from fire area if this can be done without risk. Use water spray to keep fire-exposed containers cool.

Special protective equipment for fire-fighters : Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.

Remark : Flammable liquid.

Section 6. Accidental release measures

Personal precautions, protective equipment and emergency procedures

For non-emergency personnel : No action shall be taken involving any personal risk or without suitable training. Evacuate surrounding areas. Keep unnecessary and unprotected personnel from entering. Do not touch or walk through spilled material. Shut off all ignition sources. No flares, smoking or flames in hazard area. Avoid breathing vapor or mist. Provide adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Put on appropriate personal protective equipment.

For emergency responders : If specialized clothing is required to deal with the spillage, take note of any information in Section 8 on suitable and unsuitable materials. See also the information in "For non-emergency personnel".

Environmental precautions : Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers. Inform the relevant authorities if the product has caused environmental pollution (sewers, waterways, soil or air).

Methods and materials for containment and cleaning up

Small spill : Stop leak if without risk. Move containers from spill area. Use spark-proof tools and explosion-proof equipment. Dilute with water and mop up if water-soluble. Alternatively, or if water-insoluble, absorb with an inert dry material and place in an appropriate waste disposal container. Dispose of via a licensed waste disposal contractor.

Large spill : Stop leak if without risk. Move containers from spill area. Use spark-proof tools and explosion-proof equipment. Approach release from upwind. Prevent entry into sewers, water courses, basements or confined areas. Wash spillages into an effluent treatment plant or proceed as follows. Contain and collect spillage with non-combustible, absorbent material e.g. sand, earth, vermiculite or diatomaceous earth and place in container for disposal according to local regulations (see Section 13). Dispose of via a licensed waste disposal contractor. Contaminated absorbent material may pose the same hazard as the spilled product. Note: see Section 1 for emergency contact information and Section 13 for waste disposal.

Section 7. Handling and storage

Precautions for safe handling

Protective measures : Put on appropriate personal protective equipment (see Section 8). Persons with a history of skin sensitization problems or asthma, allergies or chronic or recurrent respiratory disease should not be employed in any process in which this product is used. Do not get in eyes or on skin or clothing. Do not ingest. Avoid breathing vapor or mist. Use only with adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Do not enter storage areas and confined spaces unless adequately ventilated. Keep in the original container or an approved alternative made from a compatible material, kept tightly closed when not in use. Store and use away from heat, sparks, open flame or any other ignition source. Use explosion-proof electrical (ventilating, lighting and material handling) equipment. Use only non-sparking tools. Take precautionary measures against electrostatic discharges. Empty containers retain product residue and can be hazardous. Do not reuse container.

Section 7. Handling and storage

Advice on general occupational hygiene : Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking. Remove contaminated clothing and protective equipment before entering eating areas. See also Section 8 for additional information on hygiene measures.

Conditions for safe storage, including any incompatibilities : Store in accordance with local regulations. Store in a segregated and approved area. Store in original container protected from direct sunlight in a dry, cool and well-ventilated area, away from incompatible materials (see Section 10) and food and drink. Store locked up. Eliminate all ignition sources. Separate from oxidizing materials. Keep container tightly closed and sealed until ready for use. Containers that have been opened must be carefully resealed and kept upright to prevent leakage. Do not store in unlabeled containers. Use appropriate containment to avoid environmental contamination. See Section 10 for incompatible materials before handling or use.

Section 8. Exposure controls/personal protection

Control parameters

Occupational exposure limits (OSHA United States)

Ingredient name	CAS #	Exposure limits
Hexamethylene Diisocyanate Polymer	28182-81-2	None.
Methyl n-Amyl Ketone	110-43-0	**ACGIH TLV (United States, 1/2024).** TWA: 50 ppm 8 hours. TWA: 233 mg/m³ 8 hours. **NIOSH REL (United States, 10/2020).** TWA: 100 ppm 10 hours. TWA: 465 mg/m³ 10 hours. **OSHA PEL (United States, 5/2018).** TWA: 100 ppm 8 hours. TWA: 465 mg/m³ 8 hours.
2-Butoxyethyl Acetate	112-07-2	**NIOSH REL (United States, 10/2020).** TWA: 5 ppm 10 hours. TWA: 33 mg/m³ 10 hours. **ACGIH TLV (United States, 1/2024).** TWA: 20 ppm 8 hours.
Ethyl 3-Ethoxypropionate	763-69-9	None.
Hexamethylene Diisocyanate (max.)	822-06-0	**ACGIH TLV (United States, 1/2024).** TWA: 0.005 ppm 8 hours. TWA: 0.03 mg/m³ 8 hours. **NIOSH REL (United States, 10/2020).** TWA: 0.005 ppm 10 hours. TWA: 0.035 mg/m³ 10 hours. CEIL: 0.02 ppm 10 minutes. CEIL: 0.14 mg/m³ 10 minutes.

Occupational exposure limits (Canada)

Ingredient name	CAS #	Exposure limits
Hexamethylene Diisocyanate Polymer	28182-81-2	**CA Quebec Provincial (Canada, 2/2024). [Isocyanate oligomers] Skin sensitizer. Inhalation sensitizer.**
Methyl n-amyl ketone	110-43-0	**CA Alberta Provincial (Canada, 3/2023).** OEL: 233 mg/m³ 8 hours. OEL: 50 ppm 8 hours. **CA British Columbia Provincial (Canada, 8/2023).** TWA: 50 ppm 8 hours.

Section 8. Exposure controls/personal protection

		CA Ontario Provincial (Canada, 6/2019). TWA: 25 ppm 8 hours. TWA: 115 mg/m³ 8 hours. **CA Quebec Provincial (Canada, 2/2024).** TWAEV: 50 ppm 8 hours. TWAEV: 233 mg/m³ 8 hours. **CA Saskatchewan Provincial (Canada, 4/2021).** STEL: 60 ppm 15 minutes. TWA: 50 ppm 8 hours.
Ethylene glycol butyl ether acetate	112-07-2	**CA British Columbia Provincial (Canada, 8/2023).** TWA: 20 ppm 8 hours. **CA Ontario Provincial (Canada, 6/2019).** TWA: 20 ppm 8 hours. **CA Alberta Provincial (Canada, 3/2023).** OEL: 131 mg/m³ 8 hours. OEL: 20 ppm 8 hours. **CA Saskatchewan Provincial (Canada, 4/2021).** STEL: 30 ppm 15 minutes. TWA: 20 ppm 8 hours. **CA Quebec Provincial (Canada, 2/2024).** TWAEV: 10 ppm 8 hours.
Hexamethylene diisocyanate	822-06-0	**CA Alberta Provincial (Canada, 3/2023).** OEL: 0.005 ppm 8 hours. OEL: 0.03 mg/m³ 8 hours. **CA British Columbia Provincial (Canada, 8/2023). Inhalation sensitizer.** TWA: 0.005 ppm 8 hours. C: 0.01 ppm **CA Quebec Provincial (Canada, 2/2024). Skin sensitizer. Inhalation sensitizer.** TWAEV: 0.005 ppm 8 hours. TWAEV: 0.034 mg/m³ 8 hours. **CA Saskatchewan Provincial (Canada, 4/2021).** STEL: 0.015 ppm 15 minutes. TWA: 0.005 ppm 8 hours. **CA Ontario Provincial (Canada, 6/2019). [Isocyanates, organic compounds]** Ceiling Limit: 0.02 ppm TWA: 0.005 ppm 8 hours.

Occupational exposure limits (Mexico)

	CAS #	Exposure limits
Methyl n-Amyl Ketone	110-43-0	**NOM-010-STPS-2014 (Mexico, 4/2016).** TWA: 50 ppm 8 hours.
2-Butoxyethyl Acetate	112-07-2	**NOM-010-STPS-2014 (Mexico, 4/2016).** TWA: 20 ppm 8 hours.

Biological exposure indices (United States)

Section 8. Exposure controls/personal protection

Ingredient name	Exposure indices
Hexamethylene Diisocyanate (max.)	**ACGIH BEI (United States, 1/2024)** BEI: 15 µg/g creatinine, 1,6-hexamethylene diamine [in urine]. Sampling time: end of shift.

Biological exposure indices (Canada)

No exposure indices known.

Biological exposure indices (Mexico)

No exposure indices known.

Appropriate engineering controls : Use only with adequate ventilation. Use process enclosures, local exhaust ventilation or other engineering controls to keep worker exposure to airborne contaminants below any recommended or statutory limits. The engineering controls also need to keep gas, vapor or dust concentrations below any lower explosive limits. Use explosion-proof ventilation equipment.

Environmental exposure controls : Emissions from ventilation or work process equipment should be checked to ensure they comply with the requirements of environmental protection legislation. In some cases, fume scrubbers, filters or engineering modifications to the process equipment will be necessary to reduce emissions to acceptable levels.

Individual protection measures

Hygiene measures : Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Appropriate techniques should be used to remove potentially contaminated clothing. Contaminated work clothing should not be allowed out of the workplace. Wash contaminated clothing before reusing. Ensure that eyewash stations and safety showers are close to the workstation location.

Eye/face protection : Safety eyewear complying with an approved standard should be used when a risk assessment indicates this is necessary to avoid exposure to liquid splashes, mists, gases or dusts. If contact is possible, the following protection should be worn, unless the assessment indicates a higher degree of protection: chemical splash goggles.

Skin protection

Hand protection : Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary. Considering the parameters specified by the glove manufacturer, check during use that the gloves are still retaining their protective properties. It should be noted that the time to breakthrough for any glove material may be different for different glove manufacturers. In the case of mixtures, consisting of several substances, the protection time of the gloves cannot be accurately estimated.

Body protection : Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product. When there is a risk of ignition from static electricity, wear anti-static protective clothing. For the greatest protection from static discharges, clothing should include anti-static overalls, boots and gloves.

Other skin protection : Appropriate footwear and any additional skin protection measures should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Respiratory protection : Based on the hazard and potential for exposure, select a respirator that meets the appropriate standard or certification. Respirators must be used according to a respiratory protection program to ensure proper fitting, training, and other important aspects of use.

Section 9. Physical and chemical properties

The conditions of measurement of all properties are at standard temperature and pressure unless otherwise indicated.

Appearance

Physical state : Liquid.

Color : Clear.

Odor : Not available.

Odor threshold : Not available.

pH : Not applicable.

Melting point/freezing point : Not available.

Boiling point, initial boiling point, and boiling range : 147°C (296.6°F)

Flash point : Closed cup: 57°C (134.6°F) [Pensky-Martens Closed Cup]

Evaporation rate : 0.33 (butyl acetate = 1)

Flammability : Flammable liquid.

Lower and upper explosion limit/flammability limit : Lower: 0.5%
Upper: 12.1%

Vapor pressure : 0.51 kPa (3.855 mm Hg)

Relative vapor density : 3.94 [Air = 1]

Relative density : 0.99

Solubility(ies) :

Media	Result
cold water	Not soluble

Partition coefficient: n-octanol/water : Not applicable.

Auto-ignition temperature : Not available.

Decomposition temperature : Not available.

Viscosity : Kinematic (40°C (104°F)): >20.5 mm^2/s (>20.5 cSt)

Molecular weight : Not applicable.

Heat of combustion : 14.99 kJ/g

Section 10. Stability and reactivity

Reactivity : No specific test data related to reactivity available for this product or its ingredients.

Chemical stability : The product is stable.

Possibility of hazardous reactions : Under normal conditions of storage and use, hazardous reactions will not occur.

Conditions to avoid : Avoid all possible sources of ignition (spark or flame). Do not pressurize, cut, weld, braze, solder, drill, grind or expose containers to heat or sources of ignition. Do not allow vapor to accumulate in low or confined areas.

Incompatible materials : Reactive or incompatible with the following materials:
oxidizing materials

Section 10. Stability and reactivity

Hazardous decomposition products : Under normal conditions of storage and use, hazardous decomposition products should not be produced.

Section 11. Toxicological information

Information on toxicological effects

Acute toxicity

Product/ingredient name	Result	Species	Dose	Exposure
Hexamethylene Diisocyanate Polymer	LC50 Inhalation Dusts and mists	Rat	18500 mg/m³	1 hours
Methyl n-Amyl Ketone	LD50 Oral	Rat	1600 mg/kg	-
2-Butoxyethyl Acetate	LD50 Dermal	Rabbit	1500 mg/kg	-
	LD50 Oral	Rat	2400 mg/kg	-
Ethyl 3-Ethoxypropionate	LD50 Oral	Rat	3200 mg/kg	-
Hexamethylene Diisocyanate (max.)	LC50 Inhalation Dusts and mists	Rat	124 mg/m³	4 hours

Irritation/Corrosion

Product/ingredient name	Result	Species	Score	Exposure	Observation
Hexamethylene Diisocyanate Polymer	Eyes - Moderate irritant	Rabbit	-	100 mg	-
	Skin - Moderate irritant	Rabbit	-	500 mg	-
Methyl n-Amyl Ketone	Skin - Mild irritant	Rabbit	-	24 hours 14 mg	-
2-Butoxyethyl Acetate	Eyes - Mild irritant	Rabbit	-	24 hours 500 mg	-
	Skin - Mild irritant	Rabbit	-	500 mg	-
Ethyl 3-Ethoxypropionate	Skin - Mild irritant	Rabbit	-	24 hours 500 mg	-

Sensitization

Not available.

Mutagenicity

Not available.

Carcinogenicity

Not available.

Reproductive toxicity

Not available.

Teratogenicity

Not available.

Specific target organ toxicity (single exposure)

Name	Category	Route of exposure	Target organs
Hexamethylene Diisocyanate Polymer	Category 3	-	Respiratory tract irritation
Methyl n-Amyl Ketone	Category 3	-	Narcotic effects
Hexamethylene Diisocyanate (max.)	Category 3	-	Respiratory tract irritation

Specific target organ toxicity (repeated exposure)

Not available.

Section 11. Toxicological information

Aspiration hazard

Not available.

Information on the likely routes of exposure : Not available.

Potential acute health effects

Eye contact : Causes serious eye irritation.

Inhalation : Can cause central nervous system (CNS) depression. May cause drowsiness or dizziness. May cause respiratory irritation. May cause allergy or asthma symptoms or breathing difficulties if inhaled.

Skin contact : Causes skin irritation. May cause an allergic skin reaction.

Ingestion : Can cause central nervous system (CNS) depression.

Symptoms related to the physical, chemical and toxicological characteristics

Eye contact : Adverse symptoms may include the following:
pain or irritation
watering
redness

Inhalation : Adverse symptoms may include the following:
respiratory tract irritation
coughing
wheezing and breathing difficulties
asthma
nausea or vomiting
headache
drowsiness/fatigue
dizziness/vertigo
unconsciousness

Skin contact : Adverse symptoms may include the following:
irritation
redness

Ingestion : No specific data.

Delayed and immediate effects and also chronic effects from short and long term exposure

Short term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Long term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Potential chronic health effects

Not available.

General : Once sensitized, a severe allergic reaction may occur when subsequently exposed to very low levels.

Carcinogenicity : No known significant effects or critical hazards.

Mutagenicity : No known significant effects or critical hazards.

Teratogenicity : No known significant effects or critical hazards.

Developmental effects : No known significant effects or critical hazards.

Section 11. Toxicological information

Fertility effects : No known significant effects or critical hazards.

Numerical measures of toxicity

Acute toxicity estimates

Route	ATE value
Oral	3962.76 mg/kg
Dermal	16853.63 mg/kg
Inhalation (vapors)	26.75 mg/l
Inhalation (dusts and mists)	8.51 mg/l

Section 12. Ecological information

Toxicity

Product/ingredient name	Result	Species	Exposure
Methyl n-Amyl Ketone	Acute LC50 131000 µg/l Fresh water	Fish - *Pimephales promelas*	96 hours

Persistence and degradability

Product/ingredient name	Aquatic half-life	Photolysis	Biodegradability
Methyl n-Amyl Ketone	-	-	Readily
2-Butoxyethyl Acetate	-	-	Readily

Bioaccumulative potential

Product/ingredient name	$LogP_{ow}$	BCF	Potential
Hexamethylene Diisocyanate Polymer	-	367.7	Low
Hexamethylene Diisocyanate (max.)	-	57.63	Low

Mobility in soil

Soil/water partition coefficient (K_{OC}) : Not available.

Other adverse effects : No known significant effects or critical hazards.

Section 13. Disposal considerations

Disposal methods : The generation of waste should be avoided or minimized wherever possible. Disposal of this product, solutions and any by-products should at all times comply with the requirements of environmental protection and waste disposal legislation and any regional local authority requirements. Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Waste should not be disposed of untreated to the sewer unless fully compliant with the requirements of all authorities with jurisdiction. Waste packaging should be recycled. Incineration or landfill should only be considered when recycling is not feasible. This material and its container must be disposed of in a safe way. Care should be taken when handling emptied containers that have not been cleaned or rinsed out. Empty containers or liners may retain some product residues. Vapor from product residues may create a highly flammable or explosive atmosphere inside the container. Do not cut, weld or grind used containers unless they have been cleaned thoroughly internally. Avoid dispersal of spilled material and runoff and contact

Section 13. Disposal considerations

with soil, waterways, drains and sewers.

Section 14. Transport information

	DOT Classification	TDG Classification	Mexico Classification	IATA	IMDG
UN number	UN1263	UN1263	UN1263	UN1263	UN1263
UN proper shipping name	PAINT RELATED MATERIAL	PAINT RELATED MATERIAL	PAINT RELATED MATERIAL	PAINT RELATED MATERIAL	PAINT RELATED MATERIAL
Transport hazard class(es)	3 	3 	3 	3 	3 
Packing group	III	III	III	III	III
Environmental hazards	No.	No.	No.	No.	No.
Additional information	This product may be re-classified as "Combustible Liquid," unless transported by vessel or aircraft. Non-bulk packages (less than or equal to 119 gal) of combustible liquids are not regulated as hazardous materials. **ERG No.** 128	Product classified as per the following sections of the Transportation of Dangerous Goods Regulations: 2.18-2.19 (Class 3). **ERG No.** 128	- **ERG No.** 128	-	**Emergency schedules** F-E, S-E

Special precautions for user : Multi-modal shipping descriptions are provided for informational purposes and do not consider container sizes. The presence of a shipping description for a particular mode of transport (sea, air, etc.), does not indicate that the product is packaged suitably for that mode of transport. All packaging must be reviewed for suitability prior to shipment, and compliance with the applicable regulations is the sole responsibility of the person offering the product for transport. People loading and unloading dangerous goods must be trained on all of the risks deriving from the substances and on all actions in case of emergency situations.

Transport in bulk according to IMO instruments : Not available.

Proper shipping name : Not available.

Section 15. Regulatory information

SARA 313

All data given below are MAXIMUM THEORETICAL VALUES based on the product AS CURRENTLY FORMULATED and rely on information provided to us by our raw material suppliers. Our suppliers often provide an estimated value or range less than a certain upper limit. We calculate MAXIMUM THEORETICAL VALUES using defined values, if provided, or the upper limit reported by our supplier. Additionally, the suppliers' information may include amounts present in the product as unintentional byproducts or impurities. Variations may occur in individual batches due to adjustments made during production.

Ingredient name	% by weight	CAS number
Glycol Ethers (SARA) 2-Butoxyethyl Acetate	9 9	 112-07-2

California Prop. 65

Not applicable.

International regulations

Montreal Protocol

Not listed.

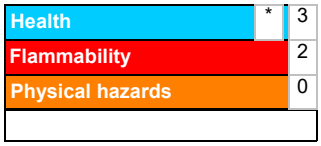
Stockholm Convention on Persistent Organic Pollutants

Not listed.

International lists : **Australia inventory (AIIC)**: Not determined.
China inventory (IECSC): Not determined.
Japan inventory (CSCL): Not determined.
Japan inventory (ISHL): Not determined.
Korea inventory (KECI): Not determined.
New Zealand Inventory of Chemicals (NZIoC): Not determined.
Philippines inventory (PICCS): Not determined.
Taiwan Chemical Substances Inventory (TCSI): Not determined.
Thailand inventory: Not determined.
Turkey inventory: Not determined.
Vietnam inventory: Not determined.

Section 16. Other information

Hazardous Material Information System (U.S.A.)



The customer is responsible for determining the PPE code for this material. For more information on HMIS® Personal Protective Equipment (PPE) codes, consult the HMIS® Implementation Manual.

Caution: HMIS® ratings are based on a 0-4 rating scale, with 0 representing minimal hazards or risks, and 4 representing significant hazards or risks. Although HMIS® ratings and the associated label are not required on SDSs or products leaving a facility under 29 CFR 1910.1200, the preparer may choose to provide them. HMIS® ratings are to be used with a fully implemented HMIS® program. HMIS® is a registered trademark and service mark of the American Coatings Association, Inc.

Procedure used to derive the classification

Section 16. Other information

Classification	Justification
FLAMMABLE LIQUIDS - Category 3	On basis of test data
SKIN CORROSION/IRRITATION - Category 2	Calculation method
SERIOUS EYE DAMAGE/ EYE IRRITATION - Category 2A	Calculation method
RESPIRATORY SENSITIZATION - Category 1	Calculation method
SKIN SENSITIZATION - Category 1	Calculation method
SPECIFIC TARGET ORGAN TOXICITY (SINGLE EXPOSURE) (Respiratory tract irritation) - Category 3	Calculation method
SPECIFIC TARGET ORGAN TOXICITY (SINGLE EXPOSURE) (Narcotic effects) - Category 3	Calculation method

History

Date of printing : 12/12/2024

Date of issue/Date of revision : 12/12/2024

Date of previous issue : 9/28/2024

Version : 14.01

Key to abbreviations : ATE = Acute Toxicity Estimate
BCF = Bioconcentration Factor
GHS = Globally Harmonized System of Classification and Labelling of Chemicals
IATA = International Air Transport Association
IBC = Intermediate Bulk Container
IMDG = International Maritime Dangerous Goods
LogPow = logarithm of the octanol/water partition coefficient
MARPOL = International Convention for the Prevention of Pollution From Ships, 1973 as modified by the Protocol of 1978. ("Marpol" = marine pollution)
N/A = Not available
SGG = Segregation Group
UN = United Nations

Indicates information that has changed from previously issued version.

Notice to reader

It is recommended that each customer or recipient of this Safety Data Sheet (SDS) study it carefully and consult resources, as necessary or appropriate, to become aware of and understand the data contained in this SDS and any hazards associated with the product. This information is provided in good faith and believed to be accurate as of the effective date herein. However, no warranty, express or implied, is given. The information presented here applies only to the product as shipped. The addition of any material can change the composition, hazards and risks of the product. Products shall not be repackaged, modified, or tinted except as specifically instructed by the manufacturer, including but not limited to the incorporation of products not specified by the manufacturer, or the use or addition of products in proportions not specified by the manufacturer. Regulatory requirements are subject to change and may differ between various locations and jurisdictions. The customer/buyer/user is responsible to ensure that his activities comply with all country, federal, state, provincial or local laws. The conditions for use of the product are not under the control of the manufacturer; the customer/buyer/user is responsible to determine the conditions necessary for the safe use of this product. The customer/buyer/user should not use the product for any purpose other than the purpose shown in the applicable section of this SDS without first referring to the supplier and obtaining written handling instructions. Due to the proliferation of sources for information such as manufacturer-specific SDS, the manufacturer cannot be responsible for SDSs obtained from any other source.

Safety Data Sheet (SDS)

Date Prepared/Revised: 2/3/25 Version no.: 05 Supersedes: 9/5/23

1.) Identification of the Mixture and of the Company

Product identifier**: Crown Dry Graphite Lubricant - Aerosol**

Product name: **8078 Dry Graphite Lubricant**

Relevant identified uses of the substance: Use on bearings, locks, oven parts, pre-assembled moving parts, sliding windows and doors. Use as a parting compound on dies, sand cores, match plates, drawing extrusions, die casting, and pewter moldings. Also use as a coating on conductive material, or sealant. Uses advised against: Poorly ventilated areas.

CAS No:	**Not Applicable (mixture)**
EC No:	**Not Applicable (mixture)**
Index No:	**Not Applicable (mixture)**
Manufacturer/Supplier:	**Aervoe LLC**
Street address/P.O. Box:	**1100 Mark Circle**
Country ID/Postcode/Place	**Gardnerville, Nevada 89410**
Telephone number:	**1-775-782-0100**
e-mail:	**mailbox@aervoe.com**
National contact:	**Aervoe LLC**
For Product Information:	**1-800-227-0196**
Emergency telephone number:	**1-800-424-9300 (CHEMTREC – 24 hrs)**

2. Hazards identification

Classifications

Physical Hazards:	Aerosol - Category 1 Flam. Gas 1 Flam. Liq. 2 Press. Gas
Health Hazards:	Eye Irrit. 2 STOT SE3
Environmental Hazards:	N/AV

Labeling

Signal Word:	Danger
Hazard Statements:	H220 – Extremely flammable gas. H222 – Extremely Flammable Aerosol H225 – Highly flammable liquid and vapour. H229 - Pressurized container: may burst if heated H319 – Causes serious eye irritation. H336 – May cause drowsiness or dizziness.

Precautionary Statements:

P101 - If medical advice is needed, have product container or label at hand
P102 - Keep out of reach of children
P103 - Read label before use
P210 - Keep away from heat/sparks/open flames/hot surfaces - no smoking
P211 - Do not spray on an open flame or other ignition source
P251 - Pressurized container: Do not pierce or burn, even after use
P261 - Avoid breathing dust/fume/gas/mist/vapours/spray
P262 - Do not get in eyes, on skin, or on clothing
P264 - Wash … thoroughly after handling
P280 - Wear protective gloves/eye protection/face protection

P303+P361+P353 - If on skin or hair, remove/takeoff immediately all contaminated clothing. Rinse skin with water/shower.
P410+P412 - Protect from sunlight. Do not expose to temperatures exceeding 50ºC/122ºF
P501 - Dispose of contents/container in accordance with local/regional/national/international regulation

Symbols/Pictograms:



3. Composition / Information on Ingredients

Composition

Chemical	Synonyms	CAS Number	EINECS Number	Weight Percent	Hazard Category	H-Code
Acetone	Propanone	67-64-1	200-662-2	15-40%	Flam. Liq. 2 Eye Irrit. 2 STOT SE 3	H225, H319, H336
Hydrocarbon Propellant	LPG	68476-86-8	270-705-8	15-40%	Press. Gas Flam. Gas 1	H220 H229
Dimethyl Carbonate	D.M.C.	616-38-6	210-478-4	15-40%	Flam. Liq. 2	H225
Graphite Powder	Graphite	7782-42-5	231-955-3	1-5%	N/AV	N/AV

Other Product Information

Chemical Identity: Mixture

4.) First Aid Measures

General Advice:	If symptoms persist, always call a doctor.
Inhalation First Aid:	Remove victim to fresh air and provide oxygen if breathing is difficult. If not breathing, give artificial respiration, preferably mouth to mouth. Get medical attention immediately.
Skin Contact First Aid:	Wash with soap and water. Remove contaminated clothing and shoes. Get medical attention immediately. Wash clothing before reuse.
Eye Contact First Aid:	If contact with eyes, immediately flush eyes with plenty of water for at least 15 minutes, while holding eyelids open. Get medical attention immediately.
Ingestion First Aid:	If swallowed, wash out mouth with water provided the person is conscious. Do not induce vomiting. Never give anything by mouth to an unconscious person. Get medical attention immediately.
Most Important Symptoms/Effects:	Exposure may cause slight irritation to the skin, eyes, and respiratory tract. Excessive exposure may cause central nervous system effects.

5. Fire Fighting Measures

Flammable Properties:	Aerosol
Auto Ignition Temperature:	Not Available
Suitable extinguishing media:	Carbon dioxide, dry chemical, water spray.
Unsuitable extinguishing media:	None known
Special hazards arising from the substance or mixture:	None known
Hazardous combustion products:	Carbon dioxide, Carbon monoxide
Fire & Explosion Hazards:	Closed Containers may rupture due to the buildup of pressure from extreme temperatures.
Precautions for fire-fighters:	Use water spray to cool containers exposed to heat or fire to prevent pressure build up. In the event of a fire, wear full protective clothing and NIOSH- approved self-contained breathing apparatus with full face piece operated in the pressure demand or other positive pressure mode.

6. Accidental Release Measures

PERSONAL PRECAUTIONARY MEASURES:

1) Follow personal protective equipment recommendations found in section 8.
2) Maintain adequate ventilation.

SPILL CLEAN-UP PROCEDURES:

1.) Evacuate unprotected personnel from the area.
2.) Remove sources of ignition if safe to do so.
3.) Pickup spilled materials using non-sparking tools and place in an appropriate container for disposal.
4.) Contain spill to prevent material from entering sewage or ground water systems.
5.) Always dispose of waste materials in accordance with all EU, National and Local Regulations.

7. Handling and Storage

Handling:

Flammable Aerosol, use in a well ventilated area.
Do not use near sources of ignition.
Do not to eat, drink and smoke while working with this material.
Wash hands after use.

Conditions for safe storage, including any incompatibilities:

Store out of direct sunlight.
Storage Temperature: 32° to 120°F (0° to 49°C).
No known incompatibilities.

8. Exposure Controls / Personal Protection

Appropriate engineering controls:
Ensure adequate ventilation. A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits.
Keep away from sources of ignition.
Take precautionary measures against static discharge.

Personal Protection:
Eye & face protection devices such as safety glasses, safety goggles or face shield are recommended.

Skin protection
Wear the appropriate protective clothing, including boots, gloves, lab coat, apron or coveralls, as appropriate, to prevent skin contact.

Respiratory protection:
Use only in an adequately ventilated area. For unknown vapor concentrations use a positive-pressure, pressure-demand, self-contained breathing apparatus (SCBA).

Hazardous Ingredient	CAS Number	ACGIH TLV (TWA)	ACGIH TLV (STEL)	OSHA PEL (TWA)	OSHA PEL (STEL)
Acetone	67-64-1	250PPM	500PPM	1000PPM	N/A
Hydrocarbon Propellant	68476-86-8	N/A	N/A	N/A	N/A
Dimethyl Carbonate	616-38-6	N/A	N/A	N/A	N/A
Graphite Powder	7782-42-5	2mg/m3 (R)	N/A	15mg/m3 (TOTAL DUST) 5mg/m3 (RESPIRABLE FRACTION)	N/A

***Values are based on the 2019 Guide to Occupational Exposure Values by ACGIH**

9. Information on Basic Physical and Chemical Properties

Appearance: Black liquid	Odor: Ethereal
Odor Threshold: N/AV	pH: Not Applicable (solvent Base)
Melting Point: N/AV	Freezing Point: N/AV
Initial Boiling Point: N/AV	Boiling Point Range: N/AV
Flash Point: <0° F (-18° C)	Evaporation Rate: Faster than n-Butyl Acetate
Flammability Solid/Gas: Flammable gas	LEL: 1.2% UEL: 12.8%
Vapor Pressure: N/AV	Vapor Density: Heavier Than Air
Relative Density: N/AV	Solubility: Negligible
Partition Coefficient: n-octanol/ water: N/AV	Auto-ignition Temperature: N/AV
Decomposition Temperature: N/AV	Viscosity: N/AV
Explosive Properties: N/AV	Oxidizing Properties: N/AV

10. Stability & Reactivity

Possibility of hazardous reactions: Hazardous polymerization will not occur under normal conditions
Chemical stability: Stable under normal conditions
Conditions to avoid: Heat and ignition sources
Incompatible materials: Strong Oxidizing Agents
Hazardous decomposition products: Will not occur

11. Toxicological Information

Reports have associated repeated and prolonged overexposure to solvents with permanent brain and nervous system damage. Repeated overexposure can also damage kidneys, lungs, liver, heart and blood

Routes of exposure: Eyes, skin, ingestion, and/or inhalation

Acute toxicological data:	(Acetone) LD50: 5800 mg/kg (Rat-Oral) (Acetone) LC50: 21000 ppm/8 hr (Rat-Inha)
Eye irritation data:	N/AV
Skin irritation/sensitization/absorption data:	N/AV
Reproductive toxicity data:	N/AV
Mutagenicity data:	N/AV
Symptoms associated with physical contact:	N/AV
Acute/chronic effects from short/long term exposure:	Irritating to skin. Prolonged/repeated contact may

cause defatting of the skin which can lead to dermatitis. Not expected to be a skin sensitizer.

Known reportable carcinogens via the following agencies:

NTP:	N/AV
IARC:	N/AV
OSHA:	TLV-A4

12. Ecological Information

Ecotoxicity: **No Data Available**
Persistence and degradability: **No Data Available**
Bioaccumulative potential: **No Data Available**
Mobility in soil: **No Data Available**
Results of PBT and vPvB assessment: **No Data Available**
Other adverse effects: **No Data Available**

13. Disposal Considerations

Waste Disposal: Dispose of material in accordance with EU, national and local requirements. For proper disposal of used material, an assessment must be completed to determine the proper and permissible waste management options permitted under applicable rules, regulations and/or laws governing your location.
Product / Packaging disposal: Dispose of packaging in accordance with federal, state and local requirements, regulations and/or laws governing your location.

14. Transportation Information

US DOT

UN Number	Proper Shipping Name	Hazard Class	Packing Group	Marine Pollutant	Special Provisions
UN1950	Aerosols	2.1	Not Applicable	Not Applicable	Reference 49 CFR 172.101

IMDG

UN Number	Proper Shipping Name	Hazard Class	Packing Group	Marine Pollutant	Special Provisions
UN1950	Aerosols	2.1	Not Applicable	Not Applicable	Reference IMDG code part 3

IATA:

UN Number	Proper Shipping Name	Hazard Class	Packing Group	Marine Pollutant	Special Provisions
UN1950	Aerosols, Flammable	2.1	Not	Not	Reference

			Applicable	Applicable	IATA Dangerous Goods Regulation

15. Regulatory Information

Workplace classification:
This product is considered hazardous under the OSHA Hazard Communication Standard (29 CFR 1910.1200). The Occupational Safety and Health Administration's interpretation of the product's hazard to workers.
SARA Title 3:
Section 311/312 Categorizations (40 CFR 372): This product is a hazardous chemical under 29 CFR 1910.1200, and is categorized as an immediate and delayed health, and flammability physical hazard. Superfund Amendment and Reauthorization Act (SARA) category. SARA requires reporting any spill of any hazardous substance.
TSCA status: All chemicals in this product are listed, or are exempt from listing, on the TSCA Inventory.
WHMIS: This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations (CPR) and the (M)SDS contains all of the information required by the CPR.
PROP 65 (CA): WARNING: Cancer and Reproductive Harm – www.P65Warnings.ca.gov.

16. Other Information

This SDS has been completed in accordance with GHS Rev04 (2011): U.S OSHA, CMA, ANSI, Canadian WHMIS standards, and European Directives.

Date of Preparation/Revision: 2/3/25
Supersedes: (9/5/23)

To the best of our knowledge, the information contained herein is believed to be accurate. However, the above data does not imply any guarantee or warranty of any kind, expressed or implied. The final determination of the suitability of any material is the sole responsibility of the user. All materials made present un-known hazards and should be used with caution. Although certain hazards are described herein, we cannot guarantee these are the only hazards existing.

Safety Data Sheet

91% Isopropyl Rubbing Alcohol

Section 1. Identification

Product Identifier	91% Isopropyl Rubbing Alcohol
Synonyms	MDS098012; MSD_SDS0343
Manufacturer Stock Numbers	MDS098012
Recommended use	First Aid
Uses advised against	Use only as directed.
Manufacturer Contact Address	Medline 3 Lakes Drive Northfield, IL, 60093 USA

Phone	Emergency Phone	Fax
(800) 633-5463	(800) 424-9300 CHEMTREC	(847) 643-4436

Website
www.Medline.com

Section 2. Hazards Identification

Classification	FLAMMABLE LIQUIDS - Category 2 SERIOUS EYE DAMAGE /EYE IRRITATION - Category 2B SPECIFIC TARGET ORGAN TOXICITY (Single Exposure) - Category 3
Signal Word	Danger

Pictogram	
Hazard Statements	Causes serious eye irritation Highly flammable liquid and vapor May cause respiratory irritation; May cause drowsiness or dizziness
Precautionary Statements	
Response	Call a POISON CENTER or doctor/physician if you feel unwell. If eye irritation persists: Get medical advice or attention. IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing. If on skin (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower. In case of fire: Use CO2, dry chemical, or foam for extinction.
Prevention	Avoid breathing dust/fume/gas/mist/ vapors/spray. Ground/bond container and receiving equipment. Keep away from heat/sparks/open flames/hot surfaces. - No smoking Keep container tightly closed. Take precautionary measures against static discharge. Use explosion-proof electrical/ventilating/lighting/equipment. Use only non-sparking tools. Use only outdoors or in a well-ventilated area. Wear protective gloves/protective clothing/eye protection/face protection.
Storage	Store in a well-ventilated place. Keep container tightly closed. Store locked up.
Disposal	Dispose of contents and container to an approved waste disposal plant.
Ingredients of unknown toxicity	0%
Hazards not Otherwise Classified	
Other information:	May be harmful if swallowed. PROLONGED OR REPEATED CONTACT MAY DRY SKIN AND CAUSE IRRITATION.
Interactions with Other Chemicals:	No information available.

Section 3. Ingredients

CAS	Ingredient Name	Weight %
67-63-0	Isopropyl alcohol	50% - 100%
7732-18-5	Water	0% - 10%

Occupational exposure limits, if available, are listed in Section 8.

Section 4. First-Aid Measures

General Advice:	Show this safety data sheet to the doctor in attendance.
Eye contact:	If symptoms persist, call a physician. Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Keep eye wide open while rinsing. Do not rub affected area.
Skin contact:	In the case of skin irritation or allergic reactions see a physician. Wash off immediately with soap and plenty of water while removing all contaminated clothes and shoes.
Inhalation:	Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, (trained personnel should) give oxygen.
Ingestion:	Do NOT induce vomiting. Rinse mouth immediately and drink plenty of water. Never give anything by mouth to an unconscious person. Call a physician.
Self-protection of the first aider:	Ensure that medical personnel are aware of the material(s) involved, take precautions to protect themselves and prevent spread of contamination.
Most important symptoms and effects, both acute and delayed:	Burning sensation.
Indication of Any Immediate Medical Attention and Special Treatment Needed:	Notes to Physician: Effects of exposure (inhalation, ingestion or skin contact) to substance may be delayed.

Section 5. Fire Fighting Measures

Suitable Extinguishing Media	Dry chemical. Carbon dioxide (CO2). Water spray. Alcohol resistant foam.
Unsuitable Extinguishing Media	CAUTION: All these products have a very low flash point. Use of water spray when fighting fire may be inefficient. Do not use dry chemical extinguishers to control fires involving nitromethane or nitroethane. Do not use straight streams.
Specific hazards arising from the chemical:	Vapors can form explosive mixtures with air. Vapors may travel to source of ignition and flash back. Most vapors are heavier than air. They will spread along ground and collect in low or confined areas (sewers, basements, tanks). Vapor explosion hazard indoors, outdoors or in sewers. Runoff to sewer may create fire or explosion hazard.
Uniform Fire Code:	Flammable Liquid: I-B Irritant: Liquid
Explosion data:	Sensitivity to Mechanical Impact: No Sensitivity to Static Discharge: Yes
Protective Equipment and Precautions for Firefighters:	Move containers from fire area if you can do it without risk.

Section 6. Accidental Release Measures

Personal Precautions, Protective Equipment and Emergency Procedures:

Personal Precautions:
ELIMINATE all ignition sources (no smoking, flares, sparks or flames in immediate area). All equipment used when handling the product must be grounded. Do not touch or walk through spilled material. Stop leak if you can do it without risk.

Other Information:
Water spray may reduce vapor; but may not prevent ignition in closed spaces.

Environmental Precautions:

Prevent entry into waterways, sewers, basements or confined areas.

Methods and material for containment and cleaning up:

Methods for containment:
A vapor suppressing foam may be used to reduce vapors. Absorb or cover with dry earth, sand or other non-combustible material and transfer to containers.

Methods for cleaning up:
Use clean non-sparking tools to collect absorbed material.

Section 7. Handling and Storage

Precautions for safe handling:

Handle in accordance with good industrial hygiene and safety practice. Avoid contact with skin, eyes or clothing. Do not eat, drink or smoke when using this product. Use personal protection equipment. Avoid breathing vapors or mists. Keep away from heat/sparks/open flames/hot surfaces. - No smoking. Use grounding and bonding connection when transferring this material to prevent static discharge, fire or explosion. Use with local exhaust ventilation. Use spark-proof tools and explosion-proof equipment. Keep in an area equipped with sprinklers. Use according to package label instructions.

Conditions for safe storage, including any incompatibilities:

Storage:
Keep containers tightly closed in a dry, cool and well-ventilated place. Keep away from heat, sparks, flame and other sources of ignition (i.e., pilot lights, electric motors and static electricity). Keep in properly labeled containers. Do not store near combustible materials. Keep in an area equipped with sprinklers. Store in accordance with the particular national regulations. Store in accordance with local regulations.

Incompatible Products:
Strong oxidizing agents. Acids. Chlorinated compounds.

Section 8. Exposure Controls/Personal Protection

Occupational Exposure Limits

Ingredient Name	ACGIH TLV	OSHA PEL	STEL
Isopropyl alcohol	TWA: 200 ppm STEL: 400 ppm	TWA: 400 ppm STEL: 500 ppm	N/A
Water	N/A	N/A	N/A

Personal Protective Equipment

Goggles, Gloves

Appropriate engineering controls:	Showers; Eyewash stations; Ventilation systems
Eye/face protection:	If splashes are likely to occur: Tight sealing safety goggles.
Skin and body protection:	Wear protective gloves and protective clothing. Long sleeved clothing. Chemical resistant apron. Impervious gloves. Antistatic boots.
Respiratory Protection:	No protective equipment is needed under normal use conditions. If exposure limits are exceeded or irritation is experienced, ventilation and evacuation may be required.
Hygiene Measures:	Handle in accordance with good industrial hygiene and safety practice. Avoid contact with skin, eyes or clothing. Wear suitable gloves and eye/face protection. Do not eat, drink or smoke when using this product. Contaminated work clothing should not be allowed out of the workplace. Regular cleaning of equipment, work area and clothing is recommended. Wash hands before breaks and immediately after handling the product.

Section 9. Physical and Chemical Properties

Physical State	Water thin liquid
Color	Clear, colorless
Odor	Alcohol
Odor Threshold	N.D.
Solubility	Miscible in water
Partition coefficient Water/n-octanol	N.D.
VOC%	N/A
Viscosity	N.D.
Specific Gravity	0.818
Density lbs/Gal	N/A
Pounds per Cubic Foot	N/A
Flash Point	14 °C/57 °F
FP Method	N.D.
pH	Unknown
Melting Point	N.D.
Boiling Point	82.5 °C/180 °F
Boiling Range	N.D.
LEL	N/A
UEL	N/A
Evaporation Rate	N.D.
Flammability	N.D.
Decomposition Temperature	N.D.
Auto-ignition Temperature	N.D.
Vapor Pressure	N.D.
Vapor Density	N.D.

Section 10. Stability and Reactivity

Reactivity:	No data available.
Chemical stability:	Stable under recommended storage conditions.
Possibility of hazardous reactions:	None under normal processing.
Hazardous polymerization:	Hazardous polymerization does not occur.
Conditions to avoid:	Heat, flames, and sparks.
Incompatible materials:	Strong oxidizing agents. Acids. Chlorinated compounds.
Hazardous Decomposition Products:	Carbon oxides.

Section 11. Toxicological Information

Information on likely routes of exposure:	Inhalation: Specific test data for the substance or mixture is not available. Eye contact: Specific test data for the substance or mixture is not available. Skin contact: Specific test data for the substance or mixture is not available. Ingestion: Specific test data for the substance or mixture is not available.
Component Information:	Isopropyl Alcohol CAS-No. 67-63-0 LD50 Oral = 4396 mg/kg (Rat) LD50 Dermal = 12800 mg/kg (Rabbit) LC50 Inhalation = 16000 ppm (Rat) 8 h
Information on toxicological effects:	Symptoms: May cause redness and tearing of the eyes. Symptoms of overexposure may be headache, dizziness, tiredness, nausea and vomiting.
Sensitization:	No information available.
Mutagenic Effects:	No information available.
Carcinogenicity:	Isopropyl alcohol CAS-No. 67-63-0 IARC: Group 3 OSHA: X
Reproductive toxicity:	No information available.
Specific Target Organ Toxicity - Single Exposure:	No information available.
Specific Target Organ Toxicity - Repeated Exposure:	No information available.
Chronic Toxicity:	No known effect based on information supplied.
Target Organ Effects:	Eyes. Respiratory system. Skin. Blood. Kidney. Liver. Spleen. Systemic Toxicity.
Aspiration Hazard:	No information available.
Numerical measures of toxicity:	ATEmix (oral): 4,831.00 mg/kg ATEmix (dermal): 14,066.00 mg/kg (ATE) ATEmix (inhalation-vapor): 61.11 ATEmix

Section 12. Ecological Information

Ecotoxicity:	The environmental impact of this product has not been fully investigated.
Persistence/degradability:	No information available.
Bioaccumulation:	No information available.
Other adverse effects:	No information available.

Section 13. Disposal

Disposal methods:	This material, as supplied, is a hazardous waste according to federal regulations (40 CFR 261).
Contaminated packaging:	Dispose of contents/containers in accordance with local regulations.
US EPA Waste Number:	D001

Section 14. Transport Information

UN Number	1219
UN Proper Shipping Name	Isopropanol
DOT Classification	3
Packing Group	II
IATA - UN Number:	1219
IATA - UN Proper Shipping Name:	Isopropanol
IATA - Hazard Class:	3
IATA - Packing Group:	II
IMDG - UN Number:	1219
IMDG - UN Proper Shipping Name:	Isopropanol
IMDG - Hazard Class:	3
IMDG - Packing Group:	II

Section 15. Regulatory Information

SARA 311/312:	Refer to Section 2 of the SDS.
SARA 302:	N.A.
SARA 304:	N.A.
SARA 313:	Isopropyl Alcohol.
TSCA:	All components are listed or exempt.
CERCLA Hazardous Substance List:	N.A.
Clean Air Act (CAA) Section 112, 112 (r):	N.A.
New Jersey Right to Know Components:	ISOPROPYL ALCOHOL.
Pennsylvania Right to Know Components:	2-PROPANOL.

Rhode Island Right to Know Components:	isopropyl alcohol.

Section 16. Other Information

Revision Date	11/1/2022
Legend	N.A. - Not Applicable N.E. - Not Established N.D. - Not Determined
National Fire Protection Association (U.S.A): Health Hazard	2
National Fire Protection Association (U.S.A): Flammability	3
National Fire Protection Association (U.S.A): Instability:	0
HMIS (U.S.A.): Health Hazard	2
HMIS (U.S.A.): Flammability	3
HMIS (U.S.A.): Physical Hazard	0
Additional Information:	The information contained herein is furnished without warranty or legal responsibility of any kind. Employers should use this information only as a supplement to other information gathered by them and must make independent determination of suitability and completeness of information from all sources to assure proper use of these materials and the safety and health of employees.

SAFETY DATA SHEET

Issuing Date 28-Oct 2014 **Revision Date** 17-Oct-2014 **Revision Number** 1

1. IDENTIFICATION OF THE SUBSTANCE/PREPARATION AND OF THE COMPANY/UNDERTAKING

Product identifier

Product SDS Name **Clear Epoxy Resin – Syringe – Part A**

J-B Weld FG SKU Part Numbers Covered

50112, 50101, 50132, 50112-F, 50101-F, 50132-F, 80112, 40002

J-B Weld Product Names Covered

ClearWeld™ (all), PlasticWeld™ Syringe, MinuteWeld™ Syringe, Wood Restore™ Liquid Epoxy

J-B Weld Product Type

Epoxy

Recommended use of the chemical and restrictions on use

Recommended Use	General Purpose Adhesive
Uses advised against	No information available

Details of the supplier of the safety data sheet

Supplier Name	J-B WELD COMPANY,LLC
Supplier Address	1130 COMO ST SULPHUR SPRINGS, TX 75482 USA
Emergency Telephone Numbers	Transportation Emergencies: Chemtrec (24 hour transportation emergency response info): 800-424-9300 or 703-527-3887 Poison/Medical Emergencies: Poison Control Centers (24 hour emergency poison / medical response info): 800-222-1222
Supplier Email	info@jbweld.com
Supplier Phone Number	903-885-7696

2. HAZARDS IDENTIFICATION

Classification

This chemical is considered hazardous by the 2012 OSHA Hazard Communication Standard (29 CFR 1910.1200)

Skin corrosion/irritation	Category 2
Serious eye damage/eye irritation	Category 1
Skin sensitization	Category 1

GHS Label elements, including precautionary statements

Emergency Overview

Signal word **Warning**

Hazard Statements

Causes severe skin irritation
May cause an allergic skin reaction
May cause serious eye damage / eye irritation



Appearance Clear **Physical State** Gel Liquid **Odor** Ammoniacal

Precautionary Statements - Prevention

Obtain special instructions before use
Do not handle until all safety precautions have been read and understood
Use personal protective equipment as required
Wash face, hands and any exposed skin thoroughly after handling
Do not eat, drink or smoke when using this product
Use only outdoors or in a well-ventilated area
Do not breathe dust/fume/gas/mist/vapors/spray
Contaminated work clothing should not be allowed out of the workplace
Wear protective gloves

Precautionary Statements - Response

Immediately call a doctor/physician or poison control center.
Specific treatment (see supplemental first aid instructions on this label)

Eyes

IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing
Immediately call a doctor/physician

Skin

Call a POISON CENTER or doctor/physician if you feel unwell
Wash contaminated clothing before reuse
IF ON SKIN (or hair): Remove/Take off immediately all contaminated clothing. Rinse skin with water/shower
If skin irritation or rash occurs: Get medical advice/attention

Inhalation
IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing
Call a POISON CENTER or doctor/physician if you feel unwell

Ingestion
IF SWALLOWED: Call a POISON CENTER or doctor/physician if you feel unwell
Rinse mouth
Do NOT induce vomiting
Precautionary Statements - Storage
Store locked up

Precautionary Statements - Disposal
Dispose of contents/container to an approved waste disposal plant

Hazards not otherwise classified (HNOC)

Not applicable

Unknown Toxicity
75% of the mixture consists of ingredient(s) of unknown toxicity

Other information

Harmful to aquatic life with long lasting effects
Repeated or prolonged skin contact may cause allergic reactions with susceptible persons

Interactions with Other Chemicals
Use of alcoholic beverages may enhance toxic effects.

3. COMPOSITION/INFORMATION ON INGREDIENTS

.

Chemical Name	CAS No	Weight-%
Diglycidyl bisphenol A resin	25085-99-8	95
Oxirane, [[4-(1,1-dimethylethyl)phenoxy]methyl]-	3101-60-8	5

4. FIRST AID MEASURES

· **4.1 Description of first aid measures**
· **After inhalation:**
Supply fresh air. If required, provide artificial respiration. Keep patient warm. Consult doctor if symptoms persist.
In case of unconsciousness place patient stably in side position for transportation.
· **After skin contact:**
Immediately wash with water and soap and rinse thoroughly.
Immediately remove any clothing soiled by the product. If skin irritation continues, consult a doctor.
· **After eye contact:**
Protect unharmed eye.
Rinse opened eye for several minutes under running water. Then consult a doctor. Do not remove contact lenses if worn.

· **After swallowing:**
Rinse out mouth and then drink plenty of water.
Do not induce vomiting; call for medical help immediately.
· **4.2 Most important symptoms and effects, both acute and delayed** Allergic reactions
Nausea
Dizziness
· **Hazards** Danger of impaired breathing.
· **4.3 Indication of any immediate medical attention and special treatment needed**
Treat skin and mucous membrame with antihistamine and corticoid preparations.
Monitor circulation.

5. FIRE-FIGHTING MEASURES

· **5.1 Extinguishing media**
· **Suitable extinguishing agents:** Use fire extinguishing methods suitable to surrounding conditions.
· **5.2 Special hazards arising from the substance or mixture**
Formation of toxic gases is possible during heating or in case of fire.
· **5.3 Advice for firefighters**
· **Protective equipment:**
Wear self-contained respiratory protective device.
Wear fully protective suit.
· **Additional information** Cool endangered receptacles with water spray.

6. ACCIDENTAL RELEASE MEASURES

· **6.1 Personal precautions, protective equipment and emergency procedures**
Use respiratory protective device against the effects of fumes/dust/aerosol.
Remove persons from danger area.
Ensure adequate ventilation
Wear protective equipment. Keep unprotected persons away.
· **6.2 Environmental precautions:** Do not allow to enter sewers/ surface or ground water.
· **6.3 Methods and material for containment and cleaning up:**
Absorb with liquid-binding material (sand, diatomite, acid binders, universal binders, sawdust).
Dispose contaminated material as waste according to item 13.
Clean the affected area carefully; suitable cleaners are:
Warm water and cleansing agent
· **6.4 Reference to other sections**
See Section 7 for information on safe handling.
See Section 8 for information on personal protection equipment. See Section 13 for disposal information.

7. HANDLING AND STORAGE

· **7.1 Precautions for safe handling**
Ensure good ventilation/exhaustion at the workplace.
Prevent formation of aerosols.
· **Information about fire - and explosion protection:** No special measures required.

· **7.2 Conditions for safe storage, including any incompatibilities**

· **Storage:**

· **Requirements to be met by storerooms and receptacles:** No special requirements.
· **Information about storage in one common storage facility:**
Store away from oxidizing agents.
Store away from foodstuffs.
Do not store together with acids.
· **Further information about storage conditions:** Store in cool, dry conditions in well sealed receptacles.
· **7.3 Specific end use(s)** No further relevant information available.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

· **Additional information about design of technical facilities:** No further data; see item 7.

· **8.1 Control parameters**
· **Ingredients with limit values that require monitoring at the workplace:**
The product does not contain any relevant quantities of materials with critical values that have to be monitored at the workplace.
· **Additional information:** The lists valid during the making were used as basis.

· **8.2 Exposure controls**
· **Personal protective equipment:**
· **General protective and hygienic measures:**
Keep away from foodstuffs, beverages and feed.
Immediately remove all soiled and contaminated clothing
Wash hands before breaks and at the end of work.
Avoid contact with the eyes and skin.
· **Respiratory protection:**
Use suitable respiratory protective device in case of insufficient ventilation.
Use suitable respiratory protective device when aerosol or mist is formed.
· **Protection of hands:**


Protective gloves

The glove material has to be impermeable and resistant to the product/ the substance/ the preparation. Due to missing tests no recommendation to the glove material can be given for the product/ the preparation/ the chemical mixture.
Selection of the glove material on consideration of the penetration times, rates of diffusion and the degradation

· **Material of gloves**
Butyl rubber, BR
The selection of the suitable gloves does not only depend on the material, but also on further marks of quality and varies from manufacturer to manufacturer. As the product is a preparation of several substances, the resistance of the glove material cannot be calculated in advance and has therefore to be checked prior to the application.

· **Penetration time of glove material**
The exact break through time has to be found out by the manufacturer of the protective gloves and has to be observed.

· **Eye protection:**


Safety glasses

Goggles recommended during refilling

9. PHYSICAL AND CHEMICAL PROPERTIES

· **9.1 Information on basic physical and chemical properties** · **General Information**	
· **Appearance:**	
Form:	Liquid
Colour:	Light yellow
· **Odour:**	Characteristic
· **Odour threshold:**	Not determined.
· **pH-value:**	Not determined.
· **Change in condition**	
Melting point/Melting range:	Undetermined.
Boiling point/Boiling range:	> 200°C (> 392 °F)
· **Flash point:**	> 93,3°C (> 200 °F)
· **Flammability (solid, gaseous):**	Not applicable.
· **Ignition temperature:**	
Decomposition temperature:	Not determined.
· **Self-igniting:**	Product is not selfigniting.
· **Danger of explosion:**	Product does not present an explosion hazard.
· **Explosion limits:**	
Lower:	Not determined.
Upper:	Not determined.

· **Vapour pressure:**	Not determined.
· **Density at 20°C:**	1,13 g/cm³
· **Relative density**	Not determined. ·
Vapour density	Not determined.
· **Evaporation rate**	Not determined.
· **Solubility in/Miscibility with water:**	Not miscible or difficult to mix.
· **Partition coefficient (n-octanol/water):**	Not determined.
· **Viscosity:**	
Dynamic:	Not determined.
Kinematic:	Not determined.
· **VOC (% content)**	<1%
Dynamic:	Not determined.
· **9.2 Other information**	No further relevant information available.

10. STABILITY AND REACTIVITY

· **10.1 Reactivity**
· **10.2 Chemical stability**
· **Thermal decomposition / conditions to be avoided:**
No decomposition if used according to specifications.
· **10.3 Possibility of hazardous reactions**
Reacts with oxidizing agents.
Reacts with amines.
Exothermic polymerization.
· **10.4 Conditions to avoid** No further relevant information available.
· **10.5 Incompatible materials:** No further relevant information available.
· **10.6 Hazardous decomposition products:** Carbon monoxide and carbon dioxide

11. TOXICOLOGY INFORMATION

· **11.1 Information on toxicological effects**
· **Acute toxicity:**
· **Primary irritant effect:**
· **on the skin:** Irritant to skin and mucous membranes.
· **on the eye:** Irritating effect.
· **Sensitization:**
Sensitization possible through skin contact.
Sensitizing effect through inhalation is possible by prolonged exposure.

· **Additional toxicological information:**
The product shows the following dangers according to the calculation method of the General EU Classification Guidelines for Preparations as issued in the latest version: Irritant

12. ECOLOGICAL INFORMATION

· **12.1 Toxicity**
· **Aquatic toxicity:** The product contains materials that are harmful to the environment.
· **12.2 Persistence and degradability:** The product is not easily, but potentially degradable.
· **12.3 Bioaccumulative potential**
Due to the distribution coefficient n-octanol/water an accumulation in organisms is possible.
· **12.4 Mobility in soil** No further relevant information available.
· **Additional ecological information:**
· **General notes:**
Water hazard class 2 (German Regulation) (Self-assessment): hazardous for water
Do not allow product to reach ground water, water course or sewage system.
Danger to drinking water if even small quantities leak into the ground.
· **12.5 Results of PBT and vPvB assessment**
· **PBT:** Not applicable.
· **vPvB:** Not applicable.
· **12.6 Other adverse effects:** No further relevant information available.

13. DISPOSAL CONSIDERATIONS

· **13.1 Waste treatment methods**
· **Recommendation**
Must not be disposed together with household garbage. Do not allow product to reach sewage system.
Can be burned with household garbage after consulting with the waste disposal facility operator and the pertinent authorities and adhering to the necessary technical regulations.
· **Uncleaned packaging:**
· **Recommendation:** Disposal must be made according to official regulations.

14. TRANSPORT INFORMATION

· **14.1 UN-Number**	
· **DOT, ADR, ADN, IMDG, IATA**	Not Regulated
· **14.2 UN proper shipping name**	
· **DOT, ADR, ADN, IMDG, IATA**	Not Regulated
· **14.3 Transport hazard class(es)**	
· **DOT, ADR, ADN**	
· **Class**	Not Regulated

· **IMDG, IATA**	
	
· **Class**	Not Regulated
· **14.4 Packing group**	
· **DOT, ADR, IMDG, IATA**	Not Regulated
· **14.5 Environmental hazards:**	
· **Marine pollutant:**	Not Regulated
· **Special marking (IATA):**	Not applicable.
· **14.6 Special precautions for user**	Not applicable.
· **14.7 Transport in bulk according to Annex II of MARPOL73/78 and the IBC Code**	Not applicable.
· **UN "Model Regulation":**	-

15. REGULATORY INFORMATION

· **15.1 Safety, health and environmental regulations/legislation specific for the substance or mixture**
· **United States (USA)**
· **SARA**

· **Section 355 (extremely hazardous substances):**
None of the ingredients is listed.
· **Section 313 (Specific toxic chemical listings):**
None of the ingredients is listed.
· **TSCA (Toxic Substances Control Act):**
All ingredients are listed.

· **Proposition 65 (California):**

· **Chemicals known to cause cancer:**	
None of the ingredients is listed.	
· **Chemicals known to cause reproductive toxicity for females:**	
None of the ingredients is listed.	
· **Chemicals known to cause reproductive toxicity for males:**	
None of the ingredients is listed.	

· **Chemicals known to cause developmental toxicity:**
None of the ingredients is listed.

· **Carcinogenic Categories**

· **EPA (Environmental Protection Agency)**
None of the ingredients is listed.

· **IARC (International Agency for Research on Cancer)**
None of the ingredients is listed.
· **TLV (Threshold Limit Value established by ACGIH)**
None of the ingredients is listed.
· **NIOSH-Ca (National Institute for Occupational Safety and Health)**
None of the ingredients is listed.
· **OSHA-Ca (Occupational Safety & Health Administration)**
None of the ingredients is listed.

· **Canada**

· **Canadian Domestic Substances List (DSL)**
All ingredients are listed.
· **Canadian Ingredient Disclosure list (limit 0.1%)**
None of the ingredients is listed.
· **Canadian Ingredient Disclosure list (limit 1%)**
None of the ingredients is listed.

· **15.2 Chemical safety assessment:** A Chemical Safety Assessment has not been carried out.

16. OTHER INFORMATION

This information is based on our present knowledge. However, this shall not constitute a guarantee for any specific product features and shall not establish a legally valid contractual relationship.

· **Relevant phrases**

H315: Causes skin irritation.
H317: May cause an allergic skin reaction.
H319: Causes serious eye irritation.
H341: Suspected of causing genetic defects.
H411: Toxic to aquatic life with long lasting effects.

R36/38: Irritating to eyes and skin.
R38: Irritating to skin.
R43: May cause sensitisation by skin contact.
R46: May cause heritable genetic damage. R51: Toxic to aquatic organisms.

· **Abbreviations and acronyms:**

ADR: Accord européen sur le transport des marchandises dangereuses par Route (European Agreement concerning the International Carriage of Dangerous Goods by Road)
IMDG: International Maritime Code for Dangerous Goods DOT: US Department of Transportation
IATA: International Air Transport Association
GHS: Globally Harmonized System of Classification and Labelling of Chemicals
ACGIH: American Conference of Governmental Industrial Hygienists
NFPA: National Fire Protection Association (USA)
HMIS: Hazardous Materials Identification System (USA)
WHMIS: Workplace Hazardous Materials Information System (Canada)

Disclaimer

The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text

End of Safety Data Sheet

SAFETY DATA SHEET

Issuing Date 27-Oct 2014 **Revision Date** 17-Oct-2014 **Revision Number** 1

1. IDENTIFICATION OF THE SUBSTANCE/PREPARATION AND OF THE COMPANY/UNDERTAKING

Product identifier

Product SDS Name **Clear Epoxy Hardener - Syringe - Part B**

J-B Weld FG SKU Part Numbers Covered

50112, 80112, 50112-F

J-B Weld Product Names Covered

ClearWeld™ (all)

J-B Weld Product Type

Epoxy

Recommended use of the chemical and restrictions on use

Recommended Use	General Purpose Adhesive
Uses advised against	No information available

Details of the supplier of the safety data sheet

Supplier Name	J-B WELD COMPANY,LLC
Supplier Address	1130 COMO ST SULPHUR SPRINGS, TX 75482 USA
Emergency Telephone Numbers	Transportation Emergencies: Chemtrec (24 hour transportation emergency response info): 800-424-9300 or 703-527-3887 Poison/Medical Emergencies: Poison Control Centers (24 hour emergency poison / medical response info): 800-222-1222
Supplier Email	info@jbweld.com
Supplier Phone Number	903-885-7696

2. HAZARDS IDENTIFICATION

Classification

This chemical is considered hazardous by the 2012 OSHA Hazard Communication Standard (29 CFR 1910.1200)

Skin corrosion/irritation	Category 1B
Serious eye damage/eye irritation	Category 1
Skin sensitization	Category 1

GHS Label elements, including precautionary statements

Emergency Overview

Signal word **Warning**

Hazard Statements

Causes severe skin irritation

May cause serious eye damage / eye irritation

May cause an allergic skin reaction



Appearance Pale yellow **Physical State** Gel Liquid **Odor** Ammoniacal

Precautionary Statements - Prevention

Obtain special instructions before use
Do not handle until all safety precautions have been read and understood
Use personal protective equipment as required
Wash face, hands and any exposed skin thoroughly after handling
Do not eat, drink or smoke when using this product
Use only outdoors or in a well-ventilated area
Do not breathe dust/fume/gas/mist/vapors/spray
Contaminated work clothing should not be allowed out of the workplace
Wear protective gloves

Precautionary Statements - Response

Immediately call a POISON CENTER or doctor/physician
Specific treatment (see supplemental first aid instructions on this label)

Eyes

IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing
Immediately call a POISON CENTER or doctor/physician

Skin

Call a POISON CENTER or doctor/physician if you feel unwell
Wash contaminated clothing before reuse
IF ON SKIN (or hair): Remove/Take off immediately all contaminated clothing. Rinse skin with water/shower
If skin irritation or rash occurs: Get medical advice/attention

Inhalation

IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing
Call a POISON CENTER or doctor/physician if you feel unwell

Ingestion
IF SWALLOWED: Call a POISON CENTER or doctor/physician if you feel unwell
Rinse mouth
Do NOT induce vomiting
Precautionary Statements - Storage
Store locked up

Precautionary Statements - Disposal
Dispose of contents/container to an approved waste disposal plant

Hazards not otherwise classified (HNOC)

Not applicable

Unknown Toxicity
75% of the mixture consists of ingredient(s) of unknown toxicity

Other information

Harmful to aquatic life with long lasting effects
Repeated or prolonged skin contact may cause allergic reactions with susceptible persons

Interactions with Other Chemicals
Use of alcoholic beverages may enhance toxic effects.

3. COMPOSITION/INFORMATION ON INGREDIENTS

.

Chemical Name	CAS No	Weight-%
2,4,6-Tri(dimethylaminomethyl)phenol	90-72-2	7 - 13
1-(2-Aminoethyl) piperazine	140-31-8	<5%
Benzyl alcohol	100-51-6	3 - 5
Ethylbenzene	100-41-4	<1%

4. FIRST AID MEASURES

First aid measures

General Advice
Immediate medical attention is required. Show this safety data sheet to the doctor in attendance.

Eye Contact
Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. Keep eye wide open while rinsing. Do not rub affected area. Seek immediate medical attention/advice. Remove contact lenses, if present and easy to do. Continue rinsing.

Skin Contact
Immediate medical attention is required. Wash off immediately with soap and plenty of water while removing all contaminated clothes and shoes. May cause an allergic skin reaction.

Inhalation
Remove to fresh air. Get medical attention immediately if symptoms occur. If breathing is difficult, (trained personnel should) give oxygen. If breathing has stopped, give artificial respiration. Get medical attention immediately. Avoid direct contact with skin. Use barrier to give mouth-to-mouth resuscitation.

Ingestion Do NOT induce vomiting. Rinse mouth immediately and drink plenty of water. Never give anything by mouth to an unconscious person. Call a physician or poison control center immediately.

Self-protection of the first aider Ensure that medical personnel are aware of the material(s) involved, take precautions to protect themselves and prevent spread of contamination. Avoid direct contact with skin. Use barrier to give mouth-to-mouth resuscitation. Use personal protective equipment as required. Wear personal protective clothing (see section 8). Avoid breathing vapors or mists. Avoid contact with skin, eyes or clothing.

Most important symptoms and effects, both acute and delayed

Most Important Symptoms and Effects Burning sensation. Coughing and/ or wheezing. Difficulty in breathing. Itching. Rashes. Hives.

Indication of any immediate medical attention and special treatment needed

Notes to Physician Treat symptomatically. Product is a corrosive material. Use of gastric lavage or emesis is contraindicated. Possible perforation of stomach or esophagus should be investigated. Do not give chemical antidotes. Asphyxia from glottal edema may occur. Marked decrease in blood pressure may occur with moist rales, frothy sputum, and high pulse pressure. May cause sensitization of susceptible persons.

5. FIRE-FIGHTING MEASURES

Suitable Extinguishing Media
Use extinguishing measures that are appropriate to local circumstances and the surrounding environment.

Unsuitable extinguishing media
CAUTION: Use of water spray when fighting fire may be inefficient.

Specific Hazards Arising from the Chemical
The product causes burns of eyes, skin and mucous membranes. Thermal decomposition can lead to release of irritating gases and vapors. Product is or contains a sensitizer. May cause sensitization by skin contact.

Uniform Fire Code Combustible Liquid: III-B
Sensitizer: Liquid

Hazardous Combustion Products
Carbon oxides.

Explosion Data
Sensitivity to Mechanical Impact No. **Sensitivity**

to Static Discharge No.

Protective equipment and precautions for firefighters
As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear.

6. ACCIDENTAL RELEASE MEASURES

Personal precautions, protective equipment and emergency procedures

Personal Precautions Attention! Corrosive material. Avoid contact with skin, eyes or clothing. Ensure adequate ventilation. Use personal protective equipment as required. Evacuate personnel to safe areas. Keep people away from and upwind of spill/leak. Avoid breathing vapors or mists. Avoid generation of dust.

Other Information Refer to protective measures listed in Sections 7 and 8.

Environmental Precautions

Environmental Precautions Refer to protective measures listed in Sections 7 and 8. Prevent further leakage or spillage if safe to do so. Should not be released into the environment. Do not allow to enter into soil/subsoil. Prevent product from entering drains.

Methods and material for containment and cleaning up

Methods for Containment Prevent further leakage or spillage if safe to do so.

Methods for cleaning up Soak up with inert absorbent material. Pick up and transfer to properly labeled containers.

7. HANDLING AND STORAGE

Precautions for safe handling

Handling Handle in accordance with good industrial hygiene and safety practice. Avoid contact with skin, eyes or clothing. Avoid breathing vapors or mists. Use only with adequate ventilation and in closed systems. In case of insufficient ventilation, wear suitable respiratory equipment. Do not eat, drink or smoke when using this product. Take off contaminated clothing and wash before reuse.

Conditions for safe storage, including any incompatibilities

Storage Keep containers tightly closed in a dry, cool and well-ventilated place. Protect from moisture. Store locked up. Keep out of the reach of children. Store away from other materials.

Incompatible Products Acids. Bases. Oxidizing agent.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Control parameters

Exposure Guidelines

Chemical Name	ACGIH TLV	OSHA PEL	NIOSH IDLH
Ethylbenzene 100-41-4	TWA: 20 ppm	TWA: 100 ppm TWA: 435 mg/m^3 (vacated) TWA: 100 ppm (vacated) TWA: 435 mg/m^3 (vacated) STEL: 125 ppm (vacated) STEL: 545 mg/m^3	IDLH: 800 ppm TWA: 100 ppm TWA: 435 mg/m^3 STEL: 125 ppm STEL: 545 mg/m^3

Other Exposure Guidelines See section 15 for national exposure control parameters

Appropriate engineering controls

Engineering Measures Showers
Eyewash stations

Ventilation systems

Individual protection measures, such as personal protective equipment

Eye/Face Protection	Tight sealing safety goggles. Face protection shield.
Skin and Body Protection	Wear protective gloves and protective clothing. Long sleeved clothing. Chemical resistant apron. Impervious gloves.
Respiratory Protection	No protective equipment is needed under normal use conditions. If exposure limits are exceeded or irritation is experienced, ventilation and evacuation may be required.
Hygiene Measures	Handle in accordance with good industrial hygiene and safety practice. Do not eat, drink or smoke when using this product. Take off contaminated clothing and wash before reuse. Avoid contact with skin, eyes or clothing. Wear suitable gloves and eye/face protection. Contaminated work clothing should not be allowed out of the workplace. Regular cleaning of equipment, work area and clothing is recommended. Wash hands before breaks and immediately after handling the product. For environmental protection, remove and wash all contaminated protective equipment before re-use.

9. PHYSICAL AND CHEMICAL PROPERTIES

Physical and Chemical Properties

Physical State	Gel Liquid		
Appearance	Pale yellow	**Odor**	Ammoniacal
Color	No information available	**Odor Threshold**	No information available

Property	**Values**	**Remarks/ Method**
pH	UNKNOWN	None known
Melting / freezing point	No data available	None known
Boiling point / boiling range	100 °C / 212 °F	None known
Flash Point	140 C / 284 F	None known
Evaporation Rate	No data available	None known
Flammability (solid, gas)	No data available	None known
Flammability Limit in Air		
Upper flammability limit	No data available	
Lower flammability limit	No data available	
Vapor pressure	No data available	None known
Vapor density	No data available	None known
Specific Gravity	No data available	None known
Water Solubility	Miscible in water	None known
Solubility in other solvents	No data available	None known
Partition coefficient: n-octanol/water	No data available	None known
Autoignition temperature	No data available	None known
Decomposition temperature	No data available	None known
Kinematic viscosity	No data available	None known
Dynamic viscosity	400	None known
Explosive properties	No data available	
Oxidizing Properties	No data available	

Other Information

Softening Point	No data available
VOC Content (%)	<1%
Particle Size	No data available
Particle Size Distribution	

10. STABILITY AND REACTIVITY

Reactivity

No data available.

Chemical stability
Stable under recommended storage conditions.

Possibility of Hazardous Reactions
None under normal processing.

Hazardous Polymerization
Hazardous polymerization does not occur.

Conditions to avoid
Exposure to air or moisture over prolonged periods. Excessive heat.

Incompatible materials
Acids. Bases. Oxidizing agent.

Hazardous Decomposition Products
Carbon oxides.

11. TOXICOLOGICAL INFORMATION

Information on likely routes of exposure

Product Information .

Inhalation
Specific test data for the substance or mixture is not available. Corrosive by inhalation. (based on components). Inhalation of corrosive fumes/gases may cause coughing, choking, headache, dizziness, and weakness for several hours. Pulmonary edema may occur with tightness in the chest, shortness of breath, bluish skin, decreased blood pressure, and increased heart rate. Inhaled corrosive substances can lead to a toxic edema of the lungs. Pulmonary edema can be fatal. May cause irritation of respiratory tract. Harmful by inhalation.

Eye Contact
Specific test data for the substance or mixture is not available. Causes burns. (based on components). Corrosive to the eyes and may cause severe damage including blindness. Causes serious eye damage. May cause irreversible damage to eyes.

Skin Contact
Specific test data for the substance or mixture is not available. Corrosive. (based on components). Causes burns. May be absorbed through the skin in harmful amounts. Harmful in contact with skin.

Ingestion
Specific test data for the substance or mixture is not available. Causes burns. (based on components). Ingestion causes burns of the upper digestive and respiratory tracts. May cause severe burning pain in the mouth and stomach with vomiting and diarrhea of dark blood. Blood pressure may decrease. Brownish or yellowish stains may be seen around the mouth. Swelling of the throat may cause shortness of breath and choking. May cause lung damage if swallowed. May be fatal if swallowed and enters airways. Ingestion may cause irritation to mucous membranes. Ingestion may cause gastrointestinal irritation, nausea, vomiting and diarrhea. May be harmful if swallowed.

Component Information

Chemical Name	Oral LD50	Dermal LD50	Inhalation LC50

2,4,6-Tri(dimethylaminomethyl)phen ol 90-72-2	= 1000 mg/kg (Rat)	= 1280 mg/kg (Rat)	-
1-(2-Aminoethyl) piperazine 140-31-8	= 2140 mg/kg (Rat)	= 880 µL/kg (Rabbit)	-
Benzyl alcohol 100-51-6	= 1230 mg/kg (Rat)	= 2 g/kg (Rabbit)	= 8.8 mg/L (Rat) 4 h
Ethylbenzene 100-41-4	= 3500 mg/kg (Rat)	= 15354 mg/kg (Rabbit)	= 17.2 mg/L (Rat) 4 h

Information on toxicological effects

Symptoms Erythema (skin redness). Burning. May cause blindness. Coughing and/ or wheezing. Itching. Rashes. Hives.

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Sensitization May cause sensitization of susceptible persons. May cause sensitization by skin contact. May cause sensitization by inhalation.

Mutagenic Effects No information available.

Carcinogenicity The table below indicates whether each agency has listed any ingredient as a carcinogen.

Chemical Name	ACGIH	IARC	NTP	OSHA
Ethylbenzene 100-41-4	A3	Group 2B		X

ACGIH (American Conference of Governmental Industrial Hygienists)
A3 - Animal Carcinogen
IARC (International Agency for Research on Cancer)
Group 2B - Possibly Carcinogenic to Humans
OSHA (Occupational Safety and Health Administration of the US Department of Labor)
X - Present

Reproductive Toxicity No information available.

STOT - single exposure No information available.

STOT - repeated exposure No information available.

Chronic Toxicity Chronic exposure to corrosive fumes/gases may cause erosion of the teeth followed by jaw necrosis. Bronchial irritation with chronic cough and frequent attacks of pneumonia are common. Gastrointestinal disturbances may also be seen. Contains a known or suspected carcinogen.

Target Organ Effects Respiratory system. Eyes. Skin. Gastrointestinal tract (GI). Central Nervous System (CNS).

Aspiration Hazard No information available.

Numerical measures of toxicity Product Information

The following values are calculated based on chapter 3.1 of the GHS document

ATEmix (oral)
728.00 mg/kg
ATEmix (dermal)
1,140.00 mg/kg (ATE)
ATEmix (inhalation-gas)
18,750.00 ppm (4 hr)
ATEmix (inhalation-dust/mist)
6.20 mg/l
ATEmix (inhalation-vapor)
46.00 ATEmix

12. ECOLOGICAL INFORMATION

Ecotoxicity

Harmful to aquatic life with long lasting effects.

Chemical Name	Toxicity to Algae	Toxicity to Fish	Toxicity to Microorganisms	Daphnia Magna (Water Flea)
1-(2-Aminoethyl) piperazine 140-31-8	72h EC50: = 495 mg/L (Pseudokirchneriella subcapitata)	96h LC50: > 1000 mg/L (Poecilia reticulata) 96h LC50: >= 100 mg/L (Oncorhynchus mykiss) 96h LC50: 1950 - 2460 mg/L (Pimephales promelas)	EC50 > 10000 mg/L 17 h	48h EC50: = 32 mg/L
Benzyl alcohol 100-51-6	3h EC50: = 35 mg/L (Anabaena variabilis)	96h LC50: = 10 mg/L (Lepomis macrochirus) 96h LC50: = 460 mg/L (Pimephales promelas)	EC50 = 50 mg/L 5 min EC50 = 63.7 mg/L 15 min EC50 = 63.7 mg/L 5 min EC50 = 71.4 mg/L 30 min	48h EC50: = 23 mg/L
Ethylbenzene 100-41-4	72h EC50: = 4.6 mg/L (Pseudokirchneriella subcapitata) 96h EC50: > 438 mg/L (Pseudokirchneriella subcapitata) 72h EC50: 2.6 - 11.3 mg/L (Pseudokirchneriella subcapitata) 96h EC50: 1.7 - 7.6 mg/L (Pseudokirchneriella subcapitata)	96h LC50: 11.0 - 18.0 mg/L (Oncorhynchus mykiss) 96h LC50: = 4.2 mg/L (Oncorhynchus mykiss) 96h LC50: 7.55 - 11 mg/L (Pimephales promelas) 96h LC50: = 32 mg/L (Lepomis macrochirus) 96h LC50: 9.1 - 15.6 mg/L (Pimephales promelas) 96h LC50: = 9.6 mg/L (Poecilia reticulata)	EC50 = 9.68 mg/L 30 min EC50 = 96 mg/L 24 h	48h EC50: 1.8 - 2.4 mg/L

Persistence and Degradability

No information available.

Bioaccumulation

No information available

Chemical Name	Log Pow
1-(2-Aminoethyl) piperazine 140-31-8	-1.48
Benzyl alcohol 100-51-6	1.1
Ethylbenzene 100-41-4	3.118

Other adverse effects

No information available.

13. DISPOSAL CONSIDERATIONS

Waste treatment methods

Disposal methods

This material, as supplied, is not a hazardous waste according to Federal regulations (40 CFR 261). This material could become a hazardous waste if it is mixed with or otherwise comes in contact with a hazardous waste, if chemical additions are made to this material, or if the material is processed or otherwise altered. Consult 40 CFR 261 to determine whether the altered material is a hazardous waste. Consult the appropriate state, regional, or local regulations for additional requirements.

Contaminated Packaging

Dispose of contents/containers in accordance with local regulations.

Chemical Name	RCRA	RCRA - Basis for Listing	RCRA - D Series Wastes	RCRA - U Series Wastes
Ethylbenzene 100-41-4		Included in waste stream: F039		

California Hazardous Waste Codes 331

Chemical Name	California Hazardous Waste
Ethylbenzene 100-41-4	Toxic Ignitable

14. TRANSPORT INFORMATION

DOT NOT REGULATED
Proper Shipping Name NON REGULATED
Hazard Class N/A

TDG Not regulated

MEX Not regulated

ICAO Not regulated

IATA Not regulated
Proper Shipping Name NON REGULATED
Hazard Class N/A

IMDG/IMO Not regulated
Hazard Class N/A

RID Not regulated

ADR Not regulated

ADN Not regulated

15. REGULATORY INFORMATION

International Inventories

TSCA Complies
DSL All components are listed either on the DSL or NDSL.

TSCA - United States Toxic Substances Control Act Section 8(b) Inventory
DSL/NDSL - Canadian Domestic Substances List/Non-Domestic Substances List

US Federal Regulations

SARA 313

Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 (SARA). This product contains a chemical or chemicals which are subject to the reporting requirements of the Act and Title 40 of the Code of Federal Regulations, Part 372

Chemical Name	CAS No	Weight-%	SARA 313 - Threshold Values %
Ethylbenzene - 100-41-4	100-41-4	1 - 5	0.1

SARA 311/312 Hazard Categories

Acute Health Hazard Yes
Chronic Health Hazard Yes
Fire Hazard No
Sudden release of pressure hazard No
Reactive Hazard No

CWA (Clean Water Act)

This product does not contain any substances regulated as pollutants pursuant to the Clean Water Act (40 CFR 122.21 and 40 CFR 122.42)

Chemical Name	CWA - Reportable Quantities	CWA - Toxic Pollutants	CWA - Priority Pollutants	CWA - Hazardous Substances
Ethylbenzene 100-41-4	1000 lb	X	X	X

CERCLA

This material, as supplied, contains one or more substances regulated as a hazardous substance under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) (40 CFR 302)

Chemical Name	Hazardous Substances RQs	Extremely Hazardous Substances RQs	RQ
Ethylbenzene 100-41-4	1000 lb		RQ 1000 lb final RQ RQ 454 kg final RQ

US State Regulations

California Proposition 65

This product contains the following Proposition 65 chemicals.

Chemical Name	California Proposition 65
Ethylbenzene - 100-41-4	Carcinogen

U.S. State Right-to-Know Regulations

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Chemical Name	New Jersey	Massachusetts	Pennsylvania	Rhode Island	Illinois
1-(2-Aminoethyl) piperazine 140-31-8	X	X	X		
Benzyl alcohol 100-51-6		X	X		
Ethylbenzene 100-41-4	X	X	X	X	X

International Regulations

Mexico National occupational exposure limits

Component	Carcinogen Status	Exposure Limits
Ethylbenzene 100-41-4 (1 - 5)		Mexico: TWA 100 ppm Mexico: TWA 435 mg/m^3 Mexico: STEL 125 ppm Mexico: STEL 545 mg/m^3

Mexico - Occupational Exposure Limits - Carcinogens

Canada

WHMIS Hazard Class

D2A - Very toxic materials

D2B - Toxic materials



16. OTHER INFORMATION

NFPA	**Health Hazards** 3	**Flammability** 1	**Instability** 0	**Physical and Chemical Hazards** -
HMIS	**Health Hazards** 3 *	**Flammability** 1	**Physical Hazard** 0	**Personal Protection** X

Chronic Hazard Star Legend * = Chronic Health Hazard

Prepared By J-B Weld Company

Revision Date 17-Oct-2014
Revision Note No information available

Notice to reader

NON-WARRANTY: The information presented in this publication is based upon the research and experience of J-B Weld Company. No representation or warranty is made, however, concerning the accuracy or completeness of the information presented in this publication. J-B Weld Company makes no warranty or representation of any kind, express or implied, including without limitation any warranty of merchantability or fitness for any particular purpose, and no warranty or representation shall be implied by law or otherwise. Any products sold by J-B Weld Company are not warranted as suitable for any particular purpose to the buyer. The suitability of any products for any purpose particular to the buyers is for the buyer to determine. J-B Weld Company assumed no responsibility for the selection of products suitable to the particular purposes of any particular buyer. J-B Weld Company shall in no event be liable for any special, incidental, or consequential damages.

End of Safety Data Sheet

SAFETY DATA SHEET
Klean-Strip Lacquer Thinner

Printed: 02/23/2023
Revision: 02/22/2023
Supersedes Revision: 05/20/2020

1. PRODUCT AND COMPANY IDENTIFICATION

Product Name: Klean-Strip Lacquer Thinner

Company Name: W. M. Barr
2105 Channel Avenue
Memphis, TN 38113

Web site address: www.wmbarr.com

Emergency Contact: 3E 24 Hour Emergency Contact (800)451-8346

Information: W.M. Barr Customer Service (800)398-3892

Product Category: Paint Thinner

Product Code: CML170SC, GML170SC, GML170PSC, GML1702SC, QML170SC, QML1704SC

2. HAZARDS IDENTIFICATION

Flammable Liquids, Category 2
Serious Eye Damage/Eye Irritation, Category 2A
Specific Target Organ Toxicity (single exposure), Category 3



GHS Signal Word: **Danger**

GHS Hazard Phrases:
H225: Highly flammable liquid and vapor.
H319: Causes serious eye irritation.
H335: May cause respiratory irritation.

GHS Precautionary Phrases:
P210: Keep away from heat/sparks/open flames/hot surfaces. - No smoking.
P233: Keep container tightly closed.
P240: Ground/bond container and receiving equipment.
P241: Use explosion-proof electrical/ventilating/lighting/ equipment.
P242: Use only non-sparking tools.
P243: Take precautionary measures against static discharge.
P261: Avoid breathing gas/mist/vapors/spray.
P264: Wash hands thoroughly after handling.
P271: Use only outdoors or in a well-ventilated area.
P280: Wear protective gloves/protective clothing/eye protection/face protection.
P235: Keep cool.

GHS Response Phrases:
P303+361+353: IF ON SKIN (or hair): Remove/take off immediately all contaminated clothing. Rinse skin with water/shower.
P304+340: IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing.
P305+351+338: IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P312: Call a POISON CENTER or doctor/physician if you feel unwell.
P337+313: If eye irritation persists, get medical advice/attention.
P370+378: In case of fire, use dry chemical powder to extinguish.

GHS Storage and Disposal Phrases:
P403+233: Store container tightly closed in well-ventilated place.
P405: Store locked up.
P501: Dispose of contents/container according to local, state and federal regulations.

OSHA Regulatory Status: This material is classified as hazardous under OSHA regulations.

Potential Health Effects (Acute and Chronic):

Inhalation Acute Exposure Effects:
Vapor harmful. May lead to central nervous system effects, such as dizziness, drowsiness, headaches, and nausea. High vapor concentrations are irritating to the eyes, nose, throat, and lungs.

Skin Contact Acute Exposure Effects:
May cause skin irritation. Prolonged or repeated contact can result in defatting and drying of the skin which may result in skin irritation and dermatitis. Acetone can facilitate the absorption of other materials through the skin.

Eye Contact Acute Exposure Effects:
This material is an eye irritant. May cause moderate to severe irritation. May cause discomfort, pain, and redness. May cause moderate corneal injury. Effects may be slow to heal.

Ingestion Acute Exposure Effects:
Harmful if swallowed. May cause dizziness, headache, nausea, and irritation of the mouth, throat, and stomach.

Swallowing small amounts of 2-butoxyethanol as a result of normal operations is not likely to cause injury; however, swallowing larger amounts may cause injury. In animals, effects have been reported on the following organs: blood (hemolysis) and secondary effects on the kidney and liver. Human red blood cells have been shown to be significantly less sensitive to hemolysis than those of rodents and rabbits. Massive ingestion may produce metabolic acidosis and subsequent secondary effects such as hemolysis, central nervous system and kidney effects.

Chronic Exposure Effects:
Reports have associated repeated and prolonged overexposure to solvents with neurological and other physiological damage. Intentional misuse by deliberately concentrating and inhaling solvents may be harmful or fatal.

Medical Conditions Generally Aggravated By Exposure: Skin, eye, lung (asthma-like conditions)

3. COMPOSITION/INFORMATION ON INGREDIENTS

CAS #	Hazardous Components (Chemical Name)	Concentration
67-64-1	Acetone {2-Propanone}	80.0 -100.0 %
111-76-2	Ethanol, 2-Butoxy- {Ethylene glycol n-butyl ether, (a glycol ether)}	1.0 -5.0 %

Additional Chemical Information Specific percentage of composition is being withheld as a trade secret.

4. FIRST AID MEASURES

Emergency and First Aid Procedures:

Skin:
Immediately begin washing the skin thoroughly with large amounts of water and mild soap, if available, while removing contaminated clothing. Seek medical attention if irritation persists.

Eyes:
Immediately begin to flush eyes with water, remove any contact lens. Continue to flush the eyes for at least 15 minutes, then seek immediate medical attention.

Inhalation:
Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get immediate medical attention.

Ingestion:
If swallowed, do NOT induce vomiting. Seek immediate medical attention. Call a physician, hospital emergency room, or poison control center immediately. Never give anything by mouth to an unconscious person.

Signs and Symptoms Of Exposure: Primary Routes of Exposure:
Inhalation, ingestion, and dermal.

5. FIRE FIGHTING MEASURES

Flammability Classification: Class IB

Flash Pt: 0.00 F Method Used: Setaflash Closed Cup (Rapid Setaflash)

Explosive Limits: LEL: N.D. UEL: N.D.

Autoignition Pt:

Suitable Extinguishing Media: Use carbon dioxide, dry powder, water spray, or foam.

Unsuitable Extinguishing Media: Straight water streams may be ineffective.

Fire Fighting Instructions: Self-contained respiratory protection should be provided for fire fighters fighting fires in buildings or confined areas. Storage containers exposed to fire should be kept cool with water spray to prevent pressure build-up. Stay away from heads of containers that have been exposed to intense heat or flame.

Flammable Properties and Hazards: This material is a static accumulator.

Hazardous Combustion Products: carbon monoxide, carbon dioxide

6. ACCIDENTAL RELEASE MEASURES

Steps To Be Taken In Case Material Is Released Or Spilled: Vapors may cause flash fire or ignite explosively.

Clean up: Keep unnecessary people away; isolate hazard area and deny entry. Stay upwind, out of low areas, and ventilate closed spaces before entering. Shut off ignition sources; keep flares, smoking or flames out of hazard area. Use non-sparking tools. Use proper bonding and grounding methods for all equipment and processes. Keep out of waterways and bodies of water. Be cautious of vapors collecting in small enclosed spaces, sewers, low lying areas, confined spaces, etc.

Small spills: Take up with sand, earth or other noncombustible absorbent material and place in a plastic container where applicable.

Large spills: Dike far ahead of spill for later disposal.

Waste Disposal: Dispose in accordance with applicable local, state and federal regulations.

7. HANDLING AND STORAGE

Precautions To Be Taken in Handling: Read carefully all cautions and directions on product label before use. Since empty container retains residue, follow all label warnings even after container is empty. Dispose of empty container according to all regulations. Do not reuse this container.

Do not use this product near any source of heat or open flame, furnace areas, pilot lights, stoves, etc.

Do not use in small enclosed spaces, such as basements and bathrooms. Vapors can accumulate and explode if ignited.

Do not spread this product over large surface areas because fire and health safety risks will increase dramatically.

Precautions To Be Taken in Storing: Keep container tightly closed when not in use. Store in a cool, dry place. Do not store near flames or at elevated temperatures.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

CAS #	Chemical Name	Jurisdiction	Recommended Exposure Limits	Notations
67-64-1	Acetone {2-Propanone}	ACGIH TLV	TLV: 500 ppm STEL: 750 ppm	
		OSHA PELs	PEL: 1000 ppm	
111-76-2	Ethanol, 2-Butoxy- {Ethylene glycol n-butyl ether, (a glycol ether)}	ACGIH TLV	TLV: 20 ppm	
		OSHA PELs	PEL: 50 ppm	

Respiratory Equipment (Specify Type): For OSHA controlled work place and other regular users. Use only with adequate ventilation under engineered air control systems designed to prevent exceeding appropriate TLV. For occasional use, where engineered air control is not feasible, use properly maintained and properly fitted NIOSH approved respirator for organic solvent vapors. A dust mask does not provide protection against vapors.

Eye Protection: Where contact with the eyes or face is likely, a faceshield or chemical splash goggles should be worn to prevent eye contact.

Protective Gloves: Wear gloves with as much resistance to the chemical ingredients as possible. Glove materials such as nitrile rubber may provide protection. Glove selection should be based on chemicals being used and conditions of use. Consult your glove supplier for additional information. Gloves contaminated with product should be discarded and not reused.

Other Protective Clothing: Various application methods can dictate use of additional protective safety equipment, such as impermeable aprons, etc., to minimize exposure.

Engineering Controls (Ventilation etc.): Use process enclosures, local exhaust ventilation, or other engineering controls to control airborne levels below recommended exposure limits.

Use only with adequate ventilation to prevent buildup of vapors. Do not use in areas

	where vapors can accumulate and concentrate, such as basements, bathrooms or small enclosed areas. Whenever possible, use outdoors in an open air area. If using indoors open all windows and doors and maintain a cross ventilation of moving fresh air across the work area. If strong odor is noticed or you experience slight dizziness, headache, nausea or eye-watering -- STOP -- ventilation is inadequate. Leave area immediately and move to fresh air.
Work/Hygienic/Maintenance Practices:	Wash hands thoroughly after use and before eating, drinking, or smoking. Do not eat, drink, or smoke in the work area. Discard any clothing or other protective equipment that cannot be decontaminated. Facilities storing or handling this material should be equipped with an emergency eyewash and safety shower.

9. PHYSICAL AND CHEMICAL PROPERTIES

Physical States:	[ ] Gas [X] Liquid [ ] Solid
Appearance and Odor:	Clear colorless liquid with a characteristic ketone odor. Odor threshold not determined.
pH:	N.D.
Melting Point:	N.D.
Boiling Point:	> 37.70 C
Flash Pt:	0.00 F Method Used: Setaflash Closed Cup (Rapid Setaflash)
Evaporation Rate:	> 1 (BuAC=1)
Flammability (solid, gas):	
Explosive Limits:	LEL: N.D. UEL: N.D.
Vapor Pressure (vs. Air or mm Hg):	N.D.
Vapor Density (vs. Air = 1):	> 1
Specific Gravity (Water = 1):	0.7840 - 0.8040
Density:	6.52 - 6.69 LB/GA
Solubility in Water:	complete
Saturated Vapor Concentration:	N.D.
Octanol/Water Partition Coefficient:	ND
Percent Volatile:	100.0 % by weight.
VOC / Volume:	25.0000 G/L
Autoignition Pt:	
Decomposition Temperature:	N.D.
Viscosity:	< 5 CPS N.D.
a_fld_hdr[9]:	VOC/Volume (weight %): 3.00 % by weight ND = Not Determined
Information with regard to primary physical hazard:	

10. STABILITY AND REACTIVITY

Stability:	Unstable [ ] Stable [X]
Conditions To Avoid - Instability:	
Incompatibility - Materials To Avoid:	May form explosive mixtures with chromic anhydride, chromyl alcohol, hexachloromelamine, hydrogen peroxide, permonosulfuric acid, potassium tertbutoxide, and thioglycol. Strong oxidizers.
Hazardous Decomposition or Byproducts:	Decomposition may produce carbon monoxide, carbon dioxide, and other asphyxiants. 2-butoxyethanol can decompose to form aldehydes ketones, and organic acids.
Possibility of Hazardous Reactions:	Will occur [ ] Will not occur [X]
Conditions To Avoid - Hazardous Reactions:	

11. TOXICOLOGICAL INFORMATION

Toxicological Information: This product has not been tested as a whole. Refer to section 2 for acute and chronic effects.

CAS# 67-64-1:
Standard Draize Test, Eyes, Species: Rabbit, 20.00 MG, Severe.
Result:
Behavioral: Change in motor activity (specific assay).
Behavioral: Alteration of classical conditioning.
- American Journal of Ophthalmology., Ophthalmic Pub. Co., 435 N. Michigan Ave., Suite 1415, Chicago, IL 60611, Vol/p/yr: 29,1363, 1946

CAS# 111-76-2:
Acute toxicity, LC50, Inhalation, Rat, 450.0 PPM, 4 H.
Result:
Behavioral: Ataxia.
Nutritional and Gross Metabolic:Weight loss or decreased weight gain.
- Toxicology and Applied Pharmacology, Academic Press, Inc., 1 E. First St., Duluth, MN 55802, Vol/p/yr: 68,405, 1983

Acute toxicity, LD50, Skin, Species: Rabbit, 220.0 MG/KG.
Result:
Effects on Embryo or Fetus: Extra embryonic structures (e.g., placenta, umbilical cord).
Effects on Embryo or Fetus: Other effects to embryo.
Specific Developmental Abnormalities: Musculoskeletal system.
- Dow Chemical Company Reports., Dow Chemical USA, Health and Environment Research, Toxicology Research Lab, Midland, MI 48640, Vol/p/yr: MSD-46,

Acute toxicity, LD50, Oral, Rat, 250.0 mg/kg.
Result:
Lungs, Thorax, or Respiration:Changes in pulmonary vascular resistance.

Standard Draize Test, Eyes, Species: Rabbit, 100.0 MG, Severe.
Result:
Effects on Newborn: Apgar score (human only).

Effects on Newborn: Other neonatal measures or effects.
Effects on Newborn: Drug dependency.
- American Journal of Ophthalmology., Ophthalmic Pub. Co., 435 N. Michigan Ave., Suite 1415, Chicago, IL 60611, Vol/p/yr: 29,1363, 1946

Chronic Toxicological Effects:

Carcinogenicity/Other Information: IARC 3: Not Classifiable as to Carcinogenicity in Humans
ACGIH A3 - Confirmed Animal Carcinogen with Unknown Relevance to Humans
ACGIH A4 - Not Classifiable as a Human Carcinogen.

CAS #	Hazardous Components (Chemical Name)	NTP	IARC	ACGIH	OSHA
67-64-1	Acetone {2-Propanone}			A4	
111-76-2	Ethanol, 2-Butoxy- {Ethylene glycol n-butyl ether, (a glycol ether)}		3	A3	

12. ECOLOGICAL INFORMATION

General Ecological Information: This product has not been tested as a whole.

13. DISPOSAL CONSIDERATIONS

Waste Disposal Method: Dispose in accordance with applicable local, state and federal regulations.

14. TRANSPORT INFORMATION

LAND TRANSPORT (US DOT):

DOT Proper Shipping Name: Paint Related Material
DOT Hazard Class: 3 FLAMMABLE LIQUID
UN/NA Number: UN1263 **Packing Group:** II



Additional Transport Information: The shipper/supplier may apply one of the following exceptions: Combustible Liquid, Consumer Commodity, Limited Quantity, Viscous Liquid, Does Not Sustain Combustion, or others, as allowed under 49CFR Hazmat Regulations. Please consult 49CFR Subchapter C to ensure that subsequent shipments comply with these exceptions.

15. REGULATORY INFORMATION

EPA SARA (Superfund Amendments and Reauthorization Act of 1986) Lists

CAS #	Hazardous Components (Chemical Name)	S. 302 (EHS)	S. 304 RQ	S. 313 (TRI)
67-64-1	Acetone {2-Propanone}	No	Yes NA	No
111-76-2	Ethanol, 2-Butoxy- {Ethylene glycol n-butyl ether, (a glycol ether)}	No	No	Yes-Cat. N230

CAS #	Hazardous Components (Chemical Name)	Other US EPA or State Lists
67-64-1	Acetone {2-Propanone}	TSCA: Inventory
111-76-2	Ethanol, 2-Butoxy- {Ethylene glycol n-butyl ether, (a glycol ether)}	CAA HAP,ODC: Yes - Cat. TSCA: Inventory

Additional Regulatory Information	This product is regulated by the United States Consumer Product Safety Commission and is subject to certain labeling requirements under the Federal Hazardous Substances Act. These requirements differ from the classification criteria and hazard information required for safety data sheets (SDS). The product label also includes other important information, including directions for use, and should always be read in its entirety prior to using the product.

16. OTHER INFORMATION

Revision Date:	02/22/2023	**Previous revision:**	05/20/2020
Preparer Name:	W.M. Barr EHS Department	(901)775-0100	

Additional Information About This Product:

Company Policy or Disclaimer:

The information contained herein is presented in good faith and believed to be accurate as of the effective date shown above. This information is furnished without warranty of any kind. Employers should use this information only as a supplement to other information gathered by them and must make independent determination of suitability and completeness of information from all sources to assure proper use of these materials and the safety and health of employees. Any use of this data and information must be determined by the user to be in accordance with applicable federal, state and local laws and regulations.

Safety Data Sheet

Revision Number: 001.3

Issue date: 12/05/2018

1. PRODUCT AND COMPANY IDENTIFICATION

Product name: **Loctite Super Glue Liquid Control**
Product type: Cyanoacrylate
Restriction of Use: None identified
Company address:
Henkel Corporation
One Henkel Way
Rocky Hill, Connecticut 06067

IDH number: 2051840

Region: United States
Contact information:
Telephone: +1 (860) 571-5100
MEDICAL EMERGENCY Phone: Poison Control Center
1-877-671-4608 (toll free) or 1-303-592-1711
TRANSPORT EMERGENCY Phone: CHEMTREC
1-800-424-9300 (toll free) or 1-703-527-3887
Internet: www.henkelna.com

2. HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW	
WARNING:	BONDS SKIN IN SECONDS. COMBUSTIBLE LIQUID. CAUSES EYE IRRITATION. MAY CAUSE RESPIRATORY IRRITATION.

HAZARD CLASS	HAZARD CATEGORY
FLAMMABLE LIQUID	4
EYE IRRITATION	2B
SPECIFIC TARGET ORGAN TOXICITY - SINGLE EXPOSURE	3

PICTOGRAM(S)



Precautionary Statements

Prevention:

Keep away from heat, sparks, open flames, hot surfaces - no smoking. Avoid breathing vapors, mist, or spray. Wash affected area thoroughly after handling. Use only outdoors or in a well-ventilated area. Wear protective gloves, eye protection, and face protection.

Response:

IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing. Call a POISON CENTER or physician if you feel unwell. IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If eye irritation persists: Get medical attention. In case of fire: Use foam, dry chemical or carbon dioxide to extinguish.

Storage:

Store in a well-ventilated place. Keep container tightly closed. Store in a well-ventilated place. Keep cool. Store locked up.

Disposal:

Dispose of contents and/or container according to Federal, State/Provincial and local governmental regulations.

Classification complies with OSHA Hazard Communication Standard (29 CFR 1910.1200) and is consistent with the provisions of the United Nations Globally Harmonized System of Classification and Labeling of Chemicals (GHS).

See Section 11 for additional toxicological information.

3. COMPOSITION / INFORMATION ON INGREDIENTS

Hazardous Component(s)	CAS Number	Percentage*
Ethyl 2-cyanoacrylate	7085-85-0	80 - 90

* Exact percentages may vary or are trade secret. Concentration range is provided to assist users in providing appropriate protections.

4. FIRST AID MEASURES

Inhalation: Move to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.

Skin contact: Do not pull bonded skin apart. Soak in warm soapy water. Gently peel apart using a blunt instrument. If skin is burned due to the rapid generation of heat by a large drop, seek medical attention. If lips are bonded, apply warm water to the lips and encourage wetting and pressure from saliva in mouth. Peel or roll lips apart. Do not pull lips apart with direct opposing force.

Eye contact: Immediately flush with plenty of water for at least 15 minutes. Get medical attention. If eyelids are bonded closed, release eyelashes with warm water by covering with a wet pad. Do not force eye open. Cyanoacrylate will bond to eye protein and will cause a lachrymatory effect which will help to debond the adhesive. Keep eye covered until debonding is complete, usually within 1-3 days. Medical attention should be sought in case solid particles of polymerized cyanoacrylate trapped behind the eyelid caused abrasive damage.

Ingestion: Ensure breathing passages are not obstructed. The product will polymerize rapidly and bond to the mouth making it almost impossible to swallow. Saliva will separate any solidified product in several hours. Prevent the patient from swallowing any separated mass.

Symptoms: See Section 11.

5. FIRE FIGHTING MEASURES

Extinguishing media: Water spray (fog), foam, dry chemical or carbon dioxide.

Special firefighting procedures: Wear a self-contained breathing apparatus with a full face piece operated in pressure-demand or other positive pressure mode.

Unusual fire or explosion hazards: None

Hazardous combustion products: Trace amounts of toxic and/or irritating fumes may be released and the use of breathing apparatus is recommended.

6. ACCIDENTAL RELEASE MEASURES

Use personal protection recommended in Section 8, isolate the hazard area and deny entry to unnecessary and unprotected personnel.

Environmental precautions: Ventilate area. Do not allow product to enter sewer or waterways.

Clean-up methods: Do not use cloths for mopping up. Flood with water to complete polymerization and scrape off the floor. Cured material can be disposed of as non-hazardous waste. Refer to Section 8 "Exposure Controls / Personal Protection" prior to clean up.

7. HANDLING AND STORAGE

Handling: Prevent contact with eyes, skin and clothing. Do not breathe vapor and mist. Wash thoroughly after handling. Avoid contact with fabric or paper goods. Contact with these materials may cause rapid polymerization which can generate smoke and strong irritating vapors, and cause thermal burns.

Storage: For safe storage, store between -20 °C (-4°F) and 50 °C (122°F)
Keep in a cool, well ventilated area away from heat, sparks and open flame.
Keep container tightly closed until ready for use.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

Employers should complete an assessment of all workplaces to determine the need for, and selection of, proper exposure controls and protective equipment for each task performed.

Hazardous Component(s)	ACGIH TLV	OSHA PEL	AIHA WEEL	OTHER
Ethyl 2-cyanoacrylate	1 ppm STEL 0.2 ppm TWA (Respiratory sensitization) (Dermal sensitization)	None	None	None

Engineering controls: Use positive down-draft exhaust ventilation if general ventilation is insufficient to maintain vapor concentration below established exposure limits.

Respiratory protection: Use a NIOSH approved air-purifying respirator with an organic vapor cartridge.

Eye/face protection: Safety goggles or safety glasses with side shields. Full face protection should be used if the potential for splashing or spraying of product exists.

Skin protection: Use nitrile gloves and aprons as necessary to prevent contact. Do not use PVC, nylon or cotton.

9. PHYSICAL AND CHEMICAL PROPERTIES

Physical state: Liquid, transparent
Color: Colorless, Straw
Odor: Irritating
Odor threshold: Not available.
pH: Not available.
Vapor pressure: Not available.
Boiling point/range: Not available.
Melting point/ range: Not available.
Vapor density: Not available.
Flash point: 80 - 93 °C (176°F - 199.4 °F)
Flammable/Explosive limits - lower: Not available.
Flammable/Explosive limits - upper: Not available.
Autoignition temperature: Not available.
Flammability: Not applicable
Evaporation rate: Not available.
Solubility in water: Not available.
Partition coefficient (n-octanol/water): Not available.
VOC content: < 2 %; < 20 g/l (California SCAQMD Method 316B) (Estimated)
Viscosity: Not available.
Decomposition temperature: Not available.

10. STABILITY AND REACTIVITY

Stability: Stable under recommended storage conditions.

Hazardous reactions: Rapid exothermic polymerization will occur in the presence of water, amines, alkalis and alcohols.

Hazardous decomposition products: None

Incompatible materials: Water, amines, alkalis and alcohols.

Reactivity: Not available.

Conditions to avoid: Spontaneous polymerization.

11. TOXICOLOGICAL INFORMATION

Relevant routes of exposure: Skin, Inhalation, Eyes

Potential Health Effects/Symptoms

Inhalation: May cause respiratory tract irritation. Exposure to vapors above the established exposure limit results in respiratory irritation, which may lead to difficulty in breathing and tightness in the chest.

Skin contact: May cause skin irritation. Bonds skin in seconds. Cyanoacrylates generate heat on solidification. In rare circumstances a large drop will burn the skin. Cured adhesive does not present a health hazard even if bonded to the skin. Cyanoacrylates have been reported to cause allergic reaction but due to rapid polymerization at the skin surface, an allergic response is rare.

Eye contact: Irritating to eyes. Causes excessive tearing. Eyelids may bond.

Ingestion: Not expected to be harmful by ingestion. Rapidly polymerizes (solidifies) and bonds in mouth. It is almost impossible to swallow.

Hazardous Component(s)	LD50s and LC50s	Immediate and Delayed Health Effects
Ethyl 2-cyanoacrylate	None	Irritant, Allergen, Respiratory

Hazardous Component(s)	NTP Carcinogen	IARC Carcinogen	OSHA Carcinogen (Specifically Regulated)
Ethyl 2-cyanoacrylate	No	No	No

12. ECOLOGICAL INFORMATION

Ecological information: Not available.

13. DISPOSAL CONSIDERATIONS

Information provided is for unused product only.

Recommended method of disposal: Follow all local, state, federal and provincial regulations for disposal.

Hazardous waste number: Not a RCRA hazardous waste.

14. TRANSPORT INFORMATION

The transport information provided in this section only applies to the material/formulation itself, and is not specific to any package/configuration.

U.S. Department of Transportation Ground (49 CFR)

Proper shipping name:	Combustible liquid, n.o.s. (Cyanoacrylate ester)
Hazard class or division:	Combustible Liquid
Identification number:	NA 1993
Packing group:	III
Exceptions:	(Not more than 450 Liters), Unrestricted

International Air Transportation (ICAO/IATA)

Proper shipping name:	Aviation regulated liquid, n.o.s. (Cyanoacrylate ester)
Hazard class or division:	9
Identification number:	UN 3334
Packing group:	III
Exceptions:	Primary packs containing less than 500ml are unregulated by this mode of transport and may be shipped unrestricted.

Water Transportation (IMO/IMDG)

Proper shipping name:	Not regulated
Hazard class or division:	None
Identification number:	None
Packing group:	None

15. REGULATORY INFORMATION

United States Regulatory Information

TSCA 8 (b) Inventory Status:	All components are listed or are exempt from listing on the Toxic Substances Control Act Inventory.
TSCA 12 (b) Export Notification:	None above reporting de minimis
CERCLA/SARA Section 302 EHS:	None above reporting de minimis.
CERCLA/SARA Section 311/312:	Immediate Health, Delayed Health, Fire, Reactive
CERCLA/SARA Section 313:	None above reporting de minimis.
California Proposition 65:	No California Proposition 65 listed chemicals are known to be present.

Canada Regulatory Information

CEPA DSL/NDSL Status:	Contains one or more components listed on the Non-Domestic Substances List. All other components are listed on or are exempt from listing on the Domestic Substances List. Components listed on the NDSL must be tracked by all Canadian Importers of Record as required by Environment Canada. They may be imported into Canada in limited quantities. Please contact Regulatory Affairs for additional details.

16. OTHER INFORMATION

This safety data sheet contains changes from the previous version in sections: New Safety Data Sheet format.

Prepared by: Product Safety and Regulatory Affairs

Issue date: 12/05/2018

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GHS SAFETY DATA SHEET (SDS)

SECTION 1 – PRODUCT AND COMPANY IDENTIFICATION

PRODUCT NAME: PART #69 - MEKP Hardener

FIBRE GLAST DEVELOPMENTS CORP.
385 Carr Drive
BROOKVILLE, OH 45309

TELEPHONE: (937) 833-5200
FAX: (937) 833-6555
FOR CHEMICAL EMERGENCY
CALL (801) 629-0667 24 HRS.

RECOMMENDED USE: Initiator/catalyst

SECTION 2 – HAZARDS IDENTIFICATION

Emergency Overview

Color: colourless
Physical state: liquid
Form: oily
Odor: sweet

***Classification of the substance or mixture:**
Organic peroxides, Type D, H242 Inhalation:
Acute toxicity, Category 4, H332 Skin
corrosion, Category 1B, H314
Serious eye damage, Category 1, H318
Reproductive toxicity, Category 2, H361
Chronic aquatic toxicity, Category 2, H411

*For the full text of the H-Statements mentioned in this Section, see Section 16

GHS-Labelling

Hazard pictograms:

Signal word: **Danger Hazard**

statements:
H242 : Heating may cause a fire.
H314 : Causes severe skin burns and eye damage. H332

: Harmful if inhaled.
H361 : Suspected of damaging fertility or the unborn child. H411 :
Toxic to aquatic life with long lasting effects.

Supplemental Hazard Statements:
Organic peroxide.
Hazardous decomposition may occur.



Precautionary statements:

Prevention:
P201 : Obtain special instructions before use.
P202 : Do not handle until all safety precautions have been read and understood.
P210 : Keep away from heat/sparks/open flames/hot surfaces. No smoking.
P220 : Keep/Store away from clothing/ combustible materials.
P234 : Keep only in original container.
P261 : Avoid breathing dust/ fume/ gas/ mist/ vapours/ spray.
P264 : Wash skin thoroughly after handling.
P271 : Use only outdoors or in a well-ventilated area.
P273 : Avoid release to the environment.
P280 : Wear protective gloves and protective clothing and eye protection and face protection.
P281 : Use personal protective equipment as required.

Response:
P301 + P330 + P331 : IF SWALLOWED: Rinse mouth. Do NOT induce vomiting.
P303 + P361 + P353 : IF ON SKIN (or hair): Remove/ Take off immediately all contaminated clothing. Rinse skin with water/ shower.
P304 + P340 : IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing. P305 + P351 + P338 : IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P308 + P313 : IF exposed or concerned: Get medical advice/ attention. P310 : Immediately call a POISON CENTER/doctor.
P363 : Wash contaminated clothing before reuse. P391 : Collect spillage.

Storage:
P405 : Store locked up. P410 : Protect from sunlight.
P411 + P235 : Maximum storage temperature is specified on label and in section 7 of SDS. Keep cool.
P420 : Store away from other materials.

Disposal:
P501 : Dispose of contents or container to an approved waste disposal plant.

Supplemental information:

Potential Health Effects:
If swallowed, may cause severe irritation and injury to the mouth, throat and digestive tract.

SECTION 3 – COMPOSITION/INFORMATION ON INGREDITENTS

Chemical Name	CAS-No.	Wt/Wt	GHS Classification**
Propanoic acid, 2-methyl-, 2,2-dimethyl-1-(1-methylethyl)-1,3-propanediyl ester	6846-50-0	>= 57 - < 59 %	H361, H411
2-Butanone, peroxide	1338-23-4	>= 32 - < 34 %	H242, H302, H332, H314, H318
2,4-Pentanediol, 2-methyl-	107-41-5	>= 5.5 - < 6.5 %	H319
2-Butanone	78-93-3	>= 1 - < 2 %	H225, H319, H336

**For the full text of the H-Statements mentioned in this Section, see Section 16.

SECTION 4 – FIRST AID MEASURES

4.1. Description of necessary first-aid measures:

Inhalation:
If inhaled, remove to fresh air and keep at rest in a position comfortable for breathing. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.

Skin:
In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Get medical attention immediately. Wash clothing before reuse. Thoroughly clean shoes before reuse.

Eyes:
In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Get medical attention immediately.

Ingestion:
If swallowed, DO NOT induce vomiting. Get medical attention immediately. If victim is fully conscious, give a cupful of water. Never give anything by mouth to an unconscious person.

4.2 Most important symptoms/effects, acute and delayed:

For most important symptoms and effects (acute and delayed), see Section 2 (Hazard Statements and Supplemental Information if applicable) and Section 11 (Toxicology Information) of this SDS.

4.3 Indication of immediate medical attention and special treatment needed, if necessary:

Unless otherwise noted in Notes to Physician, no specific treatment noted; treat symptomatically

SECTION 5 – FIRE FIGHTING MEASURES

Extinguishing media (suitable):
Water spray, Carbon dioxide (CO2), Foam, Dry chemical

Protective equipment:
Fire fighters and others who may be exposed to products of combustion should wear full firefighting turn out gear (full Bunker Gear) and self-contained breathing apparatus (pressure demand / NIOSH approved or equivalent).

Further firefighting advice:
Fight fire with large amounts of water from a safe distance. Cool closed containers exposed to fire with water spray.
Closed containers of this material may explode when subjected to heat from surrounding fire. After a fire, wait until the material has cooled to room temperature before initiating clean-up activities. Do not allow run-off from firefighting to enter drains or water courses.
Firefighting equipment should be thoroughly decontaminated after use.

Fire and explosion hazards:
Contact with incompatible materials or exposure to temperatures exceeding the SADT may result in a self-accelerating decomposition reaction with release of flammable vapors which may auto ignite.
When burned, the following hazardous products of combustion can occur: Carbon oxides
Hazardous organic compounds

SECTION 6 – ACCIDENTAL RELEASE MEASURES

Personal precautions, Emergency procedures, Methods and materials for containment/clean-up:
Prevent further leakage or spillage if you can do so without risk. Evacuate area of all unnecessary personnel. Ventilate the area. Eliminate all ignition sources. Avoid generation of vapors. Contain and collect spillage with non- combustible absorbent material such as clean sand, earth, diatomaceous earth or non-acidic clay and place into suitable properly labeled containers for prompt disposal. DO NOT USE peat moss. DO NOT USE vermiculite.
Sweep or scoop up using non-sparking tools and place into suitable properly labeled containers for prompt disposal. The sweepings should be wetted down further with water. Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers. Consult a regulatory specialist to determine appropriate state or local reporting requirements, for assistance in waste characterization and/or hazardous waste disposal and other requirements listed in pertinent environmental permits. Add inhibitor to prevent polymerization.

Protective equipment:
Appropriate personal protective equipment is set forth in Section 8.

SECTION 7 – HANDLING AND STORAGE

Handling

General information on handling:
Contact with materials to avoid or exposure to temperatures exceeding the SADT may result in a self-accelerating decomposition reaction with release of flammable vapors which may autoignite.
Do not taste or swallow.

Do not get in eyes, on skin, or on clothing.
Do not breathe vapor or mist.
Keep away from heat, sparks and flames.
No smoking.
Use only with adequate ventilation.
Wash thoroughly after handling.
Prevent product contamination.
Keep container tightly closed and away from combustible materials.
Keep only in the original container.
Do not reuse container as it may retain hazardous product residue.
Emptied container retains vapor and product residue.
Container hazardous when empty.
Improper disposal or reuse of this container may be dangerous and/or illegal.

General information on storage conditions:
Store in well-ventilated area away from heat and sources of ignition such as flame, sparks and static electricity. Store in closed containers, in a secure area to prevent container damage and subsequent spillage. Segregated or detached storage is preferred. Store out of direct sunlight in a cool well-ventilated place. Store in original container. Store away from combustibles and materials to avoid. Refer also to National Fire Protection Association (NFPA) Code 400, Hazardous Materials Code.

Storage stability – Remarks:
Follow the recommended storage temperatures provided in this Section in order to maintain stability and oxygen content.

Storage incompatibility – General:
Store away from excessive heat, sources of ignition,
and reactive materials. Store separate from:
Strong acids
Strong bases
Strong oxidizing agents
Reducing agents Accelerators
Friedel – Crafts reaction catalyst
Transition metal salts
Metal ions
Brass
Copper
Iron

For all Organic Peroxides, compatible materials of contact are stainless steel 304 or 316 (preferred), high-density polyethylene (HDPE), polytetrafluoroethylene or glass linings

Temperature tolerance – Do not store below:
50 °F (10 °C)

Temperature tolerance – Do not store above:
100 °F (38 °C)

SECTION 8 – EXPOSURE CONTROLS / PERSONAL PROTECTION

Airborne Exposure Guidelines:

2-Butanone, peroxide (1338-23-4)

US. ACGIH Threshold Limit Values

Ceiling Limit Value	0.2 ppm

2,4-Pentanediol, 2-methyl- (107-41-5)

US. ACGIH Threshold Limit Values

Form:	Aerosol, inhalable.
Short Term Exposure Limit (STEL):	10 mg/m3 Form:
Vapor fraction	
Short Term Exposure Limit (STEL):	50 ppm Form:
Vapor fraction	
Time weighted average	25 ppm

2-Butanone (78-93-3)

US. ACGIH Threshold Limit Values

Time weighted average	200 ppm
Short Term Exposure Limit (STEL):	300 ppm

US. OSHA Table Z-1 Limits for Air Contaminants (29 CFR 1910.1000) PEL: 200 ppm (590 mg/m3)

Only those components with exposure limits are printed in this section. Limits with skin contact designation above have skin contact effect. Air sampling alone is insufficient to accurately quantitate exposure. Measures to prevent significant cutaneous absorption may be required. Limits with a sensitizer designation above mean that exposure to this material may cause allergic reactions.

Engineering controls:
Investigate engineering techniques to reduce exposures below airborne exposure limits or to otherwise reduce exposures. Provide ventilation if necessary to minimize exposures or to control exposure levels to below airborne exposure limits (if applicable see above). If practical, use local mechanical exhaust ventilation at sources of air contamination such as open process equipment

Consult ACGIH ventilation manual or NFPA Standard 91 for design of exhaust systems

Respiratory protection:
Do not breathe vapor or mist. Where airborne exposure is likely or airborne exposure limits are exceeded (if applicable, see above), use NIOSH approved respiratory protection equipment appropriate to the material and/or its components. Full facepiece equipment is recommended and, if used, replaces need for face shield and/or chemical goggles. Consult respirator manufacturer to determine appropriate type equipment for a given application. Observe respirator use limitations specified by NIOSH or the manufacturer. For emergency and other conditions where there may be a potential for significant exposure or where exposure limit may be significantly exceeded, use an approved full face positive-pressure, self-contained breathing apparatus or positive-pressure airline with auxiliary self-contained air supply. Respiratory protection programs must comply with 29 CFR § 1910.134.

Skin protection:
Wear appropriate chemical resistant protective clothing and chemical resistant gloves to prevent skin contact. Consult glove manufacturer to determine appropriate type glove material for given application. Wear chemical goggles, a face shield, and chemical resistant clothing such as a rubber apron when splashing may occur.
Rinse immediately if skin is contaminated. Remove contaminated clothing immediately and wash before reuse. Clean protective equipment before reuse. Provide a safety shower at any location where skin contact can occur. Wash thoroughly after handling.

Eye protection:
Where there is potential for eye contact, wear a face shield, chemical goggles, and have eye flushing equipment immediately available.

SECTION 9 – PHYSICAL AND CHEMICAL PROPERTIES

Color:	colourless
Physical state:	liquid
Form:	oily
Odor:	sweet
Odor threshold:	No data available

Flash point	203 °F (95 °C) (Setaflash closed cup

Auto-ignition temperature:

No data available.

Lower flammable limit (LFL):

No data available

Upper flammable limit (UFL):

No data available

pH:	No data available
Density:	1.0077 g/cm3 (68 °F (20 °C))

Specific Gravity (Relative density):

1.0088 (68 °F(20 °C))Water=1 (liquid)

Vapor pressure:	5.20 mmHg (66 °F (19 °C))

Boiling point/boiling range:

Decomposes before boiling. Rate of decomposition increases with rising temperature.

Melting point/range:	No data available.
Freezing point:	No data available
Evaporation rate:	No data available
Solubility in water:	slightly soluble
Refractive index:	1.4356
Viscosity, dynamic:	17.30 mPa.s 68 °F (20 °C)

Oil/water partition coefficient:

No data available.

Self-Accelerating Decomposition Temperature (SADT):

167 °F (75 °C) 45 pound container

Thermal decomposition:	Decomposes on heating.
Active oxygen content:	8.7 - 9.0 %
Flammability:	See GHS Classification in Section 2 if applicable

SECTION 10 – STABILITY AND REACTIVITY

Stability:
This material is chemically unstable and should only be handled under specified conditions. See HANDLING AND STORAGE section of this MSDS for specified conditions.

Hazardous reactions:
Hazardous polymerization does not occur.

Materials to avoid:
Strong acids
Strong bases
Strong oxidizing agents
Reducing agents Accelerators
Friedel – Crafts reaction catalyst
Transition metal salts
Metal ions
Brass
Copper
Iron
For all Organic Peroxides, compatible materials of contact are stainless steel 304 or 316 (preferred), high-density polyethylene (HDPE), polytetrafluoroethylene or glass linings

Conditions / hazards to avoid:
SADT - Self Accelerating Decomposition Temperature. Lowest temperature at which the tested package size will undergo a self-accelerating decomposition reaction. This reaction will generate flammable vapors which may autoignite. The length of time to generate a decomposition reaction, after the SADT has been reached or exceeded, is dependent upon how much the SADT has been exceeded and the length of time needed for the reaction exotherm (heat spike from increasing decomposition rate) to initiate a rapid decomposition reaction.
Typically, SADT is inversely proportional to package size. Larger packages will have a lower SADT due to smaller ratio to heat transfer area to volume of product. See HANDLING AND STORAGE section of this MSDS for specified conditions.
See Hazardous Decomposition Products below.

Hazardous decomposition products:

Temperatures at or above SADT can result in the release of hazardous decomposition products which are flammable and may autoignite.
Thermal decomposition giving flammable and toxic products : Carbon oxides
Hazardous organic compounds

SECTION 11 – TOXICOLOGY INFORMATION

Data on this material and/or its components are summarized below.

Data for LUPEROX® DDM-9 Acute

toxicity

Oral:
Acute toxicity estimate 3,039 mg/kg.

Dermal:
Acute toxicity estimate > 5,000 mg/kg.

Inhalation:
4 h Acute toxicity estimate 4.55 mg/l. (dust/mist)

Data for Propanoic acid, 2-methyl-, 2,2-dimethyl-1-(1-methylethyl)-1,3-propanediyl ester (6846-50-0)

Acute toxicity

Oral:
No deaths occurred. (rat) LD0 > 2,000 mg/kg.

Dermal:
No deaths occurred. (rabbit) LD0 > 2,000 mg/kg.

Inhalation:
No deaths occurred. (rat) 6 h LC0 > 5.3 mg/l. (saturated vapor)

Skin Irritation:
Not irritating. (rabbit) (4 h)

Eye Irritation:
Not irritating. (rabbit)

Skin Sensitization:
Not a sensitizer. Repeated skin exposure. (guinea pig) No skin allergy or irritation was observed.

Repeated dose toxicity
Sub chronic dietary administration to rat / affected organ(s): kidney / signs: hyaline droplet nephropathy / (not considered relevant in humans)

Subchronic dietary administration to Dog / No adverse systemic effects reported.

Genotoxicity

Assessment in Vitro:
No genetic changes were observed in laboratory tests using: bacteria, animal cells

Developmental toxicity
Reproductive/Developmental Effects Screening Assay. dietary (rat) / Birth defects were observed.

Reproductive effects
Reproductive/Developmental Effects Screening Assay. dietary (rat) / At high dose : levels produced toxic effects in the mothers and offspring

Human experience Skin contact:
No skin allergy was observed.. (studied using human volunteers)

Data for 2-Butanone, peroxide (1338-23-4)

Acute toxicity

Oral:
Harmful if swallowed. (rat) LD50 = 1,017 mg/kg. (35 - 39 %) (In solution in Dimethyl phthalate)

Dermal:
May be harmful in contact with skin. (rabbit) LD50 = 4,000 mg/kg. (35 - 39 %) (In solution in Dimethyl phthalate)

Inhalation:
Harmful if inhaled. (rat) 4 h LC50 = 1.5 mg/l. (40 %) (dust/mist, data for a similar material)

Skin Irritation:
Causes severe skin burns. (rabbit) (4 h) (33 %) (occluded exposure, In solution in Dimethyl phthalate)

Eye Irritation:
Causes serious eye damage. (rabbit) (33 - 39 %) (In solution in Dimethyl phthalate)

Skin Sensitization:

Not a sensitizer. Guinea pig maximization test. No skin allergy was observed. (40 %) (In solution in Dimethyl phthalate)

Repeated dose toxicity
Repeated oral administration to rat / affected organ(s): Stomach, liver / signs: Irritation of the gastric mucosa, increased organ weight

Subchronic oral administration to rat / No adverse systemic effects reported.

Genotoxicity

Assessment in Vitro:
No genetic changes were observed in laboratory tests using: bacteria, animal cells

Genotoxicity

Assessment in Vivo:
No genetic changes were observed in laboratory tests using: mice

Developmental toxicity
Exposure during pregnancy. Oral (rat) / No birth defects were observed.

Reproductive effects
Reproductive/Developmental Effects Screening Assay. Oral (rat) / No toxicity to reproduction.

Human experience Skin contact:
No skin allergy was observed. (studied using human volunteers)

Skin allergy was observed. Isolated case reports after exposure to a mixture containing this substance.

Human experience Eye contact:
Eyes: Pain, tearing, sensitivity to light, irritation. Mist and/or vapor are reported to cause irritation when proper industrial hygiene controls/procedures are not used. (based on reports of occupational exposure to workers) (severity of effects depends on extent of exposure)

Eyes: Pain, causes severe burns. (accidental exposure to concentrated solutions) (based on reports of occupational exposure to workers) (severity of effects depends on extent of exposure)

Human experience Ingestion:
Esophagus: Severe irritation, burns. (accidental exposure to concentrated solutions)

Data for 2,4-Pentanediol, 2-methyl- (107-41-5) Acute

toxicity

Oral:
No deaths occurred. (rat) LD0 > 2,000 mg/kg. signs: GI tract irritation, central nervous system depression

Dermal:
No deaths occurred. (rat) LD0 > 2,000 mg/kg.

Inhalation:
No deaths occurred. (rat) 8 h LC0 = 0.34 mg/l. (saturated vapor)

Skin Irritation:
Practically non-irritating. (rabbit) (4 h)

Eye Irritation:
Causes serious eye irritation.

Skin Sensitization:
Not a sensitizer. Guinea pig maximization test. No skin allergy was observed.

Repeated dose toxicity
Subchronic oral administration to rat / affected organ(s): kidney, liver, Stomach / signs: Irritation of the gastric mucosa / No significant impairment of function.

Repeated inhalation administration to rat / affected organ(s): upper respiratory tract / Local irritation (Aerosol)

Genotoxicity

Assessment in Vitro:
No genetic changes were observed in laboratory tests using: bacteria, animal cells

Developmental toxicity
Exposure during pregnancy. Oral (rat) / No birth defects were observed. (delays in development, at doses that produce effects in mothers)

Reproductive effects
Reproductive/Developmental Effects Screening Assay. Oral (rat) / No toxicity to reproduction. At high dose : Effects on offspring / (increased mortality in the offspring, decreased growth rate)

Human experience Inhalation:
Discomfort. (severity of effects depends on extent of exposure) (studied using human volunteers)

Human experience Skin contact:
No skin allergy was observed.. (studied using human volunteers) Local irritation, redness, swelling. (subjects with dermatitis or eczema)
Central nervous system depression. (severity of effects depends on extent of exposure)

Human experience Eye contact:
Discomfort, slightly irritating. (liquid or aerosol) (studied using human volunteers) (severity of effects depends on extent of exposure)

Data for 2-Butanone (78-93-3)

Acute toxicity

Oral:
May be harmful if swallowed. (rat) LD50 = 2,193 mg/kg.

Dermal:
Practically nontoxic. (rabbit) LD50 > 8,100 mg/kg.

Inhalation:
Practically nontoxic. (rat) 4 h LC50 = 34.5 mg/l. (vapor)

Specific target organ toxicity - single exposure:
May cause drowsiness or dizziness.

Skin Irritation:
Not irritating. (rabbit) (4 h)

Eye Irritation:
Causes serious eye irritation. (rabbit)

Skin Sensitization:
Not a sensitizer. Buehler method. (guinea pig) No skin allergy was observed.

Repeated dose toxicity
Subchronic inhalation administration to rat / affected organ(s): liver / signs: blood chemistry changes, changes in organ weights

Genotoxicity

Assessment in Vitro:
No genetic changes were observed in laboratory tests using: bacteria, animal cells, yeast

Genotoxicity

Assessment in Vivo:

No genetic changes were observed in laboratory tests using: mice

Developmental toxicity
Exposure during pregnancy. inhalation (mouse) / No birth defects were observed. (skeletal variations, delays in development)
Exposure during pregnancy. inhalation (rat) / No birth defects were observed. (delays in development, at doses that produce effects in mothers)

Reproductive effects
Reproduction test. drinking water (rat) / No toxicity to reproduction / (similar material)

Human experience Inhalation:
Upper respiratory tract: irritation. (vapor)

Central nervous system: drowsiness, dizziness. Exposure to other materials makes the association questionable. (based on reports of occupational exposure to workers)

Nervous system: altered reflexes, changes in motor activity. Exposure to other materials makes the association questionable. (based on reports of occupational exposure to workers)

Human experience Skin contact:
Skin: No skin allergy was observed.. (studied using human volunteers)

Skin: dermatitis, cracking. Has a degreasing effect on the skin. (repeated or prolonged exposure)

Human experience Eye contact:
Eyes: irritating. (vapor)

SECTION 12 – ECOLOGICAL INFORMATION

Chemical Fate and Pathway
Data on this material and/or its components are summarized below.

Data for Propanoic acid, 2-methyl-, 2,2-dimethyl-1-(1-methylethyl)-1,3-propanediyl ester (6846-50-0)

Biodegradation:
Not readily biodegradable. (aerobic, 28 d) biodegradation 71 % / The 10 day time window criterion is not fulfilled.

Bioaccumulation:
= 195 (Lepomis macrochirus (Bluegill sunfish))

Octanol Water Partition Coefficient:
log Pow: = 4.04 - 4.91(Method: calculated)
Data for 2-Butanone, peroxide (1338-23-4) Biodegradation:
Readily biodegradable. (28 d) biodegradation 87 % / OECD guideline 301D (Closed bottle test)

Octanol Water Partition Coefficient:
log Pow: < 2.04, at 77 °F (25 °C) (Method: OECD Test Guideline 117)
Data for 2,4-Pentanediol, 2-methyl- (107-41-5) Biodegradation:
Readily biodegradable. (28 d) biodegradation 81 % / OECD Test Guideline 301 F

Octanol Water Partition Coefficient:
log Pow: = -0.14(Method: calculated)

Data for 2-Butanone (78-93-3) Biodegradation:
Readily biodegradable. (28 d) biodegradation 98 % / OECD Test Guideline 301 D

Ecotoxicology
Data on this material and/or its components are summarized below.
Data for Propanoic acid, 2-methyl-, 2,2-dimethyl-1-(1-methylethyl)-1,3-propanediyl ester (6846-50-0)

Aquatic toxicity data:
No effect up to the limit of solubility. Lepomis macrochirus (Bluegill sunfish) 96 h NOEC > 6 mg/l

Aquatic invertebrates:
No effect up to the limit of solubility. Daphnia magna (Water flea) 48 h EC50 > 1.46 mg/l

Algae:
No effect up to the limit of solubility. Pseudokirchneriella subcapitata (green algae) 72 h EC50 (growth rate) > 7.49 mg/l

Chronic toxicity to aquatic invertebrates:
Toxic. Daphnia magna (Water flea) 21 d NOEC (reproduction) = 0.7 mg/l

Data for 2-Butanone, peroxide (1338-23-4) Aquatic toxicity data:

Harmful. Poecilia reticulata (guppy) 96 h LC50 = 44.2 mg/l (In solution in Dimethyl phthalate)

Aquatic invertebrates:
Harmful. Daphnia (water flea) 48 h EC50 = 39 mg/l (In solution in Dimethyl phthalate)

Algae:
Toxic. Pseudokirchneriella subcapitata (green algae) 72 h ErC50 = 5.6 mg/l (In solution in Dimethyl phthalate)

Microorganisms:
Respiration inhibition / Activated sludge 30 min EC50 = 48 mg/l (In solution in Dimethyl phthalate)

Chronic toxicity to aquatic plants:
Pseudokirchneriella subcapitata (green algae) 72 h ErC10 2.1 mg/l

Data for 2-Butanone (78-93-3) Aquatic toxicity data:

Practically nontoxic. Pimephales promelas (fathead minnow) 96 h LC50 = 2,993 mg/l

Aquatic invertebrates:
Practically nontoxic. Daphnia magna (Water flea) 48 h EC50 = 308 mg/l

Algae:
Practically nontoxic. Pseudokirchneriella subcapitata (green algae) 72 h EC50 = 1,972 mg/l

Microorganisms:
Pseudomonas putida 16 h Toxicity threshold = 1,150 mg/l

Chronic toxicity to aquatic plants:
Practically nontoxic. Pseudokirchneriella subcapitata (green algae) 96 h ErC10 = 1289 mg/l

SECTION 13 – DISPOSAL CONSIDERATIONS

Waste disposal:
Dilution followed by incineration is the preferred method. Dilution ratio of 10:1 in a clean, compatible, combustible solvent (i.e., Fuel Oil #2, mineral oil) will reduce reactivity hazard during incineration and transportation. Dispose of in accordance with federal, state and local regulations. Consult a regulatory specialist to determine appropriate state or local reporting requirements, for assistance in waste characterization and/or hazardous waste disposal and other requirements listed in pertinent environmental permits. Note: Chemical additions to, processing of, or otherwise altering this material may make this waste management information incomplete, inaccurate, or otherwise inappropriate. Furthermore, state and local waste disposal requirements may be more restrictive or otherwise different from federal laws and regulations.

Take appropriate measures to prevent release to the environment.

SECTION 14 – TRANSPORT INFORMATION

US Department of Transportation (DOT)

UN Number	:	3105
Proper shipping name	:	Organic peroxide type D, liquid
Technical name	:	(Methyl ethyl ketone peroxide(s), <= 45%)
Class	:	5.2
Marine pollutant	:	yes
Reportable quantity	:	10 lbs (Methyl ethyl ketone peroxide(s))

International Maritime Dangerous Goods Code (IMDG)

UN Number	:	3105
Proper shipping name	:	ORGANIC PEROXIDE TYPE D, LIQUID
Technical name	:	(METHYL ETHYL KETONE PEROXIDE, <= 45%)
Class	:	5.2
Marine pollutant	:	yes
Flash point	:	203 °F (95 °C) Setaflash closed cup

SECTION 15 - REGULATORY INFORMATION

Chemical Inventory Status

United States TSCA Inventory	TSCA	The components of this product are all on the TSCA Inventory.
Canadian Domestic Substances List (DSL)	DSL	All components of this product are on the Canadian DSL

China. Inventory of Existing Chemical Substances in China (IECSC)

IECSC (CN) Conforms to

Japan. ENCS - Existing and New Chemical Substances Inventory

ENCS (JP) Conforms to

Japan. ISHL - Inventory of Chemical Substances	ISHL (JP)	Conforms to
Korea. Korean Existing Chemicals Inventory (KECI)	KECI (KR)	Conforms to

Philippines Inventory of Chemicals and Chemical Substances (PICCS)

PICCS (PH) Conforms to

Australia Inventory of Chemical Substances (AICS) AICS Conforms to

United States – Federal Regulations

SARA Title III – Section 302 Extremely Hazardous Chemicals:

Chemical name	CAS-No.	SARA Reportable Quantities	SARA Threshold Planning Quantity
Hydrogen peroxide	7722-84-1	1000 lbs	1000 lbs

SARA Title III - Section 311/312 Hazard Categories:
Acute Health Hazard, Reactivity Hazard, Chronic Health Hazard

SARA Title III – Section 313 Toxic Chemicals:
This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.

Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) - Reportable Quantity (RQ):

Chemical name	CAS-No.	Reportable quantity
2-Butanone, peroxide	1338-23-4	10 lbs
2-Butanone	78-93-3	5000 lbs

United States – State Regulations

New Jersey Right to Know

Chemical name	CAS-No.
2-Butanone, peroxide	1338-23-4

2,4-Pentanediol, 2-methyl-	107-41-5
2-Butanone	78-93-3

New Jersey Right to Know – Special Health Hazard Substance(s)

Chemical name	CAS-No.
2-Butanone, peroxide	1338-23-4
2-Butanone	78-93-3

Pennsylvania Right to Know

Chemical name	CAS-No.
Propanoic acid, 2-methyl-, 2,2-dimethyl-1-(1-methylethyl)-1,3-propanediyl ester	6846-50-0
2-Butanone, peroxide	1338-23-4
2,4-Pentanediol, 2-methyl-	107-41-5

2-Butanone	78-93-3
Hydrogen peroxide	7722-84-1

Pennsylvania Right to Know – Environmentally Hazardous Substance(s)

Chemical name	CAS-No.
2-Butanone, peroxide	1338-23-4
2-Butanone	78-93-3
Hydrogen peroxide	7722-84-1

California Prop. 65
This product does not contain any chemicals known to the State of California to cause cancer, birth defects, or any other reproductive defects

SECTION 16 – OTHER INFORMATION

Revision Date

8/18/2023

Full text of H-Statements referred to under sections 2 and 3.

H225	Highly flammable liquid and vapour.
H242	Heating may cause a fire.
H302	Harmful if swallowed.
H314	Causes severe skin burns and eye damage.
H318	Causes serious eye damage.
H319	Causes serious eye irritation.
H332	Harmful if inhaled.
H336	May cause drowsiness or dizziness.
H361	Suspected of damaging fertility or the unborn child.
H411	Toxic to aquatic life with long lasting effects.

The information accumulated herein is believed to be accurate but is not warranted to be whether originating with **Fibre Glast Developments Corporation** or not. Recipients are advised to confirm in advance of need that the information is current, applicable, and suitable to their circumstances.

PRO-SET® LAM-135 Resin

Safety Data Sheet

According to the Hazard Communication Standard (CFR29 1910.1200) HazCom 2012 and the Hazardous Products Regulations (HPR) WHMIS 2015

Date of issue: 06/01/2015 Revision date: 01/25/2019 Version: LAM-135 -2019a

SECTION 1: Identification

Identification

Product form : Mixtures

Product name : PRO-SET® LAM-135 Resin

Product code : LAM-135, LAM-135-1, LAM-135-2, LAM-135-3, LAM-135-4, LAM-135-5, LAM-135-6

Relevant identified uses of the substance or mixture and uses advised against

Recommended use : Laminating resin for composites.

Details of the supplier of the safety data sheet

Manufacturer

Gougeon Brothers, Inc
100 Patterson Ave.
Bay City, MI 48706 - U.S.A.
T 888-377-6738 or 989-684-7286
www.prosetepoxy.com

Emergency telephone number

Emergency number : CHEMTREC 1 (800) 424-9300
CHEMTREC International +1 (703) 527-3887 24 hr

SECTION 2: Hazard(s) identification

Classification of the substance or mixture

Skin Irrit. 2
Eye Irrit. 2A
Skin Sens. 1
Aquatic Chronic 2

Label elements

Hazard pictograms (GHS) :



GHS07 GHS09

Signal word (GHS) :

Warning

Hazard statements (GHS) :

Causes skin irritation. May cause an allergic skin reaction. Causes serious eye irritation. Toxic to aquatic life with long lasting effects.

Precautionary statements (GHS) :

Avoid breathing dust, fume, gas, mist, vapours, spray. Wash hands thoroughly after handling. Contaminated work clothing must not be allowed out of the workplace. Avoid release to the environment. Wear protective gloves, protective clothing, eye protection, face protection. If on skin: Wash with plenty of soap and water. If in eyes: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If skin irritation or rash occurs: Get medical advice/attention. If eye irritation persists: Get medical advice/attention. Take off contaminated clothing and wash it before reuse. Collect spillage. Dispose of contents/container to hazardous or special waste collection point, in accordance with local, regional, national and/or international regulation.

Other hazards

No additional information available

Unknown acute toxicity

No additional information available

SECTION 3: Composition/information on ingredients

Substance

Not applicable

Mixtures

Name	Product identifier	HPR %
Oxirane, 2,2'-[(1-methylethylidene)bis(4,1-phenyleneoxymethylene)]bis-, homopolymer	(CAS No) 25085-99-8	80 - 100
1,3-Propanediol, 2-ethyl-2-(hydroxymethyl)-, polymer with (chloromethyl)oxirane	(CAS No) 30499-70-8	10 - 30

The exact chemical identity and/or exact percentage (concentration) of each ingredient may be held as confidential business information (CBI). Any ingredient not disclosed in this section may have been determined not to be hazardous to health or the environment, or it may be present at a level below its disclosure threshold.

SECTION 4: First aid measures

Description of first aid measures

First-aid measures after inhalation : If breathing is difficult, remove victim to fresh air and keep at rest in a position comfortable for breathing. Get medical advice/attention if you feel unwell.

First-aid measures after skin contact : In case of contact, immediately flush skin with plenty of water. Remove contaminated clothing and shoes. Wash contaminated clothing before reuse. If skin irritation or rash occurs: Get medical advice/attention.

First-aid measures after eye contact : In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. If easy to do, remove contact lenses, if worn. If irritation persists, get medical attention.

First-aid measures after ingestion : If swallowed, do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. Get medical advice/attention if you feel unwell.

Most important symptoms and effects, both acute and delayed

Symptoms/injuries after inhalation : May cause respiratory tract irritation.

Symptoms/injuries after skin contact : Causes skin irritation. Symptoms may include redness, edema, drying, defatting and cracking of the skin. May cause an allergic skin reaction.

Symptoms/injuries after eye contact : Causes serious eye irritation. Symptoms may include discomfort or pain, excess blinking and tear production, with marked redness and swelling of the conjunctiva.

Symptoms/injuries after ingestion : May be harmful if swallowed. May cause stomach distress, nausea or vomiting.

Indication of any immediate medical attention and special treatment needed

Symptoms may not appear immediately. In case of accident or if you feel unwell, seek medical advice immediately (show the label or SDS where possible).

SECTION 5: Firefighting measures

Extinguishing media

Suitable extinguishing media : Foam. Carbon dioxide. Dry chemical.

Unsuitable extinguishing media : Do not use a heavy water stream.

Special hazards arising from the substance or mixture

Fire hazard : Products of combustion may include, and are not limited to: oxides of carbon, phenolics.

Reactivity : No dangerous reaction known under conditions of normal use.

Advice for firefighters

Protection during firefighting : Keep upwind of fire. Wear full fire fighting turn-out gear (full Bunker gear) and respiratory protection (SCBA).

SECTION 6: Accidental release measures

Personal precautions, protective equipment and emergency procedures

General measures : Use personal protection recommended in Section 8. Isolate the hazard area and deny entry to unnecessary and unprotected personnel.

For non-emergency personnel

No additional information available

For emergency responders

No additional information available

Environmental precautions

Prevent from entering into soil, ditches, sewers, waterways and/or groundwater. See Section 12, Ecological Information.

Methods and material for containment and cleaning up

For containment : Contain and/or absorb spill with inert material (e.g. sand, vermiculite), then place in a suitable container. Do not flush to sewer or allow to enter waterways. Use appropriate Personal Protective Equipment (PPE).

Methods for cleaning up : Scoop up material and place in a disposal container. Provide ventilation.

Reference to other sections

See section 8 for further information on protective clothing and equipment and section 13 for advice on waste disposal.

SECTION 7: Handling and storage

Precautions for safe handling

Precautions for safe handling : Avoid contact with skin and eyes. Avoid breathing dust, fume, gas, mist, vapours, spray. Do not swallow. Handle and open container with care. When using do not eat, drink or smoke. When mixed with epoxy curing agents this product causes an exothermic reaction, which in large masses, can produce enough heat to damage or ignite surrounding materials and emit fumes and vapors that vary widely in composition and toxicity.

Hygiene measures : Launder contaminated clothing before reuse. Wash hands before eating, drinking, or smoking. Contaminated work clothing should not be allowed out of the workplace.

Conditions for safe storage, including any incompatibilities

Storage conditions : Keep out of the reach of children. Keep container tightly closed. Store in dry, cool, well-ventilated area. Protect from moisture. Storage temperature : 40°F (4°C) - 120°F (49°C).

SECTION 8: Exposure controls/personal protection

Control parameters

Oxirane, 2,2'-[(1-methylethylidene)bis(4,1-phenyleneoxymethylene)]bis-, homopolymer (25085-99-8)
Not applicable

1,3-Propanediol, 2-ethyl-2-(hydroxymethyl)-, polymer with (chloromethyl)oxirane (30499-70-8)
Not applicable

Exposure controls

Appropriate engineering controls : Use ventilation adequate to keep exposures (airborne levels of dust, fume, vapor, etc.) below recommended exposure limits.

Hand protection : Wear chemically resistant protective gloves.

Eye protection : Wear eye/face protection.

Skin and body protection : Wear suitable protective clothing.

Respiratory protection : In case of insufficient ventilation, wear suitable respiratory equipment. Respirator selection must be based on known or anticipated exposure levels, the hazards of the product and the safe working limits of the selected respirator.

Environmental exposure controls : Maintain levels below Community environmental protection thresholds.

Other information : Do not eat, smoke or drink where material is handled, processed or stored. Wash hands carefully before eating or smoking. Handle according to established industrial hygiene and safety practices.

SECTION 9: Physical and chemical properties

Information on basic physical and chemical properties

Physical state : Liquid

Appearance : Viscous

Colour : Colourless

Odour : Mild.

Odour threshold : No data available

pH : No data available

Melting point : No data available

Freezing point : No data available

Boiling point : > 400 °F (204°C)

Flash point : > 200 °F (93°C) Based on ASTM D92 test results from similar product.

Relative evaporation rate (butylacetate=1) : No data available

Flammability (solid, gas) : Not flammable

Vapour pressure	:	No data available
Relative vapour density at 20 °C	:	Heavier than air (Estimated based on ingredient data)
Relative density	:	1.16
Solubility	:	No data available
Partition coefficient n-octanol/water	:	No data available
Auto-ignition temperature	:	No data available
Decomposition temperature	:	No data available
Viscosity, kinematic	:	5939 mm²/s @ 20°C / 68°F
Viscosity, dynamic	:	No data available
Explosive limits	:	No data available
Explosive properties	:	No data available
Oxidising properties	:	No data available
Other information		
Bulk density	:	9.7 lb/gal (1.16 kg/L)

SECTION 10: Stability and reactivity

Reactivity	:	No dangerous reaction known under conditions of normal use.
Chemical stability	:	Stable under normal storage conditions.
Possibility of hazardous reactions	:	No dangerous reaction known under conditions of normal use. A mass of more than one pound of product plus an aliphatic amine will cause irreversible polymerization with significant heat buildup. Strong acids, bases, amines and mercaptans can cause polymerization.
Conditions to avoid	:	Heat. Incompatible materials.
Incompatible materials	:	Strong acids. Bases. Amines. Mercaptans.
Hazardous decomposition products	:	May include, and are not limited to: oxides of carbon, phenolics.

SECTION 11: Toxicological information

Information on toxicological effects

Oxirane, 2,2'-[(1-methylethylidene)bis(4,1-phenyleneoxymethylene)]bis-, homopolymer (25085-99-8)	
LD50 oral rat	> 15000 mg/kg
LD50 dermal rabbit	> 23000 mg/kg

1,3-Propanediol, 2-ethyl-2-(hydroxymethyl)-, polymer with (chloromethyl)oxirane (30499-70-8)	
LD50 oral rat	> 2000 mg/kg
LD50 dermal rabbit	> 2000 mg/kg

Acute toxicity (oral)	:	Not classified.
Acute toxicity (dermal)	:	Not classified.
Acute toxicity (inhalation)	:	Not classified.
Skin corrosion/irritation	:	Causes skin irritation.
Serious eye damage/irritation	:	Causes serious eye irritation.
Respiratory or skin sensitization	:	May cause an allergic skin reaction.
Germ cell mutagenicity	:	Not classified.
Carcinogenicity	:	Not classified.
Reproductive toxicity	:	Not classified.
STOT-single exposure	:	Not classified.
STOT-repeated exposure	:	Not classified.
Aspiration hazard	:	Not classified.

PRO-SET® LAM-135 Resin	
Viscosity, kinematic (calculated value) (20°C / 68°F)	5939 mm²/s

Symptoms/injuries after inhalation	:	May cause respiratory tract irritation.
Symptoms/injuries after skin contact	:	Causes skin irritation. Symptoms may include redness, edema, drying, defatting and cracking of the skin. May cause an allergic skin reaction.

Symptoms/injuries after eye contact : Causes serious eye irritation. Symptoms may include discomfort or pain, excess blinking and tear production, with marked redness and swelling of the conjunctiva.

Symptoms/injuries after ingestion : May be harmful if swallowed. May cause stomach distress, nausea or vomiting.

Other information : Likely routes of exposure: ingestion, inhalation, skin and eye.

SECTION 12: Ecological information

Toxicity

Ecology - general : Toxic to aquatic life with long lasting effects.

Persistence and degradability

PRO-SET® LAM-135 Resin	
Persistence and degradability	Not established.

Bioaccumulative potential

PRO-SET® LAM-135 Resin	
Bioaccumulative potential	Not established.

Mobility in soil

PRO-SET® LAM-135 Resin	
Ecology - soil	No additional information available.

Other adverse effects

Effect on the global warming : No known effects from this product.

Ingredient	CAS#	Ecotoxicity Classification Information
Oxirane, 2,2'-[(1-methylethylidene)bis(4,1-phenyleneoxymethylene)]bis-, homopolymer	25085-99-8	Aquatic Chronic Cat. 2
1,3-Propanediol, 2-ethyl-2-(hydroxymethyl)-, polymer with (chloromethyl)oxirane	30499-70-8	Aquatic Chronic Cat. 3

Other information : Avoid release to the environment.

SECTION 13: Disposal considerations

Waste treatment methods

Product/Packaging disposal recommendations : Avoid release to the environment. This material must be disposed of in accordance with all local, state, provincial, and federal regulations. The generation of waste should be avoided or minimized wherever possible.

SECTION 14: Transport information

Department of Transportation (DOT) and Transportation of Dangerous Goods (TDG)

In accordance with DOT and TDG

Not regulated

Transport by sea

In accordance with IMDG

UN-No. (IMDG) : 3082

Proper Shipping Name (IMDG) : ENVIRONMENTALLY HAZARDOUS SUBSTANCE, LIQUID, N.O.S. (Epoxy Resin)

Class (IMDG) : 9

Packing group (IMDG) : III

EmS Number : F-A, S-F

Marine pollutant : Yes

Transport by sea

In accordance with IATA

UN-No. (IATA) : 3082

Proper Shipping Name (IATA) : Environmentally hazardous substance, liquid, n.o.s. (Epoxy Resin)

Class (IATA) : 9

Packing group (IATA) : III

Marine pollutant : Yes

SECTION 15: Regulatory information

Federal regulations

All components of this product are listed, or excluded from listing, on the United States Environmental Protection Agency Toxic Substances Control Act (TSCA) inventory.

All components of this product are listed, or excluded from listing, on the Canadian DSL (Domestic Substances List) and NDSL (Non-Domestic Substances List) inventories.

Oxirane, 2,2'-[(1-methylethylidene)bis(4,1-phenyleneoxymethylene)]bis-, homopolymer **(25085-99-8)**	
EPA TSCA Regulatory Flag	XU - XU - indicates a substance exempt from reporting under the Inventory Update Reporting Rule, i.e, Partial Updating of the TSCA Inventory Data Base Production and Site Reports (40 CFR 710(C)).

1,3-Propanediol, 2-ethyl-2-(hydroxymethyl)-, polymer with (chloromethyl)oxirane **(30499-70-8)**	
EPA TSCA Regulatory Flag	XU - XU - indicates a substance exempt from reporting under the Inventory Update Reporting Rule, i.e, Partial Updating of the TSCA Inventory Data Base Production and Site Reports (40 CFR 710(C)).

Epichlorohydrin (106-89-8)	
Listed on the United States SARA Section 302 Subject to reporting requirements of United States SARA Section 313	
CERCLA RQ	100 lb
SARA Section 302 Threshold Planning Quantity (TPQ)	1000 lb
SARA Section 313 - Emission Reporting	0.1 %

International regulations

No additional information available

US State regulations

California Proposition 65 - This product contains, or may contain, trace quantities of a substance(s) known to the state of California to cause cancer, developmental and/or reproductive harm

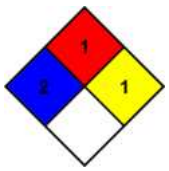
Epichlorohydrin (106-89-8)				
U.S. - California - Proposition 65 - Carcinogens List	U.S. - California - Proposition 65 - Developmental Toxicity	U.S. - California - Proposition 65 - Reproductive Toxicity - Female	U.S. - California - Proposition 65 - Reproductive Toxicity - Male	Non-significant risk level (NSRL)
Yes	No	No	Yes	9 µg/day

Epichlorohydrin (106-89-8)
U.S. - New Jersey - Right to Know Hazardous Substance List U.S. - Pennsylvania - RTK (Right to Know) - Environmental Hazard List U.S. - Pennsylvania - RTK (Right to Know) - Special Hazardous Substances U.S. - Pennsylvania - RTK (Right to Know) List

SECTION 16: Other information

Date of issue : 06/01/2015
Revision date : 01/25/2019
Other information : None.

NFPA health hazard : 2
NFPA fire hazard : 1
NFPA reactivity : 1



HMIS III Rating
Health : 2 Moderate Hazard
Flammability : 1 Slight Hazard
Physical : 1 Slight Hazard

Disclaimer: We believe the statements, technical information and recommendations contained herein are reliable, but they are given without warranty or guarantee of any kind. The information contained in this document applies to this specific material as supplied. It may not be valid for this material if it is used in combination with any other materials. It is the user's responsibility to satisfy oneself as to the suitability and completeness of this information for the user's own particular use.

PRO-SET® LAM-224 Hardener

Safety Data Sheet

According to the Hazard Communication Standard (CFR29 1910.1200) HazCom 2012 and the Hazardous Products Regulations (HPR) WHMIS 2015

Date of issue: 06/01/2015 Revision date: 01/25/2019 Version: LAM-224 -2019a

SECTION 1: Identification

Identification

Product form : Mixtures

Product name : PRO-SET® LAM-224 Hardener

Product code : LAM-224, LAM-224-1, LAM-224-2, LAM-224-3, LAM-224-4, LAM-224-5

Relevant identified uses of the substance or mixture and uses advised against

Recommended use : Curing agent for epoxy resins

Details of the supplier of the safety data sheet

Manufacturer

Gougeon Brothers, Inc
100 Patterson Ave.
Bay City, MI 48706 - U.S.A.
T 888-377-6738 or 989-684-7286
www.prosetepoxy.com

Emergency telephone number

Emergency number : CHEMTREC 1 (800) 424-9300
CHEMTREC International +1 (703) 527-3887 24 hr

SECTION 2: Hazard(s) identification

Classification of the substance or mixture

Acute Tox. 4 (Dermal)
Acute Tox. 4 (Inhalation)
Skin Corr. 1B
Eye Dam. 1
Skin Sens. 1
Repr. 2
Aquatic Acute 1
Aquatic Chronic 1

Label elements

Hazard pictograms (GHS) :



GHS05 GHS07 GHS08 GHS09

Signal word (GHS) :

Danger

Hazard statements (GHS) :

Harmful in contact with skin or if inhaled. Causes severe skin burns and eye damage. May cause an allergic skin reaction. Suspected of damaging fertility or the unborn child. Very toxic to aquatic life. Very toxic to aquatic life with long lasting effects.

Precautionary statements (GHS) :

Obtain special instructions before use. Do not handle until all safety precautions have been read and understood. Do not breathe dust, fume, gas, mist, vapours, spray. Wash hands thoroughly after handling. Use only outdoors or in a well-ventilated area. Contaminated work clothing must not be allowed out of the workplace. Avoid release to the environment. Wear protective gloves, protective clothing, eye protection, face protection. If swallowed: rinse mouth. Do NOT induce vomiting. If on skin (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower. If inhaled: Remove person to fresh air and keep comfortable for breathing. If in eyes: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If exposed or concerned: Get medical advice/attention. Immediately call a poison center/doctor. If skin irritation or rash occurs: Get medical attention/advice. Take off contaminated clothing and wash it before reuse. Collect spillage. Store locked up. Dispose of contents/container to hazardous or special waste collection point, in accordance with local, regional, national and/or international regulation.

Other hazards

No additional information available

Unknown acute toxicity

No additional information available

SECTION 3: Composition/information on ingredients

Substance

Not applicable

Mixtures

Name	Product identifier	HPR %
1-Piperazineethanamine	(CAS No) 140-31-8	10 - 30
1,3-Benzenedimethanamine	(CAS No) 1477-55-0	10 - 30
4-tert-Butylphenol	(CAS No) 98-54-4	10 - 30
Trimethylhexamethylenediamine	(CAS No) 25620-58-0	10 - 30
Formaldehyde, oligomeric reaction products with phenol and m-phenylenebis(methylamine)	(CAS No) 57214-10-5	10 - 30
1,3-Propanediamine, N,N''-1,2-ethanediylbis-	(CAS No) 10563-26-5	5 - 10
Phenol, 4-nonyl-, branched	(CAS No) 84852-15-3	0.1 - 1.5

The exact chemical identity and/or exact percentage (concentration) of each ingredient may be held as confidential business information (CBI). Any ingredient not disclosed in this section may have been determined not to be hazardous to health or the environment, or it may be present at a level below its disclosure threshold..

SECTION 4: First aid measures

Description of first aid measures

First-aid measures after inhalation : If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Immediately call a POISON CENTER or doctor/physician.

First-aid measures after skin contact : IF ON SKIN (or hair): Remove/Take off immediately all contaminated clothing. Rinse skin with water/shower. Wash contaminated clothing before reuse. Immediately call a POISON CENTER or doctor/physician.

First-aid measures after eye contact : In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. If easy to do, remove contact lenses, if worn. Get medical attention immediately.

First-aid measures after ingestion : Immediately call a POISON CENTER or doctor/physician. Rinse mouth. Do NOT induce vomiting.

Most important symptoms and effects, both acute and delayed

Symptoms/injuries after inhalation : Harmful if inhaled. May cause respiratory tract irritation.

Symptoms/injuries after skin contact : Harmful in contact with skin. Causes severe burns. Symptoms may include redness, pain, blisters. Repeated exposure to this material can result in absorption through skin causing significant health hazard. May cause an allergic skin reaction.

Symptoms/injuries after eye contact : Causes serious eye damage. Symptoms may include discomfort or pain, excess blinking and tear production, with marked redness and swelling of the conjunctiva. May cause burns.

Symptoms/injuries after ingestion : May be harmful if swallowed. May cause burns or irritation of the linings of the mouth, throat, and gastrointestinal tract. May cause stomach distress, nausea or vomiting.

Indication of any immediate medical attention and special treatment needed

Symptoms may not appear immediately. In case of accident or if you feel unwell, seek medical advice immediately (show the label or SDS where possible).

SECTION 5: Firefighting measures

Extinguishing media

Suitable extinguishing media : Foam. Carbon dioxide. Dry chemical.

Unsuitable extinguishing media : Do not use a heavy water stream.

Special hazards arising from the substance or mixture

Fire hazard : Products of combustion may include, and are not limited to: oxides of carbon, nitrogen oxides, amines, ammonia, nitric acid, cyanides, aldehydes, nitrosamines. When mixed with sawdust, wood chips, or other cellulosic material, spontaneous combustion can occur under certain conditions. Heat is generated as the air oxidizes the amine. If the heat is not dissipated quickly enough, it can ignite the sawdust.

Reactivity : No dangerous reaction known under conditions of normal use.

Advice for firefighters

Protection during firefighting : Keep upwind of fire. Wear full fire fighting turn-out gear (full Bunker gear) and respiratory protection (SCBA).

SECTION 6: Accidental release measures

Personal precautions, protective equipment and emergency procedures

General measures : Use personal protection recommended in Section 8. Isolate the hazard area and deny entry to unnecessary and unprotected personnel.

For non-emergency personnel

No additional information available

For emergency responders

No additional information available

Environmental precautions

Prevent from entering into soil, ditches, sewers, waterways and/or groundwater. See Section 12, Ecological Information.

Methods and material for containment and cleaning up

For containment : Contain and/or absorb spill with inert material (e.g. sand, vermiculite), then place in a suitable container. Do not flush to sewer or allow to enter waterways. Use appropriate Personal Protective Equipment (PPE). Do not absorb in sawdust, paper, cloth or other combustible absorbents.

Methods for cleaning up : Scoop up material and place in a disposal container. Provide ventilation.

Reference to other sections

See section 8 for further information on protective clothing and equipment and section 13 for advice on waste disposal.

SECTION 7: Handling and storage

Precautions for safe handling

Precautions for safe handling : Obtain special instructions before use. Do not handle until all safety precautions have been read and understood. Do not get in eyes, on skin, or on clothing. Do not breathe dust, fume, gas, mist, vapours, spray. Do not swallow. Handle and open container with care. Use only outdoors or in a well-ventilated area. Do not eat, drink or smoke when using this product. Use personal protective equipment as required. When mixed with epoxy resin this product causes an exothermic reaction, which in large masses, can produce enough heat to damage or ignite surrounding materials and emit fumes and vapors that vary widely in composition and toxicity.

Hygiene measures : Launder contaminated clothing before reuse. Wash hands before eating, drinking, or smoking. Contaminated work clothing should not be allowed out of the workplace.

Conditions for safe storage, including any incompatibilities

Storage conditions : Keep out of the reach of children. Keep container tightly closed. Store in dry, cool, well-ventilated area. Protect from moisture. Storage temperature : 40°F (4°C) - 90°F (32°C).

SECTION 8: Exposure controls/personal protection

Control parameters

1-Piperazineethanamine (140-31-8)		
Not applicable		

1,3-Benzenedimethanamine (1477-55-0)		
ACGIH	ACGIH Ceiling (mg/m³)	0.1 mg/m³
NIOSH	NIOSH REL (ceiling) (mg/m³)	0.1 mg/m³

4-tert-Butylphenol (98-54-4)
Not applicable

Trimethylhexamethylenediamine (25620-58-0)
Not applicable

Formaldehyde, oligomeric reaction products with phenol and m-phenylenebis(methylamine) (57214-10-5)
Not applicable

1,3-Propanediamine, N,N''-1,2-ethanediylbis- (10563-26-5)
Not applicable

Phenol, 4-nonyl-, branched (84852-15-3)
Not applicable

Exposure controls

Appropriate engineering controls : Use ventilation adequate to keep exposures (airborne levels of dust, fume, vapor, etc.) below recommended exposure limits.

Hand protection : Wear chemically resistant protective gloves.

Eye protection : Wear approved eye protection (properly fitted dust- or splash-proof chemical safety goggles) and face protection (face shield).

Skin and body protection : Wear suitable protective clothing.

Respiratory protection : In case of inadequate ventilation wear respiratory protection. Respirator selection must be based on known or anticipated exposure levels, the hazards of the product and the safe working limits of the selected respirator.

Environmental exposure controls : Maintain levels below Community environmental protection thresholds.

Other information : Do not eat, smoke or drink where material is handled, processed or stored. Wash hands carefully before eating or smoking. Handle according to established industrial hygiene and safety practices.

SECTION 9: Physical and chemical properties

Information on basic physical and chemical properties

Physical state : Liquid

Appearance : No data available

Colour : Colourless

Odour : Ammonia

Odour threshold : No data available

pH : 11.4

Melting point : No data available

Freezing point : No data available

Boiling point : > 400 °F (204°C) estimated based on similar product.

Flash point : > 200 °F (93°C) estimated based similar product.

Relative evaporation rate (butylacetate=1) : No data available

Flammability (solid, gas) : Not flammable

Vapour pressure : < 1 mm Hg @ 20°C / 68°F (estimated based on ingredient data)

Relative vapour density at 20 °C : No data available

Relative density : 1

Solubility : No data available

Partition coefficient n-octanol/water : No data available

Auto-ignition temperature : No data available

Decomposition temperature : No data available

Viscosity, kinematic : 75 mm^2/s @ 20°C / 68°F

Viscosity, dynamic : No data available

Explosive limits : No data available

Explosive properties : No data available

Oxidising properties : No data available

Other information

VOC content : LAM-125 / LAM-224: 3.60 g/L (0.03 lbs/gal); LAM-135 / LAM-224: 1.66 g/L (0.01 (lbs/gal)

Bulk density : 8.34 lb/gal (1.00 kg/L)

SECTION 10: Stability and reactivity

Reactivity : No dangerous reaction known under conditions of normal use.

Chemical stability : Stable under normal storage conditions.

Possibility of hazardous reactions : No dangerous reaction known under conditions of normal use. A mass of more than one pound of product plus an epoxy resin will cause irreversible polymerization with significant heat buildup and pressure.

Conditions to avoid : Heat. Incompatible materials.

Incompatible materials : Acids. Oxidizing materials. Halogenated compounds.

Hazardous decomposition products : May include, and are not limited to: oxides of carbon, nitrogen oxides, amines, ammonia, nitric acid, cyanides, aldehydes, nitrosamines, phenolics.

SECTION 11: Toxicological information

Information on toxicological effects

1-Piperazineethanamine (140-31-8)	
LD50 oral rat	2097 mg/kg
LD50 dermal rabbit	866 mg/kg

1,3-Benzenedimethanamine (1477-55-0)	
LD50 oral rat	980 mg/kg
LD50 dermal rabbit	2000 mg/kg
LC50 inhalation rat	1.34 mg/l/4h

4-tert-Butylphenol (98-54-4)	
LD50 oral rat	> 2000 mg/kg
LD50 dermal rat	No data. Intraperitoneal – mouse – 78 mg/kg.
LC50 inhalation rat	5.6 mg/l Remarks: Nutritional and Metabolic: Weight loss or decreased weight gain

Trimethylhexamethylenediamine (25620-58-0)	
LD50 oral rat	910 mg/kg

1,3-Propanediamine, N,N''-1,2-ethanediylbis- (10563-26-5)	
LD50 oral rat	1200 mg/kg
LD50 dermal rabbit	190 - 210 mg/kg

Phenol, 4-nonyl-, branched (84852-15-3)	
LD50 oral rat	1412 mg/kg

Acute toxicity (oral) : Not classified.

Acute toxicity (dermal) : Dermal: Harmful in contact with skin.

Acute toxicity (inhalation) : Inhalation: Harmful if inhaled.

Skin corrosion/irritation : Causes severe skin burns

Serious eye damage/irritation : Causes serious eye damage.

Respiratory or skin sensitization : May cause an allergic skin reaction.

Germ cell mutagenicity : Not classified.

Carcinogenicity : Not classified.

Reproductive toxicity : Suspected of damaging fertility or the unborn child.

STOT-single exposure : Not classified.

STOT-repeated exposure : Not classified.

Aspiration hazard : Not classified.

PRO-SET® LAM-224 Hardener	
Viscosity, kinematic (calculated value) (20°C / 68°F)	75 mm²/s

Potential adverse human health effects and symptoms : Harmful in contact with skin. Harmful if inhaled.

Symptoms/injuries after inhalation : Harmful if inhaled. May cause respiratory tract irritation.

Symptoms/injuries after skin contact : Harmful in contact with skin. Causes severe burns. Symptoms may include redness, pain, blisters. Repeated exposure to this material can result in absorption through skin causing significant health hazard. May cause an allergic skin reaction.

Symptoms/injuries after eye contact : Causes serious eye damage. Symptoms may include discomfort or pain, excess blinking and tear production, with marked redness and swelling of the conjunctiva. May cause burns.

Symptoms/injuries after ingestion : May be harmful if swallowed. May cause burns or irritation of the linings of the mouth, throat, and gastrointestinal tract. May cause stomach distress, nausea or vomiting.

Other information : Likely routes of exposure: ingestion, inhalation, skin and eye.

SECTION 12: Ecological information

Toxicity

Ecology - general : Very toxic to aquatic life with long lasting effects.

1-Piperazineethanamine (140-31-8)	
LC50 fish 1	1950 - 2460 mg/l (Exposure time: 96 h - Species: Pimephales promelas [flow-through])
EC50 Daphnia 1	32 mg/l (Exposure time: 48 h - Species: Daphnia magna)
LC50 fish 2	> 1000 mg/l (Exposure time: 96 h - Species: Poecilia reticulata [semi-static])

4-tert-Butylphenol (98-54-4)	
LC50 fish 1	4.71 - 5.62 mg/l (Exposure time: 96 h - Species: Pimephales promelas [flow-through])
EC50 Daphnia 1	3.9 mg/l (Exposure time: 48 h - Species: Daphnia magna)
LC50 fish 2	6.9 mg/l (Exposure time: 96 h - Species: Cyprinus carpio [static])
EC50 Daphnia 2	3.4 - 4.5 mg/l (Exposure time: 48 h - Species: Daphnia magna [Static])

Phenol, 4-nonyl-, branched (84852-15-3)	
LC50 fish 1	0.135 mg/l (Exposure time: 96 h - Species: Pimephales promelas [flow-through])
EC50 Daphnia 1	0.14 mg/l (Exposure time: 48 h - Species: Daphnia magna)
LC50 fish 2	0.1351 mg/l (Exposure time: 96 h - Species: Lepomis macrochirus [flow-through])

Persistence and degradability

PRO-SET® LAM-224 Hardener	
Persistence and degradability	Not established.

Bioaccumulative potential

PRO-SET® LAM-224 Hardener	
Bioaccumulative potential	Not established.

1-Piperazineethanamine (140-31-8)	
BCF fish 1	(no bioaccumulation expected)
Partition coefficient n-octanol/water	-1.48

4-tert-Butylphenol (98-54-4)	
BCF fish 1	34 - 240
Partition coefficient n-octanol/water	2.44

Trimethylhexamethylenediamine (25620-58-0)	
Partition coefficient n-octanol/water	0.77 (at 23 °C)

Phenol, 4-nonyl-, branched (84852-15-3)	
BCF fish 1	271

Mobility in soil

PRO-SET® LAM-224 Hardener	
Ecology - soil	No additional information available.

Other adverse effects

Effect on the global warming : No known effects from this product.

Ingredient	**CAS#**	**Ecotoxicity Classification Information**
1-Piperazineethanamine	140-31-8	Acute Aquatic Cat. 3; Chronic Aquatic Cat. 3
1,3-Benzenedimethanamine	1477-55-0	Acute Aquatic Cat. 3; Chronic Aquatic Cat. 3
4-tert-Butylphenol	98-54-4	Acute Aquatic Cat. 2; Chronic Aquatic Cat. 2
Trimethylhexamethylenediamine	25620-58-0	Acute Aquatic Cat. 3; Chronic Aquatic Cat. 3
Formaldehyde, oligomeric reaction products with phenol and m-phenylenebis(methylamine)	57214-10-5	Acute Aquatic Cat. 1; Chronic Aquatic Cat. 1
1,3-Propanediamine, N,N''-1,2-ethanediylbis-	10563-26-5	Not classified
Phenol, 4-nonyl-, branched	84852-15-3	Acute Aquatic Cat. 1; Chronic Aquatic Cat. 1

Other information : Avoid release to the environment.

SECTION 13: Disposal considerations

Waste treatment methods

Product/Packaging disposal recommendations : Avoid release to the environment. This material must be disposed of in accordance with all local, state, provincial, and federal regulations. The generation of waste should be avoided or minimized wherever possible.

SECTION 14: Transport information

Department of Transportation (DOT) and Transportation of Dangerous Goods (TDG)

In accordance with DOT and TDG

UN-No.(DOT/TDG) : UN2735

Proper Shipping Name (DOT/TDG) : Polyamines, liquid, corrosive, n.o.s. (1,3-Benzenedimethanamine)

Class (DOT/TDG) : 8

Packing group (DOT/TDG) : II

Marine Pollutant : No

Transport by sea

In accordance with IMDG

UN-No. (IMDG) : 2735

Proper Shipping Name (IMDG) : POLYAMINES, LIQUID, CORROSIVE, N.O.S. (1,3-Benzenedimethanamine)

Class (IMDG) : 8

Packing group (IMDG) : II

EmS Number : F-A, S-B

Marine pollutant : Yes

Transport by sea

In accordance with IATA

UN-No. (IATA) : 2735

Proper Shipping Name (IATA) : Polyamines, liquid, corrosive, n.o.s. (1,3-Benzenedimethanamine)

Class (IATA) : 8

Packing group (IATA) : II

Marine pollutant : Yes

SECTION 15: Regulatory information

Federal regulations

All components of this product are listed, or excluded from listing, on the United States Environmental Protection Agency Toxic Substances Control Act (TSCA) inventory.

All components of this product are listed, or excluded from listing, on the Canadian DSL (Domestic Substances List) and NDSL (Non-Domestic Substances List) inventories.

Formaldehyde, oligomeric reaction products with phenol and m-phenylenebis(methylamine) **(57214-10-5)**	
EPA TSCA Regulatory Flag	P - P - indicates a commenced PMN substance. XU - XU - indicates a substance exempt from reporting under the Inventory Update Reporting Rule, i.e, Partial Updating of the TSCA Inventory Data Base Production and Site Reports (40 CFR 710(C)).

Phenol, 4-nonyl-, branched (84852-15-3)	
Subject to reporting requirements of United States SARA Section 313	
EPA TSCA Regulatory Flag	SP - SP - indicates a substance that is identified in a proposed Significant New Uses Rule.
SARA Section 313 - Emission Reporting	1 %

International regulations

No additional information available

US State regulations

California Proposition 65 - This product does not contain any substances known to the state of California to cause cancer, developmental and/or reproductive harm

1-Piperazineethanamine (140-31-8)
U.S. - New Jersey - Right to Know Hazardous Substance List
U.S. - Pennsylvania - RTK (Right to Know) List

1,3-Benzenedimethanamine (1477-55-0)
U.S. - New Jersey - Right to Know Hazardous Substance List
U.S. - Pennsylvania - RTK (Right to Know) List

Trimethylhexamethylenediamine (25620-58-0)
U.S. - New Jersey - Right to Know Hazardous Substance List

SECTION 16: Other information

Date of issue : 06/01/2015

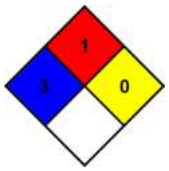
Revision date : 01/25/2019

Other information : None.

NFPA health hazard : 3

NFPA fire hazard : 1

NFPA reactivity : 0



HMIS III Rating

Health : 3 Serious Hazard

Flammability : 1 Slight Hazard

Physical : 0 Minimal Hazard

Disclaimer: We believe the statements, technical information and recommendations contained herein are reliable, but they are given without warranty or guarantee of any kind. The information contained in this document applies to this specific material as supplied. It may not be valid for this material if it is used in combination with any other materials. It is the user's responsibility to satisfy oneself as to the suitability and completeness of this information for the user's own particular use.

PARTALL Coverall Film

Safety Data Sheet
according to OSHA HCS and GHS - Canada WHMIS 2015

Version: 5.0
Revision date: 2021-01-01
Print date: 2021-02-03

SECTION 1. IDENTIFICATION OF THE SUBSTANCE/MIXTURE AND OF THE COMPANY/UNDERTAKING

1.1 Product Identifier

Product form : Mixture
Trade name : PARTALL Coverall Film

1.2 Relevant identified uses of the substance or mixture and uses advised against

Relevant identified uses : Release agent

1.3 Details of the supplier of the safety data sheet

Supplier : REXCO
P.O. Box 80996
Conyers, GA 30013
U.S.A.

Telephone : 1-770-483-7610
Fax : 1-770-483-8550
Email : info@rexco-usa.com
Website : www.rexco-usa.com

1.4 Emergency telephone number

Chemtrec (24 hours/day) : 1-800-434-9300 (USA and Canada)
: 1-703-527-3887 (international; collect calls accepted)

SECTION 2. Hazards Identification

2.1 Classification of the substance or mixture

Classification according to OSHA-HCS and GHS-Canada WHMIS 2015
Not classified

See section 16 for full text of H-phrases.

2.2 Label elements

Labeling according to the Globally Harmonized System (GHS)
Not classified

Signal word : Not classified

Hazard statements
Not classified

Precautionary statements
Not classified

2.3 Other hazards

Material does not meet the criteria for PBT or vPvB in accordance with REACH Annex XIII.

SECTION 3. Composition/information on ingredients

3.1 Substances

Not applicable. This material is not defined as a substance.

3.2 Mixtures

This material is defined as a mixture.

Components contributing to the classification of this material
This material does not contain any hazardous substances required to be mentioned.

Components not listed are either non-hazardous or are below reportable limits. Concentrations are in percent by weight.

SECTION 4. First aid measures

General information
Do not leave victim unattended. Show this safety data sheet to doctor in attendance.

4.1 Description of first aid measures

Inhalation
Provide fresh air if light-headed or having difficulty breathing. Provide artificial respiration if needed. If difficulty breathing persists, seek medical attention. If unconscious, place victim on their side for transport to medical facility.

Skin
Remove contaminated clothing and wash affected area with soap and warm water. If irritation persists, seek medical attention. Launder contaminated clothing and shoes prior to reuse.

Eyes
Flush immediately with cold water for 15 minutes. Remove contact lenses. Keep eye wide open while rinsing. Get prompt medical attention.

Ingestion
Seek immediate medical attention. Do not induce vomiting. If spontaneous vomiting occurs keep victim's head below hips to prevent aspiration into lungs. Do not leave individual unattended.

4.2 Most important symptoms and effects, both acute and delayed
May cause eye irritation. If swallowed, may cause nausea and vomiting.

4.3 Indication of any immediate medical attention and special treatment
Treat symptomatically. Seek immediate medical attention if ingested.

SECTION 5. Firefighting measures

5.1 Extinguishing media

Suitable extinguishing media
Standard procedure for chemical fires. Use dry chemicals or foam. Use extinguishing measures that are appropriate to local circumstances and the surrounding environment.

Unsuitable extinguishing media
Do not use high volume water jet. Avoid spreading burning liquid with water used for cooling purposes.

5.2 Special hazards arising from the substance or mixture
None inherent to this product.

Hazardous decomposition products formed during combusion
Carbon oxides, aldehydes, acids

5.3 Advice for firefighters
Evacuate area. Firefighters should use standard protective equipment and should use self-contained breathing apparatus in enclosed spaces. Use water spray to cool surfaces exposed to fire and to protect personnel.

SECTION 6. Accidental release measures

6.1 Personal precautions, protective equipment and emergency procedures
Use personal protective equipment. Ensure adequate ventilation. Keep sources of ignition and hot metal surfaces isolated from spill.

6.2 Environmental precautions
Prevent product from entering drains, waterways, sewers, and soil. Stop spill at source and prevent further leakage or spillage if safe to do so. Notify proper authorities if product enters sewers or public waters.

6.3 Methods and material for containment and cleaning up
Flush spilled material into suitable retaining areas or containers. Small amounts of spilled material may be absorbed with standard absorbent such as sand, vermiculite, or diatomaceous earth. Confine spill and place into suitable closed container for disposal. Dispose of in accordance with regional, national, and local laws and regulations.

6.4 Reference to other sections
Section 7: safe handling. Section 8: personal and protective equipment. Section 10: incompatible materials. Section 13: disposal information. Section 16: full text of abbreviations.

SECTION 7. Handling and storage

7.1 Precautions for safe handling
Use in a well ventilated area or use appropriate respirator when ventilation is inadequate. Do not breathe vapor. Wear personal protective clothing and equipment as indicated in Section 8. Eliminate all sources of ignition. Do not ingest. Use good industrial hygiene practices in handling this material. Do not smoke, eat or drink while using this product. Wash hands and other exposed areas with mild soap and water before eating, drinking or smoking and leaving work. Clean up spills as soon as they occur. Empty containers may contain residual amounts of this product and should be handled with care. Do not reuse containers.

7.2 Conditions for safe storage, including any incompatibilities
Store in accordance with local regulations. Store in a dry, cool and well-ventilated area away from direct sunlight. Avoid freezing. Store away from incompatible materials (see Section 10) and food and drink. Store in original container. Keep container tightly closed when not in use. Containers that have been opened must be carefully resealed and kept upright to prevent leakage. Do not store in unlabeled containers. Provide appropriate fire extinguishers and spill cleanup equipment in or near storage area. Keep unauthorized personnel away.

7.3 Specific end uses
See section 1.2

SECTION 8. Exposure controls/personal protection

8.1 Control parameters

Ingredients with limit values that require monitoring:
Contains no substances with occupational exposure limit values.

Ingredients with biological monitoring guidance values (BMGV) and/or biological exposure index (BEI):
Contains no substances with biological monitoring guidance values.

8.2 Exposure controls

Engineering controls
Provide adequate local exhaust ventilation. Maintain eye wash fountain and safety shower in work area.

Personal protective equipment

General protective and hygenic measures
Do not eat, drink, or smoke while using. Wash hands before breaks and at the end of workday. Immediately remove all soiled or contaminated clothing.

Eye and face protection
Chemical safety glasses with side shields, goggles or face shield are recommended. Eye wash stations are recommended for the work area.

Skin and body protection
Wear chemical resistant clothing and shoes. Safety showers are recommended for the work area.

Respiratory protection
Provide sufficient general and/or local exhaust. If engineering controls are not sufficient to protect worker health use a respirator approved under applicable regulatory standards.

Hand protection
Wear chemical resistant impervious gloves. Glove suitability and breakthrough time will differ depending on the specific use conditions. Contact the glove manufacturer for specific advice on glove selection and breakthrough times for your use conditions. Inspect and replace worn or damaged gloves.

Environmental controls
Prevent product from entering drains. Stop spill at source and prevent further leakage or spillage if safe to do so. If product contaminates rivers and lakes or drains, notify proper authorities.

SECTION 9. Physical and chemical properties

Physical state	: Liquid
Physical form	: Liquid
Colour	: Purple or Clear
Odour	: Mild
Odour threshold	: No data available
Melting point	: Not applicable
Freezing point	: No data available
Initial boiling point and boiling range	: No data available
Flammability	: Not classified
Upper flammability limit	: Not applicable
Lower flammability limit	: Not applicable
Flash point	: > 100 °C (> 212 °F)
Auto-ignition temperature	: No data available
Decomposition temperature	: No data available
pH	: 4.5 - 6.5
Viscosity	: 50 - 100 cP
Solubility (water)	: Fully soluble
Partition coefficient n-octanol/water (log value)	: No data available
Vapour pressure	: No data available
Relative density at 24 °C (water = 1)	: 1.20 - 1.60
Volatile organic compounds (VOC)	
VOC - actual	: 1 g/L
VOC less water & exempt solvents	: 10 g/L

SECTION 10. Stability and reactivity

10.1 Reactivity
Not reactive under normal conditions of use. Do not store in unlined metal containers.

10.2 Chemical stability
Stable under normal conditions of use.

10.3 Possibility of hazardous reactions
No dangerous reactions known under normal conditions of use.

10.4 Conditions to avoid
Avoid heat, sparks, open flames, hot surfaces, or other sources of ignition.

10.5 Incompatible materials
Strong oxidizing agents

10.6 Hazardous decomposition products
Carbon oxides, aldehydes, acids

SECTION 11. Toxicological Information

11.1 Information on toxicological effects

Acute toxicity	: Not classified
Skin corrosion/irritation	: Expected to be slightly irritating
Serious eye damage/irritation	: Expected to be slightly irritating
Respiratory or skin sensitisation	: Not classified
Germ cell mutagenicity	: Not classified
Carcinogenicity	: Not classified
Reproductive toxicity	: Not classified
STOT-single exposure	: Not classified
STOT-repeated exposure	: Not classified
Aspiration hazard	: Not classified

SECTION 12: Ecological information

12.1 Toxicity	: Not expected to be toxic.
12.2 Persistence and degradability	: Expected to be inherently biodegradable.
12.3 Bioaccumulative potential	: No data available
12.4 Mobility in soil	: No data available
12.5 Other adverse effects	: No data available
12.6 General notes	: No data available

SECTION 13. Disposal considerations

13.1 Waste treatment methods
Dispose of in accordance with regional, national, and local laws and regulations.

Material disposal	: Do not dispose of waste into sewer. Do not contaminate ponds, waterways, or ditches with product or used container. Send to a licensed waste management company.
Container disposal	: Do not dispose of waste into sewer. Do not contaminate ponds, waterways, or ditches with product or used container. Send to a licensed waste management company.

SECTION 14. Transport information

14.1 UN number
Not regulated

14.2 UN proper shipping name

DOT	: Not regulated
ADR	: Not regulated
IMDG	: Not regulated
IATA	: Not regulated

14.3 Transport hazard class
Not regulated

14.4 Packing group
Not regulated

14.5 Environmental hazards
Not regulated

14.6 Special precautions for user
Not regulated

14.7 Transport in bulk according to Annex II of MARPOL and the IBC Code

Not regulated

14.8 Additional information
Not regulated

SECTION 15. Regulatory information

15.1 Safety, health and environmental regulations/legislation specific for the substance or mixture
No information available for this material. Information provided is for components.

OSHA Hazard Communication Standard
This material is not hazardous in accordance with OSHA HazCom 2012, 29 CFR 1910.1200

Superfund Amendments and Reauthorization Act (SARA)

SARA 302 Components
No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 311/312 Hazard Categories
No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 311/312.

SARA 313 Components
No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 313.

Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)
No chemicals in this material are subject to the reporting requirements of CERCLA.

California Proposition 65
No chemicals in this material are subject to the reporting requirements of California Proposition 65.

This product contains the following Right to Know components:

Component	**U.S. State Right to Know list**
None known	: Massachusetts, New Jersey, Pennsylvania

International Agency for Research on Cancer (IARC)
This product contains the following chemicals classified by IARC as carcinogenic:
None known

Chemical inventories
Components are listed or exempted from listing on the following chemical inventories:

AICS	Australian Inventory of Chemical Substances
DSL / NDSL	Domestic Substances List / Non-Domestic Substances List
EINECS	European Inventory of Existing Commercial Chemical Substances
ENCS	Existing and New Chemical Substances
IECS	Inventory of Existing Chemical Substances Produced or Imported in China
KECI	Korea Existing Chemicals Inventory
NZIoC	New Zealand Inventory of Chemicals
PICCS	Philippine Inventory of Chemicals and Chemical Substances
TCSI	Taiwan Chemical Substance Inventory
TSCA	Toxic Substances Control Act

15.2 Chemical safety assessment
A chemical safety assessment has not been carried out for this product.

SECTION 16. Other information

DISCLAIMER: The information in this Safety Data Sheet (SDS) is believed to be correct as of the date issued. REXCO MAKES NO WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OR COURSE OF PERFORMANCE OR USAGE OF TRADE. User is responsible for determining whether this product is fit for a particular purpose and suitable for user's method of use or application. Given the variety of factors that can affect the use and application of a product, some of which are uniquely within the user's knowledge and control, it is essential that the user evaluate this product to determine whether it is fit for a particular purpose and suitable for user's method of use or application.

Abbreviations and acronyms

ADR	European Agreement concerning the International Carriage of Dangerous Goods by Road
CAS	Chemical Abstract Service
DOT	U.S. Department of Transportation
IATA	International Air Transport Association
IMDG	International Maritime Dangerous Goods
OSHA	U.S. Occupational Safety and Health Administration
OSHA HCS	U.S. Occupational Safety and Health Administration Hazard Communication Standard
PBT	Persistent, Bioaccumalative and Toxic
vPvB	very Persistent and very Bioaccumulative

SAFETY DATA SHEET
UVLS CLEAR

1. Identification of the Preparation and of The Company

Product Name and/or Code:	UVLS Clear
Effective Date:	4-Oct-17
Manufacturer:	Color Craft Ltd/ Createx Colors
	14 Airport Park Road, PO Box 120
	East Granby, CT 06026
Information Contact:	860-653-5505
	860-653-5505
Emergency Contact:	Contact your local Poison Control Center.
Product Use:	ART MATERIAL - Consumer Product.

2. Hazards Identification

Emergency Overview

CAUTION! IRRITANT.

Classification of the Product:

Label Elements	Conforms to ASTM D-4236
Pictograms	 GHS07
Signal Word	**CAUTION!**
Hazard Statement	Causes eye and skin irritation.
Precaution Statement	Avoid contact with eyes, skin and clothing. Wash thoroughly after handling. **Use with adequate ventilation.**
First Aid Statement	In case of eye contact, flush immediately with plenty of water for at least 15 minutes and get medical attention immediately; for skin, wash thoroughly with soap and water. If swallowed, get medical attention immediately.
Children's Statement	**KEEP OUT OF THE REACH OF CHILDREN.**
NFPA	Health: 1
	Flammability: 0
	Reactivity : 0
HMIS	Health : 1
	Flammability: 0
	Physical Hazard: 0
Regulation (EC) No. 1272/2008	Studies have not been performed on this particular mixture. *The information below is based on data in the individual ingredients.*

Acute Toxicity 4 H302; Acute Toxicity H312; Skin Irritation 2 H315; Eye Irritation 2 H319; Acute Toxicity 4 H332; Flammable liquid 3 H226; STOT SE 3 H336; Eye Damage 1 H318; Skin Sensitizer 1 H317; Aquatic Acute 1 H400; Flammable liquid 3 H225; Acute Toxicity 4 H314.

3.Composition/Information on Ingredients:

Substances:

Mixture of the following chemicals:

Water (CAS No. 7732-18-5) < 45.00%
Triethylamine (CAS No. 121-44-8) < 1.00%
BIT: 1,2 -Benzisothiazol-3(2H)-one, 1,2 -Benzisothiazolin-3-one (CAS No. 2634-33-5) < 50PPM

** This product contains a variety of detergents which are associated with the irritation warning as well as other non-hazardous ingredients.*

Risk and Safety Phrases:

Ingredients are marked according to CLP Regulation (CLP-Regulation (EC) No 1272/2008) and no workplace-related occupational exposure limits are specified for any of the listed ingredients. These ingredients are regarded as trade secrets.

4. First Aid Measures

Inhalation	If affected, remove to fresh air.
Skin Contact	Wash the affected area thoroughly with plenty of soap and water.
Eye Contact	Carefully flush with water for 15 minutes and get medical attention immediately.
Ingestion	Drink water or milk to dilute. Do not induce vomiting. Contact a physician.

5. Firefighting Measures

Extinguishing Media	Water, foam, carbon dioxide or dry chemical equipment.
Fire/Explosion Hazards	This product is not known to present any fire hazard.
Flashpoint/Flammability	This product is not flammable.

6. Accidental Release Measures

Environmental Precautions	Avoid release to the environment. *Studies have not been performed on this particular mixture.*
Methods and Materials for Containment and Cleaning up	Contain spill. Recover as much as possible. Absorb remainder with an inert material. Place into closed container and store in a safe location to await disposal. Wash the spill area with soap and water.

7. Handling and Storage

Safe Handling	Use under ventilated conditions. Avoid eye and skin contact. For personal protection, we recommend that employees wash thoroughly after handling product. Always wash before eating, smoking or using toilet facilities. Keep container closed when not in use. Keep container upright to prevent leakage.
Storage	Store between 50-100 deg. F., ideally 70 deg. F.

8. Exposure Controls/Personal Protection

Personal Protective Equipment	Wear goggles where spills or splashing may occur. Wear water resistant impervious gloves if handling bulk amounts.

Exposure Limits

Substance	CAS#	OSHA PEL		NIOSH REL	ACGIH
		mg/m3	8 hr TWA(ST) STEL (C) Ceiling	Up to 10 - hr TWA (ST) STEL (C) Ceiling	8 hr TWA (ST) STEL (C) Ceiling
Triethylamine	121-44-8	N/A	25 PPM	N/A	2 PPM (ST)
1,2 -Benzisothiazol-3(2H)-one, 1,2- benzisothiazolin-3-one	2634-33-5	NOT ESTABLISHED			

Respiratory and Ventilation	Wear approved NIOSH/MSHA respirator if exposure to mist or vapor exceed applicable PEL/TLV limits. Use in accordance with manufacturer's use limitations and OSHA STANDARD 1910-34. Local ventilation may be used to prevent routine inhalation.
Skin Protection	Wear water resistant impervious gloves if handling bulk amounts.
Eye Protection	Wear goggles where spills or splashing may occur.

9. Physical and Chemical Properties

Appearance	White
Physical State	Liquid
VOC Content	30.43 g/L Regulatory
Solids percentage	20.85
Color	White
Odor	Acrylic-like.
Boiling Point	Not determined.
Freezing Point	Not determined.
State (pH)	Neutral
Specific Gravity	Not determined.
Viscosity	Not determined.
Flashpoint	Not applicable to this mixture.
Vapor Pressure	Not applicable to this mixture.
Vapor Density	<1
Solubility in Water	Miscible

10. Stability and Reactivity

Reactivity:	No dangerous reaction known under conditions of normal use.
Chemical Stability	Stable under recommended storage conditions.
Conditions to Avoid	Elevated temperatures (>50°C) and freezing.
Incompatible Materials	None known.
Hazardous Decomposition Products	No dangerous decomposition products known. Decomposition products depend on conditions.

11. Toxicological Information

Health Effects:	Studies have not been performed on this particular mixture. The information below is based on data in the individual ingredients.
Oral	*BIT: US 500.00000000 mg/kg body weight* *Triethylamine: LD50 Rat: 460 mg/kg*
Dermal	*BIT: No data available.* *Triethylamine: LD50 Rabbit: 416 mg/kg*
Inhalation	*BIT: No data available.* *Triethylamine: LC50 (4h) Rat: 4.2 mg/l*
Eye Effects	Causes eye irritation.
Dermal Effects	Causes skin irritation.
Sensitization Effects	None known for the usual and ordinary uses of this product.
Inhalation Effects	None known for the usual and ordinary uses of this product.
Ingestion Effects	None known for the usual and ordinary uses of this product.
Additional Toxicological Information:	*When used and handled according to specifications, the product does not have any harmful effects according to past experience and the information provided by the manufacturer.*

12. Ecological Information

Toxicity:	Not expected to be harmful to the environment. *Studies have not been performed on this particular mixture.*
Aquatic toxicity	*BIT: 1,2- Benzisothiazol-3(2H)-one, 1,2- Benzisothiazolin-3-one is a substance known to be very toxic to aquatic life.*
Persistence and Degradability	No information available.
Bio Accumulative Potential	No information available.
Mobility in Soil	No information available.
Additional Ecological Information	No information available.

13. Disposal Considerations

Dispose of all waste material in accordance with all applicable federal, state and local regulations for the disposal of aqueous polymer wastes.

14. Transport Information

DOT Non-Bulk	This regulation does not apply to the non-bulk material.
Shipping Name	Not regulated.
Technical Shipping Name	Not regulated.
Hazard Class	Not regulated.
UN Number	Not regulated.
Packing Group	Not regulated.
IMDG	This regulation does not apply to the non-bulk material.
Shipping Name	Not regulated.
Technical Shipping Name	Not regulated.
Hazard Class	Not regulated.
UN Number	Not regulated.
Packing Group	Not regulated.
EmS Number	Not regulated.
Marine Pollutant	Not regulated.
ICAO/IATA	This regulation does not apply to the non-bulk material.
Shipping Name	Not regulated.
Technical Shipping Name	Not regulated.
Hazard Class	Not regulated.
UN Number	Not regulated.
Packing Group	Not regulated.
Marine Pollutant	Not regulated.

This information is not intended to convey all specific regulatory or operational requirements/information relating to this product. It is the responsibility of the transporting organization to follow all applicable laws, regulations and rules relating to the transportation of the materials.

15. Regulatory Information

Safety, health and environmental regulations/legislation specific for the substance or mixture.

SARA	Not applicable to this mixture.
Section 355 (Extremely hazardous substances)	Not applicable to this mixture.
Section 313 (Specific toxic chemical listing)	Not applicable to this mixture.
TSCA (Toxic Substance Control Act)	All ingredients are listed.
Proposition 65	WARNING: Cancer and Developmental - www.P65Warnings.ca.gov As of September 15, 2017, this product contains listed substances known to the State of California to cause cancer, at levels which would require a warning under the statue.

Carcinogenicity Categories:	
EPA (Environmental Protection Agency)	Not applicable to this mixture.
TLV (Threshold Limit Value established by ACGIH)	Refer to section 8.
MAK (German Maximum Workplace Concentration)	Not applicable to this mixture.
NIOSH (National Institute for Occupational Safety & Health)	Not applicable to this mixture.
OSHA (Occupational Safety & Health Administration)	Not applicable to this mixture.

16. Other Information

Product	Hazardous Ingredient
4050 UVLS Gloss Clear	(None)
4051 UVLS Satin Clear	(None)
4052 UVLS Matte Clear	(None)
Reason for Issue:	New Product

The information contained in this Safety Data Sheet was compiled using the latest and most reliable information available. The information is provided without any warranty, express or implied regarding its correctness or accuracy nor will manufacturer assume any liability for any loss or damage arising out of the use of this information including without limitation direct or indirect losses or expenses. To the extent permitted by law, no warranty expressed or implied regarding the product described herein shall be created by or inferred from any state or omission for this SDS. It is solely the responsibility of the user to determine safe conditions for use of this product and to assume liability for any loss, damage or expense whatsoever arising out of the product's improper use.

Abbreviations and acronyms:

NFPA (SCALE 0-4) National Fire Protection Association (USA)

Health: 1	**Caution:** May be irritating.
Fire: 0	Not combustible.
Reactivity: 0	Not reactive when mixed with water.

HMIS (SCALE 0-4) Hazardous Materials Identification System (USA)

Health: 1	Irritation or minor reversible injury possible.
Fire: 0	Materials that will not burn.
Reactivity: 0	Materials that are normally stable, even under fire conditions, and will NOT react with water, polymerize, decompose, condense, or self-react. Non-Explosives.

H Statements

H225 - Highly Flammable liquid and vapour.
H226 - Flammable liquid and vapour.
H302 - Harmful if swallowed.
H312 - Harmful in contact with skin.
H314 - Causes severe skin burns and eye damage.
H315 - Causes skin irritation.
H317 - May cause an allergic reaction.
H318 - Causes serious eye damage.
H319 - Causes serious eye irritation.
H332 - Harmful if inhaled.
H336 - May cause drowsiness and dizziness.
H400 - Very Toxic to aquatic life.

Exposure Limits

TWA - Time Weighted Average (8 hr.)
STEL - Short Time Exposure Limit (15 min.)
REL - Recommended Exposure Limit
PEL - Permissible Exposure Limit
IDLH - Immediately Dangerous to Life or Health

SAFETY DATA SHEET
WICKED COLORS

1. Identification of the Preparation and of The Company

1.1 Product Name and/or code:	Wicked Colors
Effective Date:	5/22/2023
1.2 Manufacturer:	Color Craft Ltd / Createx Colors 14 Airport Park Road, PO Box 120 East Granby, CT 06026
Information Contact:	860-563-5505
1.3 Emergency Contact:	800-255-3924 813-248-0573
Emergency Response Service:	ChemTel Inc. 1305 North Florida Avenue Tampa, FL 33602 USA 813-248-0573 www.chemtelinc.com
Contact Number:	MIS4120068
Within the United States, Canada, Puerto Rico, and the U.S. Virgin Islands:	1-800-255-3924
Outside the United States, Canada, Puerto Rico, and the U.S. Virgin Islands:	+01-813-248-0585
	China: 400-120-0751 Brazil: 0-800-591-6042 India: 000-800-100-4086 Mexico: 01-800-099-0731
For Health Emergencies:	Contact your local Poison Control Center.
1.4 Product Use:	Art Material – Consumer Product

2. Hazards Identification

Emergency Overview

CAUTION! MAY CAUSE EYE IRRITATION.

2.1 Classification of the Product:

Label Elements	Conforms to ASTM D-4236 (USA)
Hazard Pictograms	 GHS07
Signal Word	CAUTION!

Hazard Statement	May cause respiratory irritation if inhaled. May cause skin irritation.
Precaution Statement:	Avoid contact with eyes, skin and clothing. Avoid breathing vapors or mist. Wash thoroughly after handling. Use with adequate ventilation. Do not eat, drink or smoke when using this product. Avoid release to the environment. For spray application: Ensure fresh air entry during application and drying. If you experience eye watering, headache or dizziness, wear an appropriate, properly fitted respirator (NIOSH approved). Follow respirator manufacturer's directions for respirator use.
Children's Statement	**KEEP OUT OF REACH OF CHILDREN.**
2.2 Other hazards	
NFPA	Health: 1 *Health: 2* (If sprayed applied)* Flammability: 0 Reactivity: 0
HMIS	Health: 1 *Health: 2* (If sprayed applied)* Flammability: 0 Reactivity: 0

3.Composition/Information on Ingredients:

3.1 Substances:

Mixture of the following chemicals:	Surfactants Dispersants < 1.00% Proprietary Pigment (Mixture) ***The remainder of the formulation is composed of non-hazardous ingredients.***

4. First Aid Measures

4.1 Description of first aid measures

Inhalation	If you experience difficulty in breathing, leave the area to obtain fresh air, get medical attention immediately.
Skin Contact	Wash the affected area thoroughly with plenty of soap and water.
Eye Contact	Carefully flush with water for 15 minutes. If irritation occurs, contact a physician.
Ingestion	If swallowed, do not induce vomiting. Contact a physician immediately.

5. Firefighting Measures

5.1 Extinguishing Media	Water, foam, carbon dioxide or dry chemical equipment.

5.2 Fire/Explosion Hazards	This product is not known to present any fire hazard.
5.3 Flashpoint/Flammability	Not flammable

6. Accidental Release Measures

6.1 Methods and Materials for Containment and Cleaning up	Contain spill. Recover as much as possible. Absorb remainder with an inert material. Place into closed container and store in a safe location to await disposal. Wash the spill area with soap and water.

7. Handling and Storage

7.1 Safe Handling	Use under ventilated conditions. Avoid eye and skin contact. For personal protection, we recommend that employees wash thoroughly after handling product. Always wash before eating, smoking or using toilet facilities. Keep container closed when not in use. Keep container upright to prevent leakage.
7.2 Environmental precautions	No product should be released to the environment. Keep container closed when not in use. Keep container upright to prevent leakage.
7.3 Storage	Store containers in a cool, dry, well ventilated area.

8. Exposure Controls/Personal Protection

8.1 Personal Protective Equipment	Wear goggles where spills or splashing may occur. Wear water resistant impervious gloves if handling bulk amounts.
8.2 Exposure Limits (USA)	Not applicable.
8.3 Respiratory and Ventilation	Wear approved NIOSH/MSHA respirator if exposure to mist or vapor exceed applicable PEL/TLV limits. Use in accordance with manufacturer's use limitations and OSHA STANDARD 1910-34. Local ventilation may be used to prevent routine inhalation.
Skin Protection	Wear water resistant impervious gloves if handling bulk amounts.
Eye Protection	Wear goggles where spills or splashing may occur.

9. Physical and Chemical Properties

9.1 Information on basic physical and chemical properties

Appearance	Liquid
Physical State	Liquid
Color	Various
Odor	Ether-like odor
Boiling Point	Not determined
Freezing Point	Not determined
State (pH)	No data available
Specific Gravity	No data available
Viscosity	No data available
Flashpoint	Not Flammable

Vapor Pressure	Not determined
Vapor Density	Not determined
Solubility in water	Miscible

10. Stability and Reactivity

10.1 Reactivity	No dangerous reaction known under conditions of normal use.
10.2 Chemical Stability	Stable under recommended storage conditions.
10.3 Conditions to Avoid	Avoid all sources of ignition.
10.4 Incompatible materials	Strong oxidizing agents, strong acids, strong bases, amines, ammonia, halogenated compounds.
10.5 Hazardous Decomposition	Carbon monoxide, carbon dioxide.

11. Toxicological Information

11.1 Information on toxicological effects

Health Effects	None known for the usual and ordinary uses of this product.
Acute Toxicity	None known for the usual and ordinary uses of this product.

**Studies have not been performed on this particular mixture. The information below is based on data on the individual ingredients.*

Eye Effects	May cause eye irritation
Skin Effects	May cause skin irritation on sensitive individuals.
Inhalation	May cause respiratory irritation.
Sensitization	No effects are likely to occur during the foreseeable and reasonable use of the product.
Ingestion	No effects are likely to occur during the foreseeable and reasonable use of the product.
Chronic Effects	No effects are likely to occur during the foreseeable and reasonable use of the product.
Additional toxicological information:	When used and handled according to specifications, the product does not have any harmful effects according to past experience and the information provided.

12. Ecological Information

12.1 Toxicity:	Not expected to be harmful to the environment. No product should be released to the environment.
Aquatic toxicity	Non-hazardous to water.
12.2 Persistence and degradability	Not persistent. Biodegradable. *Not relevant to this mixture.*
12.3 Bio accumulative potential	Does not occur. *Not relevant to this mixture.*
12.4 Mobility in soil	Mixture is similar to water. *Not relevant to this mixture.*
12.5 Additional ecological information	As a general rule, no product should be released to the environment.

13. Disposal Considerations

13.1 Dispose of all waste material in accordance with all applicable federal, state and local regulations for the disposal of aqueous polymer wastes.

14. Transport Information

14.1 The following transportation categories do not apply to this mixture sold as a consumer use product (non-bulk).

DOT	This regulation does not apply to the non-bulk material.
IMDG	This regulation does not apply to the non-bulk material.
ICAO/IATA	This regulation does not apply to the non-bulk material.

14.2 This information is not intended to convey all specific regulatory or operational requirements/information relating to this product. It is the responsibility of the transporting organization to follow all applicable laws, regulations and rules relating to the transportation of the materials.

15. Regulatory Information

15.1 Safety, health and environmental regulations/legislation specific for the substance or mixture.

SARA	Not applicable to this mixture.
Section 355 (extremely hazardous substances)	Not applicable to this mixture.
Section 313 (specific toxic chemical listing)	Not applicable to this mixture.
TSCA (Toxic Substance Control Act)	All ingredients are listed.

California Proposition 65

W005, W007, W009, W015, W016, W081, W083, W301, W303, W304, W305	As of May 17, 2023, this product contains no listed substances known to the state of California to cause cancer, birth defects or other reproductive harm, at concentrations which would require a warning under the statue.
W002, W011, W013, W030, W031, W050, W052, W055, W065, W069, W082, W085, W087, W300	⚠ WARNING: This product can expose you to Titanium Dioxide, Silica, Carbon Black which are known to the State of California to cause cancer. For more information go to www.P65Warnings.ca.gov.
W011	⚠ WARNING: This product can expose you to chemicals including 1,4 dioxane, ethylene oxide, polychlorinated biphenyls which are known to the State of California to cause cancer, and birth defects or other reproductive harm. For more information go to www.P65Warnings.ca.gov.
W011	⚠ WARNING: This product can expose you to chemicals including 3,3'-dichlorobenzidine which is known to the State of California to cause cancer. For more information go to www.P65Warnings.ca.gov.

Carcinogenicity categories	Not applicable to this mixture.
EPA (Environmental Protection Agency)	Not applicable to this mixture.
TLV (Threshold Limit Value established by ACGIH)	Not applicable to this mixture. Refer to section 8 for further information on individual substances of this mixture.
NIOSH (National Institute for Occupational Safety & Health)	Not applicable to this mixture.
OSHA (Occupational Safety & Health Administration)	Not applicable to this mixture.

16. Other Information

Color List

PRODUCT CODE	*PRODUCT NAME*
W002	Black
W005	Red
W007	Blue
W009	Phthalo Green
W011	Golden Yellow
W013	Laguna Blue
W015	Crimson
W016	Apple Green
W030	Opaque White
W031	Opaque Jet Black
W050	Detail White
W052	Detail Yellow
W055	Detail Violet
W065	Detail Yellow Ochre
W069	Burnt Umber
W081	Bismuth Vanadate Yellow
W082	Pyrrole Orange
W083	Pyrrole Red
W085	Limelight Green
W087	Daylight Blue
W300	Pearl Black
W301	Pearl White
W303	Pearl Red
W304	Pearl Blue
W305	Pearl Lime Green

Prepared by: Chief Toxicologist and President
ENVIRONMENTAL MEDICINE, INC.

778 Carver Avenue
WESTWOOD, NJ 07675
jaegerr@envmed.com
201-666-7929 x13

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Abbreviations and acronyms:

NFPA (SCALE 0-4) National Fire Protection Association (USA)	
Health:	1 - Caution. May be irritating. 2 - Warning. May be harmful if inhaled or absorbed. *
Fire:	0 - Not combustible.
Reactivity:	0 - Stable. Not reactive when mixed with water.
HMIS (SCALE 0-4) Hazardous Materials Identification System (USA)	
Health:	1 - Slight hazard: Irritation or minor reversible injury possible. 2 - Moderate hazard: Temporary or minor injury may occur.*
Fire:	0 - Minimal hazard: Materials that will not burn.
Physical Hazard:	0 - Minimal hazard: This material is normally stable, even under fire conditions and will not react with water, polymerize, decompose, condense, or self-react. Non-Explosives.

Exposure Limits

TWA - Time Weighted Average (8 hr.)
STEL - Short Time Exposure Limit (15 min.)
REL - Recommended Exposure Limit
PEL - Permissible Exposure Limit
IDLH - Immediately Dangerous to Life or Health

SAFETY DATA SHEET

SDS No. 892

Revision Date: January 2, 2020 Version: 13.0

☑ GHS Compliant

Section 1 - Identification of the substance/mixture and of the company

1.1 Product Identifier: Universal® Aerosol

1.2 General Use: Mold Release Agents

1.3 Manufacturer: Smooth-On, Inc.,
5600 Lower Macungie Rd., Macungie, PA 18062
Phone (610) 252-5800, FAX (610) 252-6200

1.4 Emergency Contact: Chem-Tel Domestic: 800-255-3924 International: 813-248-0585

Section 2 – Hazard(s) Identification

2.1 Classification of the substance or mixture:

H223 Flammable aerosols – Category 2
H229 Aerosols – Category 2

2.2 GHS Label elements, including precautionary statements
Pictogram(s):



Signal word: Warning

Physical Hazards

H223+H229	Flammable aerosol. Pressurized container: may burst if heated.

Precautionary Statements

P210	Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking.
P211	Do not spray on an open flame or other ignition source.
P251	Do not pierce or burn, even after use.
P410 + P412	Protect from sunlight. Do not expose to temperatures exceeding 50 °C/122 °F.

Hazards not otherwise classified (HNOC) or not covered by GHS – none known
This product contains a chemical known to be hazardous according to California Safe Drinking Water and Toxic Enforcement Act of 1986 (Proposition 65). (See also Section 3 and 15)

Section 3 - Composition / Information on Ingredients

3.1 Substances
The following ingredients are hazardous according to Regulation 2012 OSHA Hazard Communication Standard: 29 CFR 1910.1200:

CAS	Component	Concentration

115-10-6	Dimethyl ether	25% - 50%
75-37-6	1,1-difluoroethane	25% - 50%

Section 4 - First Aid Measures

4.1 Description of first aid measures

Inhalation: Remove source(s) of contamination and move victim to fresh air. If breathing has stopped, give artificial respiration, then oxygen if needed. Contact physician immediately.
Eye Contact: Flush eyes with plenty of water. If irritation persists, seek medical attention.
Skin Contact: In case of skin contact, wash thoroughly with soap and water.
Ingestion: Do not induce vomiting unless instructed by a physician. Never give anything by mouth to an unconscious person.

4.2 Most important symptoms and effects, both acute and delayed None known.

4.3 After first aid, get appropriate in-plant, paramedic, or community medical support.

Section 5 - Fire-Fighting Measures

5.1 Extinguishing Media: Water Fog, Dry Chemical, and Carbon Dioxide Foam

5.2 Special hazards arising from the substance or mixture: None known.

5.3 Advice for firefighters: Use water spray to cool fire-exposed surfaces and to protect personnel. Shut off "fuel" to fire. If a leak or spill has not ignited, use water spray to disperse the vapors. Either allow fire to burn under controlled conditions or extinguish with foam or dry chemical. Try to cover liquid spills with foam. Because fire may produce toxic thermal decomposition products, wear a self-contained breathing apparatus (SCBA) with a full face piece operated in pressure demand or positive-pressure mode.

Section 6 - Accidental Release Measures

6.1 Personal precautions, protective equipment and emergency procedures: Only properly protected personnel should remain in the spill area; dike and contain spill. Stop or reduce discharge if it can be done safely**.**

6.2 Environmental precautions: Large Spills: Dike far ahead of liquid spill for later recovery and disposal. Prevent entry into waterways, sewers, basements or confined areas.

Additional information:

Land Spill: Eliminate all ignition sources (no smoking, flares, sparks or flames in immediate area). Stop leak if you can do it without risk. All equipment used when handling the product must be grounded. Do not touch or walk through spilled material. Prevent entry into waterways, sewer, basements or confined areas. A vapor suppressing foam may be used to reduce vapors. Use clean non-sparking tools to collect absorbed material. Absorb or cover with dry earth, sand or other non-combustible material and transfer to containers. Large Spills: Water spray may reduce vapor; but may not prevent ignition in closed spaces.

Water Spill: Stop leak if you can do it without risk. Eliminate sources of ignition. Warn other shipping. If the Flash Point exceeds the Ambient Temperature by 10 °C or more, use containment booms and remove from the surface by skimming or with suitable absorbents when conditions permit. If the Flash Point does not exceed the Ambient Air Temperature by at least 10 °C, use booms as a barrier to protect shorelines and allow material to evaporate. Seek the advice of a specialist before using dispersants.

Water spill and land spill recommendations are based on the most likely spill scenario for this material; however, geographic conditions, wind, temperature, (and in the case of a water spill) wave and current direction and speed may greatly influence the appropriate action to be taken. For this reason, local experts should be consulted. Note: Local regulations may prescribe or limit action to be taken.

6.3 Methods and material for containment and cleaning up: Put on appropriate protective gear including NIOSH/MSHA approved self-contained breathing apparatus, rubber boots and heavy rubber gloves. Dike and contain spill; absorb or scrape up excess into suitable container for disposal; wash area with dilute ammonia solution. Stop or reduce discharge if it can be done safely**.** Follow applicable OSHA regulations (29 CFR 1910.120) for disposal.

6.4 Reference to other sections: See Section 3 for list of Hazardous Ingredients; Sections 8 for Exposure Controls; and Section 13 for Disposal.

Section 7 - Handling and Storage

7.1 Precautions for safe handling: Use good general housekeeping procedures. Wash hands after use. Do not get in eyes, on skin or on clothing. Do not breathe vapors or mists. Use good personal hygiene practices.

7.2 Conditions for safe storage, including any incompatibilities: Keep container(s) tightly closed and properly labeled. Store in cool, dry, well ventilated place away from heat, direct sunlight, strong oxidizers and any incompatibles. Store in approved containers and protect against physical damage. Keep containers securely sealed when not in use. Indoor storage should meet OSHA standards and appropriate fire codes. Containers that have been opened must be carefully resealed to prevent leakage. Empty containers retain residue and may be dangerous. Avoid water contamination.

7.3 Specific end use(s): These precautions are for room temperature handling. Other uses including elevated temperatures or aerosol/spray applications may require added precautions.

Section 8 - Exposure Controls / Personal Protection

8.1 Control parameters: none defined

8.2 Exposure controls:

Respiratory Protection: Respiratory protection is not normally required when using this product with adequate local exhaust ventilation. Where risk assessment shows air-purifying respirators are appropriate, follow OSHA respirator regulations 29 CFR 1910.134 and European Standards EN 141, 143 and 371; wear an MSHA/NIOSH or European Standards EN 141, 143 and 371 approved respirators equipped with appropriate filter cartridges as a backup to engineering controls.
Hand Protection: Wear any liquid-tight gloves such as butyl rubber, neoprene or PVC.
Eye Protection: Safety glasses with side shields per OSHA eye- and face-protection regulations 29 CFR 1910.133 and European Standard EN166. Contact lenses are not eye protective devices. Appropriate eye protection must be worn instead of, or in conjunction with contact lenses.
Other Protective Clothing/Equipment: Additional protective clothing or equipment is not normally required. Provide eye bath and safety shower.
Comments: Never eat, drink, or smoke in work areas. Practice good personal hygiene after using this material, especially before eating, drinking, smoking, using the toilet, or applying cosmetics. Wash thoroughly after handling.

Section 9 - Physical and Chemical Properties

9.1 Information on basic physical and chemical properties:

Appearance : aerosol
Odor/Threshold: slight ethereal
pH: N.A. (non-aqueous)
Melting Point/Freezing Point: N.A.
Low/High Boiling Point: N.A.
Flash Point: >300 °F
Evaporation Rate: Not available
Flammability: nonflammable aerosol
UEL/LEL: Not available

Vapor Pressure: 518 mmHg @ 70 °F
Vapor Density (Air=1): ~4
Specific Gravity (H_2O=1, at 4 °C): NA
Water Solubility: negligible
Partition coefficient: Not available
Auto-ignition temperature: Not available
Decomposition temperature: Not available
Viscosity: Not applicable
% Volatile: 497 g/l

Section 10 - Stability and Reactivity

10.1 Reactivity: No hazardous reactions if stored and handled as prescribed/indicated., No corrosive effect on metal. Not fire propagating.
10.2 Chemical stability: These products are stable at room temperature in closed containers under normal storage and handling conditions.
10.3 Possibility of hazardous reactions: Hazardous polymerization cannot occur.
10.4 Conditions to avoid: none known
10.5 Incompatible materials: strong bases and acids
10.6 Hazardous decomposition products: Thermal oxidative decomposition can produce carbon oxides, gasses/vapors, and traces of incompletely burned carbon compounds.

Section 11- Toxicological Information

11.1 Information on toxicological effects:
Skin Corrosion/Irritation: no data
Serious Eye Damage/Irritation: no data
Respiratory/Skin Sensitization: no data
Germ Cell Mutagenicity: no data
Carcinogenicity: No component of these products present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by IARC, ACGIH or NTP.
Reproductive Toxicity: no data
Specific Target Organ Toxicity – Single Exposure: no data
Specific Target Organ Toxicity – Repeated Exposure: no data
Aspiration Hazard: no data
Acute Toxicity: no data
Chronic Exposure: no data
Potential Health Effects – Miscellaneous: no data

Section 12 - Ecological Information

12.1 Toxicity: no data
12.2 Persistence and Degradability: no data
12.3 Bioaccumulative Potential: no data
12.4 Mobility in Soil: no data
12.5 Results of PBT and vPvB assessment: no data
12.6 Other Adverse Effects: no data

Section 13 - Disposal Considerations

13.1 Waste treatment methods: Under Resource Conservation and Recovery Act (RCRA) it is the responsibility of the user of the product to determine at the time of disposal whether the product meets RCRA criteria for hazardous waste as defined in 40 CFR Part 261. Waste management should be in full compliance with federal, state and local laws. Empty containers retain product residue which may exhibit hazards of material, therefore to not pressurize, cut, glaze, weld or use for any other purposes. Return drums to reclamation centers for proper cleaning and reuse.

Section 14 - Transport Information

DOT	IATA	IMDG
Shipping Name: Aerosols, flammable **UN**: 1950 **HC**:2.1 **Limited Quantity = 1 L**	**Shipping Name**: Aerosols, flammable **UN**: 1950 **HC**:2.1 **Limited Quantity = 1 L**	**Shipping Name**: Aerosols, flammable **UN**: 1950 **HC**:2.1 **Limited Quantity = 1 L** **EmS:** F-D,S-U

Section 15 - Regulatory Information

15.1 Safety health and environmental regulations/legislation specific for the substance or mixture:

REACH: Regulation (EC) No 1907/2006 of The European Parliament and of The Council of December 2006 (including amendments and corrigenda as of June 2020): This product complies with REACH or is not subject to regulation under REACH. The product does not contain an ingredient listed on either the Candidate List or Authorization List for Substances of Very High Concern (SVHC).

In the United States (EPA Regulations):
TSCA Inventory Status (40 CFR710): All components of this formulation are listed in the TSCA Inventory. No component of this formulation has been determined to be subject to manufacturing or use restrictions under the Significant New Use Rules (SNURs).

SARA 302 Components: No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components: No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 313.

SARA 311/312 Hazards: Fire

California Proposition 65: This product does not intentionally contain any chemicals known to the state of California to cause cancer, birth defects or other reproductive harm.

15.2 Chemical safety assessment: No chemical safety assessment has been carried out for this substance/mixture by the supplier.

16 - Other Information

HMIS	
H	2
F	2
R	0



NFPA

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Revision Date: January 2, 2021 Version 13.0

Glossary: ACGIH-American Conference of Governmental Industrial Hygienists; ANSI-American National Standards Institute; Canadian TDG-Canadian Transportation of Dangerous Goods; CAS-Chemical Abstract Service; Chemtrec-Chemical Transportation Emergency Center (US); CHIP-Chemical Hazard Information and Packaging; DSL-Domestic Substances List; EC-Equivalent Concentration; EH40 (UK)-HSE Guidance Note EH40 Occupational Exposure Limits; EPCRA-Emergency Planning and Community Right-To-Know Act; ESL-Effects screening levels; GHS-Globally Harmonized System of Classification and Labelling of Chemicals; HMIS-Hazardous Material Information Service; IATA-International Air Transport Association; IMDG-International Maritime Dangerous Goods Code; LC-Lethal Concentration; LD-Lethal Dose; LEL-Lower Explosion Level; NFPA-National Fire Protection Association; OEL-Occupational Exposure Limit; OSHA-Occupational Safety and Health Administration, US Dept. of Labor; PEL-Permissible Exposure Limit; SARA (Title III)-Superfund Amendments and Reauthorization Act; SARA 313-Superfund Amendments and Reauthorization Act, Section 313; SCBA-Self-Contained Breathing Apparatus; STEL-Short Term Exposure Limit; TCEQ-Texas Commission on Environmental Quality; TLV-Threshold Limit Value; TSCA-Toxic Substances Control Act Public Law 94-469; TWA-Time Weighted Value; UEL-Upper Explosion Level; US DOT-US Department of Transportation; WHMIS-Workplace Hazardous Materials Information System.

Disclaimer: The information contained in this Safety Data Sheet (SDS) is considered accurate as of the version date. However, no warranty is expressed or implied regarding the accuracy of the data. Since the use of this product is not within the control of Smooth-On Inc., it is the user's obligation to determine the suitability of the product for its intended application and assumes all risk and liability for its safe use.

This SDS is prepared to comply with the Globally Harmonized System of Classification and Labelling of Chemicals (GHS) as prescribed by the United States (US) Occupational Safety and Health Administration (OSHA) Hazard Communication Standard (29 CFR 1910.1200), the Canadian Workplace Hazardous Materials Information System (WHMIS), and European Union Regulation (EC) No 1907/2006 of the European Parliament and of the Council of 18 December 2006 (REACH).

Classifications of the chemical in accordance with 29 CFR 1910.1200, signal word, hazard and precautionary statement(s), symbol(s) and other information are based on listed concentration of each hazardous ingredient. Unlisted ingredients are not "hazardous" per the OSHA Hazard Communication Standard (29 CFR 1910.1200), WHMIS and EC No 1907/2006 and are considered trade secrets under US Federal Law (29 CFR and 40 CFR), Canadian Law (Health Canada Legislation), and European Union Directives.

D. Risk Assessment Appendix

A. Helios Risk Assessment Matrix

Component	Failure Mode	Effects of Failure	Causes of Failure	Prevention	Severity Ranking (1-5, 1 being not severe, 5 being very severe)	Occurrence Ranking (1-5, 1 being unlikely to occur, 5 being very likely to occur)	Prevention Ranking (1-5, 1 being easy to prevent, 5 being difficult to prevent)	Risk Priority Number	Occurrence After Prevention Ranking (1-5, 1 being unlikely to occur, 5 being very likely to occur)	Risk After Prevention Priority Number (Uses Occurence After Prevention Ranking instead of Occurence Ranking)
Nose Cone	Threaded rod unscrews from nose cone tip	No separation will occur, loss in altitude, comes down ballistic	The threaded rod is no longer in the nose cone tip, and the e-bay falls	Loctite the threaded rod to nose cone tip	5	2	1	10	1	5
General Ebay	Battery runs out of power	Data won't get collected, separation doesn't occur, rocket comes down ballistic	Battery is not charged sufficiently	Don't turn on the screw switches until the rocket is fully integrated and vertical on the rail, ensure nominal charging of the battery, battery voltage check before launch	5	3	1	15	2	10
EasyMini (primary flight computer)	EasyMini does not output electrical signal	Rocket doesn't separate, comes down ballistic	Electrical connection fails	Continuity checks and tug tests prior to launch, check EasyMini turns on before connecting to energetics, ejection testing, have redundant flight computer	5	2	1	10	1	5
	EasyMini does not output electrical signal	Rocket doesn't separate, comes down ballistic	Product defect	Ejection testing	5	2	2	20	1	10
	EasyMini outputs electrical signal too early	Separation occurs too early, drogue deploys too early, larger than nominal force would mean drogue can get ripped off and then the main parachute doesn't deploy, rocket doesn't hit altitude and/or comes down ballistic separated	EasyMini thought the rocket launched when going from horizontal to vertical when putting it on the rail so false detection of altitude	Ejection testing, have redundant flight computer, don't turn on the screw switches until the rocket is fully integrated and vertical on the rail	4	3	2	24	1	8
	EasyMini outputs electrical signal too early	Charge fires too early, so separation occurs too early, drogue deploys too early, larger than nominal force would mean drogue can get ripped off and then the main parachute doesn't deploy, rocket doesn't hit altitude and/or comes down ballistic separated	EasyMini programmed incorrectly	Ejection testing	4	2	2	16	1	8
	EasyMini outputs electrical signal too early	Charge fires too early, so separation occurs too early, drogue deploys too early, larger than nominal force would mean drogue can get ripped off and then the main parachute doesn't deploy, rocket doesn't hit altitude and/or comes down ballistic separated	Product defect	Ejection testing	4	2	2	16	1	8
	EasyMini outputs electrical signal too late	Charge fires too late, rocket comes down ballistic for a little while which is a lot of forces on the rocket, this could impact the u-bolt or cause the rocket to not separate	EasyMini programmed incorrectly	Ejection testing, have redundant flight computer	5	2	2	20	1	10
	EasyMini outputs electrical signal too late	Charge fires too late, rocket comes down ballistic for a little while which is a lot of forces on the rocket, this could impact the u-bolt or cause the rocket to not separate	Product defect	Ejection testing, have redundant flight computer	5	2	2	20	1	10
Raven4 (secondary flight computer)	Raven4 does not output electrical signal	Rocket doesn't separate, comes down ballistic	Electrical connection fails	Continuity checks and tug tests prior to launch, check Raven4 turns on before connecting to energetics, ejection testing, have redundant flight computer	5	2	1	10	1	5
	Raven4 does not output electrical signal	Rocket doesn't separate, comes down ballistic	Product defect	Ejection testing	5	2	2	20	1	10
	Raven4 outputs electrical signal too early	Separation occurs too early, drogue deploys too early, larger than nominal force would mean drogue can get ripped off and then the main parachute doesn't deploy, rocket doesn't hit altitude and/or comes down ballistic separated	Raven4 thought the rocket launched when going from horizontal to vertical when putting it on the rail so false detection of altitude	Ejection testing, have redundant flight computer, don't turn on the screw switches until the rocket is fully integrated and vertical on the rail	4	3	2	24	1	8
	Raven4 outputs electrical signal too early	Charge fires too early, so separation occurs too early, drogue deploys too early, larger than nominal force would mean drogue can get ripped off and then the main parachute doesn't deploy, rocket doesn't hit altitude and/or comes down ballistic separated	Raven4 programmed incorrectly	Ejection testing	4	2	2	16	1	8
	Raven4 outputs electrical signal too early	Charge fires too early, so separation occurs too early, drogue deploys too early, larger than nominal force would mean drogue can get ripped off and then the main parachute doesn't deploy, rocket doesn't hit altitude and/or comes down ballistic separated	Product defect	Ejection testing	4	2	2	16	1	8
	Raven4 outputs electrical signal too late	Charge fires too late, rocket comes down ballistic for a little while which is a lot of forces on the rocket, this could impact the u-bolt or cause the rocket to not separate	Raven4 programmed incorrectly	Ejection testing, have redundant flight computer	5	2	2	20	1	10
	Raven4 outputs electrical signal too late	Charge fires too late, rocket comes down ballistic for a little while which is a lot of forces on the rocket, this could impact the u-bolt or cause the rocket to not separate	Product defect	Ejection testing, have redundant flight computer	5	2	2	20	1	10
Sirin (GPS)	Sirin does not transmit data	Unable to locate rocket	Electrical connection fails	Test Sirin prior to launch, have a second GPS	3	2	2	12	1	6
	Sirin does not transmit data	Unable to locate rocket	Programmed incorrectly	Test Sirin prior to launch, have a second GPS	3	3	2	18	1	6
	Sirin signal is unretrievable	Unable to locate rocket	Conductive materials present between the user and the Sirin module	Can track Sirin's live telemetry before ground hit to locate rocket, have a second GPS	3	3	2	18	2	12
FeatherWeight (GPS)	FeatherWeight does not transmit data	Unable to locate rocket	Electrical connection fails	Test FeatherWeight prior to launch	3	2	2	12	1	6
	FeatherWeight does not transmit data	Unable to locate rocket	Product defect	Test FeatherWeight prior to launch	3	3	2	18	1	6
	FeatherWeight signal is unretrievable	Unable to locate rocket	Conductive materials present between the user and the FeatherWeight module	Can track Sirin's live telemetry before ground hit to locate rocket	3	3	2	18	2	12

Component	Failure Mode	Effects of Failure	Causes of Failure	Prevention	Severity Ranking (1-5, 1 being not severe, 5 being very severe)	Occurrence Ranking (1-5, 1 being unlikely to occur, 5 being very likely to occur)	Prevention Ranking (1-5, 1 being easy to prevent, 5 being difficult to prevent)	Risk Priority Number	Occurrence After Prevention Ranking (1-5, 1 being unlikely to occur, 5 being very likely to occur)	Risk After Prevention Priority Number (Uses Occurence After Prevention Ranking instead of Occurence Ranking)
Elvin Beacon (RF Beacon)	Elvin Beacon does not output signal	Potentially unable to recover rocket because it can't be located	Electrical connection fails	Battery voltage and continuity checks prior to launch, ensure stable readings before launch, try to use GPS as backup to find rocket	1	2	2	4	1	2
	Elvin Beacon does not output signal	Potentially unable to recover rocket because it can't be located	Programmed incorrectly	Ensure stable readings before launch, try to use GPS as backup to find rocket	1	3	2	6	2	4
	Elvin Beacon does not output signal	Potentially unable to recover rocket because it can't be located	Product defect	Ensure stable readings before launch, try to use GPS as backup to find rocket	1	2	2	4	2	4
Nose Cone Bulkhead	Charge well fails to ignite	Separation doesn't occur, rocket comes down ballistic	Not enough black powder/not fully packed inside	Ejection testing	5	2	2	20	1	10
	Charge well fails to ignite	Separation doesn't occur, rocket comes down ballistic	E-match gets crushed	Ejection testing	5	2	2	20	1	10
Recovery	Recovery lines get tangled	Parachute does not fully inflate, potential collision between nose cone and lower body in-flight	Improper packing	Ensure proper packing of the recovery system	3	2	2	12	1	6
	Recovery lines get tangled	Parachute does not fully inflate, potential collision between nose cone and lower body in-flight	Vibrations from flight forces	Ensure proper packing of the recovery system	3	2	2	12	1	6
	Drogue does not deploy/deploys incorrectly	Main will not deploy properly or at all, rocket comes down too fast, will lose guidance	Improper packing	Ensure proper packing of the recovery system	5	2	2	20	1	10
	Main does not deploy/deploys incorrectly	Rocket comes down too fast/ballistic	Improper packing	Ensure proper packing of the recovery system	5	2	2	20	1	10
	Main deploys too early	Rocket drifts too far away	Flight computer error	Ejection testing	2	2	2	8	1	4
	Main deploys too early	Rocket drifts too far away	Tendie comes loose	Ejection testing, ensure that tendie slip-fits prior to launch	2	3	2	12	2	8
	Main deploys too late	Rocket comes down too fast, possible damage	Flight computer error	Ejection testing	2	2	2	8	2	8
	Main deploys too late	Rocket comes down too fast, possible damage	Tendie doesn't separate fully/properly due to not enough black powder, or e-match getting crushed	Ejection testing	2	2	2	8	1	4
Motor	CATO	Rocket explodes	Defect, or blockage of exhaust	Ensure correct assmebly of motor with Flyer of Record	5	2	3	30	1	15
Fins	Fins snap	Rocket would likely flutter, be unable to fly	Rocket falls on launch rail onto a fin	Ensure rocket is secure on launch rail and will not fall	5	1	1	5	1	5

B. Selene Risk Assessment Matrix

Component	Failure Mode	Effects of Failure	Causes of Failure	Prevention	Severity Ranking	Occurance Ranking	Prevention Ranking	Risk Priority Number
Lower Payload Bulkhead	Screw holes fail	Payload separates from retention bulkhead	Forces from bolts at main deployment	Run simulations prior to launch	4	1	2	8
Payload Retention Bulkhead	Screw holes fail	Payload separates from retention bulkhead	Forces from bolts at main deployment	Run simulations prior to launch	4	1	2	8
Bolts	Internal frame bolts shear	Payload separates from retention bulkhead	Forces from main deployment	Run simulations prior to launch	4	1	2	8
	Upper payload bulkhead bolts shear	Payload separates from retention bulkhead	Forces from main deployment	Run simulations prior to launch	4	1	2	8
	Lower payload bulkhead bolts fail	Payload separates from retention bulkhead	Forces from main deployment	Run simulations prior to launch	4	1	2	8
	Payload retention bulkhead bolts shear	Payload separates from retention bulkhead	Forces from main deployment	Run simulations prior to launch. Tests on CF tubes to avoid zippering	4	1	2	8
Cameras	Cameras do not recieve power	No visual data collected	Camera wires disconnect	Test all cameras prior to installation, visually inspect for disconnected wires prior to integration	3	1	1	3
	Cameras do not record	No visual data collected	Signal to start recording does not occur	Test recording prior to installation	3	2	1	6
	Recordings are not stored	No visual data collected	SD card is improperly connected	Test all cameras prior to installation, visually inspect for disconnected wires prior to integration	3	2	3	18
Servos	Servos get stuck/do not actuate properly	Exeriment does not deploy	Connection between servo and moving components breaks, servo internal mechanism damaged	Test all servos prior to installation, test deployment mechanism extensivley, visually inspect for damage prior to integration	3	2	3	18
	Servos Electrically Fail	Experiment does not deploy	Servo wires disconnect, servo internal circuitry damaged	Test all servos prior to installation, visually inspect for disconnected wires prior to integration	3	1	1	3
Piezoelectrics	PZE detaches from glass	No stress or vibration data collected	Rocket virbrations detach PZE, improper assembly, glass locally breaks	Confirm proper attachment, observe results from test launch	3	1	1	3
	PZE data contains too much noise	Data is uninterpretable	Rocket vibrations are much larger than the differences in vibrations across different locations of the glass	Observe results from test launch, develop better noise reduction algorithms	2	3	1	6
	PZE disconnects from Sirin	No data collected	Wires disconnect or are damaged	Test all connections prior to launch	3	1	1	3
Wires	Wires disconnect	Exeriment does not deploy, no data collected	Poor wire connection	Examine all wire connections prior to installation to ensure good connection	5	1	1	5
	Wires short against payload	Exeriment does not deploy, no data collected	Exposed wires come into contact with payload frame	Cover exposed wires and test before installation	5	1	1	5
Glass	Glass gets stuck and does not unfurl	Experiment does not deploy	Poor 3D print quality	Test deployment prior to launch. Update 3D print as needed to accomidate glass	4	1	2	8
	Glass shatters	Experiment does not deploy. No data collected	Forces from launch	Run experiments to determine the strength of the glass, possibly layer with other material if needed	4	3	3	36

C. Airbrakes Assessment Matrix

Component	Failure Mode	Effects of Failure	Causes of Failure	Prevention	Severity Ranking	Occurence Ranking	Prevention Ranking	Risk Priority Number	Occurrence After Prevention Ranking	Risk After Prevention Priority Number
Upper Mechanism	Coupler slips	Cannot move flaps	Coupler not tighened	Check tightness before launch	2	3	1	6	2	4
	Limit switches do not trigger	Mechanism overrun, potential breakage	Faulty wiring, incorrect code	Testing (test switch reading before actuation, press switches during test before they'd be hit normally)	4	2	1	8	1	4
	Flaps are not aligned	Pitch/yaw are affected	Adjustment screws not set or tight	Set carefully, check tightness before launch	4	3	1	12	1	4
Lower Mechanism	Flaps collide with boattail	Stalled actuation or part breakage	Improper cutout placement	Check cutouts with flaps installed, ensure proper clocking before launch	5	2	3	30	1	15
	Acutation tube bending/binding	Stalled actuation or inaccurate actuation	Insufficient stiffness	Buckling calculations, ensure smooth movement before epoxying	3	3	1	9	1	3
Sirin	Determines actuation incorrectly	Incorrect apogee	Poor sensor data or incorrect code (Kalman filter failure, pre-flight calculation failure)	Testing (feed past launch data into algorithm)	3	4	3	36	2	18
	PID loop failure	Flaps oscillate and don't reach steady state	Loop tuned incorrectly, other bugs in code	Testing (feed past launch data into algorithm)	2	3	3	18	1	6
	Actuates too soon	Low apogee, mechanism overload	Poor sensor data or incorrect code (Kalman filter failure, improper mach lockout)	Testing (feed past launch data into algorithm)	4	2	2	16	1	8
Other Electronics	Batteries run out	No apogee control	Improper sizing or electrical fault	Calculation and testing (run electronics until batteries die)	2	2	1	4	1	2
	Camera failure	No footage	Improper wiring, no sd card	Pre-flight checks (ensure camera is recording nominally, secure SD card)	1	4	1	4	1	1
Superstructure	Bulkhead to motor tube joint failure	Motor not properly retained, mechanism shifts within boattail	Poor surface prep, improper epoxy mixing	Ensure surfaces are sanded and clean, follow epoxy instructions	5	2	2	20	1	10
	Motor retention failure	Motor falls out	Threaded rod failure, set screw failure	Ensure sufficient thread engagement before launch, ensure set screw is tight before launch	5	2	1	10	1	5

E. Assembly, Preflight, Launch, Recovery, and Off-Nominal Checklists Appendix

Helios Launch Checklist

1 - Pre-Launch Checklist				
Task	Steps	Verification Method	Member Sign	Lead Sign
1.1.1 GPS Verification	Connect the GPS battery in the e-bay and activate screw switch. Turn on and connect the receiver for e-bay GPS. Turn off screw switches, disconnect all batteries, and turn off GPS receivers.	E-bay GPS accurately transmits data.		
1.1.2 Battery Checks	Check all batteries for nominal voltage using a multimeter Charge any batteries that are under a voltage of 4.0 volts.	Check all 18650 and the single 16340 battery for a voltage of at least 4.0 using a DMM.		
1.1.3 Drogue Deployment Packing Test	Dry-pack all parachutes and lines (incl. Tendie–Descendie connection)	Ensure parachutes fit inside the upper body tube without sticking out Pull main parachute out to verify no tangles		
1.1.4 Main Deployment Packing Test	Remove Tendie pin connection	Main parachute inflates fully No line tangles		

Helios Launch Checklist				
1.1.5 Electronics Bay Flight Computer Programming	Program Raven4 Program EasyMini Calibrate Raven4	**Raven4** *Apo:* Flight Time > TVal Time: TVal Time = 35s Pressure Increasing Velocity < Vel1: Vel1 = 400 ft/s Time Delay: 1.5s *Main:* Flight Time > TVal Time: TVal Time = 40s Height Above Pad < AGL3: AGL3 = 1500 ft Pressure Increasing Velocity < Vel1: Vel1 = 400 ft/s **EasyMini** Main Deploy Altitude: 1500 ft Apo Delay: 1s Apo Lockout: 35s		
1.1.6 Main Electronics Bay Altimeter Firing Sequence Verification	Connect e-matches to proper channels Run a simulated flight	**Raven4** Apo charge fires shortly after simulated apo Main fires shortly after 1500 ft		

Helios Launch Checklist				
		EasyMini Main fires at 1500 ft		
1.1.7 Black Powder Ejection Testing	Connect an e-match to the screw terminal for the correct port Insert E-match into a charge well and pour black powder Fill charge well with dog barf and seal with electrical tape Fully install the electronics bay with an EasyMini programming cable attached Assemble electronics bay with upper body tube, using shear pins to secure orientation Angle the tubes upward away from everyone for safe ejection Activate the EasyMini using a screw switch, then plug cable into laptop Run flight	Upper section cleanly separates from the lower body without traveling >10 ft Main parachute comes out of the upper body tube		

Helios Launch Checklist				
	simulation, BACK AWAY 10 ft, and wait for ejection			
1.1.8 Tendie Descendie Ejection Testing	Insert an E-match into the Tendie Descendie and seal the wire with tape Pour black powder into the Delrin charge well of the pin assembly Insert pin assembly into the body with a quick link on the upper pin Suspend e-bay assembly so the upper bulkhead points downward Suspend a heavy weight (>10 lbs) from the Tendie Descendie quick link	Pin assembly cleanly ejects from the base without interference Pin assembly remains attached to the bulkhead via aircraft cable Suspended weight is released		
2 - Main Electronics Bay				
Task	Steps	Verification Method	Member Sign	Lead Sign
1.2.1 Battery Checks	Check batteries for nominal charge using DMM Charge any	Check all 18650 and the single 16340 battery for a charged voltage of 4.0 using a DMM.		

Helios Launch Checklist				
	batteries that are <4 Volts			
1.2.2 Battery Connections to Components	Connect EasyMini to battery Verify EasyMini powers on Disconnect EasyMini from battery Connect Raven4 to battery Verify Raven4 turns on Disconnect Raven4 from battery Connect Featherweight to Battery Verify Featherweight turns on Verify Featherweight connects Disconnect Featherweight from battery Connect Sirin to battery Verify Sirin turns on	Batteries are in their housing Raven4, EasyMini, and Featherweight GPS, and Sirin can all be turned on using screw switches		

Helios Launch Checklist				
	Disconnect Sirin from battery **Ensure all Connections Disconnected**			
1.2.3 Component Connections and Continuity	Connect all flight computer channels to correct bulkhead connections Use a DMM to verify continuity **Disconnect all Connections**	**EasyMini:** EasyMini main 1,2, no cross continuity EasyMini apo to 3,4, no cross continuity **Raven4:** Raven4 main 7,8, no cross continuity Raven4 apo 5,6, no cross continuity		
1.2.4 Wire Connection Tests and Organization	Ensure all wires have been twisted together. Ensure that all connections will not come out during flight	All wires are observed to be twisted. All connections stay connected after being tug-tested		
1.2.5 Electronic Match Set-up	Cut 4 Electronic Matches to length and strip ends. Wrap electrical tape around the end of e-matches for the Tendie Pull the two taped e-matches through the tendie and place the two non-taped ends	**EasyMini:** 1,2 to main charge well 3,4 to main tendie well **Raven4:** 7,8 to backup charge well 5,6 to backup tendie well		

Helios Launch Checklist				
	into the Charge Wells			
1.2.6 Measure out Black Powder	Insert all proper measurements of black powder into individual containers **Ensure that all containers are labeled** 5 grams in primary 6 grams in secondary	Visually inspect amount of black powder in each vial.		
1.2.7 Final Battery Voltage Check	Check batteries for nominal charge using DMM Charge any batteries that are <4 Volts	Check all 18650 and the single 16340 battery for a charged voltage of at least 4.0 using a DMM.		
1.2.8 Current Testing	Using a DMM, check the current through the screw terminals **Current must be less than 100mA**	Current readings are less than 100mA		
ENSURE ALL SCREW SWITCHES OFF AT THIS POINT				
1.2.9 Final Assembly	Connect batteries Insert e-bay into Nose cone, making sure the clocking notch is	All electronics are off Connections pass the tug test by two(+) people e-bay is not loose and		

Helios Launch Checklist				
	set Connect all Stripped ends of e-matches, tighten screws and verify they pass the tug test. Blue Loctite Nose Cone tip	does not rattle.		
1.2.10 Tendie Descendie Packing	Pour 0.1 grams of black powder into delrin well in pin assembly Turn e-bay on its side so tendie can be pushed into the body Attach the quicklink at the end of the recovery line to the eye nut on e-bay Tie Brunnian link to backward facing Tendie pins Push out temporary tendie plates with black plates with charge wells Repeat for second tendie charge well.	Electronic matches are installed Pin restrains loop Link does not detach when pulled and the link is not frayed Visually inspect amount of black powder in each vial. Tendie charge wells are flush with tendie body and brunnian link still does not detach when pulled		

Helios Launch Checklist				
1.2.11 Pack Charge Wells	Pour black powder into charge wells Fill in remaining volume with dog barf, packing tightly Cover in electrical tape, making an X, and wrap a final piece around the cylinder.	All black powder vials are empty All e-matches are inside charge wells, with their heads covered in black powder Top of charge well feels solid when pushed on Tape is firmly in place Wires cannot be caught or tangled.		
3 - Recovery Integration				
Task	Steps	Verification Method	Member Sign	Lead Sign
1.3.1 Pack main parachute into deployment bag	Fold parachute Untangle lines Weave lines into deployment bag Put canopy in dbag Roll up recovery line and put into deployment bag Attach main parachute quicklink to recovery line	Parachute fits in deployment bag without stressing the deployment bag The entire length of lines are fully secured in the deployment bag Quicklink at the end of the recovery line can reach the lower d-ring		
1.3.2 Prepare deployment bag	Attach quicklink at the end of the recovery line to the lower d-ring and the eye nut	The deployment bag is folded over on itself		

Helios Launch Checklist				
	on the ebay Feed the Tendie loop through the parachute quicklink and the upper d-ring Attach the Tendie loop to the quicklink at the end of the recovery line			
1.3.3 Pack drogue parachute	Attach drogue to fire blanket using quicklink Fold drogue Wrap drogue in fire blanket Attach recovery line Roll up recovery lines on either side and tape to fire blanket	 Lines are not tangled Drogue is full covered by fire blanket Drogue does not fall out when handled but is not compressed		
4 - Upper Body Integration and Installation				
Task	Steps	Verification Method	Member Sign	Lead Sign
1.4.1 Integrate Payload	Ensure kevlar loop attached and eyebolt nuts are tightened Attach payload to payload bulkhead with screws Slide payload coupler into	Payload cannot move translationally or rotationally Kevlar loop is tight and eyebolts do not move Payload cannot come free from bulkhead. Payload coupler is attached to lower body		

Helios Launch Checklist				
	lower body tube along clocking line. Slide payload into rocket along clocking line Screw 6 #10-24 bolts through the side of the airframe.	tube along clocking line and payload is exposed.		
1.4.2 Integrate Upper Body	Slide upper body tube onto nose cone coupler along the clocking line Screw 6 #10-24 bolts through the side of the airframe.	Upper body tube is and nose cone are clocked along clocking line Paint matches up along upper body tube and nose cone		
1.4.3 Install Upper Body to Lower Body Tube	Quicklink the recovery line to the payload loop Slide upper body tube over payload coupler along clocking line. Screw in 3 #2-56 nylon shear pins	Upper body and lower body tube integrated All tubes are along clocking lines Paint matches up along all tubes		
5 - Motor, Airbrakes, and Final Integration				
Task	Steps	Verification Method	Member Sign	Lead Sign
1.5.1 Assemble Motor	Follow all manufacturer's steps precisely	Motor is securely assembled		
1.5.2 Inspect Motor	Inspect nozzle for any blockage	Nozzle is clear		

Helios Launch Checklist				
	Inspect grains for crystallization	No significant distortion within the grains		
1.5.3 Attach fin can to Lower Body Tube Assemble Airbrakes Mechanism	Attach fin can to airbrakes superstructure. Use 5 #10-24 bolts to attach fin can to interface bulkhead. Install motor via threaded rod through fin can into airbrakes superstructure Secure with set screw	Fin can is securely attached to airbrakes superstructure All holes in fin can have bolts in them. Check tightness of bolts with hex key Motor cannot move freely Motor cannot translate or rotate.		
1.5.4 Attach fin can to Lower Body Tube	Attach Lower Body Tube (LBT) to interface bulkhead, ensuring alignment along clocking line. Use 5 #10-24 bolts to secure LBT to the interface bulkhead. Attach a 15-15 rail button on the hole that lines up with the clocking line using a countersink #10-24 bolt	The fin can and Lower Body Tube are securely attached Rail button is attached to bolt on clocking line Clocking line marks match up Paint scheme matches up Check tightness of bolts with hex key		

Helios Launch Checklist				
	Ensure proper clock			
1.5.5 Final Check Before Safety	Inspect entire rocket for clocking Ensure all bolts tightened	All paint should match up All bolts should be tightened All mechanisms should be integrated		

Helios Launchpad Checklist

Hardware to Bring:
Safety Glasses, Small Screwdrivers from Jewlers Kit, Stethoscope

1 - Horizontal Mounting and Activation

Task	Steps	Verification Method	Member Sign	Lead Sign
2.1.1 Install Rocket onto rail	Slide rocket onto rail	Rocket slides without interference		
2.1.2 Activate Featherweight GPS	Screw in Featherweight GPS screw switch	Ensure Featherweight GPS is communicating with base station.		
2.1.3 Activate Sirin	Screw in Sirin screw switch	Ensure Sirin is communicating with base station		
2.1.4 Activate ElvinBeacon	Screw in ElvinBeacon screw switch	Ensure ElvinBeacon pulse is picked up on handheld radio Ensure ElvinBEacon is communicating with base station		
2.1.5 Mount rocket vertically	Tilt launch rail 4 degrees into the wind	Rocket should be vertical on launch rail with a slight angle		

2 - Flight Computer Activation

Task	Steps	Verification Method	Member Sign	Lead Sign
ENSURE PEOPLE ARE HOLDING THE LADDER BEFORE CLIMBING UP KEEP HEAD AWAY FROM ROCKET, USE A STETHOSCOPE				
2.2.1 Arm Selene	Screw in payload screw switch	Ensure LED is visible from screw switch hole		
2.2.2 Activate EasyMini	Screw in EasyMini screw switch	Listen for EasyMini to start beeping		

Helios Launchpad Checklist				
2.2.3 Check EasyMini beep codes for continuity	Listen for EasyMini beep codes Count beeps	First set of beeps should have 4, indicating enough voltage Second set of beeps should have 3 to indicate that main and apo are active		
2.2.4 Activate Raven4	Screw in Raven4 screw switch	Listen for beeping from Raven4 to begin		
2.2.5 Check Raven4 beep codes for continuity	Listen for Raven4 beep codes Count number of tones and pitch (low and high)	High beep means Raven4 is on 4 High beeps for voltage 3 high beeps followed by 1 low beep for channel connection		
3 - Igniter Installation				
Task	Steps	Verification Method	Member Sign	Lead Sign
2.3.1 Insert Igniter	Strip leads of igniter Insert igniter into motor	Igniter is as far into the motor as possible\ Igniter ends are visible from bottom of the rocket		
2.3.2 Check Alligator Clips	Touch alligator clips together	**No spark from alligator clips**		
2.3.3 Connect Alligator Clips	Connect alligator clips to igniter leads	Ensure clips are freely attached to leads.		
4 - Final Steps				
Task	Steps	Verification Method	Member Sign	Lead Sign
ENSURE ALL PERSONNEL HAVE LEFT LAUNCHPADS				

Helios Launchpad Checklist				
2.4.1 Check igniter continuity	Perform continuity check on launch controller	Launch controller visual confirmation		
2.4.2 Launch	Ignite motor using igniter	Motor ignites Rocket leaves the rail		

1 - Pre-Launch Checklist

1 - Pre Launch Inspection & Testing				
Task	**Required Steps**	**Verification Method**	**Team Member**	**Sign Off**
1.1.1 Structural Check	• Check frame for debris and cracks • Check retention bulkhead bolts tightness with #10 hex key • Install both bulkheads and all frame plates except one opposite to esled attach point	• Frame is structurally sound • All fasteners are tightened and cannot be loosened by hand		

1.1.2 Battery Checks	• Check for nominal battery voltage with digital multimeter	• Electronics Bay
		  ○ Sirin (6.6 V)
		  ○ 2 Runcam (5.0 V)
		  ○ Servo Motors (3.3 V)		

1.1.3 Flight Computer Programming	• Program Sirin. • Run code before assembly.	• Code runs properly, cameras turn on, piezoelectric record data.		
1.1.4 Electronic Sled check	• Inspect both cubesat components	• No components are damaged • All connectors are securely attached to wires • Do tug test for connections		
1.1.5 Glass Assembly	• Inspect quality of glass and adhesive.	• Ensure piezoelectrics are correctly attached to the glass surface • Ensure glass is assembled into the track properly		
2 - Electronics				
Task	**Required Steps**	**Verification Method**	**Team Member**	**Sign Off**
1.2.1 Electronics sled set up and secure	• Install PDB to electronics sled • Servo control lines connected to PDB • Runcams have Micro SD cards installed • Runcams connected to PDB • LED connected to PDB • Power cables run down to	• Visual confirmation of all items • Tug tests on wires when applicable.		

	bottom ● All wires secure			
1.2.2 Battery sled set up and secure	● Confirm screw removed from screw switch ● All circuit board connections are secure. ● All batteries connected to appropriate connections on circuit board ● Battery voltages confirmed ● Battery covers installed ● Antenna installed and line is free	● Visual confirmation of items ● Use multimeter to confirm voltages across various points along the circuit boards		
1.2.3 Piezoelectric set up	● Connect piezoelectric sensors PDB ● Secure wires by tightening screw terminals on wire ferrels ● Confirm piezoelectrics on appropriate spot on glass	● Visual confirmation of all connections by at least two people Pull test on all connections		
1.2.4 Sirin power set up	● Install Sirin into the electronics sled and connect gpio data and power to the PDB	● Visual confirmation of all connections by at least two people		
1.2.5 Esled installation	● Run control lines into bottom of servo drums ● Slide sled into frame ● Screw sled into place with 4 6-36 screws. ● Install servo wires into PDB ● Reinstall screws into screw switches	● Verify all 4 screws are in place ● Varifty no wires snagged in poor locations to prevent the mechanism from moving.		
1.2.6 Electrictronics continuity test	● Confirm Sirin is powered and operating ● Perform Sirin connections check. Run code and perform simulation.	● Tests conclusive ● Code runs without bugs ● Servos and cameras activate		
3 - Frame Plate Installation				
Task	**Required Steps**	**Verification Method**	**Team Member**	**Sign Off**
1.3.1 Install	● Install last frame plate with	● All 4 frame plates are properly		

3U Frame Plates	4-40 set screws and 10-24 set screws as specified in drawings. Use #10 and #4 hex keys ● Confirm all frame plates, bulkheads, and ebay sleds installed and secured.	installed with appropriate fasteners ● Screw switches holes are lined up and accessible ● Confirm that fasteners cannot be hand loosened.		
1.3.2 Installing Payload into Rocket: Hand off to Aerostructures	● Install payload into payload bulkhead within rocket, ● Screw payload bulkhead in with 4 10-24 screws with #10 hex key	● Confirm that fasteners cannot be hand loosened. ● Confirm screw switch accessable from outside rocket airframe		
4 - Final Systems Check				
Task	**Required Steps**	**Verification Method**	**Team Member**	**Sign Off**
1.4.1 Final confirmation of Cubesat prep	● Confirm all Selene systems are assembled.	● No sounds of loose components when cubesat shaken ● Screw switch reachable ● Sirin powers on and indicates proper continuity		

2 - Launchpad Checklist

Need safety glasses

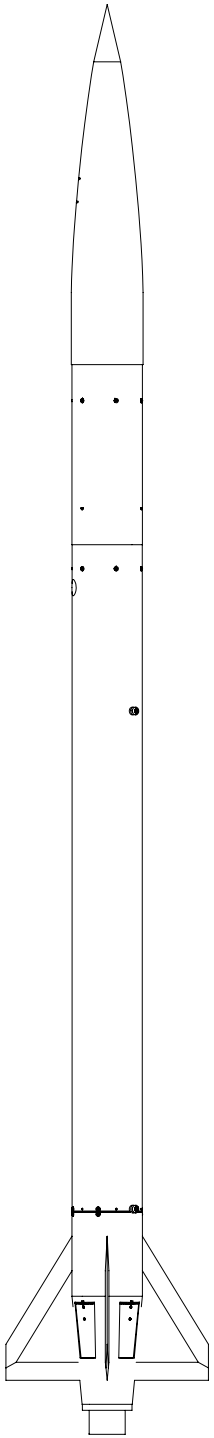
1 - Launchpad Steps				
Task	**Required Steps**	**Verification Method**	**Team Member**	**Sign Off**
2.1.1 Hand off the Payload	• Integrate Payload into Rocket	• Payload is secured in payload retention bulkhead inside Rocket		
2.1.2 Power up systems	• Screw down Sirin switch	• Sirin LED indicates proper activation.		

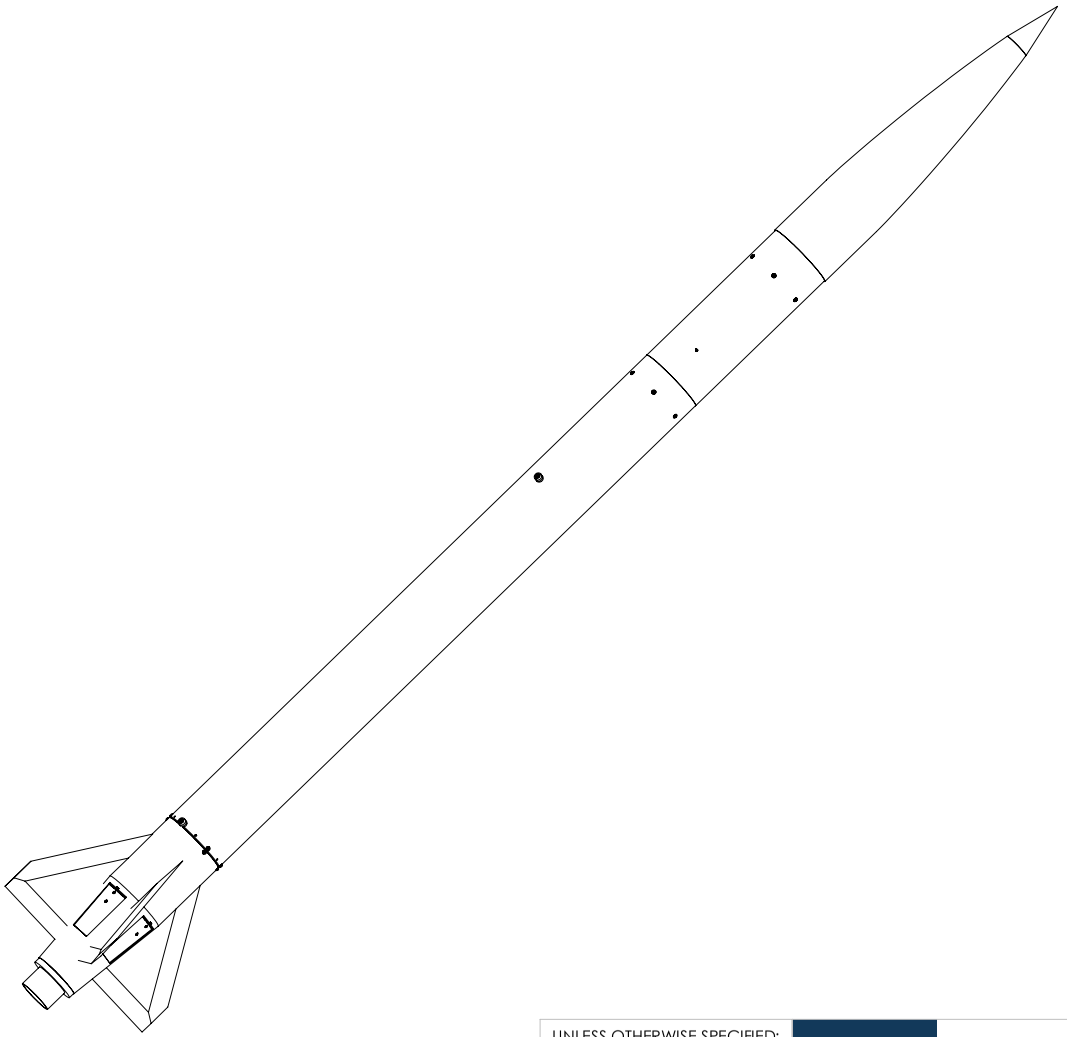
3 - Recovery Checklist

1 - Extraction				
Task	**Required Steps**	**Verification Method**	**Team Member**	**Sign Off**
3.1.1 Locate Rocket	• Locate the rocket and verify integrity of Payload inside	• Have visual contact with the rocket found.		
3.1.2 Document with Pictures	• Document every component on payload on the ground	• Upload all photos to Google Drive		
3.1.3 Determine Success of Recovery	• Run a graph of the data collected and give verdict on the success of the experiment	• Note all successful actions • Note any failed action and how they failed		
2 - Shutdown				
Task	**Required Steps**	**Verification Method**	**Team Member**	**Sign Off**
3.2.1 Electronics Power down	• Unscrew screw switches	• All LEDs should be off		
3 - Post Launch Operations				
Task	**Required Steps**	**Verification Method**	**Team Member**	**Sign Off**
3.3.1 Disassembly	• Remove frame plates • Disconnect all batteries • Disconnect all electronics	• All batteries are disconnected and removed. • Flight computer		

	• Remove upper electronics sled	connection ports are accessible • SD cards are removed from RunCams		
3.3.2 Collect Flight Data	• Download data from Sirin • Remove SD cards from Runcams and back up flight footage	• Upload all data files to Google Drive		
3.3.3 Visual Inspection	• Inspect all sections of the Payload	• Frame is structurally sound • No components are damaged • Payload is ready for return transport		

F. Engineering Drawings Appendix





UNLESS OTHERWISE SPECIFIED:
DIMENSIONS IN INCHES

TOLERANCES:
.XX ±.01 .XXX ±.005
FRACTIONS ±1/64
ANGULAR MACHINED ±.5°
ANGULAR BEND ±1°

SURFACE FINISH 125
BREAK ALL EDGES .030

DO NOT SCALE

SHEET 1 OF 5

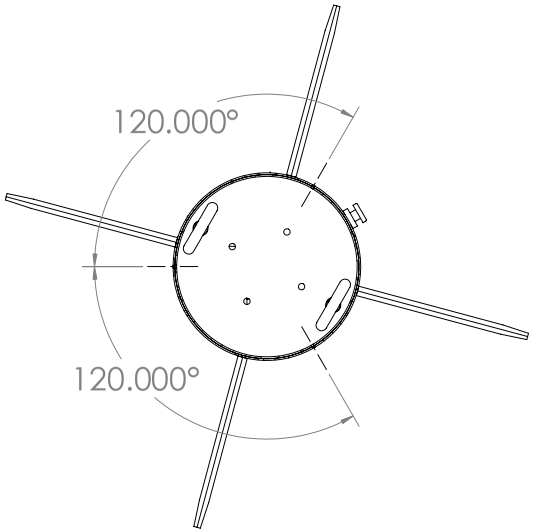
CASE ROCKET TEAM

CASE WESTERN RESERVE UNIVERSITY

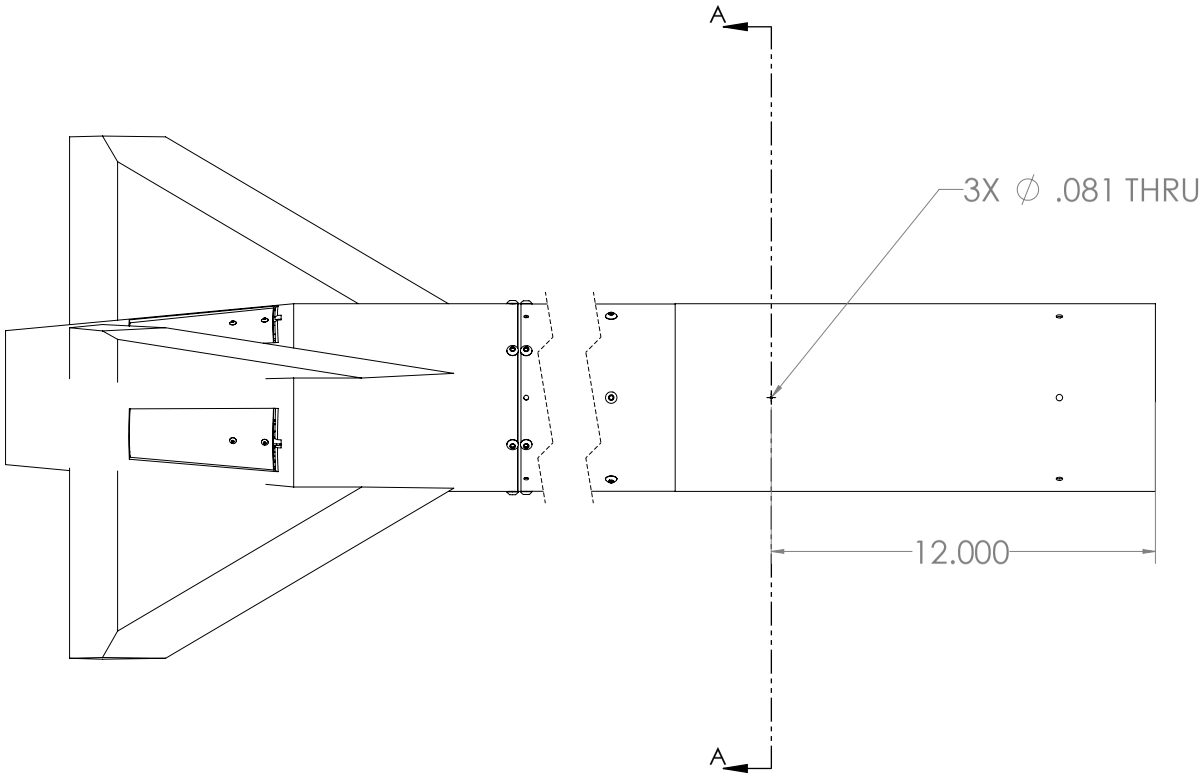
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MAIN ASSEMBLY			
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C	2/16/2025	CRP110	1
MATERIAL:		PART #:	REV:
		25A00000	C

SOLIDWORKS Educational Product. For Instructional Use Only.

NOTE 1: SLIDE 25A02001 UPPER BODY TUBE ALL THE WAY ONTO 25A05000 LOWER BODY THEN DRILL THROUGH BOTH AT ONCE



SECTION A-A
SCALE 1 : 3



UNLESS OTHERWISE SPECIFIED:
DIMENSIONS IN INCHES

TOLERANCES:
.XX ±.01 .XXX ±.005
FRACTIONS ±1/64
ANGULAR MACHINED ±.5°
ANGULAR BEND ±1°
SURFACE FINISH 125
BREAK ALL EDGES .030

DO NOT SCALE

SHEET 2 OF 5

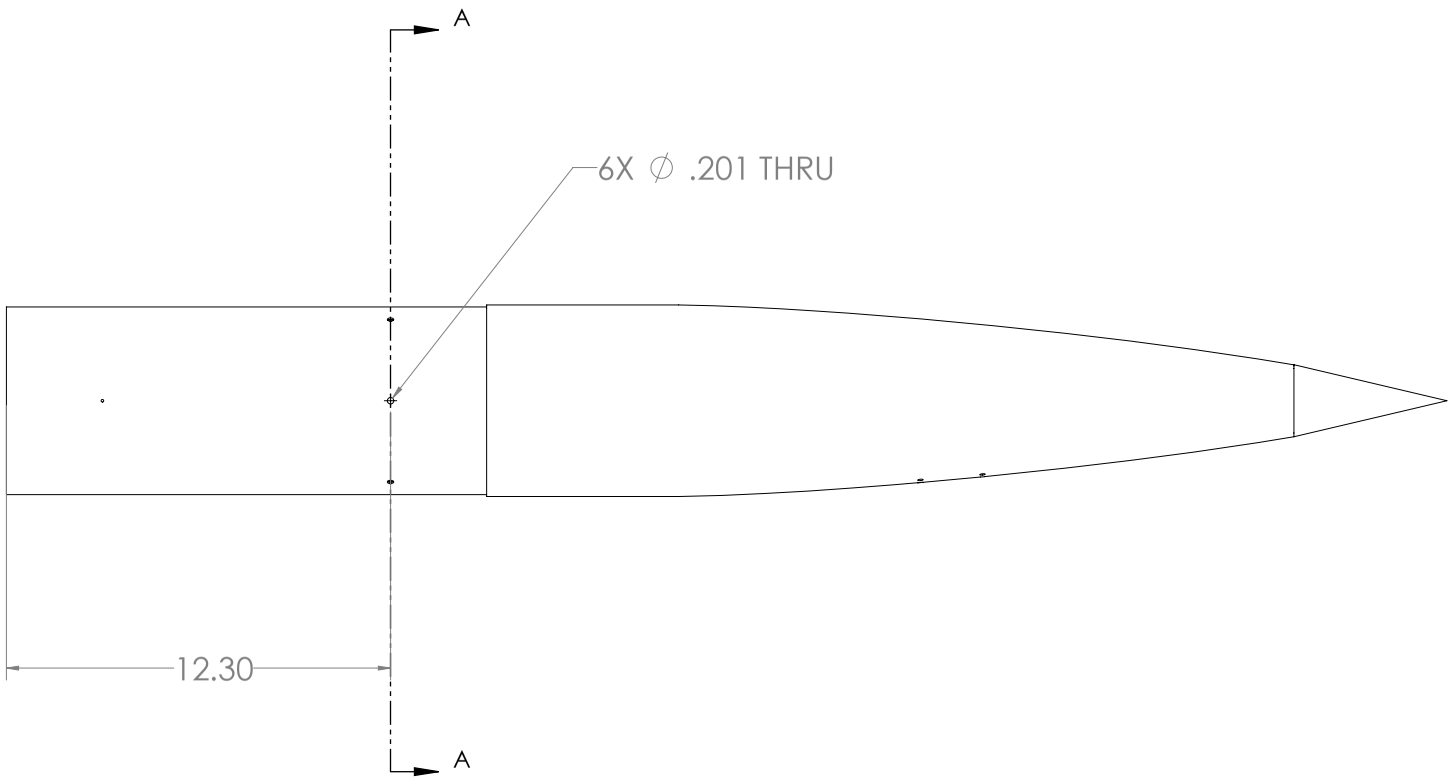
CASE ROCKET TEAM

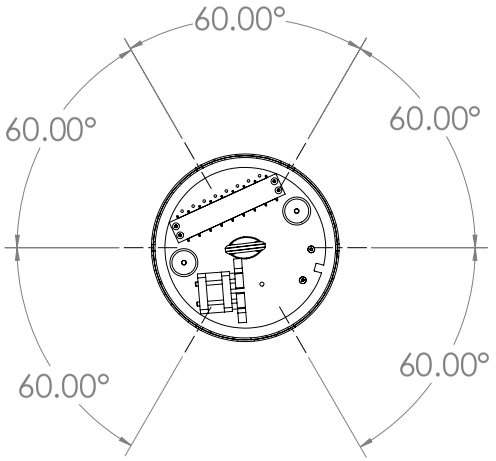
CASE WESTERN RESERVE UNIVERSITY

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C	2/16/2025	CRP110	1
MATERIAL:		PART #:	REV:
		25A00000	C

SOLIDWORKS Educational Product. For Instructional Use Only.

NOTE 1: SLIDE 25A02001 UPPER BODY TUBE ALL THE WAY ONTO 25A01000 NOSE CONE ASSEMBLY THEN DRILL THROUGH BOTH AT ONCE





SECTION A-A
SCALE 1 : 3

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS IN INCHES

TOLERANCES:
.XX ±.01 .XXX ±.005
FRACTIONS ±1/64
ANGULAR MACHINED ±.5°
ANGULAR BEND ±1°
SURFACE FINISH 125
BREAK ALL EDGES .030

DO NOT SCALE

SHEET 3 OF 5

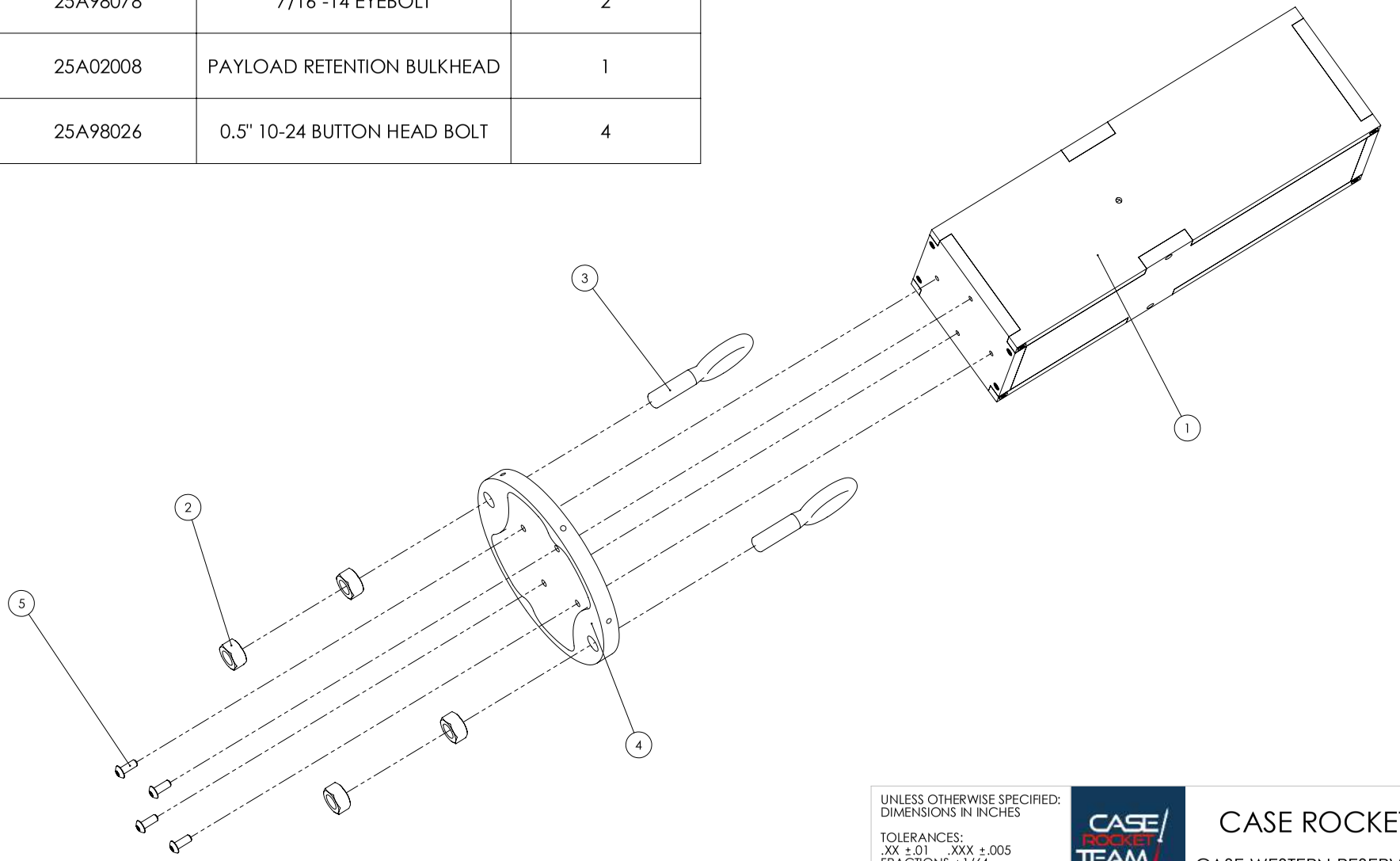
CASE ROCKET TEAM

CASE WESTERN RESERVE UNIVERSITY

TITLE: MAIN ASSEMBLY			
SIZE: C	DATE: 2/16/2025	DRAWN BY: CRP110	QUANTITY: 1
MATERIAL:		PART #: 25A00000	REV: C

SOLIDWORKS Educational Product. For Instructional Use Only.

ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	25B001	PAYLOAD MAIN ASSEMBLY	1
2	25A98079	7/16"-14 HEX NUT	4
3	25A98078	7/16"-14 EYEBOLT	2
4	25A02008	PAYLOAD RETENTION BULKHEAD	1
5	25A98026	0.5" 10-24 BUTTON HEAD BOLT	4



UNLESS OTHERWISE SPECIFIED:
DIMENSIONS IN INCHES

TOLERANCES:
.XX ±.01 .XXX ±.005
FRACTIONS ±1/64
ANGULAR MACHINED ±.5°
ANGULAR BEND ±1°

SURFACE FINISH 125
BREAK ALL EDGES .030

DO NOT SCALE

SHEET 4 OF 5

CASE ROCKET TEAM

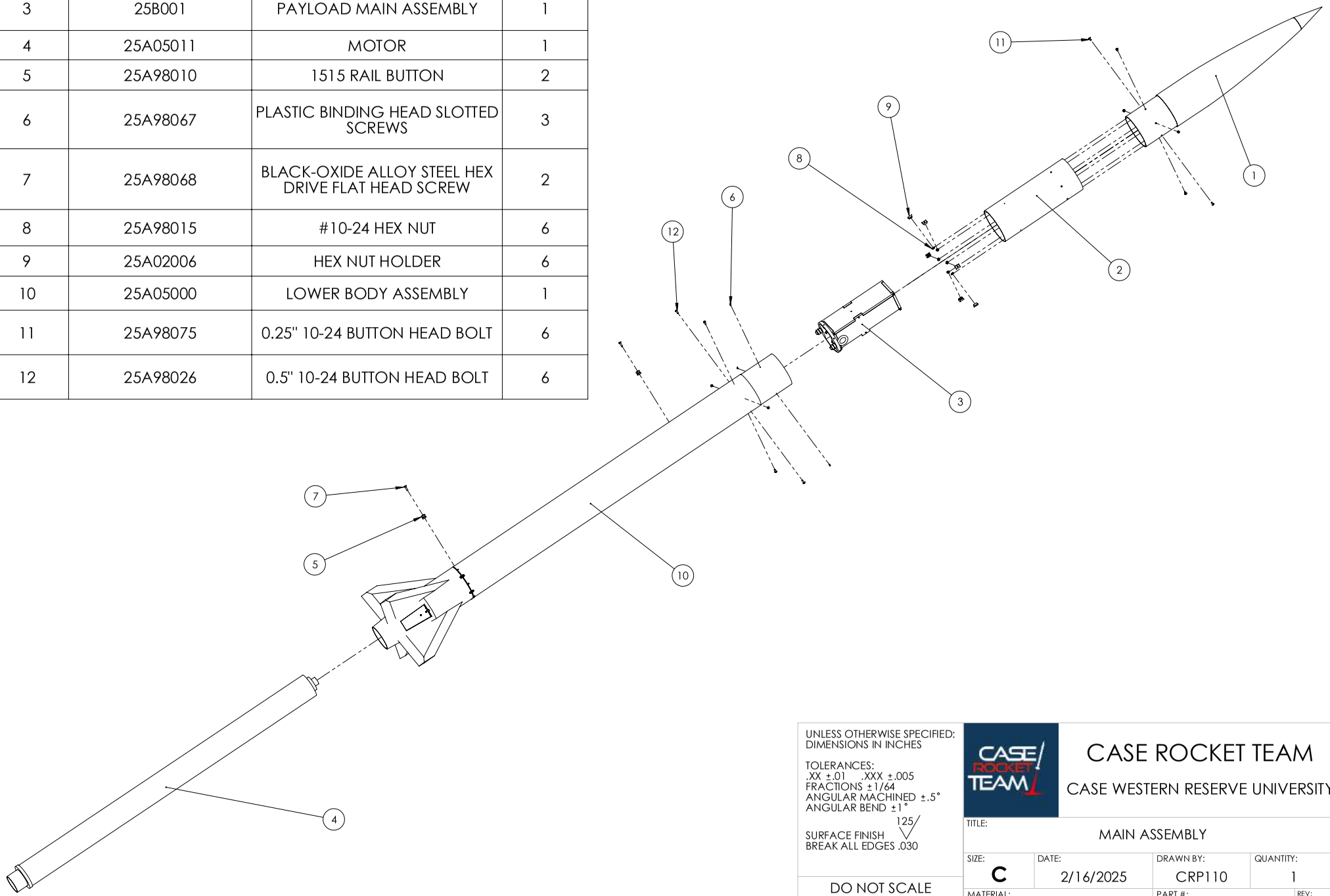
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MATERIAL:		PART #:	REV:
		25A00000	C

SOLIDWORKS Educational Product. For Instructional Use Only.

ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	25A01000	NOSE CONE ASSEMBLY	1
2	25A02000	UPPER BODY TUBE ASSEMBLY	1
3	25B001	PAYLOAD MAIN ASSEMBLY	1
4	25A05011	MOTOR	1
5	25A98010	1515 RAIL BUTTON	2
6	25A98067	PLASTIC BINDING HEAD SLOTTED SCREWS	3
7	25A98068	BLACK-OXIDE ALLOY STEEL HEX DRIVE FLAT HEAD SCREW	2
8	25A98015	#10-24 HEX NUT	6
9	25A02006	HEX NUT HOLDER	6
10	25A05000	LOWER BODY ASSEMBLY	1
11	25A98075	0.25" 10-24 BUTTON HEAD BOLT	6
12	25A98026	0.5" 10-24 BUTTON HEAD BOLT	6

NOTE 1: PAYLOAD MAIN ASSEMBLY ATTACHED TO PAYLOAD RETENTION BULKHEAD ON SHEET 4



UNLESS OTHERWISE SPECIFIED:
DIMENSIONS IN INCHES

TOLERANCES:
.XX ±.01 .XXX ±.005
FRACTIONS ±1/64
ANGULAR MACHINED ±.5°
ANGULAR BEND ±1°

SURFACE FINISH 125
BREAK ALL EDGES .030

DO NOT SCALE

SHEET 5 OF 5

CASE ROCKET TEAM

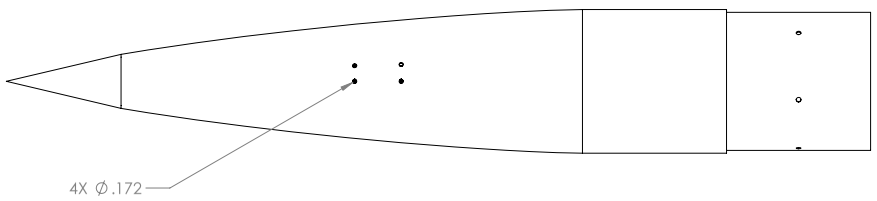
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MATERIAL:	PART #:	REV:
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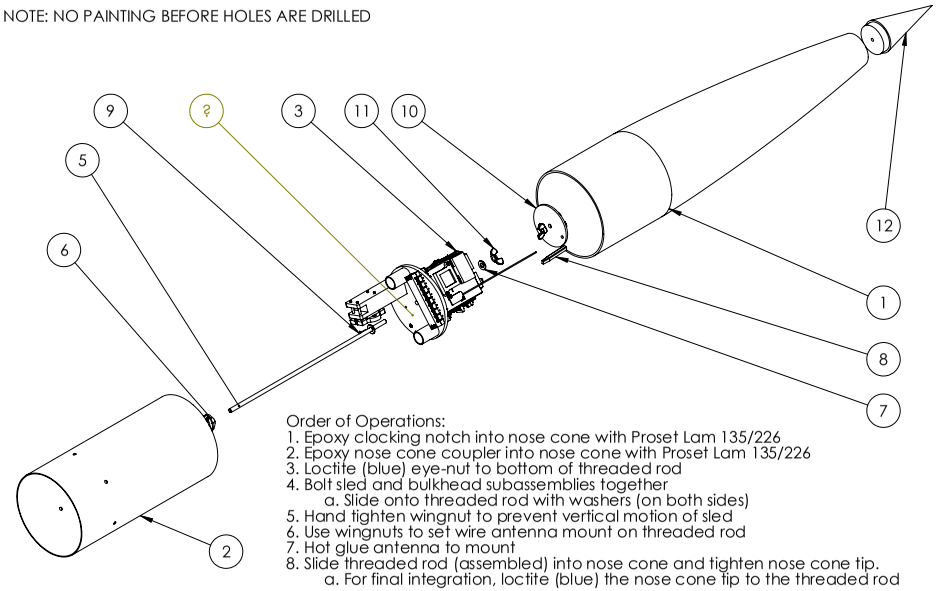
ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	25A01033	Nose Cone v3	1
2	25A01004	Nose Cone Coupler	1
3	25A01011	E-BAY SLED SUBASSEMBLY	1
4	25A01012	E-Bay Bulkhead Subassembly	1
5	25A01019	NC Threaded Rod	1
6	25A98029	1/4-20 Eye Nut	1
7	25A98040	1/4" Washer	2
8	25A01020	Clocking Notch	1
9	25A98047	0.4375" 4-40 Button Head Bolt	1
10	25A01021	Sirin Wire Antenna Mount	1
11	25A98064	1/4-20 Wingnut	3
12	25A01034	Nose Cone Tip v3	1

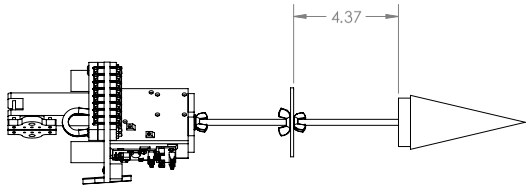
USE PROSET LAM 135/226 BETWEEN 25A01033 AND 25A01004

DRILL ∅0.172 HOLES WITH LOCATING FEATURE OF SCREW SWITCH HOLES FROM E-BAY SLED

ATTACH 25A01034 AND 25A01019 WITH BLUE LOCTITE DURING INTEGRATION

NOTE: NO PAINTING BEFORE HOLES ARE DRILLED





QUANTITY: 1

Order of Operations:
1. Epoxy clocking notch into nose cone with Proset Lam 135/226
2. Epoxy nose cone coupler into nose cone with Proset Lam 135/226
3. Loctite (blue) eye-nut to bottom of threaded rod
4. Bolt sled and bulkhead subassemblies together
   a. Slide onto threaded rod with washers (on both sides)
5. Hand tighten wingnut to prevent vertical motion of sled
6. Use wingnuts to set wire antenna mount on threaded rod
7. Hot glue antenna to mount
8. Slide threaded rod (assembled) into nose cone and tighten nose cone tip.
   a. For final integration, loctite (blue) the nose cone tip to the threaded rod

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UNLESS OTHERWISE SPECIFIED:
DIMENSIONS IN INCHES

TOLERANCES:
.XX ±.01 .XXX ±.005
FRACTIONS ±1/64
ANGULAR MACHINED ±.5°
ANGULAR BEND ±1°

SURFACE FINISH 125
BREAK ALL EDGES .030

DO NOT SCALE

SHEET 1 OF 1

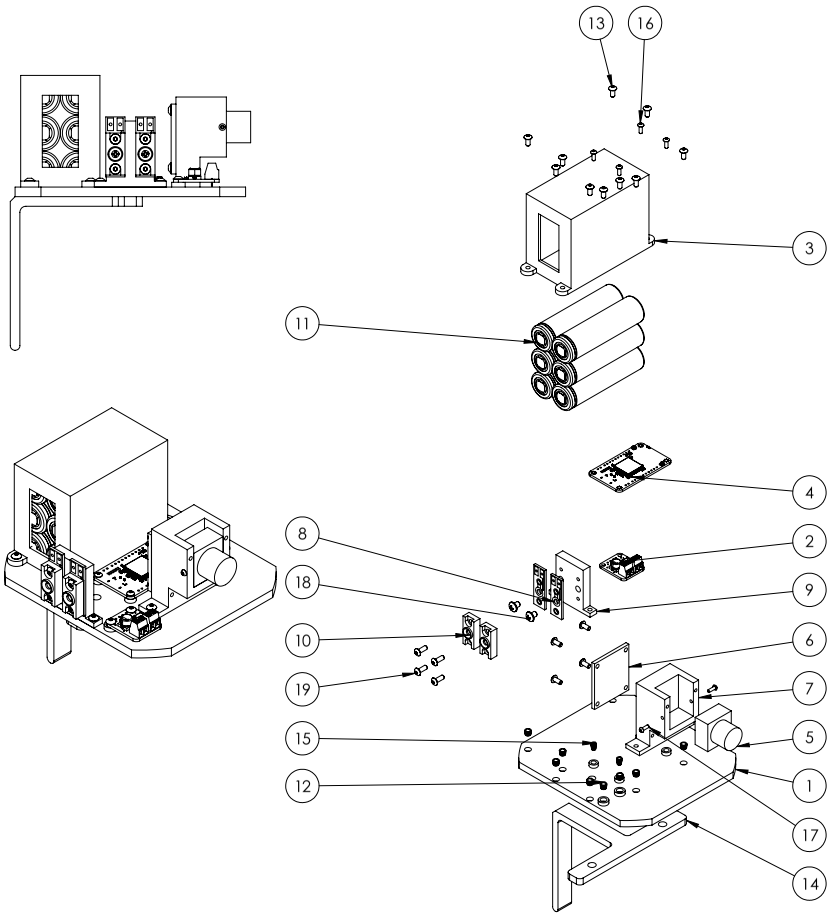
CASE ROCKET TEAM

CASE WESTERN RESERVE UNIVERSITY

TITLE: Nose Cone Assembly

SIZE:	DATE:	DRAWN BY:
B	2/13/2025	MSM268

MATERIAL:	PART #:	REV:
	25A01000	C



ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	25A03001	Base Plate	1
2	25A98057	DRV8871	1
3	25A03002	Motor Battery Mount	1
4	25A01025	Sirin S1	1
5	25A03003	Runcam Head	1
6	25A03004	Runcam Board	1
7	25A03007	Runcam Mount	1
8	25A98006	Screw Switch	2
9	25A03006	Screw Switch Mount	1
10	25A01015	Screw Switch Cover	2
11	25A98020	18650 Li-ion Battery	6
12	25A98019	4-40 Heat Set Insert	10
13	25A98028	0.25" 4-40 Button Head Bolt	14
14	25A03008	Wire Mount	1
15	25A98058	2-56 Heat Set Insert	4
16	25A98059	0.25" 2-56 Button Head Bolt	4
17	25A98080	Button Head Hex Drive Screw	2
18	25A98036	6-32 Phillips Head Bolt	2
19	25A98038	0.3125" 4-40 Button Head Bolt	4

QUANTITY: 1

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS IN INCHES

TOLERANCES:
.XX ±.01 .XXX ±.005
FRACTIONS ±1/64
ANGULAR MACHINED ±.5°
ANGULAR BEND ±1°

SURFACE FINISH 125
BREAK ALL EDGES .030

DO NOT SCALE

SHEET 1 OF 1

CASE ROCKET TEAM

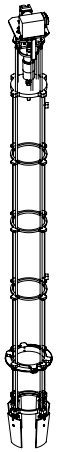
CASE WESTERN RESERVE UNIVERSITY

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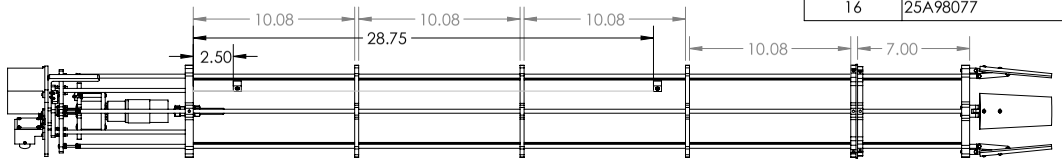
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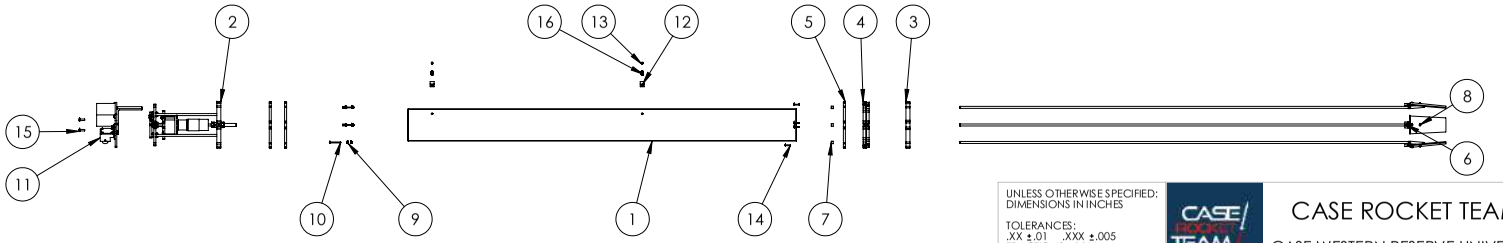


NOTE:
PRESS ALL COPIES OF 7 INTO 2, 3, 4, AND ALL COPIES OF 5
USE AEROPOXY E6209 TO SECURE 2, 3, 4, AND ALL COPIES OF 5 TO 1, ENSURING HOLE ALIGNMENT
SLIDE RODS OF 6 THROUGH ALL BULKHEADS AND BOLT TO 3 USING 14
AFFIX RODS OF 6 TO MOVING PLATE OF 2 USING 10 AND 9
BOLT 11 TO 2 USING 15

ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	25A04007	Motor Tube	1
2	25A04023	Upper Mechanism Sub-Assembly	1
3	25A04015	Actuation Mount Bulkhead	1
4	25A04016	Tube Interface Bulkhead	1
5	25A04020	Centering ring	3
6	25A04024	Lower Mechanism Sub-Assembly	4
7	25A98035	Oil-Embedded Bronze Sleeve Bearing	28
8	25A98028	0.25" 4-40 Button Head Bolt	8
9	25A98023	4-40 Hex Nut	16
10	25A98025	1.375" 4-40 Button Head Bolt	4
11	25A03000	Airbrakes E-Bay	1
12	25A04021	Set Screw Holder	2
13	25A98049	18-8 Stainless Steel Cup-Point Set Screw	2
14	25A98071	Button Head Hex Drive Screw	8
15	25A98072	Button Head Hex Drive Screw	2
16	25A98077	10-24 Heat Set Insert	2



NOTE: ADJUST FINAL DIMENSION OF 7.00" BASED ON MEASURED BOAT TAIL STRAIGHT SECTION, AND KEEP ALL 10.08" DIMENSIONS EQUAL



QUANTITY:
1

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS IN INCHES

TOLERANCES:
.XX ±.01 .XXX ±.005
FRACTIONS ±1/64
ANGULAR MACHINED ±.5°
ANGULAR BEND ±1°

SURFACE FINISH 125
BREAK ALL EDGES .030

DO NOT SCALE

SHEET 1 OF 1

CASE ROCKET TEAM

CASE WESTERN RESERVE UNIVERSITY

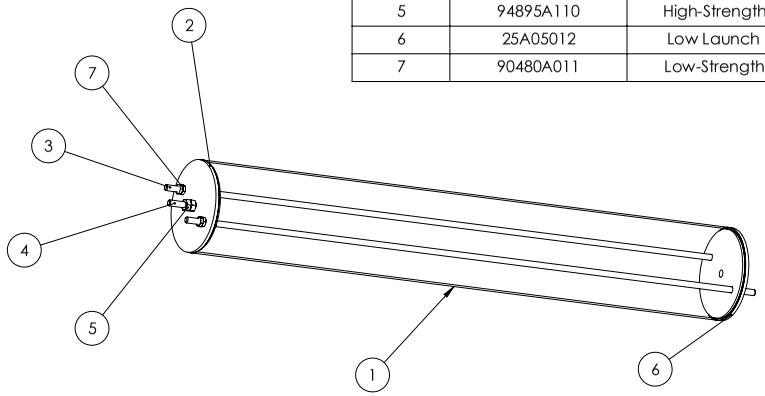
TITLE: Airbrakes

SIZE:	DATE:	DRAWN BY:
B	2/14/2025	GXM331

MATERIAL:	PART #:	REV:
	25A04000	C

SOLIDWORKS Educational Product. For Instructional Use Only.

ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	25A05008	Low Launch Coupler	1
2	25A05013	Low Launch Bottom Bulkhead	1
3	90322A659	1/4-20 Threaded Rod	2
4	90322A659	High-Strength Steel Threaded Rod	1
5	94895A110	High-Strength Steel Hex Nut	2
6	25A05012	Low Launch Top Bulkhead	1
7	90480A011	Low-Strength Steel Hex Nut	8



UNLESS OTHERWISE SPECIFIED:
DIMENSIONS IN INCHES

TOLERANCES:
.XX ±.01 .XXX ±.005
FRACTIONS ±1/64
ANGULAR MACHINED ±.5°
ANGULAR BEND ±1°
SURFACE FINISH 125
BREAK ALL EDGES .030

DO NOT SCALE

SHEET 1 OF 2

CASE ROCKET TEAM

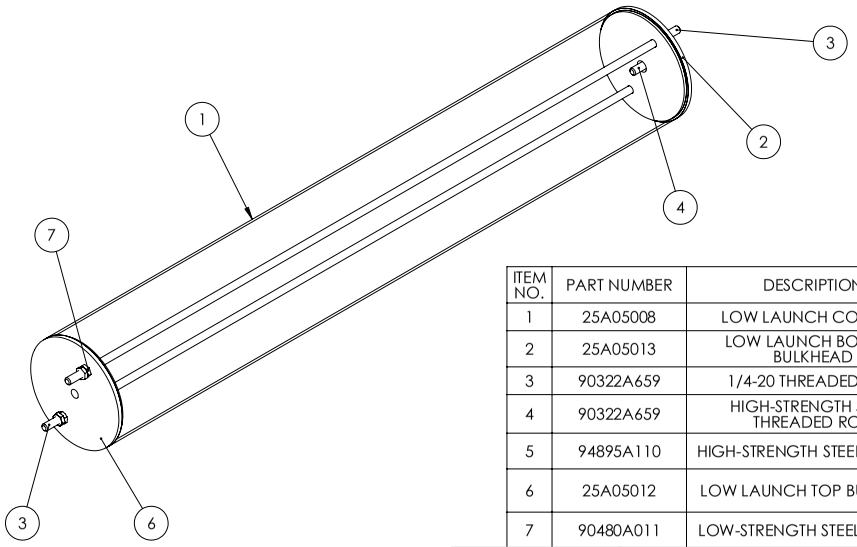
CASE WESTERN RESERVE UNIVERSITY

TITLE: LOW LAUNCH COUPLER SUBASSEMBLY

SIZE:	DATE:	DRAWN BY:	QUANTITY:
A	2/21/2025	KWW33	1

MATERIAL:	PART #:	REV:
	25A07000	A

SOLIDWORKS Educational Product. For Instructional Use Only.



ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	25A05008	LOW LAUNCH COUPLER	1
2	25A05013	LOW LAUNCH BOTTOM BULKHEAD	1
3	90322A659	1/4-20 THREADED ROD	2
4	90322A659	HIGH-STRENGTH STEEL THREADED ROD	1
5	94895A110	HIGH-STRENGTH STEEL HEX NUT	2
6	25A05012	LOW LAUNCH TOP BULKHEAD	1
7	90480A011	LOW-STRENGTH STEEL HEX NUT	8

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS IN INCHES

TOLERANCES:
.XX ±.01 .XXX ±.005
FRACTIONS ±1/64
ANGULAR MACHINED ±.5°
ANGULAR BEND ±1°

SURFACE FINISH 125
BREAK ALL EDGES .030

DO NOT SCALE

SHEET 2 OF 2

CASE ROCKET TEAM

CASE WESTERN RESERVE UNIVERSITY

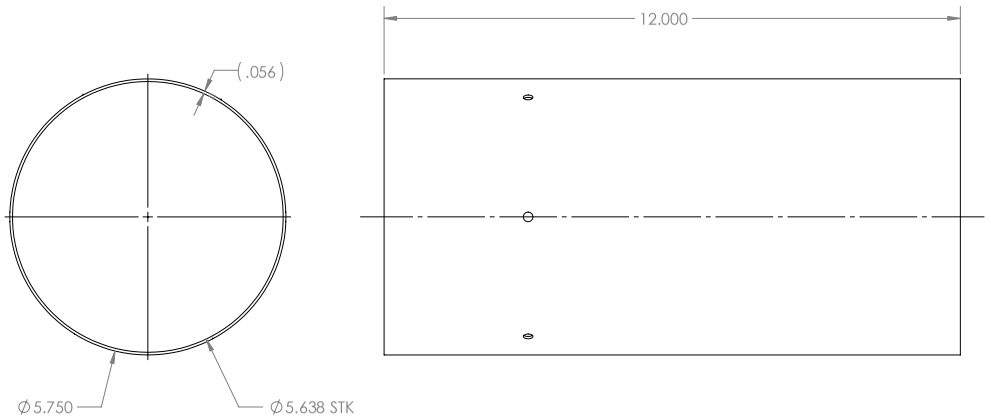
TITLE:
LOW LAUNCH COUPLER SUBASSEMBLY

SIZE:	DATE:	DRAWN BY:	QUANTITY:
A	2/21/2025	KWW33	1

MATERIAL:	PART #:	REV:
	25A07000	A

SOLIDWORKS Educational Product. For Instructional Use Only.

NOTE: RADIAL HOLES ARE ASSEMBLY FEATURES



Notes:
1. Use Coupler Mandrel
2. Cut 1 Layer of 3k CF to 14", length = enough to wrap around the Mandrel 5 times
3. Surface Prep. with Graphite then Mylar
4. Layup on Mandrel
5. Cut 1" off Each side to 12"

SOLIDWORKS Educational Product. For Instructional Use Only.

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS IN INCHES

TOLERANCES:
.XX ±.01 .XXX ±.005
FRACTIONS ±1/64
ANGULAR MACHINED ±.5°
ANGULAR BEND ±1°
SURFACE FINISH 125
BREAK ALL EDGES .030

DO NOT SCALE

SHEET 1 OF 1

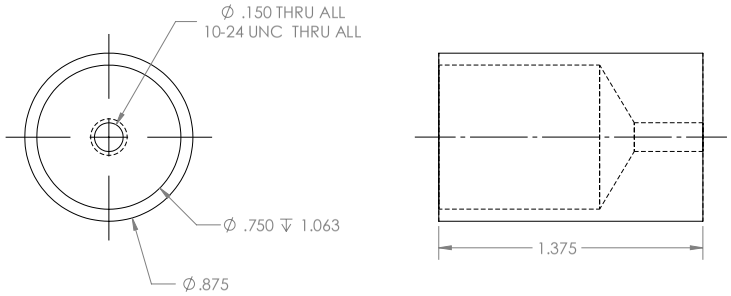
CASE ROCKET TEAM

CASE WESTERN RESERVE UNIVERSITY

TITLE: NOSE CONE COUPLER

SIZE:	DATE:	DRAWN BY:
A	2/6/2025	VJT14

MATERIAL:	PART #:	REV:
HEXCEL AS4C (3000 FILAMENTS)	25A01004	E



UNLESS OTHERWISE SPECIFIED:
DIMENSIONS IN INCHES

TOLERANCES:
.XX ±.01 .XXX ±.005
FRACTIONS ±1/64
ANGULAR MACHINED ±.5°
ANGULAR BEND ±1°
SURFACE FINISH 125
BREAK ALL EDGES .030

DO NOT SCALE

SHEET 1 OF 1

CASE ROCKET TEAM

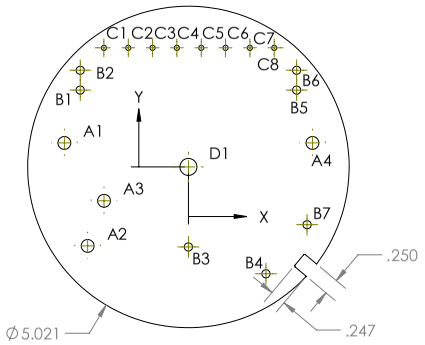
CASE WESTERN RESERVE UNIVERSITY

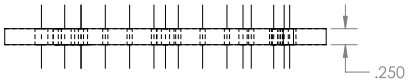
TITLE: CHARGE WELL

SIZE:	DATE:	DRAWN BY:	QUANTITY:
A	2/4/2025	AFW4	2

MATERIAL:	PART #:	REV:
6061-T6	25A01008	A

SOLIDWORKS Educational Product. For Instructional Use Only.





TAG	X LOC	Y LOC	SIZE
A1	-1.94	.38	Ø .201 THRU
A2	-1.57	-1.23	Ø .201 THRU
A3	-1.32	-.53	Ø .201 THRU
A4	1.94	.38	Ø .201 THRU
B1	-1.69	1.20	Ø .129 THRU
B2	-1.69	1.51	Ø .129 THRU
B3	-.00	-1.25	Ø .129 THRU
B4	1.21	-1.67	Ø .129 THRU
B5	1.69	1.20	Ø .129 THRU
B6	1.69	1.51	Ø .129 THRU
B7	1.85	-.90	Ø .129 THRU
C1	-1.32	1.86	Ø .081 THRU
C2	-.94	1.86	Ø .081 THRU
C3	-.56	1.86	Ø .081 THRU
C4	-.18	1.86	Ø .081 THRU
C5	.20	1.86	Ø .081 THRU
C6	.58	1.86	Ø .081 THRU
C7	.96	1.86	Ø .081 THRU
C8	1.34	1.86	Ø .081 THRU
D1	-.00	-.00	Ø .266 THRU

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS IN INCHES

TOLERANCES:
.XX ±.01 .XXX ±.005
FRACTIONS ±1/64
ANGULAR MACHINED ±.5°
ANGULAR BEND ±1°
SURFACE FINISH 125
BREAK ALL EDGES .030

DO NOT SCALE

SHEET 1 OF 1

CASE ROCKET TEAM

CASE WESTERN RESERVE UNIVERSITY

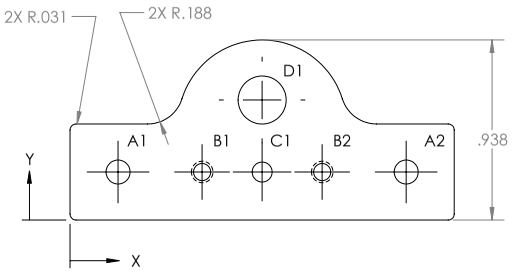
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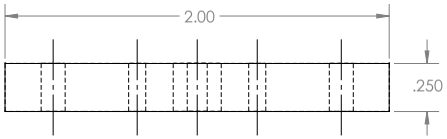
E-BAY BULKHEAD

SIZE:	DATE:	DRAWN BY:	QUANTITY:
A	2/4/2025	AFW44	1

MATERIAL:	PART #:	REV:
6061-T6	25A01010	C

SOLIDWORKS Educational Product. For Instructional Use Only.





TAG	X LOC	Y LOC	SIZE
A1	.25	.25	∅ .1240 THRU REAM
A2	1.75	.25	∅ .1240 THRU REAM
B1	.69	.25	∅ .089 THRU 4-40 UNC THRU
B2	1.31	.25	∅ .089 THRU 4-40 UNC THRU
C1	1.00	.25	∅ .104 THRU
D1	1.00	.63	∅ .250 THRU

NOTE:
USE BLANK 25A96020

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS IN INCHES

TOLERANCES:
.XX ±.01 .XXX ±.005
FRACTIONS ±1/64
ANGULAR MACHINED ±.5°
ANGULAR BEND ±1°

SURFACE FINISH 125
BREAK ALL EDGES .030

DO NOT SCALE

SHEET 1 OF 1

CASE ROCKET TEAM

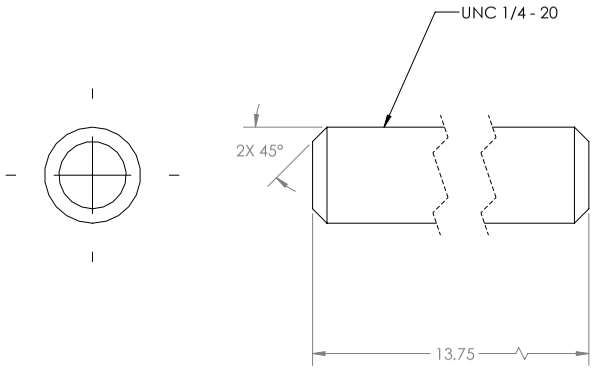
CASE WESTERN RESERVE UNIVERSITY

TITLE: REVISED TENDIE PLATE

SIZE:	DATE:	DRAWN BY:	QUANTITY:
A	2/6/2025	AFW4	4

MATERIAL:	PART #:	REV:
6061-T6	25A01016	C

SOLIDWORKS Educational Product. For Instructional Use Only.



UNLESS OTHERWISE SPECIFIED:
DIMENSIONS IN INCHES

TOLERANCES:
.XX ±.01 .XXX ±.005
FRACTIONS ±1/64
ANGULAR MACHINED ±.5°
ANGULAR BEND ±1°
SURFACE FINISH 125
BREAK ALL EDGES .030

DO NOT SCALE

SHEET 1 OF 1

CASE ROCKET TEAM

CASE WESTERN RESERVE UNIVERSITY

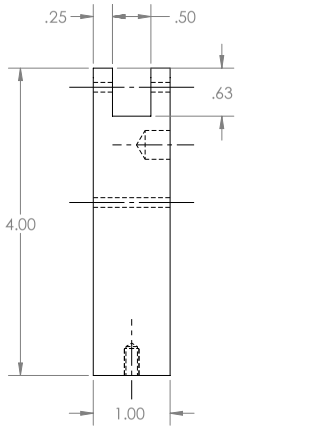
TITLE:

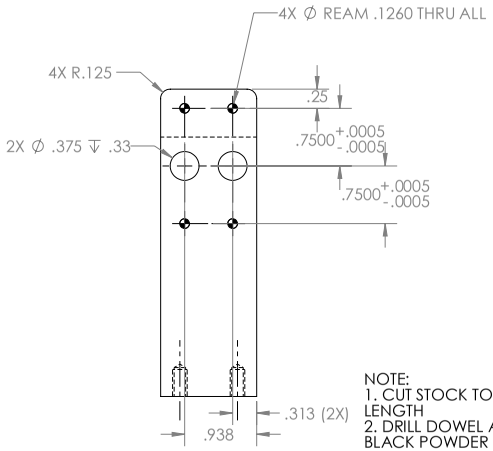
NC THREADED ROD

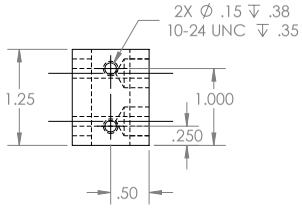
SIZE:	DATE:	DRAWN BY:	QUANTITY:
A	2/6/2025	KXR387	1

MATERIAL:	PART #:	REV:
ZN-YELLOWCHROMATE-PLATED STEEL	25A01019	C

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NOTE:
1. CUT STOCK TO LENGTH
2. DRILL DOWEL AND BLACK POWDER HOLES
3. REAM DOWEL HOLES
4. MILL SLOT
5. DRILL/TAP 10-24 HOLES
6. BREAK SHARP EDGES ON GRIND WHEEL

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS IN INCHES

TOLERANCES:
.XX ±.01 .XXX ±.005
FRACTIONS ±1/64
ANGULAR MACHINED ±.5°
ANGULAR BEND ±1°
SURFACE FINISH 125
BREAK ALL EDGES .030

DO NOT SCALE

SHEET 1 OF 1

CASE ROCKET TEAM

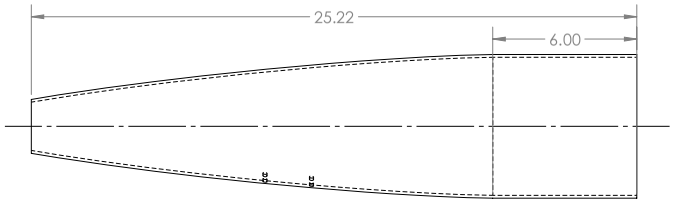
CASE WESTERN RESERVE UNIVERSITY

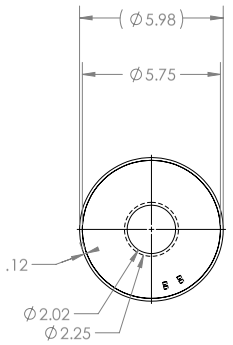
TITLE: REVISED TENDIE MAIN BODY

SIZE:	DATE:	DRAWN BY:	QUANTITY:
A	2/4/2025	ADS241	1

MATERIAL:	PART #:	REV:
6061 T6	25A01026	C

SOLIDWORKS Educational Product. For Instructional Use Only.





Notes

1. 3D Printed Mandrel - Part No. 25A96015
2. Surface Preparation on Mandrel
3. Prepare Heavy Fiberglass Sleeve
4. Layup with PRO SET LAM 135 / 226
5. Cut tip and trim bottom
6. Sand bottom to parallel and perpendicular
7. Holes drilled in assembly

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS IN INCHES

TOLERANCES:
.XX ±.01 .XXX ±.005
FRACTIONS ±1/64
ANGULAR MACHINED ±.5°
ANGULAR BEND ±1°

SURFACE FINISH 125
BREAK ALL EDGES .030

DO NOT SCALE

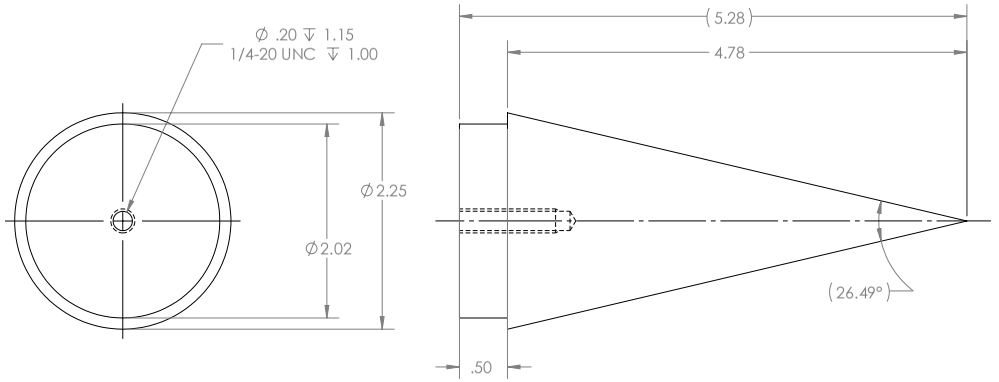
SHEET 1 OF 1

CASE ROCKET TEAM

CASE WESTERN RESERVE UNIVERSITY

TITLE: NOSE CONE V3			
SIZE: A	DATE: 2/10/2025	DRAWN BY: RXR628	QUANTITY: 1
MATERIAL: FIBERGLASS		PART #: 25A01033	REV: E

SOLIDWORKS Educational Product. For Instructional Use Only.



UNLESS OTHERWISE SPECIFIED:
DIMENSIONS IN INCHES

TOLERANCES:
.XX ±.01 .XXX ±.005
FRACTIONS ±1/64
ANGULAR MACHINED ±.5°
ANGULAR BEND ±1°
SURFACE FINISH 125
BREAK ALL EDGES .030

DO NOT SCALE

SHEET 1 OF 1

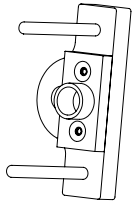
CASE ROCKET TEAM

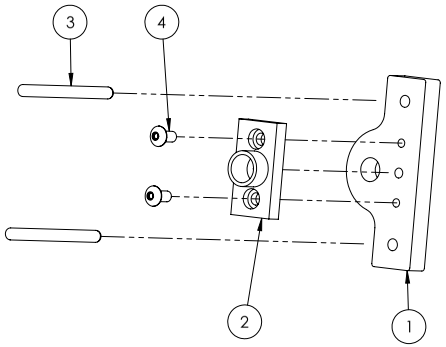
CASE WESTERN RESERVE UNIVERSITY

TITLE: NOSE CONE TIP V3			
SIZE: A	DATE: 2/6/2025	DRAWN BY: KWC53	QUANTITY: 1
MATERIAL: 6061-T6		PART #: 25A01034	REV: D

SOLIDWORKS Educational Product. For Instructional Use Only.

ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	25A01016	Revised Tendie Plate	1
2	23L01002	Charge Well Cap	1
3	25A98027	Tendie Rod	2
4	25A98028	0.25" 4-40 Button Head Bolt	2





NOTE 1: TENDIE RODS PRESS FIT INTO REVISED TENDIE PLATE

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS IN INCHES

TOLERANCES:
.XX ±.01 .XXX ±.005
FRACTIONS ±1/64
ANGULAR MACHINED ±.5°
ANGULAR BEND ±1°
SURFACE FINISH 125
BREAK ALL EDGES .030

DO NOT SCALE

SHEET 1 OF 1

CASE ROCKET TEAM

Case Western Reserve University

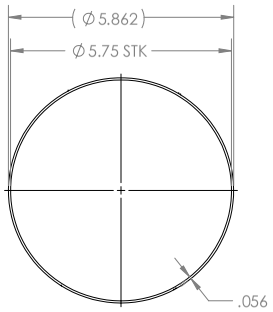
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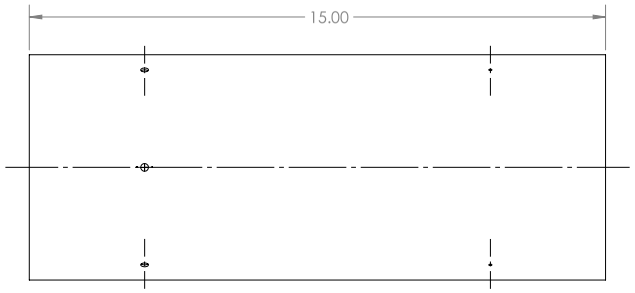
TENDIE PLATE SUBASSEMBLY

SIZE:	DATE:	DRAWN BY:	QUANTITY:
A	2/13/2025	CRP110	4

MATERIAL:	PART #:	REV:
	25A01035	C

SOLIDWORKS Educational Product. For Instructional Use Only.





NOTE: RADIAL HOLES ARE DRILLED IN 25A01000

NOTE:
Purchased steel mandrel (5.75" OD)

- Cut 1 layer that will be wrapped 5 times of 3k carbon fiber weave at 22"
- Lay up with PRO SET LAM 135/226
- Cut to 16"
- Sand to 15"

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS IN INCHES

TOLERANCES:
.XX ±.01 .XXX ±.005
FRACTIONS ±1/64
ANGULAR MACHINED ±.5°
ANGULAR BEND ±1°
SURFACE FINISH 125
BREAK ALL EDGES .030

DO NOT SCALE

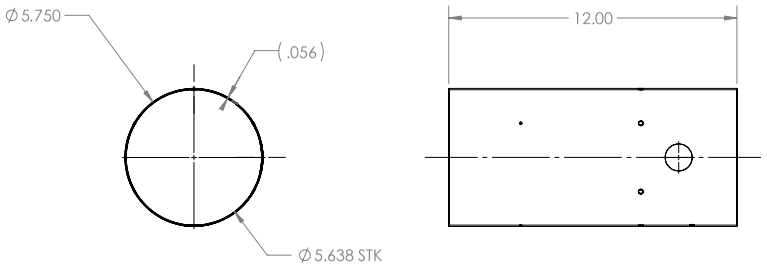
SHEET 1 OF 1

CASE ROCKET TEAM

CASE WESTERN RESERVE UNIVERSITY

TITLE: UPPER BODY TUBE			
SIZE: A	DATE: 2/13/2025	DRAWN BY: KWC53	QUANTITY: 1
MATERIAL: HEXCEL AS4C (3000 FILAMENTS)		PART #: 25A02001	REV: H

SOLIDWORKS Educational Product. For Instructional Use Only.



NOTE: ALL RADIAL HOLES ARE DRILLED AS ASSEMBLY

5 LAYERS OF 3K CARBON FIBER WEAVE
(ONE PIECE OF FABRIC WRAPPED 5 TIMES)
PRO SET LAM 135 / 226
MACHINED ALUMINUM MANDREL (5.638" OD)

SOLIDWORKS Educational Product. For Instructional Use Only.

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS IN INCHES

TOLERANCES:
.XX ±.01 .XXX ±.005
FRACTIONS ±1/64
ANGULAR MACHINED ±.5°
ANGULAR BEND ±1°
SURFACE FINISH 125
BREAK ALL EDGES .030

DO NOT SCALE

SHEET 1 OF 1

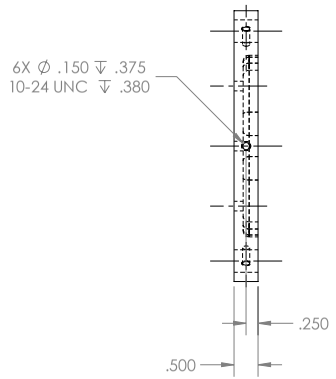
CASE ROCKET TEAM

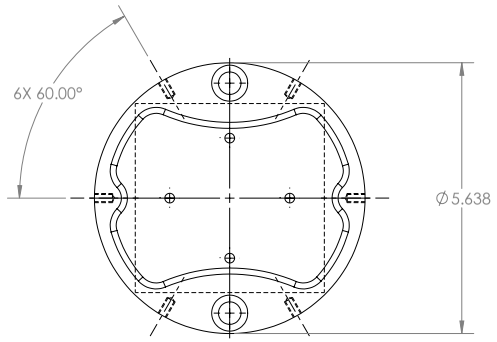
CASE WESTERN RESERVE UNIVERSITY

TITLE: PAYLOAD COUPLER

SIZE:	DATE:	DRAWN BY:	QUANTITY:
A	2/11/2025	JGF45	1

MATERIAL:	PART #:	REV:
HEXCEL AS4C (3000 FILAMENTS)	25A02004	E





NOTE:
USE BLANK 25A96027

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS IN INCHES

TOLERANCES:
.XX ±.01 .XXX ±.005
FRACTIONS ±1/64
ANGULAR MACHINED ±.5°
ANGULAR BEND ±1°

SURFACE FINISH 125
BREAK ALL EDGES .030

DO NOT SCALE

SHEET 1 OF 1

CASE ROCKET TEAM

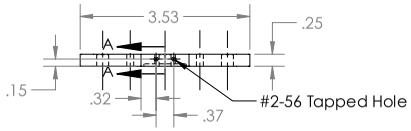
CASE WESTERN RESERVE UNIVERSITY

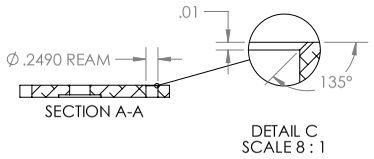
TITLE:
PAYLOAD RETENTION BULKHEAD 2.0

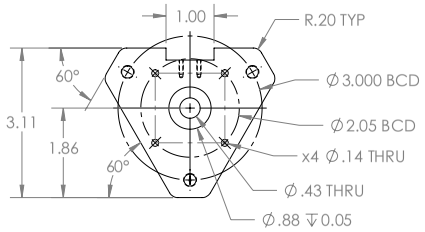
SIZE:	DATE:	DRAWN BY:	QUANTITY:
A	2/13/2025	MSM268	1

MATERIAL:	PART #:	REV:
7075-T6	25A02008	A

SOLIDWORKS Educational Product. For Instructional Use Only.







NOTE:
USE BLANK 25A96009

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS IN INCHES

TOLERANCES:
.XX ±.01 .XXX ±.005
FRACTIONS ±1/64
ANGULAR MACHINED ±.5°
ANGULAR BEND ±1°

SURFACE FINISH 125
BREAK ALL EDGES .030

DO NOT SCALE

SHEET 1 OF 1

CASE ROCKET TEAM

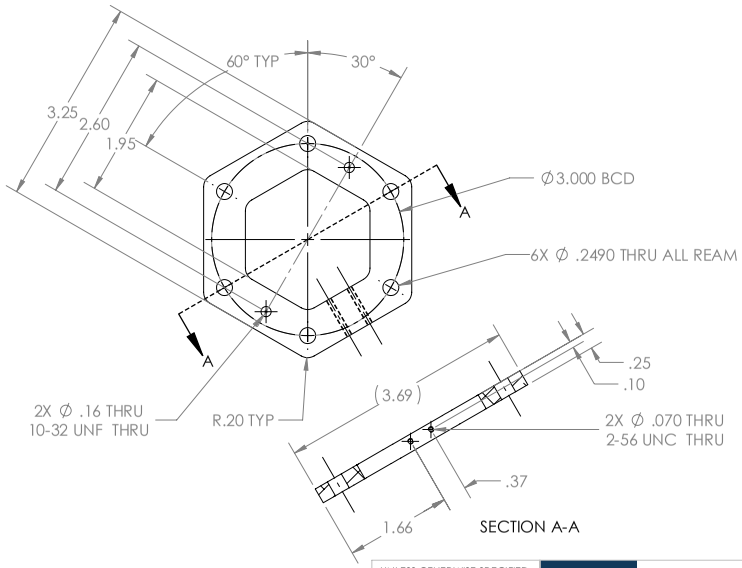
CASE WESTERN RESERVE UNIVERSITY

TITLE:
MAIN BULKHEAD

SIZE:	DATE:	DRAWN BY:	QUANTITY:
A	2/4/2025	JGF4$	1

MATERIAL:	PART #:	REV:
6061-T6	25A04001	B

SOLIDWORKS Educational Product. For Instructional Use Only.



NOTE:
USE BLANK 25A96009

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS IN INCHES

TOLERANCES:
.XX ±.01 .XXX ±.005
FRACTIONS ±1/64
ANGULAR MACHINED ±.5°
ANGULAR BEND ±1°

SURFACE FINISH 125
BREAK ALL EDGES .030

DO NOT SCALE

SHEET 1 OF 1

CASE ROCKET TEAM

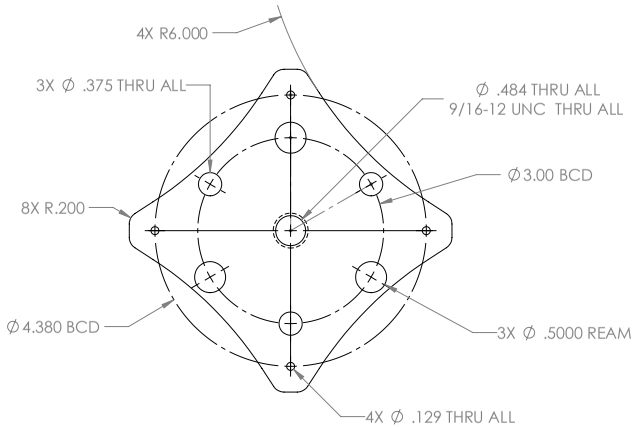
CASE WESTERN RESERVE UNIVERSITY

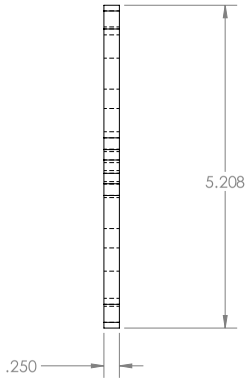
TITLE: UPPER PLATE

SIZE:	DATE:	DRAWN BY:	QUANTITY:
A	11/2/2025	ZLK8	1

MATERIAL:	PART #:	REV:
6061-T6	25A04002	A

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NOTE:
USE BLANK 25A96010

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS IN INCHES

TOLERANCES:
.XX ±.01 .XXX ±.005
FRACTIONS ±1/64
ANGULAR MACHINED ±.5°
ANGULAR BEND ±1°

SURFACE FINISH 125
BREAK ALL EDGES .030

DO NOT SCALE

SHEET 1 OF 1

CASE ROCKET TEAM

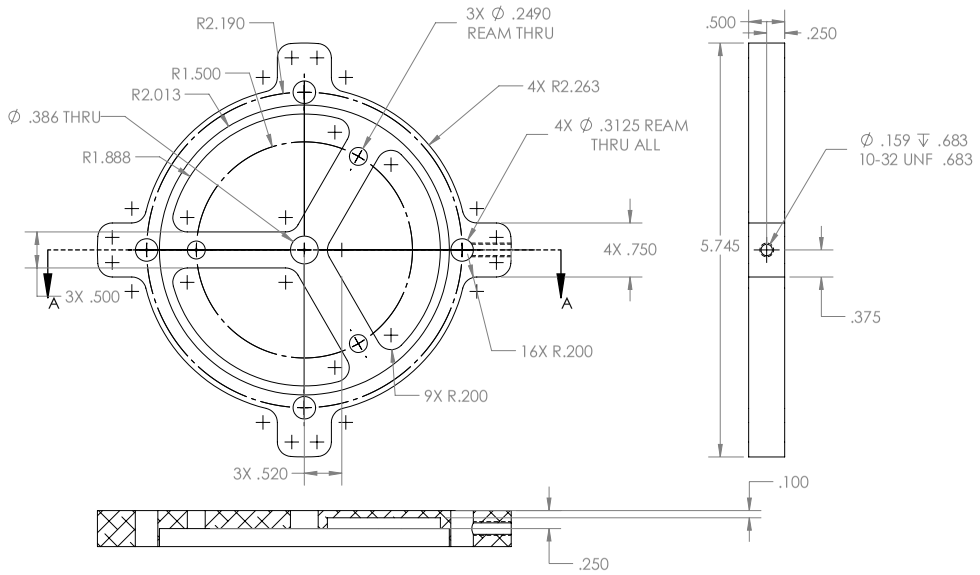
CASE WESTERN RESERVE UNIVERSITY

TITLE: MOVING PLATE

SIZE:	DATE:	DRAWN BY:	QUANTITY:
A	2/17/2025	MXD792	1

MATERIAL:	PART #:	REV:
6061-T6	25A04003	C

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SECTION A-A
SCALE 0.75 : 1

NOTE:
CNC MACHINED PART
USE BLANK: 25A96008

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS IN INCHES

TOLERANCES:
.XX ±.01 .XXX ±.005
FRACTIONS ±1/64
ANGULAR MACHINED ±.5°
ANGULAR BEND ±1°
SURFACE FINISH 125
BREAK ALL EDGES .030

DO NOT SCALE

SHEET 1 OF 1

CASE ROCKET TEAM

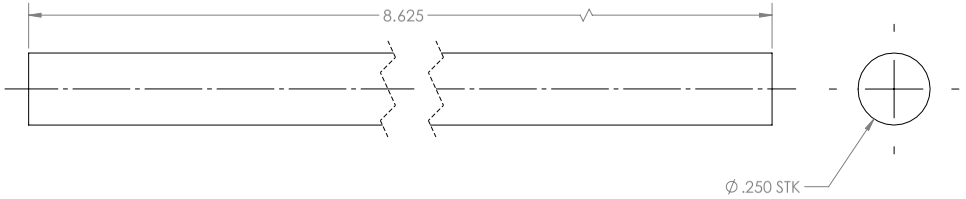
CASE WESTERN RESERVE UNIVERSITY

TITLE:
MOTOR RETAINER BULKHEAD

SIZE:	DATE:	DRAWN BY:	QUANTITY:
A	2/13/2025	DJC233	1

MATERIAL:	PART #:	REV:
AL 6061-T6	25A04004	B

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UNLESS OTHERWISE SPECIFIED:
DIMENSIONS IN INCHES

TOLERANCES:
.XX ±.01 .XXX ±.005
FRACTIONS ±1/64
ANGULAR MACHINED ±.5°
ANGULAR BEND ±1°
SURFACE FINISH 125
BREAK ALL EDGES .030

DO NOT SCALE

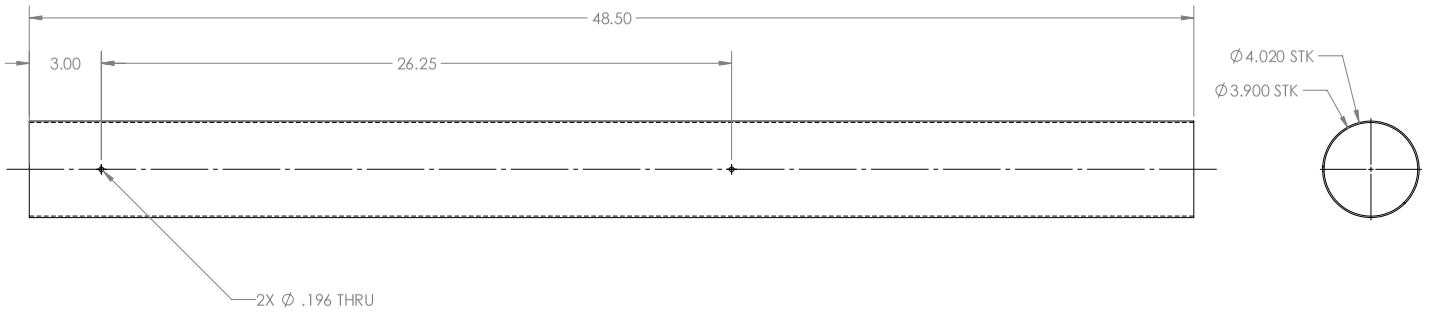
SHEET 1 OF 1

CASE ROCKET TEAM

CASE WESTERN RESERVE UNIVERSITY

TITLE: STRUCTURAL RAIL			
SIZE: A	DATE: 2/15/2025	DRAWN BY: FAR4	QUANTITY: 3
MATERIAL: AISI 304		PART #: 25A04006	REV: B

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QUANTITY: 1

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS IN INCHES

TOLERANCES:
.XX ±.01 .XXX ±.005
FRACTIONS ±1/64
ANGULAR MACHINED ±.5°
ANGULAR BEND ±1°

SURFACE FINISH 125
BREAK ALL EDGES .030

DO NOT SCALE

SHEET 1 OF 1

CASE ROCKET TEAM

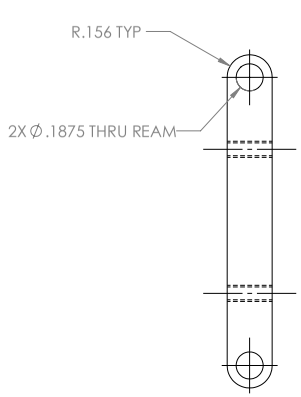
CASE WESTERN RESERVE UNIVERSITY

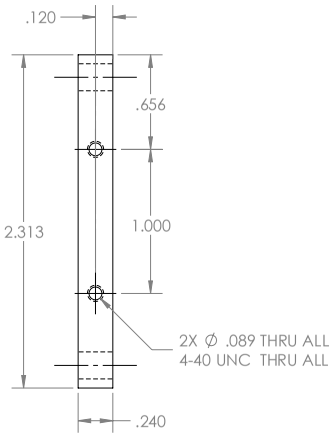
TITLE: Motor Tube

SIZE:	DATE:	DRAWN BY:	QUANTITY:
B	2/15/2025	FAR41	1

MATERIAL:	PART #:	REV:
G12	25A04007	C

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NOTE:
USE BLANK 25A96012

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS IN INCHES

TOLERANCES:
.XX ±.01 .XXX ±.005
FRACTIONS ±1/64
ANGULAR MACHINED ±.5°
ANGULAR BEND ±1°

SURFACE FINISH 125
BREAK ALL EDGES .030

DO NOT SCALE

SHEET 1 OF 1

CASE ROCKET TEAM

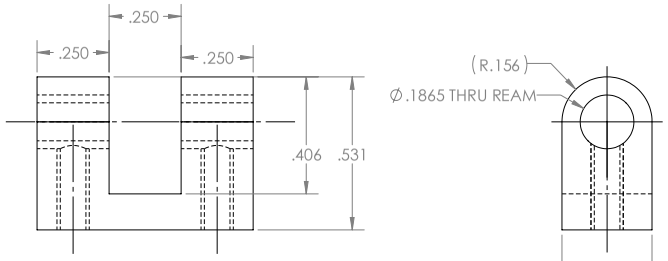
CASE WESTERN RESERVE UNIVERSITY

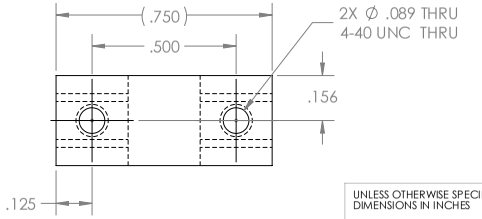
TITLE:
FLAP LINKAGE

SIZE:	DATE:	DRAWN BY:	QUANTITY:
A	11/2/2025	ZLK8	4

MATERIAL:	PART #:	REV:
6061-T6	25A04009	A

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NOTE:
USE BLANK 25A96013

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS IN INCHES

TOLERANCES:
.XX ±.01 .XXX ±.005
FRACTIONS ±1/64
ANGULAR MACHINED ±.5°
ANGULAR BEND ±1°
SURFACE FINISH 125
BREAK ALL EDGES .030

DO NOT SCALE

SHEET 1 OF 1

CASE ROCKET TEAM

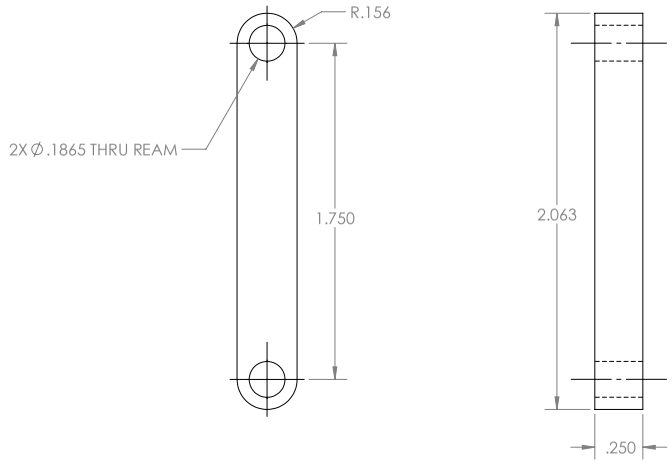
CASE WESTERN RESERVE UNIVERSITY

TITLE: FLAP MOUNT

SIZE:	DATE:	DRAWN BY:	QUANTITY:
A	4/2/2025	ZLK8	4

MATERIAL:	PART #:	REV:
6061-T6	25A04010	B

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NOTE:
USE BLANK 25A96012

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS IN INCHES

TOLERANCES:
.XX ±.01 .XXX ±.005
FRACTIONS ±1/64
ANGULAR MACHINED ±.5°
ANGULAR BEND ±1°

SURFACE FINISH 125
BREAK ALL EDGES .030

DO NOT SCALE

SHEET 1 OF 1

CASE ROCKET TEAM

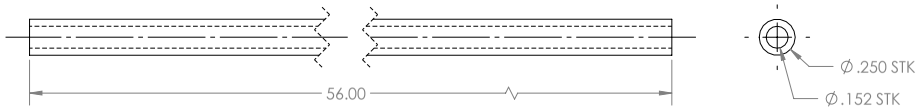
CASE WESTERN RESERVE UNIVERSITY

TITLE: ACTUATION LINKAGE

SIZE:	DATE:	DRAWN BY:	QUANTITY:
A	4/2/2025	ZLK8	8

MATERIAL:	PART #:	REV:
6061-T6	25A04011	A

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UNLESS OTHERWISE SPECIFIED:
DIMENSIONS IN INCHES

TOLERANCES:
.XX ±.01 .XXX ±.005
FRACTIONS ±1/64
ANGULAR MACHINED ±.5°
ANGULAR BEND ±1°

SURFACE FINISH 125
BREAK ALL EDGES .030

DO NOT SCALE

SHEET 1 OF 1

CASE ROCKET TEAM

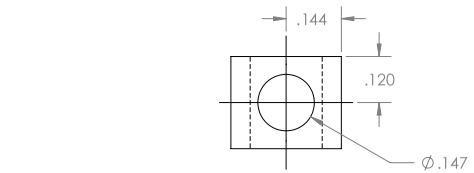
CASE WESTERN RESERVE UNIVERSITY

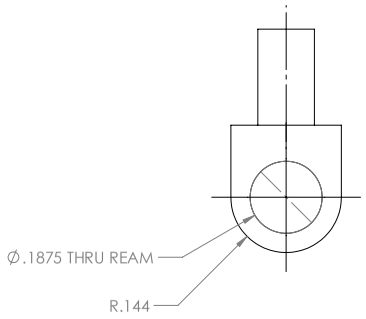
TITLE: ACTUATION TUBE

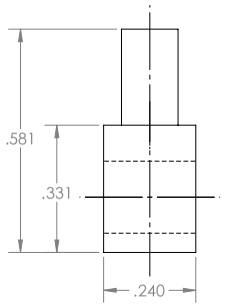
SIZE:	DATE:	DRAWN BY:	QUANTITY:
A	4/2/2025	ZLK8	4

MATERIAL:	PART #:	REV:
304 STAINLESS STEEL	25A04012	A

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NOTE:
USE BLANK 25A96012

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS IN INCHES

TOLERANCES:
.XX ±.01 .XXX ±.005
FRACTIONS ±1/64
ANGULAR MACHINED ±.5°
ANGULAR BEND ±1°

SURFACE FINISH 125
BREAK ALL EDGES .030

DO NOT SCALE

SHEET 1 OF 1

CASE ROCKET TEAM

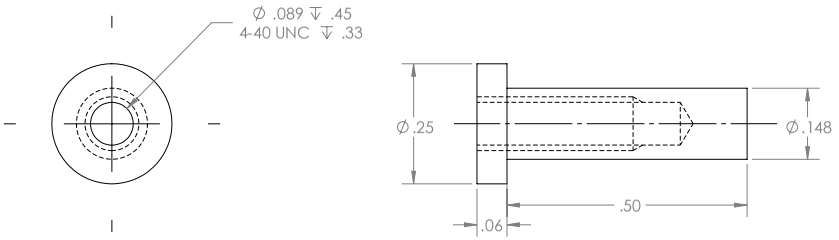
CASE WESTERN RESERVE UNIVERSITY

TITLE:
ACTUATION TUBE LINKAGE CONNECTOR

SIZE:	DATE:	DRAWN BY:	QUANTITY:
A	4/2/2025	ZLK8	4

MATERIAL:	PART #:	REV:
6061-T6	25A04013	A

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UNLESS OTHERWISE SPECIFIED:
DIMENSIONS IN INCHES

TOLERANCES:
.XX ±.01 .XXX ±.005
FRACTIONS ±1/64
ANGULAR MACHINED ±.5°
ANGULAR BEND ±1°
SURFACE FINISH 125
BREAK ALL EDGES .030

DO NOT SCALE

SHEET 1 OF 1

CASE ROCKET TEAM

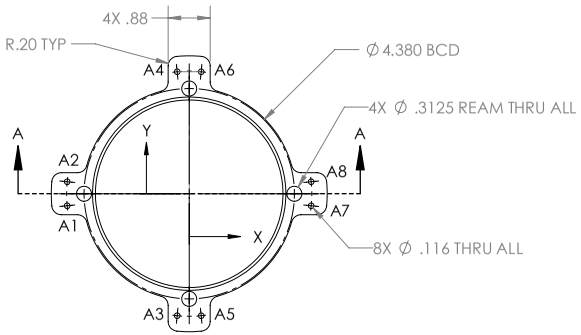
CASE WESTERN RESERVE UNIVERSITY

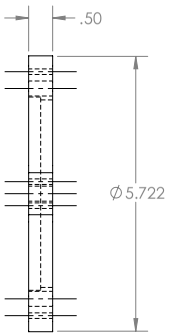
TITLE:
ACTUATION TUBE SCREW CONNECTOR

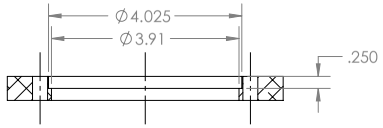
SIZE:	DATE:	DRAWN BY:	QUANTITY:
A	4/2/2025	ZLK8	4

MATERIAL:	PART #:	REV:
6061-T6 (SS)	25A04014	A

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SECTION A-A

TAG	X LOC	Y LOC	SIZE
A1	-2.540	-.250	Ø .116 THRU ALL
A2	-2.540	.250	Ø .116 THRU ALL
A3	-.250	-2.540	Ø .116 THRU ALL
A4	-.250	2.540	Ø .116 THRU ALL
A5	.250	-2.540	Ø .116 THRU ALL
A6	.250	2.540	Ø .116 THRU ALL
A7	2.540	-.250	Ø .116 THRU ALL
A8	2.540	.250	Ø .116 THRU ALL

NOTE:
USE BLANK 25A96008

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS IN INCHES

TOLERANCES:
.XX ±.01 .XXX ±.005
FRACTIONS ±1/64
ANGULAR MACHINED ±.5°
ANGULAR BEND ±1°
SURFACE FINISH 125
BREAK ALL EDGES .030

DO NOT SCALE

SHEET 1 OF 1

CASE ROCKET TEAM

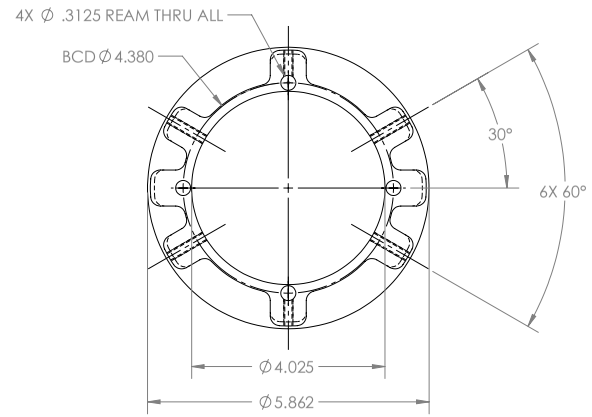
CASE WESTERN RESERVE UNIVERSITY

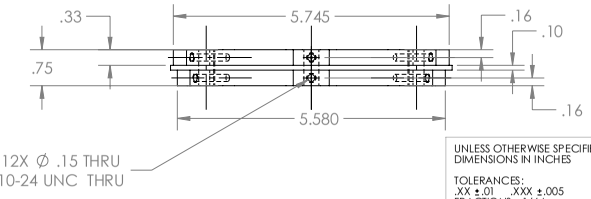
TITLE:
ACTUATION MOUNT BULKHEAD

SIZE:	DATE:	DRAWN BY:	QUANTITY:
A	6/2/2025	ZLK8	1

MATERIAL:	PART #:	REV:
6061-T6	25A04015	B

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12X Ø .15 THRU
10-24 UNC THRU

NOTE:
USE BLANK 25A96011

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS IN INCHES

TOLERANCES:
.XX ±.01 .XXX ±.005
FRACTIONS ±1/64
ANGULAR MACHINED ±.5°
ANGULAR BEND ±1°

SURFACE FINISH 125
BREAK ALL EDGES .030

DO NOT SCALE

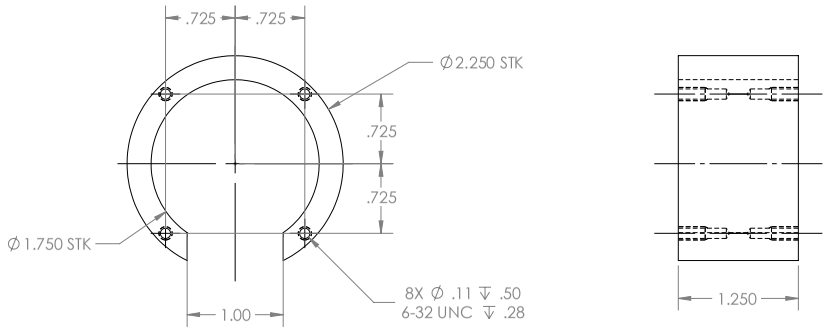
SHEET 1 OF 1

CASE ROCKET TEAM

CASE WESTERN RESERVE UNIVERSITY

TITLE: TUBE INTERFACE BULKHEAD			
SIZE: A	DATE: 11/2/2025	DRAWN BY: ZLK8	QUANTITY: 1
MATERIAL: 6061-T6	PART #: 25A04016		REV: A

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UNLESS OTHERWISE SPECIFIED:
DIMENSIONS IN INCHES

TOLERANCES:
.XX ±.01 .XXX ±.005
FRACTIONS ±1/64
ANGULAR MACHINED ±.5°
ANGULAR BEND ±1°
SURFACE FINISH 125
BREAK ALL EDGES .030

DO NOT SCALE

SHEET 1 OF 1

CASE ROCKET TEAM

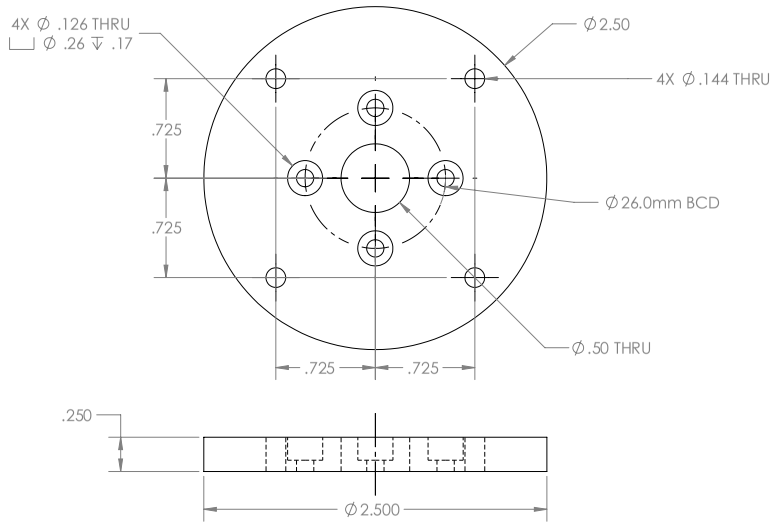
CASE WESTERN RESERVE UNIVERSITY

TITLE: E-MOTOR MOUNT TUBE

SIZE:	DATE:	DRAWN BY:	QUANTITY:
A	6/2/2025	ZLK8	1

MATERIAL:	PART #:	REV:
6061-T6	25A04018	A

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NOTE:
USE BLANK 25A96014

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS IN INCHES

TOLERANCES:
.XX ±.01 .XXX ±.005
FRACTIONS ±1/64
ANGULAR MACHINED ±.5°
ANGULAR BEND ±1°
SURFACE FINISH 125
BREAK ALL EDGES .030

DO NOT SCALE

SHEET 1 OF 1

CASE ROCKET TEAM

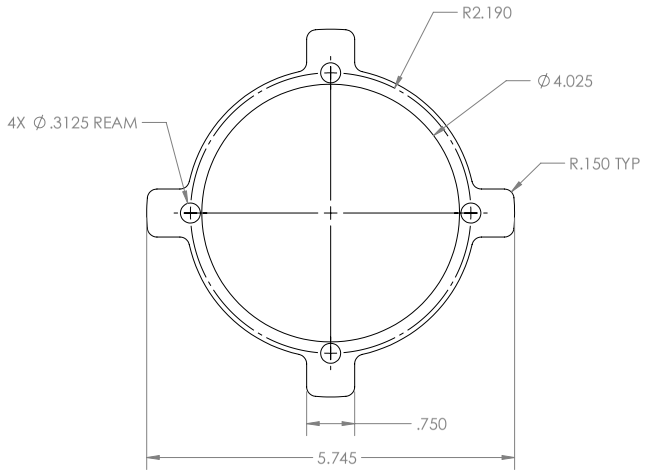
CASE WESTERN RESERVE UNIVERSITY

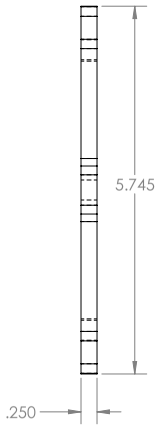
TITLE: E-MOTOR MOUNT PLATE

SIZE:	DATE:	DRAWN BY:	QUANTITY:
A	2/14/2025	MXD792	

MATERIAL:	PART #:	REV:
6061-T6	25A04019	B

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NOTE:
USE BLANK 25A96010

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS IN INCHES

TOLERANCES:
.XX ±.01 .XXX ±.005
FRACTIONS ±1/64
ANGULAR MACHINED ±.5°
ANGULAR BEND ±1°

SURFACE FINISH 125
BREAK ALL EDGES .030

DO NOT SCALE

SHEET 1 OF 1

CASE ROCKET TEAM

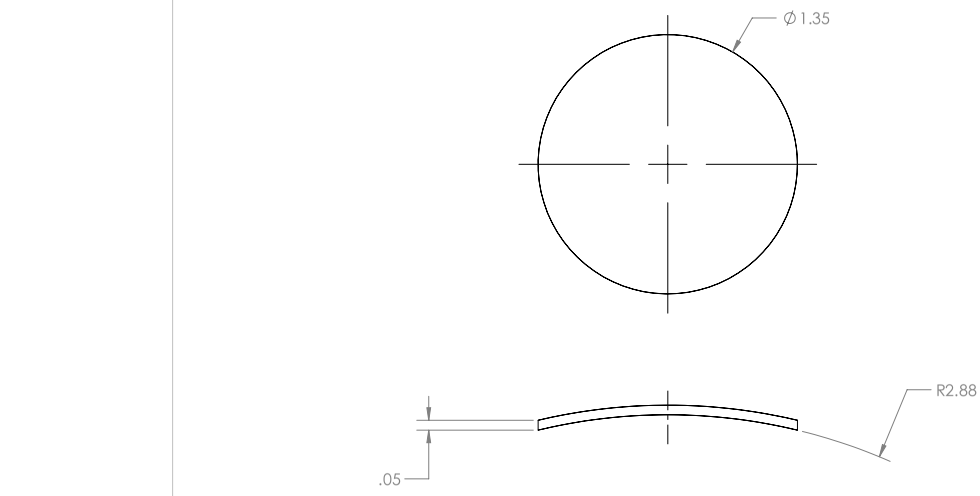
CASE WESTERN RESERVE UNIVERSITY

TITLE:
CENTERING RING

SIZE:	DATE:	DRAWN BY:	QUANTITY:
A	2/14/2025	MXD792	

MATERIAL:	PART #:	REV:
6061-T6	25A04020	C

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NOTE: BEND BY HEATING THEN FORMING OVER COUPLER

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS IN INCHES

TOLERANCES:
.XX ±.01 .XXX ±.005
FRACTIONS ±1/64
ANGULAR MACHINED ±.5°
ANGULAR BEND ±1°
SURFACE FINISH 125
BREAK ALL EDGES .030

DO NOT SCALE

SHEET 1 OF 1

CASE ROCKET TEAM

CASE WESTERN RESERVE UNIVERSITY

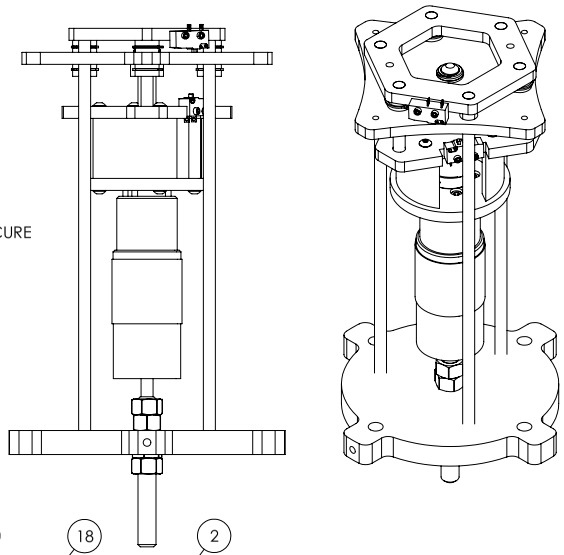
TITLE: CAMERA SHIELD

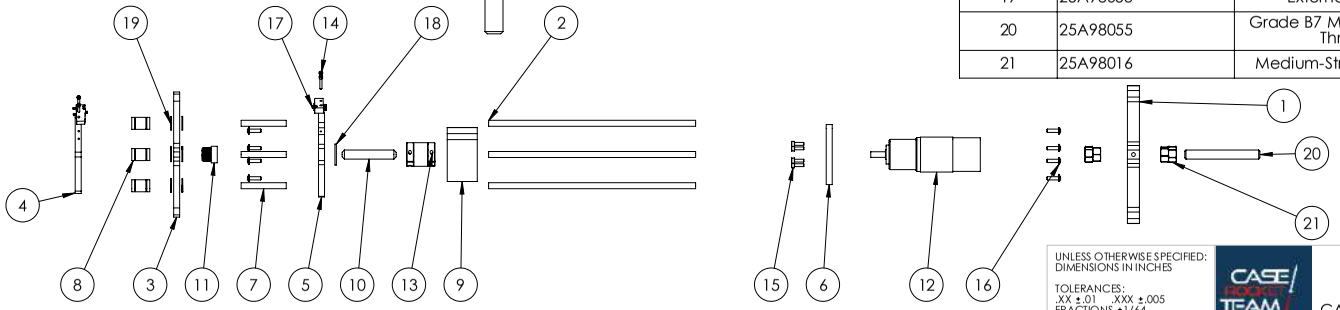
SIZE:	DATE:	DRAWN BY:	QUANTITY:
A	2/14/2025	MXD792	1

MATERIAL:	PART #:	REV:
ACRYLIC (MEDIUM-HIGH IMPACT)	25A04022	A

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NOTE:
BOLT 12 TO 6 USING 15
BOLT 6 TO 9 USING 16
CLAMP 13 ONTO 12
INSERT 18 INTO RECESS IN 5
ATTACH 9 TO 5 USING 16
INSERT 8 INTO 3 AND SECURE USING 19
SCREW 11 INTO 3
PRESS 7 INTO 4
SLIDE 8 ONTO 7
PRESS 5 ONTO 7
THREAD 10 INTO 11
CLAMP 10 INTO 13
BOLT 17 ONTO 5 USING 14
PRESS 2 INTO 4
THREAD 21 ONTO END OF 20
INSERT 20 INTO 1
THREAD 21 ONTO OTHER SIDE OF 20 TO SECURE
PRESS 1 ONTO 2
BOLT 17 ONTO 4 USING 14





ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	25A04004	Motor Retainer Bulkhead	1
2	25A04006	Structural Rail	3
3	25A04003	Moving Plate	1
4	25A04002	Upper Plate	1
5	25A04001	Main Bulkhead	1
6	25A04019	E-Motor Mount Plate	1
7	25A04005	Linear Rail	3
8	25A98033	Fixed Alignment Linear Ball Bearing	3
9	25A04018	E-Motor Mount Tube	1
10	25A98031	1018 Carbon Steel Precision Acme Lead Screw	1
11	25A98032	Precision Acme Externally Threaded Nut	1
12	25A98044	E-Motor	1
13	25A98045	E-Motor Coupler	1
14	25A98052	Black-Oxide Alloy Steel Socket Head Screw	4
15	25A98051	Alloy Steel Socket Head Screw	4
16	25A98050	Button Head Hex Drive Screw	8
17	25A98030	Subminiature Snap-Acting Switch	2
18	25A98034	High-Load Dry-Running Thrust Bearing	1
19	25A98053	External Retaining Ring	6
20	25A98055	Grade B7 Medium-Strength Steel Threaded Rod	1
21	25A98016	Medium-Strength Steel Hex Nut	4

QUANTITY: 1

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS IN INCHES

TOLERANCES:
.XX ±.01 .XXX ±.005
FRACTIONS ±1/64
ANGULAR MACHINED ±.5°
ANGULAR BEND ±1°

SURFACE FINISH 125
BREAK ALL EDGES .030

DO NOT SCALE

SHEET 1 OF 1

CASE ROCKET TEAM

CASE WESTERN RESERVE UNIVERSITY

TITLE: Upper Mechanism Sub-Assembly

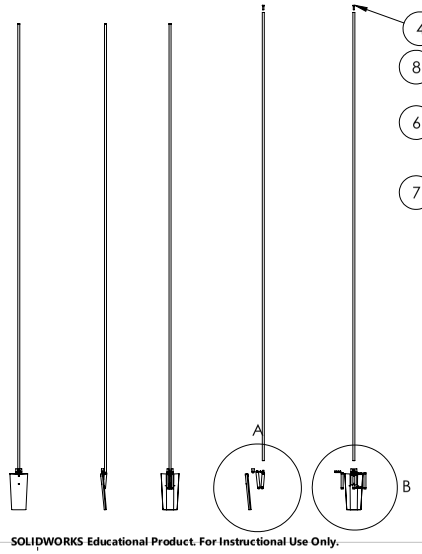
SIZE:	DATE:	DRAWN BY:
B	2/18/2025	GXM331

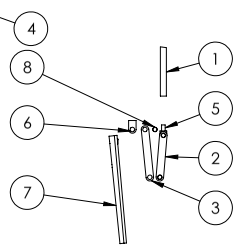
MATERIAL:	PART #:	REV:
	25A04023	B

SOLIDWORKS Educational Product. For Instructional Use Only.

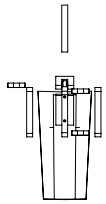
NOTE: USE PRO-SET LAM-135/226 TO SECURE 4 AND 5 TO 1. THEN PRESS FIT REMAINING COMPONENTS

ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	25A04012	Actuation Tube	1
2	25A04011	Actuation Linkage	2
3	25A05009	Flap Linkage	1
4	25A04014	Actuation Tube Screw Connector	1
5	25A04013	Actuation Tube Linkage Connector	1
6	25A04010	Flap Mount	1
7	25A04008	Flap	1
8	25A98043	Linkage Pin	3





DETAIL A
SCALE 1 : 4



DETAIL B
SCALE 1 : 4

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS IN INCHES

TOLERANCES:
.XX ±.01 .XXX ±.005
FRACTIONS ±1/64
ANGULAR MACHINED ±.5°
ANGULAR BEND ±1°

SURFACE FINISH 125
BREAK ALL EDGES .030

DO NOT SCALE

SHEET 1 OF 1

CASE ROCKET TEAM

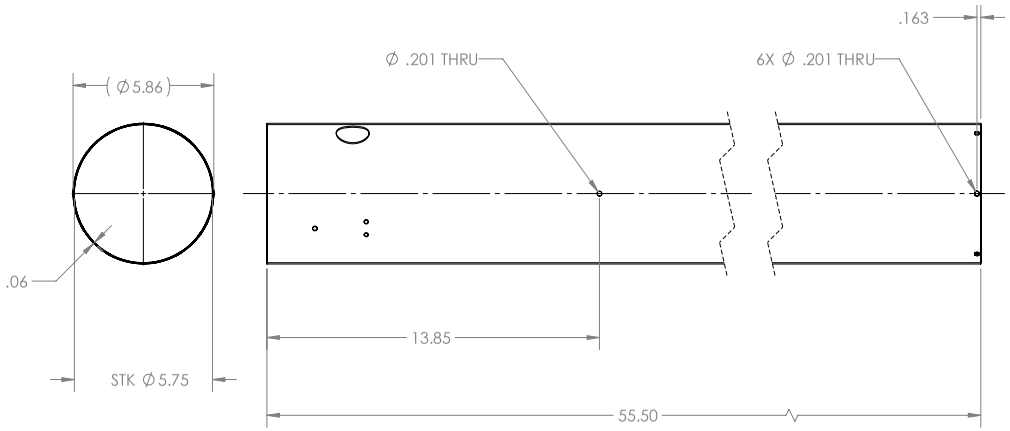
CASE WESTERN RESERVE UNIVERSITY

TITLE:
LOWER MECHANISM SUB-ASSEMBLY

SIZE:	DATE:	DRAWN BY:	QUANTITY:
A	2/19/2025	GXM331	4

MATERIAL:	PART #:	REV:
	25A04024	B

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- SINGLE SHEET 3k CARBON FIBER WEAVE WRAPPED 5 LAYERS AROUND
- PRO SET LAM 135/226
- PURCHASED STEEL MANDREL
- ALL HOLES DRILLED IN ASSEMBLY

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS IN INCHES

TOLERANCES:
.XX ±.01 .XXX ±.005
FRACTIONS ±1/64
ANGULAR MACHINED ±.5°
ANGULAR BEND ±1°
SURFACE FINISH 125
BREAK ALL EDGES .030

DO NOT SCALE

SHEET 1 OF 1

CASE ROCKET TEAM

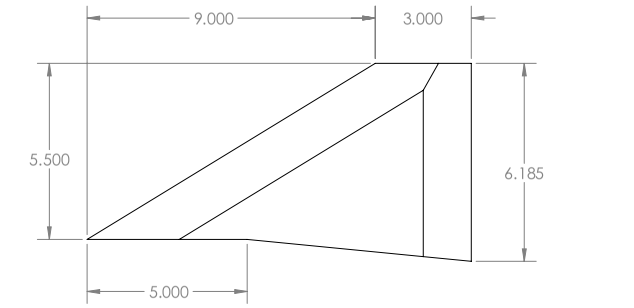
CASE WESTERN RESERVE UNIVERSITY

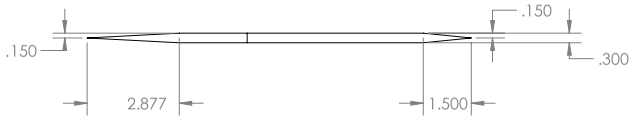
TITLE: LOWER BODY TUBE

SIZE:	DATE:	DRAWN BY:	QUANTITY:
A	2/14/2025	KXR387	1

MATERIAL:	PART #:	REV:
HEXCEL AS4C (3000 FILAMENT)	25A05001	C

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Notes
1. Surface prep G10 Fiberglass sheet
2. Layup both sides of the sheet with 2 layers 3k CF
3. Vacuum bag to cure
4. Waterjet shape
5. CNC Mill to bevel fins

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UNLESS OTHERWISE SPECIFIED:
DIMENSIONS IN INCHES

TOLERANCES:
.XX ±.01 .XXX ±.005
FRACTIONS ±1/64
ANGULAR MACHINED ±.5°
ANGULAR BEND ±1°
SURFACE FINISH 125
BREAK ALL EDGES .030

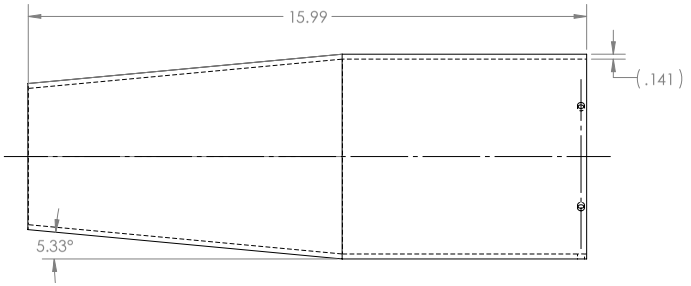
DO NOT SCALE

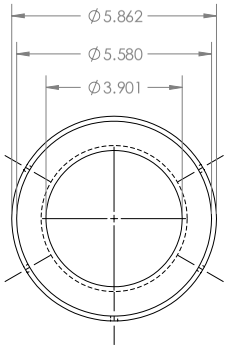
SHEET 1 OF 1

CASE ROCKET TEAM

CASE WESTERN RESERVE UNIVERSITY

TITLE:			
FIN			
SIZE:	DATE:	DRAWN BY:	QUANTITY:
A	2/6/2025	AFW44	4
MATERIAL:		PART #:	REV:
G10 Fiberglass		25A05002	C





NOTE:
RADIAL HOLES ARE DRILLED IN 25A00000
6 LAYERS 6K CARBON FIBER SLEEVE
SAND BOTH ENDS PARALLEL AND PERPENDICULAR

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS IN INCHES

TOLERANCES:
.XX ±.01 .XXX ±.005
FRACTIONS ±1/64
ANGULAR MACHINED ±.5°
ANGULAR BEND ±1°
SURFACE FINISH 125
BREAK ALL EDGES .030

DO NOT SCALE

SHEET 1 OF 1

CASE ROCKET TEAM

CASE WESTERN RESERVE UNIVERSITY

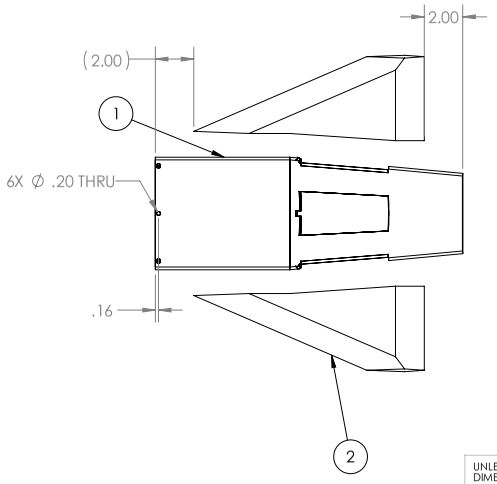
TITLE: BOAT TAIL

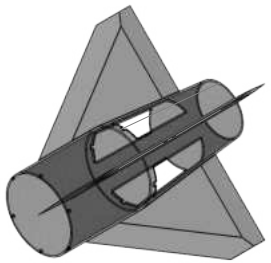
SIZE:	DATE:	DRAWN BY:	QUANTITY: 1
A	2/10/2025	MSM268	

MATERIAL:	PART #:	REV:
HEXCEL AS4C (3000 FILAMENTS)	25A05003	E

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ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	25A05003	Boat Tail	1
2	25A05002	Fin	4





Notes:
1. USE SUPERGLUE TO TACK FINS TO BOAT TAIL
2. USE AEROPOXY ES6209 TO MAKE FILLETS
3. SAND FILLETS TO CONCAVE
4. TIP TO TIP LAYUP WITH 3K CARBON FIBER WEAVE
5. USING PROSET LAM 135/226
6. VACUUM BAG AFTER EACH TIP TO TIP
7. FURTHER POST PROCESSING
8. CUT FLAP SLOTS WITH 25A96XXXX (Flap Alignment Jig)

Use 25A96026 (Fin Alignment Jig)

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS IN INCHES

TOLERANCES:
.XX ±.01 .XXX ±.005
FRACTIONS ±1/64
ANGULAR MACHINED ±.5°
ANGULAR BEND ±1°
SURFACE FINISH 125
BREAK ALL EDGES .030

DO NOT SCALE

SHEET 1 OF 2

CASE ROCKET TEAM

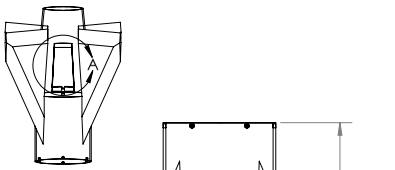
CASE WESTERN RESERVE UNIVERSITY

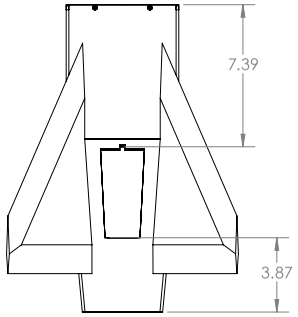
TITLE: FIN CAN SUB-ASSEMBLY

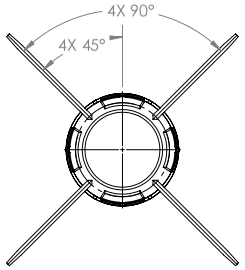
SIZE:	DATE:	DRAWN BY:	QUANTITY:
A	2/13/2025	RXR628	1

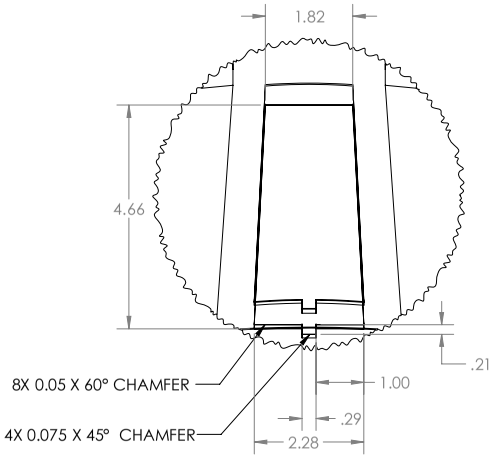
MATERIAL:	PART #:	REV:
	25A05007	D

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DETAIL A

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS IN INCHES

TOLERANCES:
.XX ±.01 .XXX ±.005
FRACTIONS ±1/64
ANGULAR MACHINED ±.5°
ANGULAR BEND ±1°

SURFACE FINISH 125
BREAK ALL EDGES .030

DO NOT SCALE

SHEET 2 OF 2

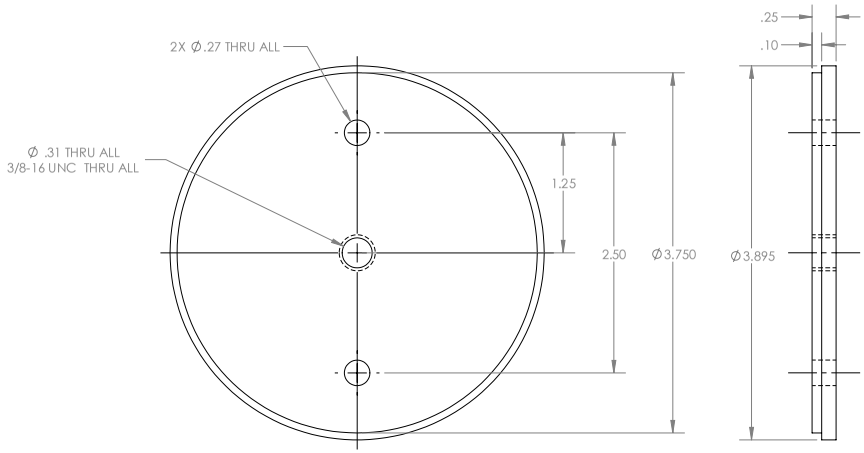
CASE ROCKET TEAM

CASE WESTERN RESERVE UNIVERSITY

TITLE: FIN CAN SUB-ASSEMBLY

SIZE:	DATE:	DRAWN BY:	
A	2/13/2025	MSM268	
MATERIAL:		PART #:	REV:
		25A05007	B

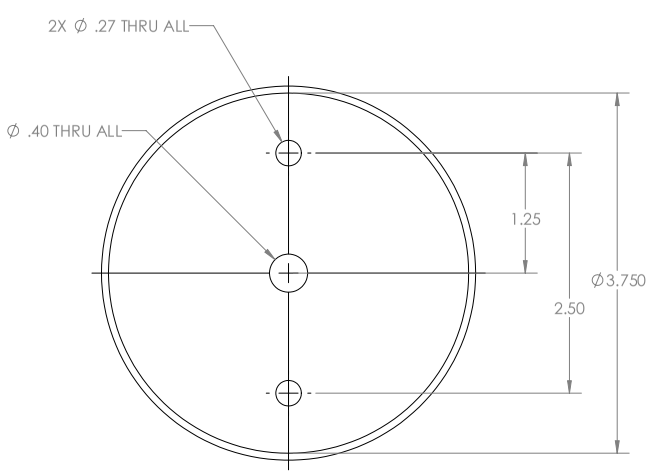
SOLIDWORKS Educational Product. For Instructional Use Only.

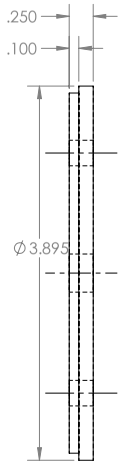


NOTE:
CNC MACHINED PART
USE BLANK 25A96009

UNLESS OTHERWISE SPECIFIED: DIMENSIONS IN INCHES TOLERANCES: .XX ±.01 .XXX ±.005 FRACTIONS ±1/64 ANGULAR MACHINED ±.5° ANGULAR BEND ±1° SURFACE FINISH 125 BREAK ALL EDGES .030	CASE ROCKET TEAM			
	CASE WESTERN RESERVE UNIVERSITY			
	TITLE: LOW LAUNCH TOP BULKHEAD			
	SIZE: A	DATE: 2/4/2025	DRAWN BY: DJC233	QUANTITY: 1
	MATERIAL: AL 6061-T6		PART #: 25A05012	REV: A
DO NOT SCALE				
SHEET 1 OF 1				

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NOTE:
CNC MACHINED PART
USE BLANK 25A96009

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS IN INCHES

TOLERANCES:
.XX ±.01 .XXX ±.005
FRACTIONS ±1/64
ANGULAR MACHINED ±.5°
ANGULAR BEND ±1°

SURFACE FINISH 125
BREAK ALL EDGES .030

DO NOT SCALE

SHEET 1 OF 1

CASE ROCKET TEAM

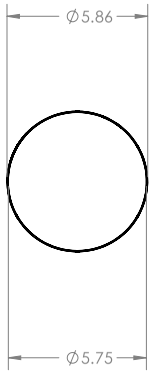
CASE WESTERN RESERVE UNIVERSITY

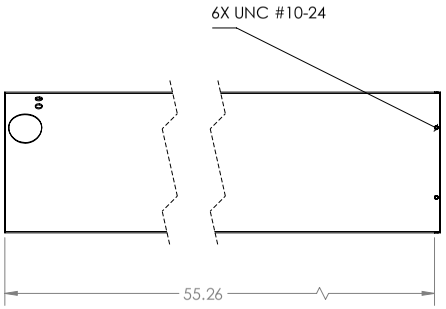
TITLE:
LOW LAUNCH BOTTOM BULKHEAD

SIZE:	DATE:	DRAWN BY:	QUANTITY:
A	2/11/2025	DJC233	1

MATERIAL:	PART #:	REV:
AL 6061-T6	25A05013	D

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- 5 LAYERS OF 3k CARBON FIBER WEAVE
- PRO SET LAM 135/226
- PURCHASED STEEL MANDREL

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS IN INCHES

TOLERANCES:
.XX ±.01 .XXX ±.005
FRACTIONS ±1/64
ANGULAR MACHINED ±.5°
ANGULAR BEND ±1°
SURFACE FINISH 125
BREAK ALL EDGES .030

DO NOT SCALE

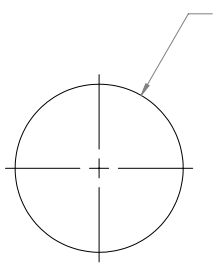
SHEET 1 OF 1

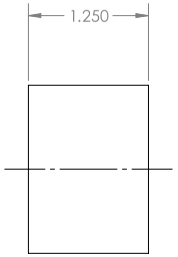
CASE ROCKET TEAM

CASE WESTERN RESERVE UNIVERSITY

TITLE:			
Lower Body Tube			
SIZE:	DATE:	DRAWN BY:	QUANTITY:
A	2/13/2025	KXR387	1
MATERIAL:		PART #:	REV:
HEXCEL AS4C (3000 FILAMENT)		25A05017	B

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NOTE 1: SLIP FIT WITH 25A04018

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS IN INCHES

TOLERANCES:
.XX ±.01 .XXX ±.005
FRACTIONS ±1/64
ANGULAR MACHINED ±.5°
ANGULAR BEND ±1°

SURFACE FINISH 125
BREAK ALL EDGES .030

DO NOT SCALE

SHEET 1 OF 1

CASE ROCKET TEAM

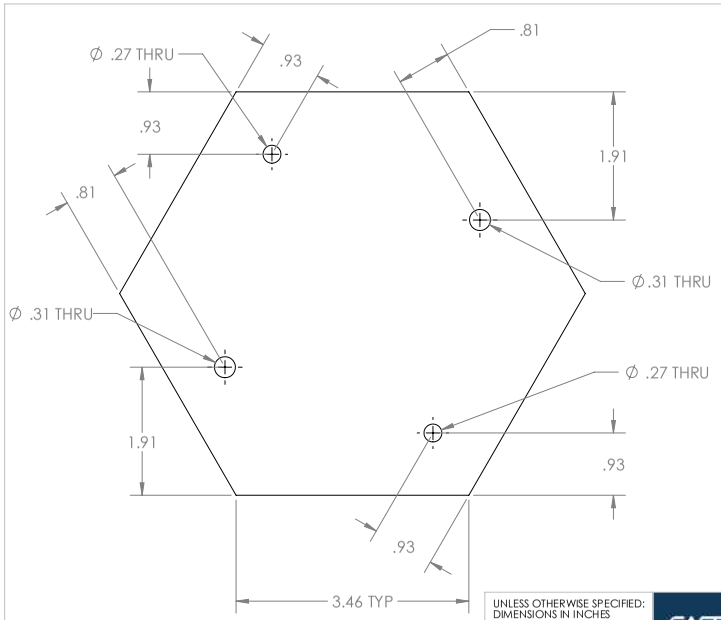
Case Western Reserve University

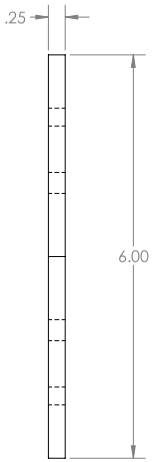
TITLE: MOTOR COUPLER JIG

SIZE:	DATE:	DRAWN BY:	QUANTITY:
A	2/6/2025	CRP110	1

MATERIAL:	PART #:	REV:
DELRIN	25A96001	B

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INTERFACES WITH 25A02008 AND 25A04016

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS IN INCHES

TOLERANCES:
.XX ±.01 .XXX ±.005
FRACTIONS ±1/64
ANGULAR MACHINED ±.5°
ANGULAR BEND ±1°

SURFACE FINISH 125
BREAK ALL EDGES .030

DO NOT SCALE

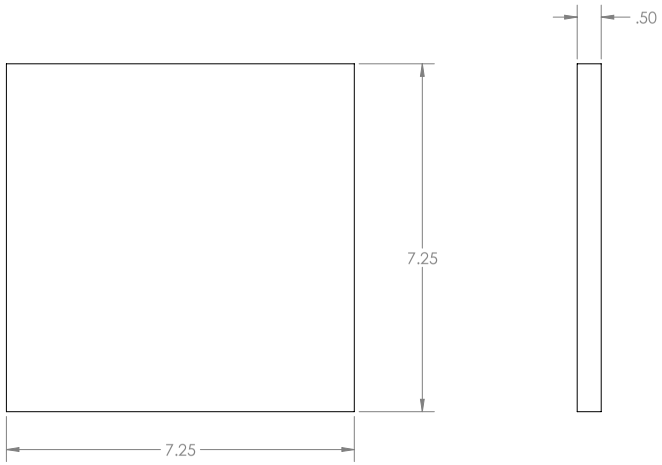
SHEET 1 OF 1

CASE ROCKET TEAM

CASE WESTERN RESERVE UNIVERSITY

TITLE: HEXAGON JIG			
SIZE: A	DATE: 2/14/2025	DRAWN BY: FAR4	QUANTITY: 1
MATERIAL: 6061-T6 (SS)		PART #: 25A96002	REV: D

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NOTE:
USED FOR 25A04004 AND 25A04015

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS IN INCHES

TOLERANCES:
.XX ±.01 .XXX ±.005
FRACTIONS ±1/64
ANGULAR MACHINED ±.5°
ANGULAR BEND ±1°
SURFACE FINISH 125
BREAK ALL EDGES .030

DO NOT SCALE

SHEET 1 OF 1

CASE ROCKET TEAM

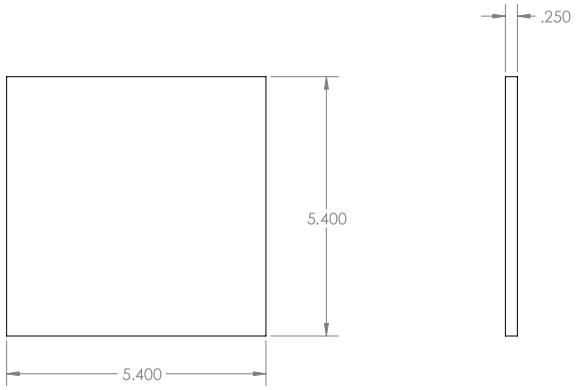
CASE WESTERN RESERVE UNIVERSITY

TITLE:
0.5" BULKHEAD BLANK

SIZE:	DATE:	DRAWN BY:	QUANTITY:
A	2/13/2025	DJC233	2

MATERIAL:	PART #:	REV:
6061-T6 (SS)	25A96008	A

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NOTE:
BLANK USED FOR 25A05012, 25A05013, 25A04001, AND 25A04002

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS IN INCHES

TOLERANCES:
.XX ±.01 .XXX ±.005
FRACTIONS ±1/64
ANGULAR MACHINED ±.5°
ANGULAR BEND ±1°

SURFACE FINISH 125
BREAK ALL EDGES .030

DO NOT SCALE

SHEET 1 OF 1

CASE ROCKET TEAM

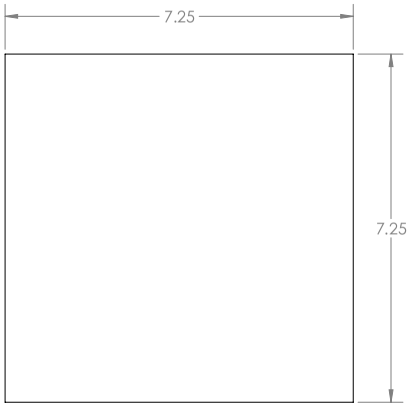
CASE WESTERN RESERVE UNIVERSITY

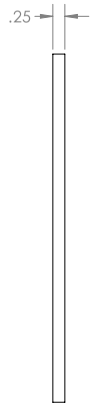
TITLE: 5.4"X5.4"X0.25" BLANK

SIZE:	DATE:	DRAWN BY:	QUANTITY:
A	2/13/2025	DJC233	4

MATERIAL:	PART #:	REV:
6061-T6 (SS)	25A96009	A

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NOTE: FOR 24A04003 AND 24A04020

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS IN INCHES

TOLERANCES:
.XX ±.01 .XXX ±.005
FRACTIONS ±1/64
ANGULAR MACHINED ±.5°
ANGULAR BEND ±1°
SURFACE FINISH 125
BREAK ALL EDGES .030

DO NOT SCALE

SHEET 1 OF 1

CASE ROCKET TEAM

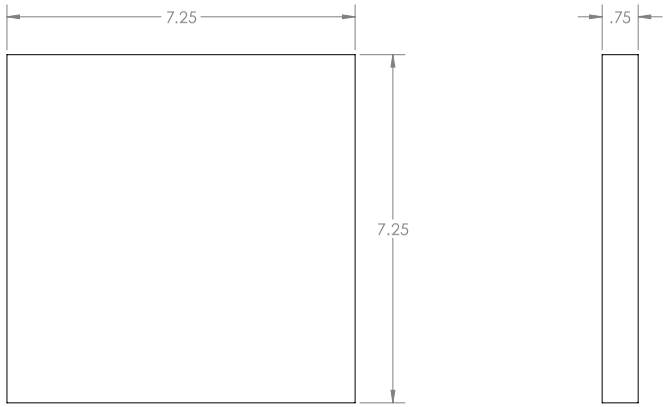
CASE WESTERN RESERVE UNIVERSITY

TITLE: 0.25" BULKHEAD BLANK

SIZE:	DATE:	DRAWN BY:	QUANTITY:
A	2/13/2025	GXM331	4

MATERIAL:	PART #:	REV:
6061-T6	25A96010	A

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NOTE: FOR 25A04016

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS IN INCHES

TOLERANCES:
.XX ±.01 .XXX ±.005
FRACTIONS ±1/64
ANGULAR MACHINED ±.5°
ANGULAR BEND ±1°
SURFACE FINISH 125
BREAK ALL EDGES .030

DO NOT SCALE

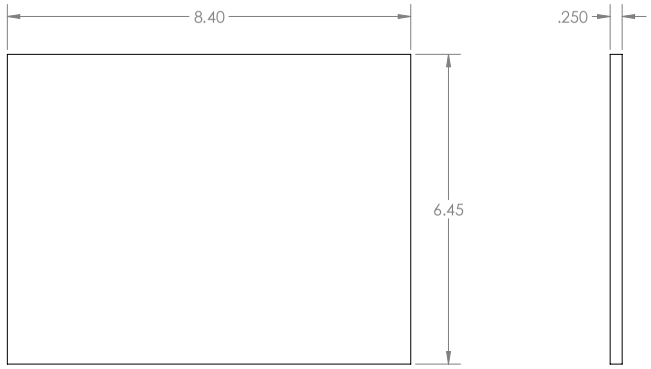
SHEET 1 OF 1

CASE ROCKET TEAM

CASE WESTERN RESERVE UNIVERSITY

TITLE: 0.75" BULKHEAD BLANK			
SIZE: A	DATE: 2/13/2025	DRAWN BY: GXM331	QUANTITY: 4
MATERIAL: 6061-T6		PART #: 25A96011	REV: A

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NOTE: FOR 25A04009, 25A04011, AND 25A04013

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS IN INCHES

TOLERANCES:
.XX ±.01 .XXX ±.005
FRACTIONS ±1/64
ANGULAR MACHINED ±.5°
ANGULAR BEND ±1°
SURFACE FINISH 125
BREAK ALL EDGES .030

DO NOT SCALE

SHEET 1 OF 1

CASE ROCKET TEAM

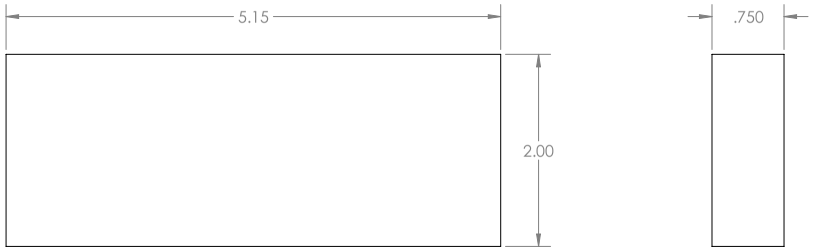
CASE WESTERN RESERVE UNIVERSITY

TITLE: LINKAGE BLANK

SIZE:	DATE:	DRAWN BY:	QUANTITY:
A	2/13/2025	GXM331	1

MATERIAL:	PART #:	REV:
6061-T6	25A96012	A

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NOTE: FOR 25A04010

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS IN INCHES

TOLERANCES:
.XX ±.01 .XXX ±.005
FRACTIONS ±1/64
ANGULAR MACHINED ±.5°
ANGULAR BEND ±1°
SURFACE FINISH 125
BREAK ALL EDGES .030

DO NOT SCALE

SHEET 1 OF 1

CASE ROCKET TEAM

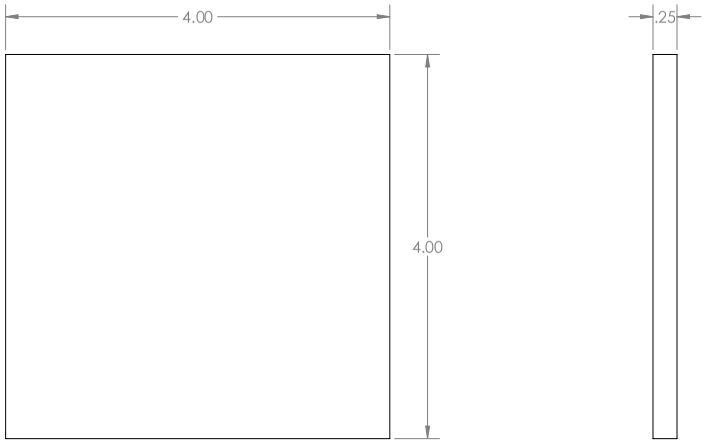
CASE WESTERN RESERVE UNIVERSITY

TITLE: ACTUATION MOUNT BLANK

SIZE:	DATE:	DRAWN BY:	QUANTITY:
A	2/13/2025	GXM331	1

MATERIAL:	PART #:	REV:
6061-T6	25A96013	A

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NOTE: FOR 25A04019

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS IN INCHES

TOLERANCES:
.XX ±.01 .XXX ±.005
FRACTIONS ±1/64
ANGULAR MACHINED ±.5°
ANGULAR BEND ±1°
SURFACE FINISH 125
BREAK ALL EDGES .030

DO NOT SCALE

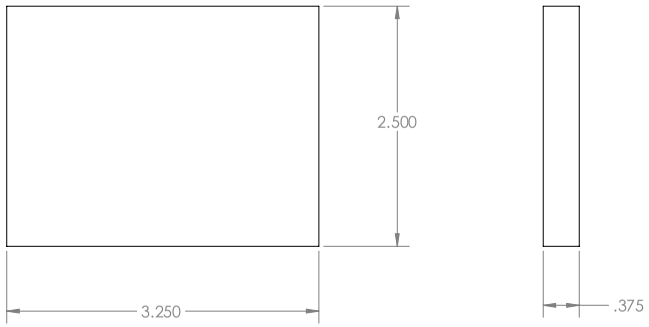
SHEET 1 OF 1

CASE ROCKET TEAM

CASE WESTERN RESERVE UNIVERSITY

TITLE: MOTOR MOUNT BLANK			
SIZE: A	DATE: 2/13/2025	DRAWN BY: GXM331	QUANTITY: 1
MATERIAL: 6061-T6		PART #: 25A96014	REV: A

SOLIDWORKS Educational Product. For Instructional Use Only.



NOTE:
USE FOR 23L01002

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS IN INCHES

TOLERANCES:
.XX ±.01 .XXX ±.005
FRACTIONS ±1/64
ANGULAR MACHINED ±.5°
ANGULAR BEND ±1°
SURFACE FINISH 125
BREAK ALL EDGES .030

DO NOT SCALE

SHEET 1 OF 1

CASE ROCKET TEAM

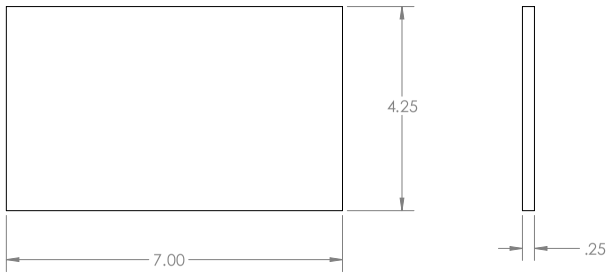
CASE WESTERN RESERVE UNIVERSITY

TITLE: 3.25"X2.5"X0.375" BLANK

SIZE:	DATE:	DRAWN BY:	QUANTITY:
A	2/15/2025	DJC233	1

MATERIAL:	PART #:	REV:
DELRIN	25A96019	A

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NOTE:
USE FOR 25A01016

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS IN INCHES

TOLERANCES:
.XX ±.01 .XXX ±.005
FRACTIONS ±1/64
ANGULAR MACHINED ±.5°
ANGULAR BEND ±1°
SURFACE FINISH 125
BREAK ALL EDGES .030

DO NOT SCALE

SHEET 1 OF 1

CASE ROCKET TEAM

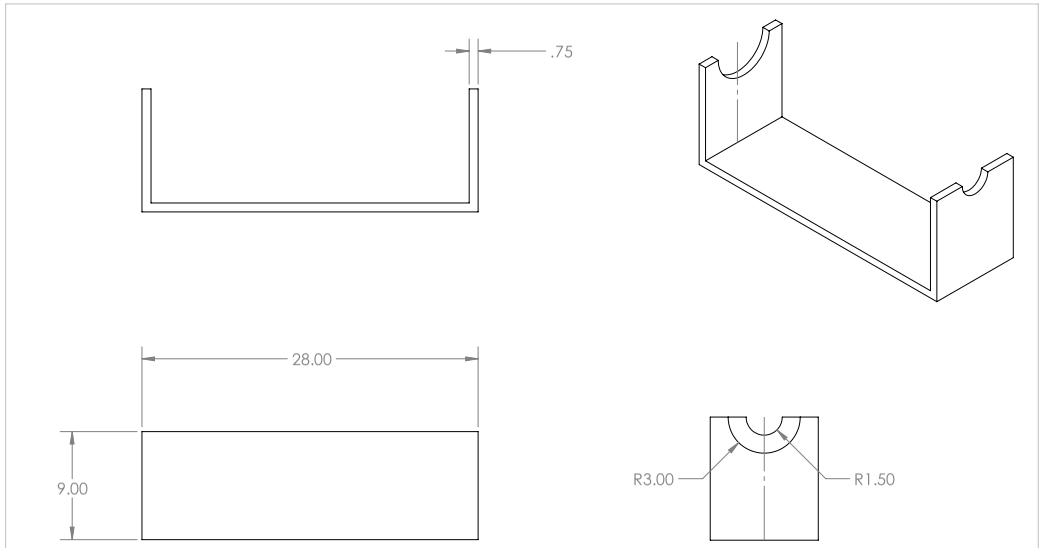
CASE WESTERN RESERVE UNIVERSITY

TITLE: 7"X4.25"X0.25" BLANK

SIZE:	DATE:	DRAWN BY:	QUANTITY:
A	2/15/2025	DJC233	1

MATERIAL:	PART #:	REV:
6061-T6	25A96020	A

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UNLESS OTHERWISE SPECIFIED:
DIMENSIONS IN INCHES

TOLERANCES:
.XX ±.01 .XXX ±.005
FRACTIONS ±1/64
ANGULAR MACHINED ±.5°
ANGULAR BEND ±1°
SURFACE FINISH 125
BREAK ALL EDGES .030

DO NOT SCALE

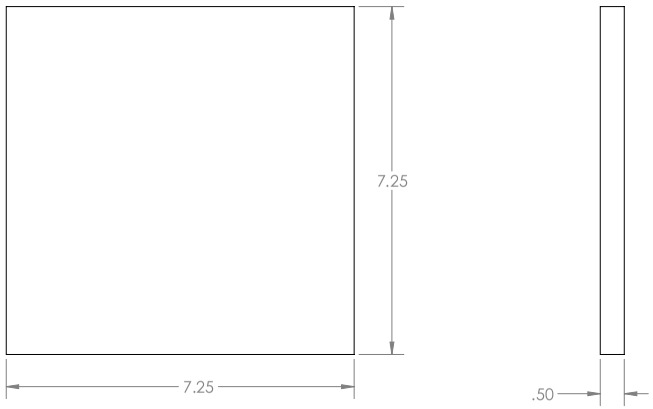
SHEET 1 OF 1

CASE ROCKET TEAM

CASE WESTERN RESERVE UNIVERSITY

TITLE: Boat Tail Jig			
SIZE: A	DATE: 2/21/2025	DRAWN BY: RXR628	QUANTITY: 1
MATERIAL: Plywood		PART #: 25A96021	REV: A

SOLIDWORKS Educational Product. For Instructional Use Only.



NOTE:
USE FOR 25A02008

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS IN INCHES

TOLERANCES:
.XX ±.01 .XXX ±.005
FRACTIONS ±1/64
ANGULAR MACHINED ±.5°
ANGULAR BEND ±1°
SURFACE FINISH 125
BREAK ALL EDGES .030

DO NOT SCALE

SHEET 1 OF 1

CASE ROCKET TEAM

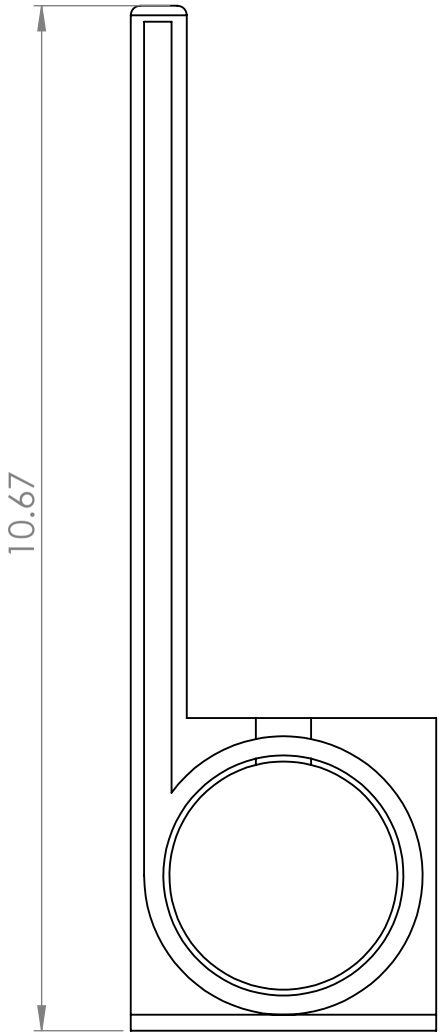
CASE WESTERN RESERVE UNIVERSITY

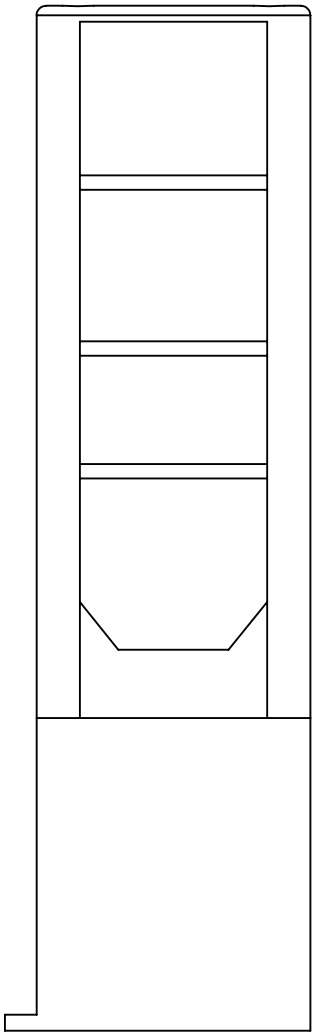
TITLE: 7.25"X7.25"X0.50"

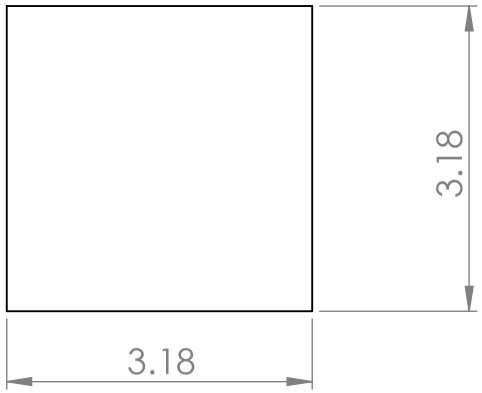
SIZE:	DATE:	DRAWN BY:	QUANTITY:
A	2/20/2025	DJC233	1

MATERIAL:	PART #:	REV:
7075-T6, PLATE (SS)	25A96027	A

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UNLESS OTHERWISE SPECIFIED:
DIMENSIONS IN INCHES

TOLERANCES:
.XX ±.01 .XXX ±.005
FRACTIONS ±1/64
ANGULAR MACHINED ±.5°
ANGULAR BEND ±1°
SURFACE FINISH 125
BREAK ALL EDGES .030

DO NOT SCALE

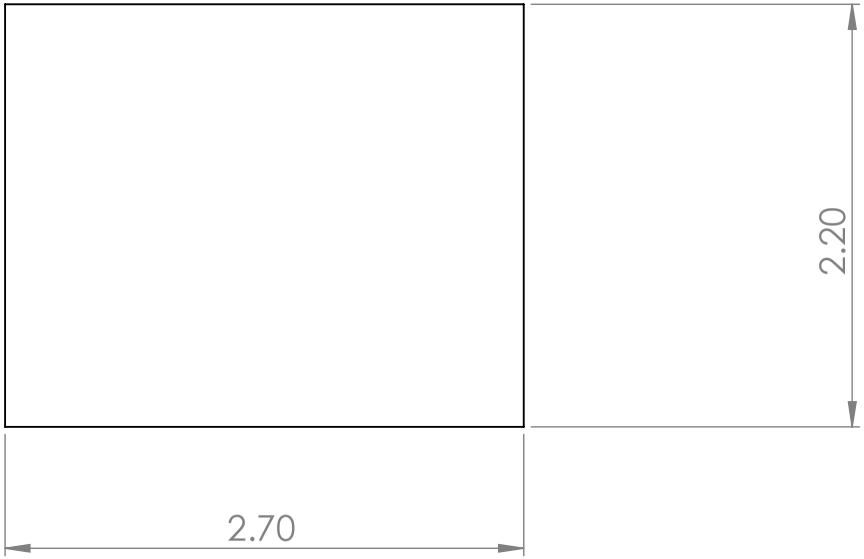
SHEET 1 OF 1

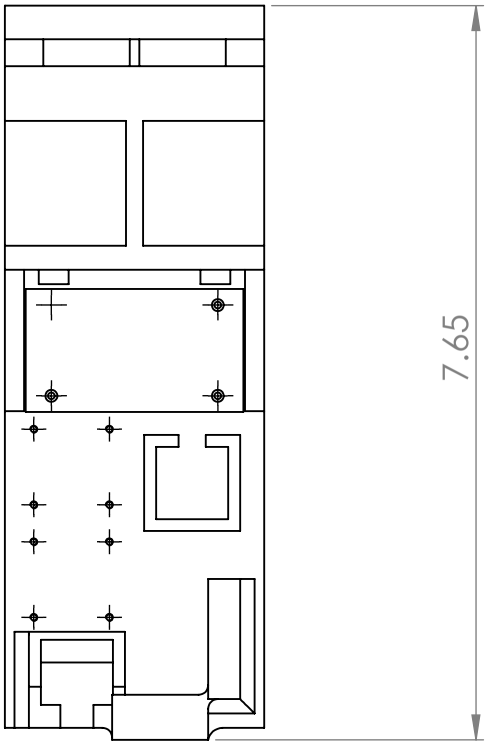
CASE ROCKET TEAM

CASE WESTERN RESERVE UNIVERSITY

TITLE: GLASS RETAINER			
SIZE: A	DATE: 2/13/2025	DRAWN BY: MAT223	
MATERIAL: PLA		PART #: 25B03006	REV: A

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UNLESS OTHERWISE SPECIFIED:
DIMENSIONS IN INCHES

TOLERANCES:
.XX ±.01 .XXX ±.005
FRACTIONS ±1/64
ANGULAR MACHINED ±.5°
ANGULAR BEND ±1°
SURFACE FINISH 125
BREAK ALL EDGES .030

DO NOT SCALE

SHEET 1 OF 1

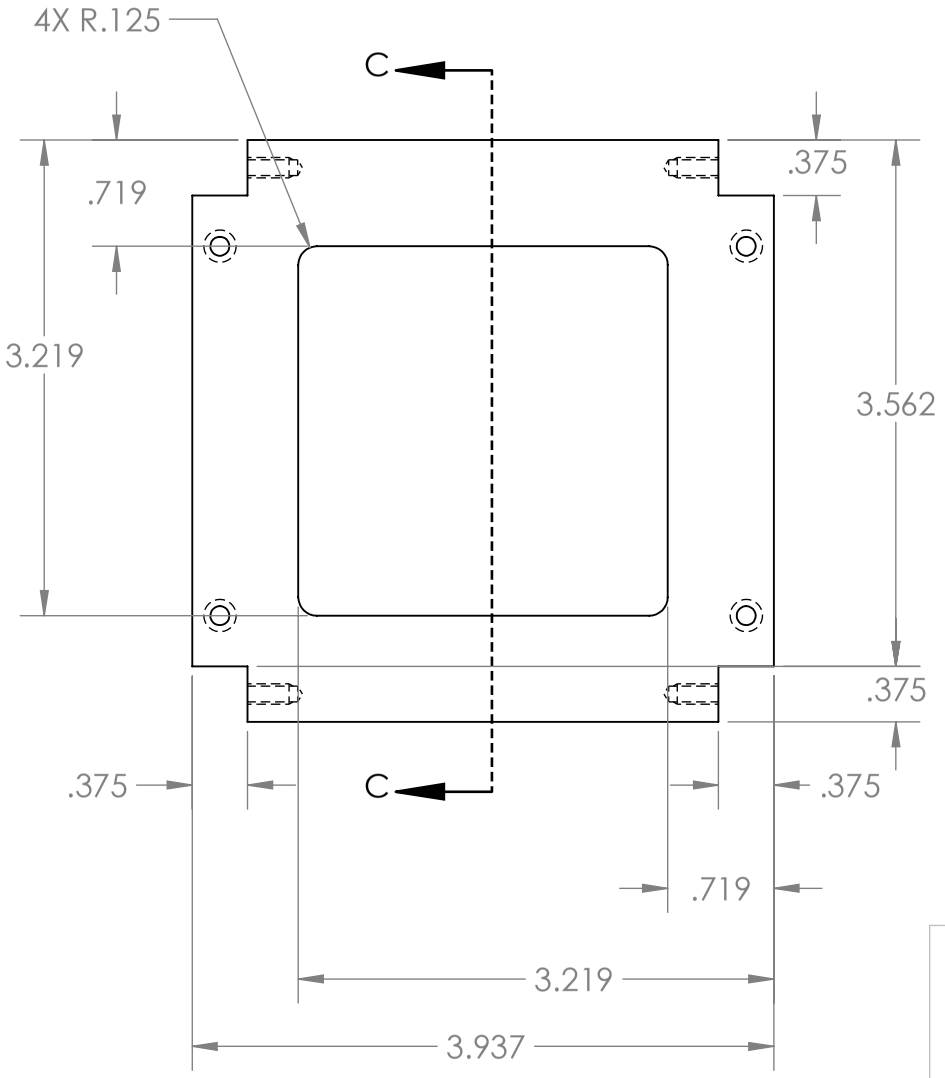
CASE ROCKET TEAM

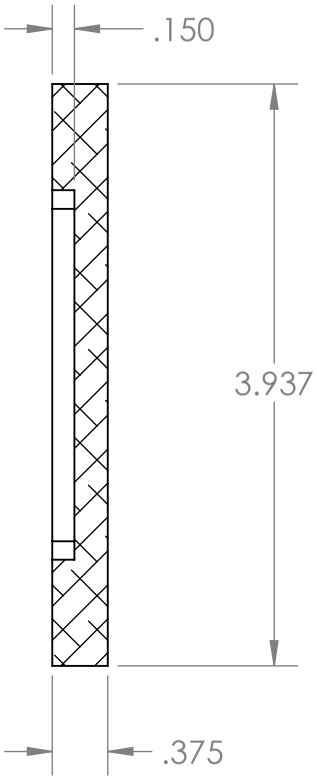
CASE WESTERN RESERVE UNIVERSITY

TITLE: ELECTRONICS SLED			
SIZE: A	DATE: 2/13/2025	DRAWN BY:	
MATERIAL: PLA		PART #: 25B02014	REV: A

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NOTE: USE BLANK 25B9802 FOR CNC OPERATION





UNLESS OTHERWISE SPECIFIED:
DIMENSIONS IN INCHES

TOLERANCES:
.XX ±.01 .XXX ±.005
FRACTIONS ±1/64
ANGULAR MACHINED ±.5°
ANGULAR BEND ±1°
SURFACE FINISH 125
BREAK ALL EDGES .030

DO NOT SCALE

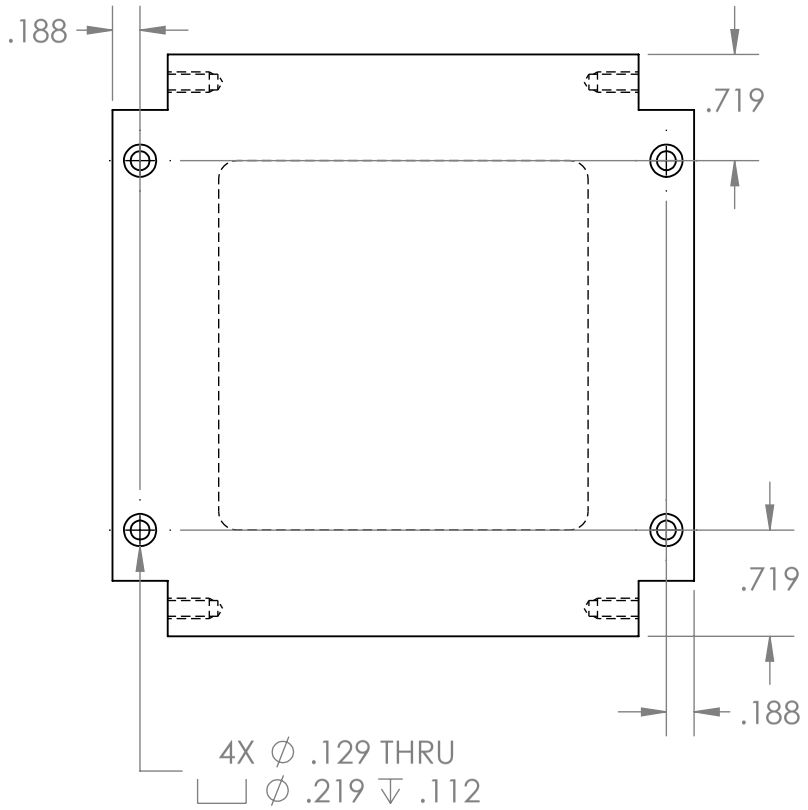
SHEET 1 OF 2

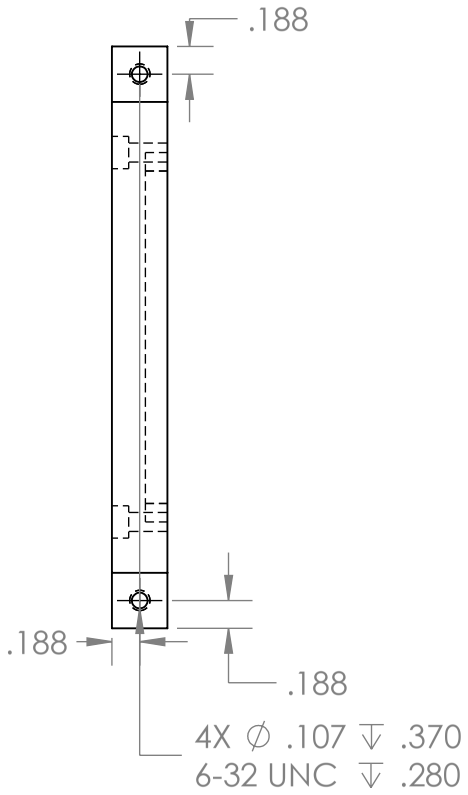
CASE ROCKET TEAM

CASE WESTERN RESERVE UNIVERSITY

TITLE: TOP BULKHEAD			
SIZE: A	DATE: 2/6/2025	DRAWN BY: MAT223	Qty: 1
MATERIAL: 6061-T6 ALUMINUM		PART #: 25B01001	REV: B

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NOTE: CBORE #4 SOCKETHEAD SCREW

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS IN INCHES

TOLERANCES:
.XX ±.01 .XXX ±.005
FRACTIONS ±1/64
ANGULAR MACHINED ±.5°
ANGULAR BEND ±1°
SURFACE FINISH 125
BREAK ALL EDGES .030

DO NOT SCALE

SHEET 2 OF 2

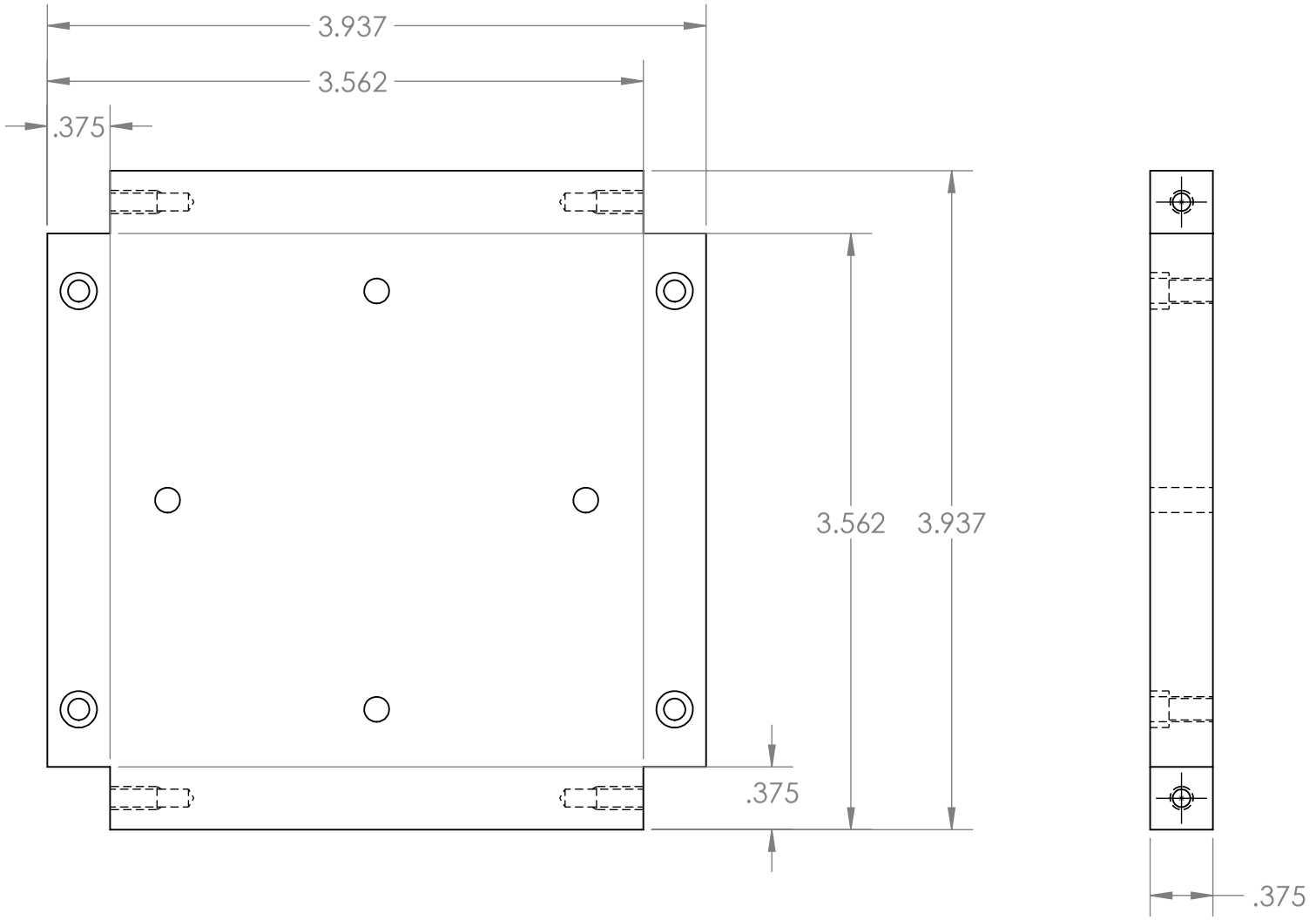
CASE ROCKET TEAM

CASE WESTERN RESERVE UNIVERSITY

TITLE:			
TOP BULKHEAD			
SIZE: A	DATE: 2/6/2025	DRAWN BY: MAT223	
MATERIAL: 6061-T6 ALUMINUM		PART #: 25B01001	REV: A

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NOTE: USE BLANK 25B9802 FOR CNC OPERATION



UNLESS OTHERWISE SPECIFIED:
DIMENSIONS IN INCHES

TOLERANCES:
.XX ±.01 .XXX ±.005
FRACTIONS ±1/64
ANGULAR MACHINED ±.5°
ANGULAR BEND ±1°
SURFACE FINISH 125
BREAK ALL EDGES .030

DO NOT SCALE

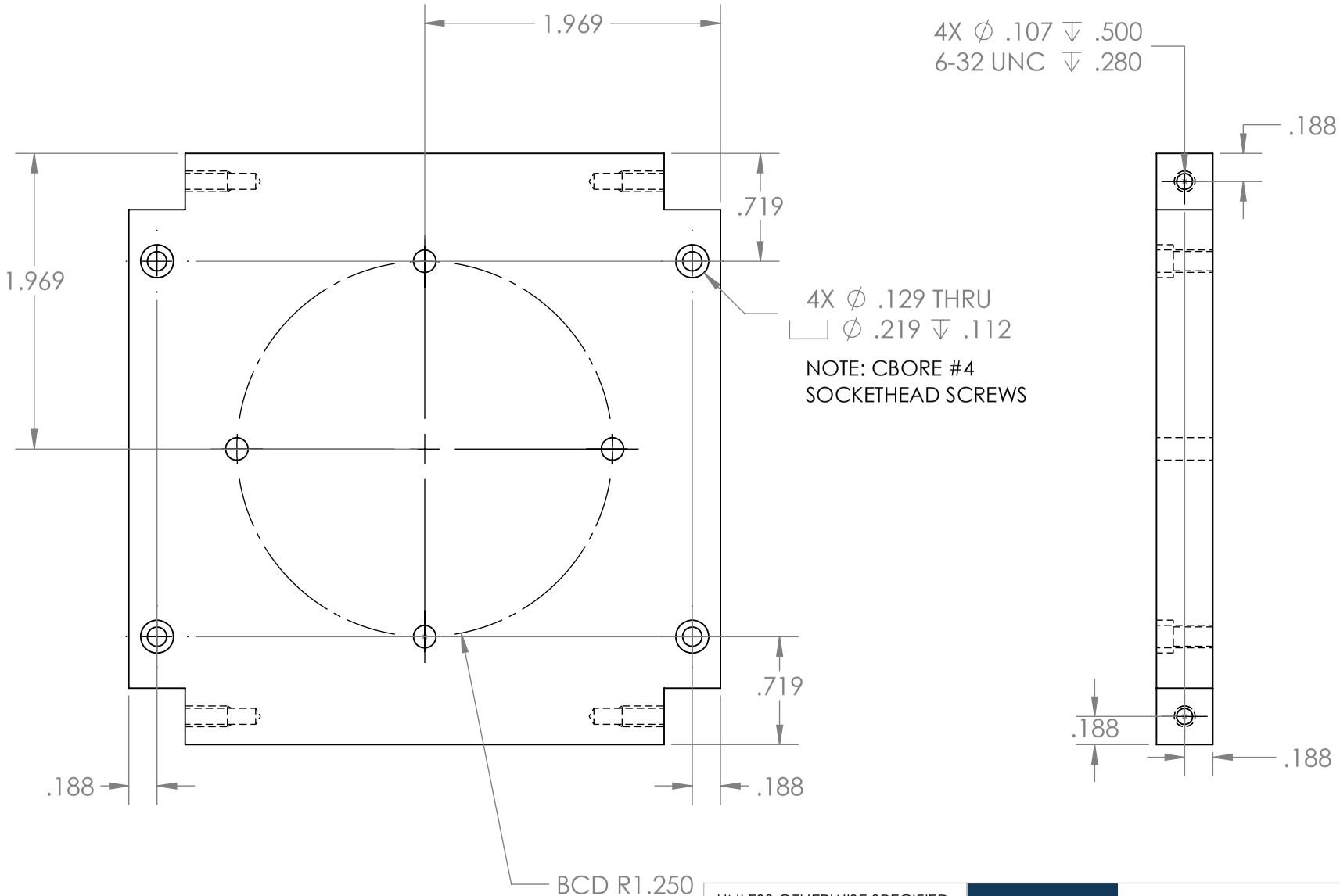
SHEET 1 OF 2

CASE ROCKET TEAM

CASE WESTERN RESERVE UNIVERSITY

TITLE: BOTTOM BULKHEAD			
SIZE: A	DATE: 2/4/2025	DRAWN BY: MAT223	QUANTITY: 1
MATERIAL: 6061-T6 ALUMINUM		PART #: 25B01002	REV: C

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UNLESS OTHERWISE SPECIFIED:
DIMENSIONS IN INCHES

TOLERANCES:
.XX ±.01 .XXX ±.005
FRACTIONS ±1/64
ANGULAR MACHINED ±.5°
ANGULAR BEND ±1°
SURFACE FINISH 125
BREAK ALL EDGES .030

DO NOT SCALE

SHEET 2 OF 2

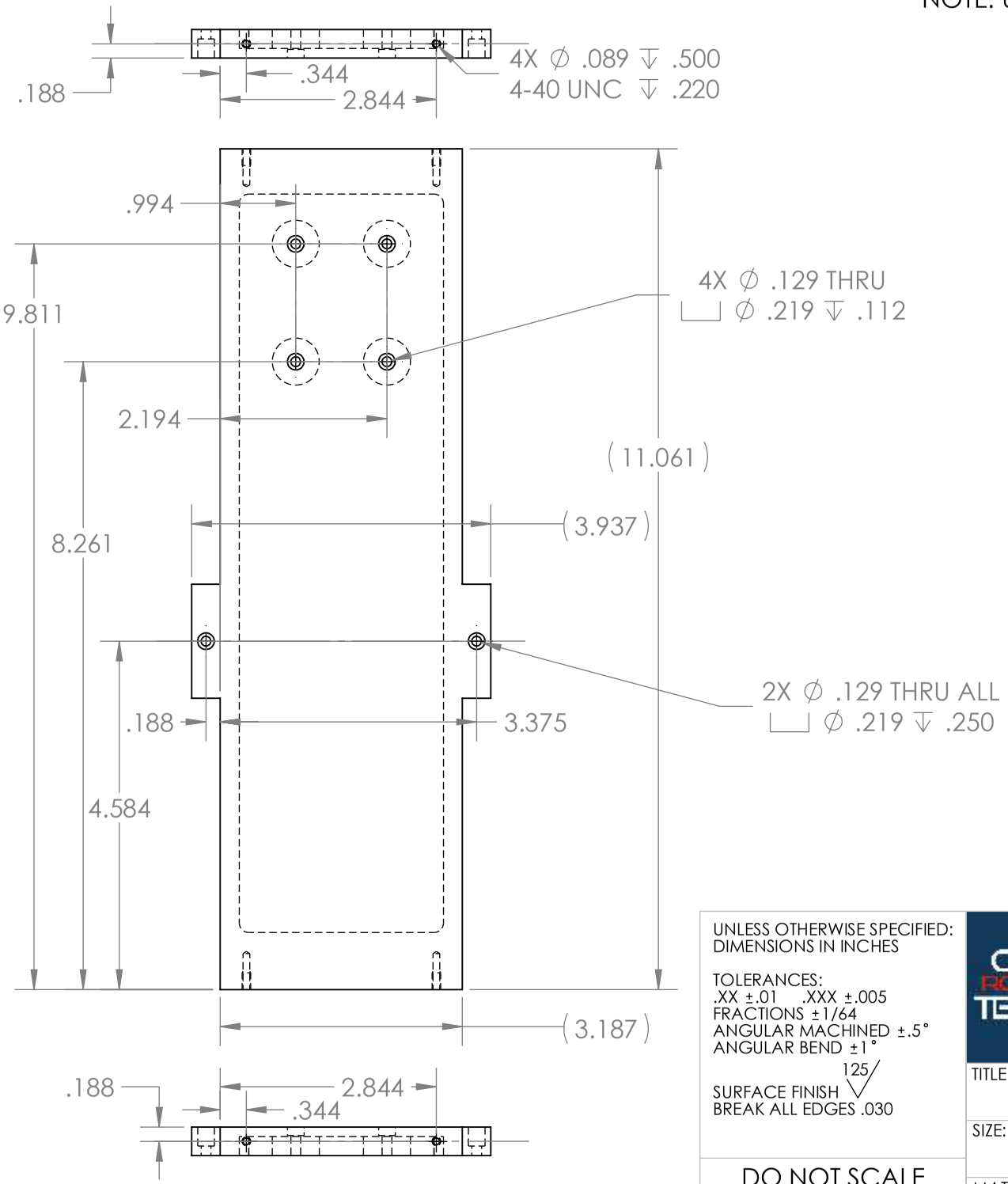
CASE ROCKET TEAM

CASE WESTERN RESERVE UNIVERSITY

TITLE: BOTTOM BULKHEAD			
SIZE: A	DATE: 2/4/2025	DRAWN BY: MAT223	
MATERIAL: 6061-T6 ALUMINUM		PART #: 25B01002	REV: A

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NOTE: USE BLANK 25B9801 FOR CNC OPERATION



UNLESS OTHERWISE SPECIFIED:
DIMENSIONS IN INCHES

TOLERANCES:
.XX ±.01 .XXX ±.005
FRACTIONS ±1/64
ANGULAR MACHINED ±.5°
ANGULAR BEND ±1°
SURFACE FINISH 125
BREAK ALL EDGES .030

DO NOT SCALE

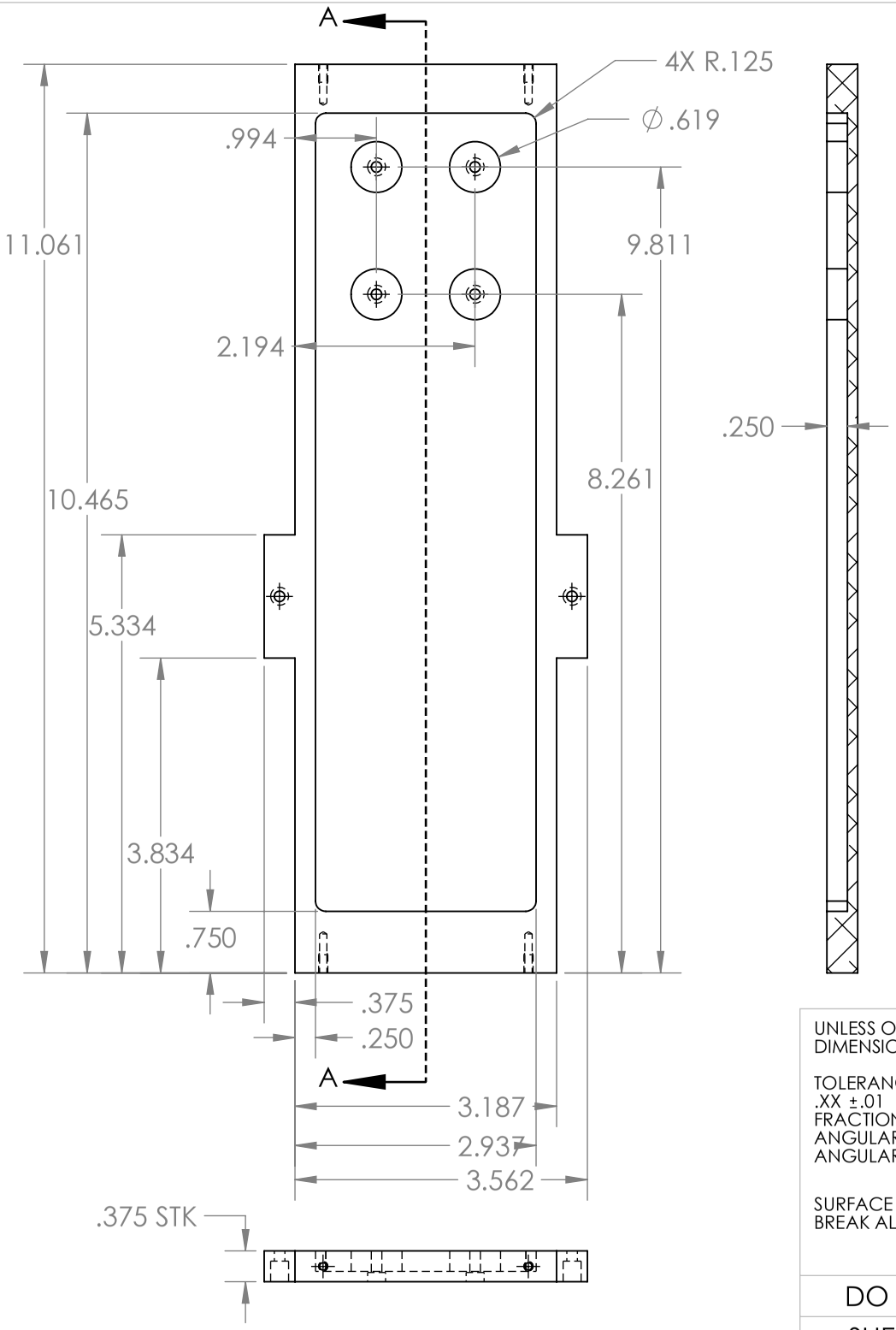
SHEET 1 OF 3

CASE ROCKET TEAM

CASE WESTERN RESERVE UNIVERSITY

TITLE:			
FRAME PLATE			
SIZE: A	DATE: 2/11/2025	DRAWN BY: MAT223	QTY: 1
MATERIAL: 6061-T6 ALUMINUM		PART #: 25B01003	REV: AA

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SECTION A-A

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS IN INCHES

TOLERANCES:
.XX ±.01 .XXX ±.005
FRACTIONS ±1/64
ANGULAR MACHINED ±.5°
ANGULAR BEND ±1°
SURFACE FINISH 125
BREAK ALL EDGES .030

DO NOT SCALE

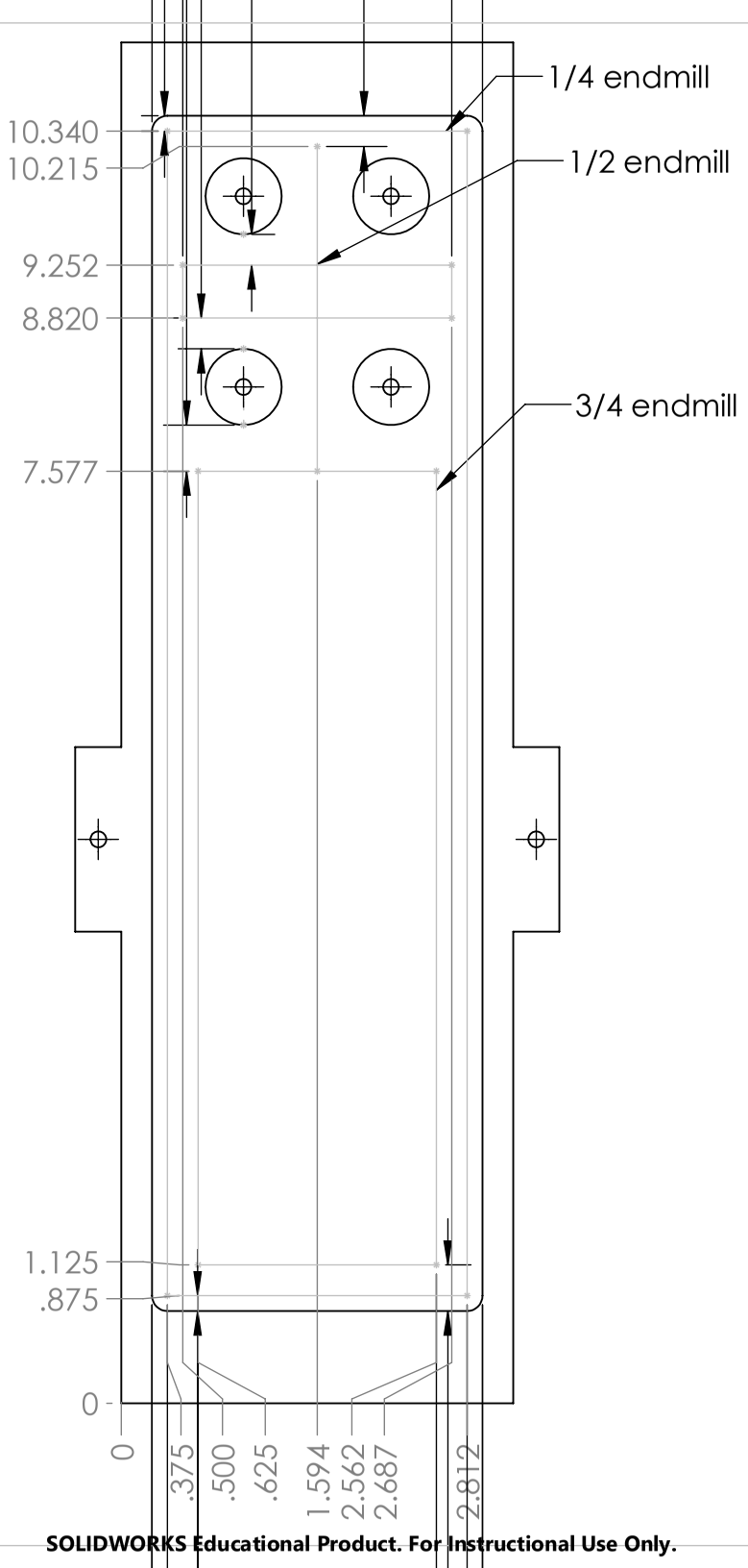
SHEET 2 OF 3

CASE ROCKET TEAM

CASE WESTERN RESERVE UNIVERSITY

TITLE:			
FRAME PLATE			
SIZE: A	DATE: 2/11/2025	DRAWN BY: CAR185	QTY: 1
MATERIAL: 6061-T6 ALUMINUM		PART #: 25B01003	REV: A

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UNLESS OTHERWISE SPECIFIED:
DIMENSIONS IN INCHES

TOLERANCES:
.XX ±.01 .XXX ±.005
FRACTIONS ±1/64
ANGULAR MACHINED ±.5°
ANGULAR BEND ±1°
SURFACE FINISH 125
BREAK ALL EDGES .030

DO NOT SCALE

SHEET 3 OF 3

CASE ROCKET TEAM

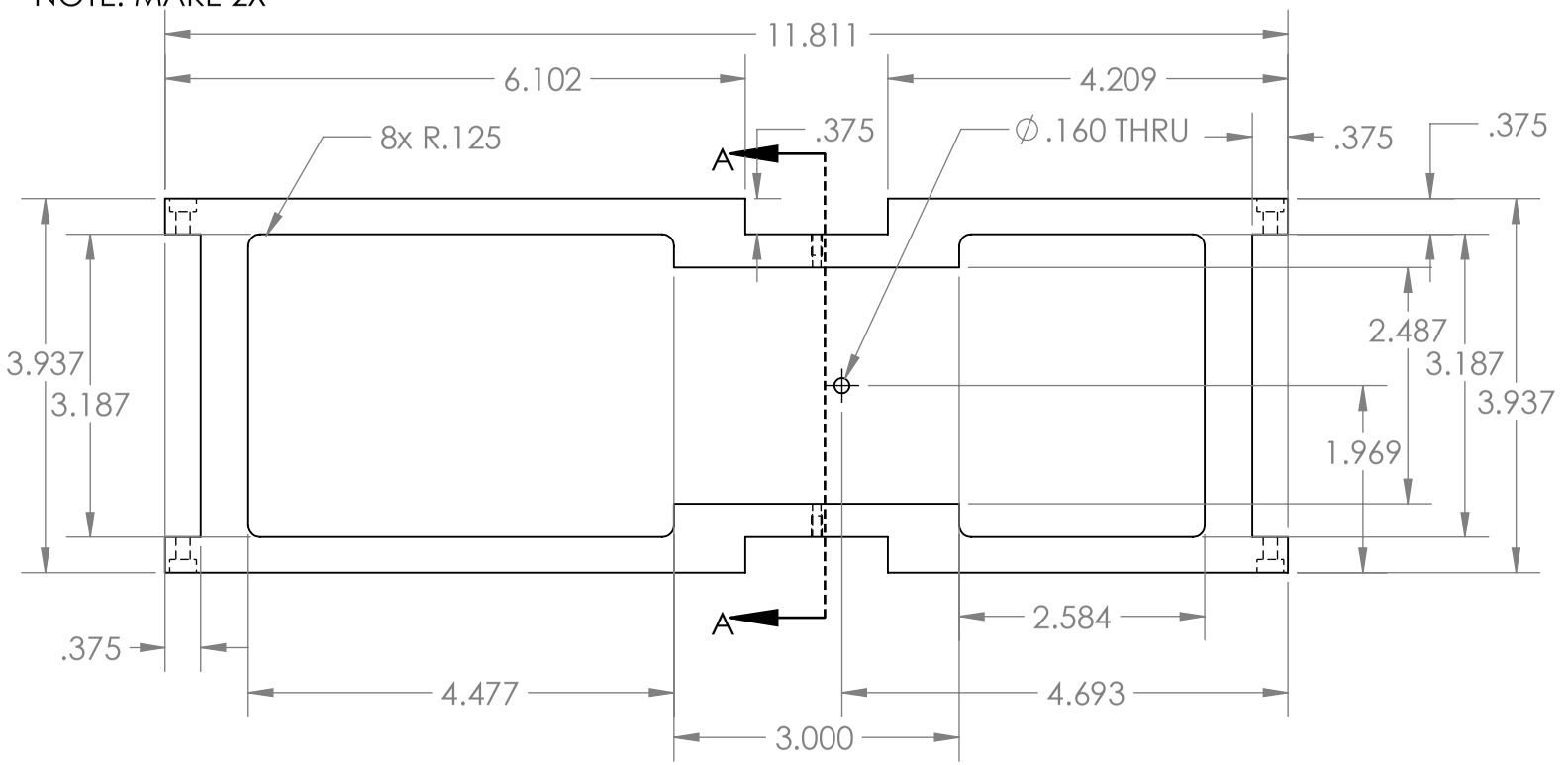
CASE WESTERN RESERVE UNIVERSITY

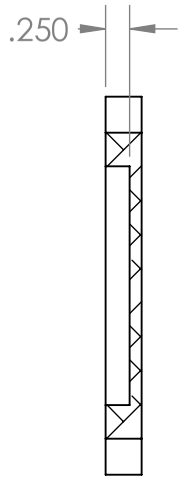
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SIZE: A	DATE: 2/11/2025	DRAWN BY:	
MATERIAL: 6061-T6 ALUMINUM		PART #: 25B01003	REV: A

SOLIDWORKS Educational Product. For Instructional Use Only.

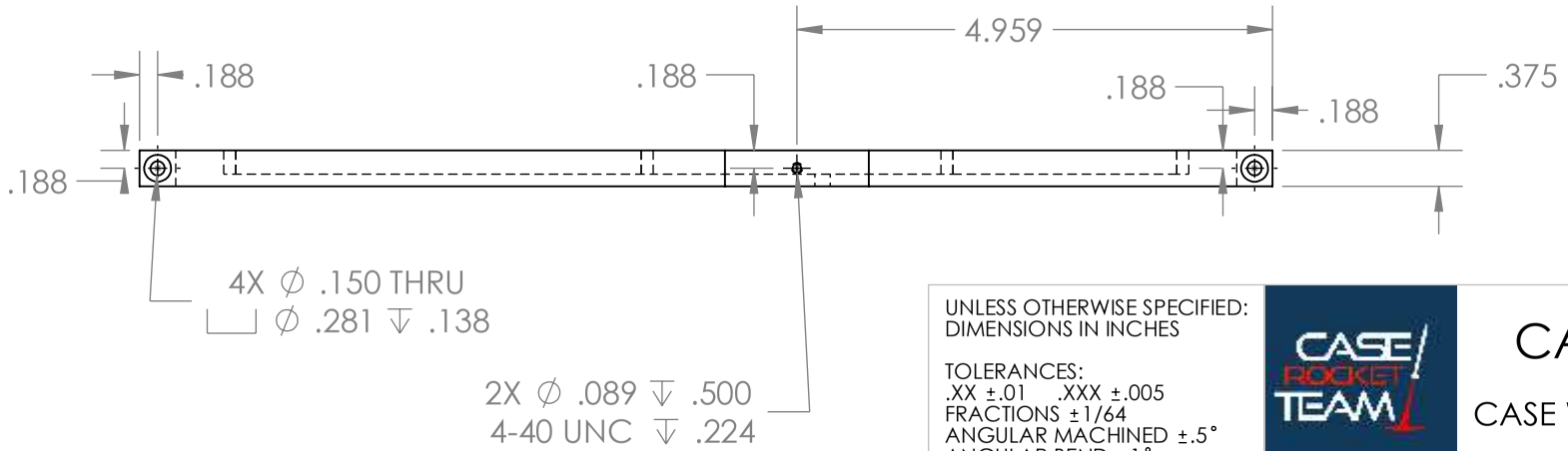
NOTE: MAKE 2X

NOTE: USE BLANK 25B9801 FOR CNC OPERATION





SECTION A-A
SCALE 1 : 2



UNLESS OTHERWISE SPECIFIED:
DIMENSIONS IN INCHES

TOLERANCES:
.XX ±.01 .XXX ±.005
FRACTIONS ±1/64
ANGULAR MACHINED ±.5°
ANGULAR BEND ±1°
SURFACE FINISH 125
BREAK ALL EDGES .030

DO NOT SCALE

SHEET 1 OF 3

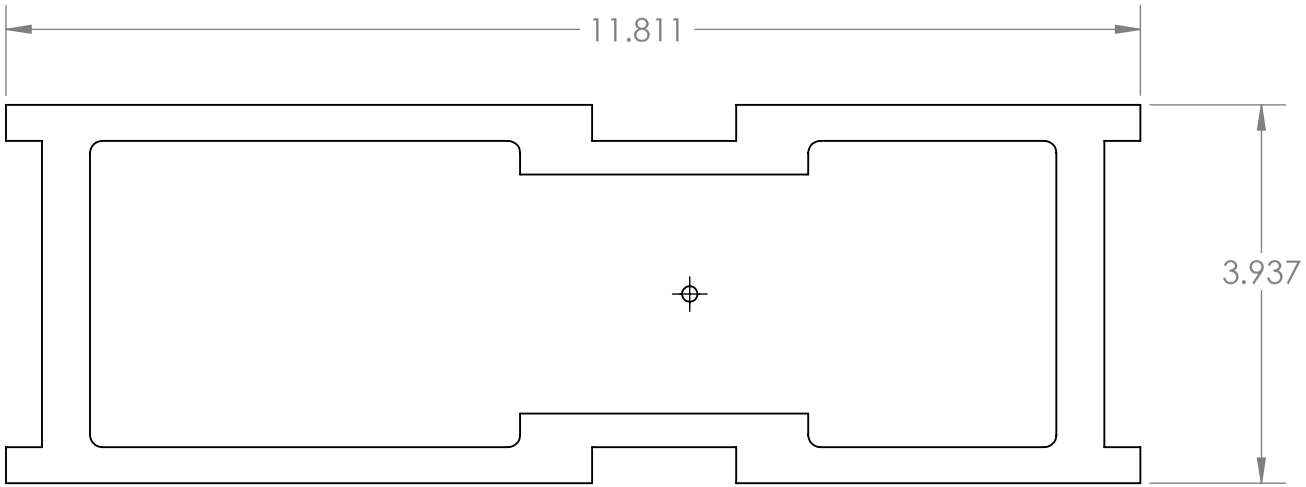
CASE ROCKET TEAM

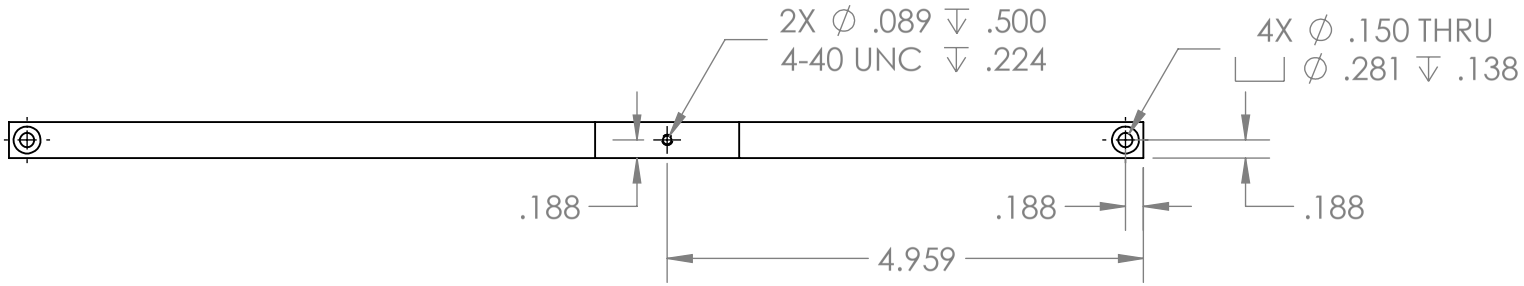
CASE WESTERN RESERVE UNIVERSITY

TITLE:			QTY:
FRAME PLATE			1
SIZE: A	DATE: 2/6/2025	DRAWN BY: MAT223	
MATERIAL: 6061-T6 (SS)		PART #: 25B01004	REV: C

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NOTE: MAKE 2X





UNLESS OTHERWISE SPECIFIED:
DIMENSIONS IN INCHES

TOLERANCES:
.XX ±.01 .XXX ±.005
FRACTIONS ±1/64
ANGULAR MACHINED ±.5°
ANGULAR BEND ±1°
SURFACE FINISH 125
BREAK ALL EDGES .030

DO NOT SCALE

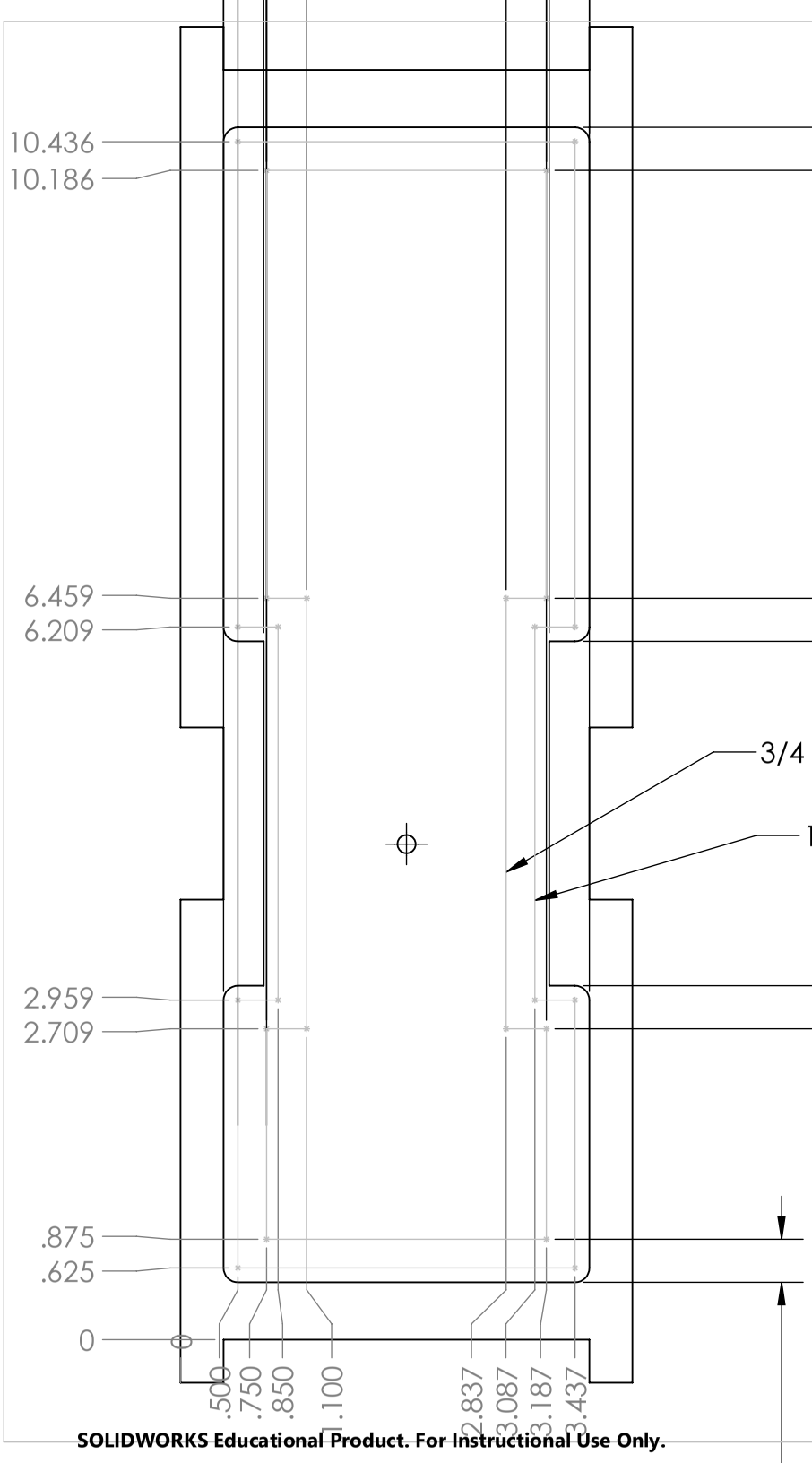
SHEET 2 OF 3

CASE ROCKET TEAM

CASE WESTERN RESERVE UNIVERSITY

TITLE: FRAME PLATE			
SIZE: A	DATE: 2/6/2025	DRAWN BY:	
MATERIAL: 6061-T6 (SS)		PART #: 25B01004	REV: C

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UNLESS OTHERWISE SPECIFIED:
DIMENSIONS IN INCHES

TOLERANCES:
.XX ±.01 .XXX ±.005
FRACTIONS ±1/64
ANGULAR MACHINED ±.5°
ANGULAR BEND ±1°
SURFACE FINISH 125
BREAK ALL EDGES .030

DO NOT SCALE

SHEET 3 OF 3

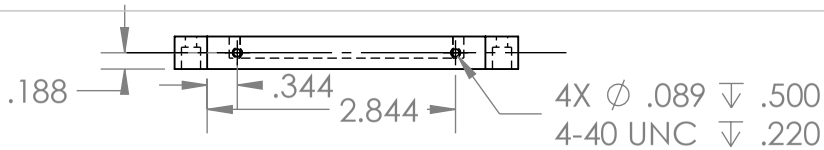
CASE ROCKET TEAM

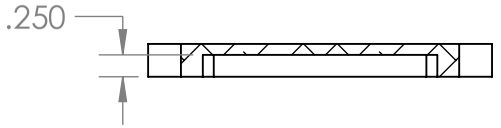
CASE WESTERN RESERVE UNIVERSITY

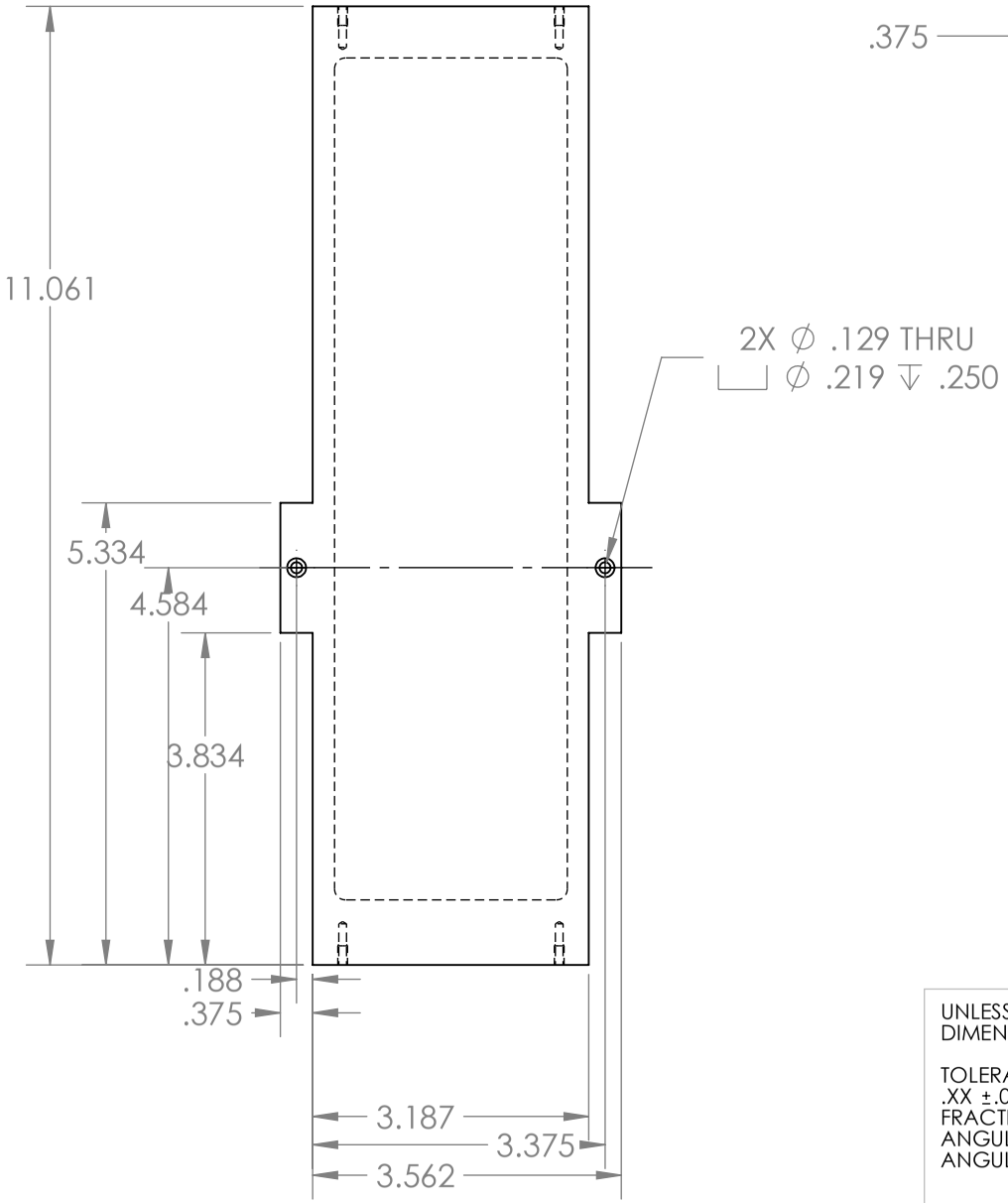
TITLE:			
FRAME PLATE			
SIZE: A	DATE: 2/6/2025	DRAWN BY:	
MATERIAL: 6061-T6 (SS)		PART #: 25B01004	REV: A

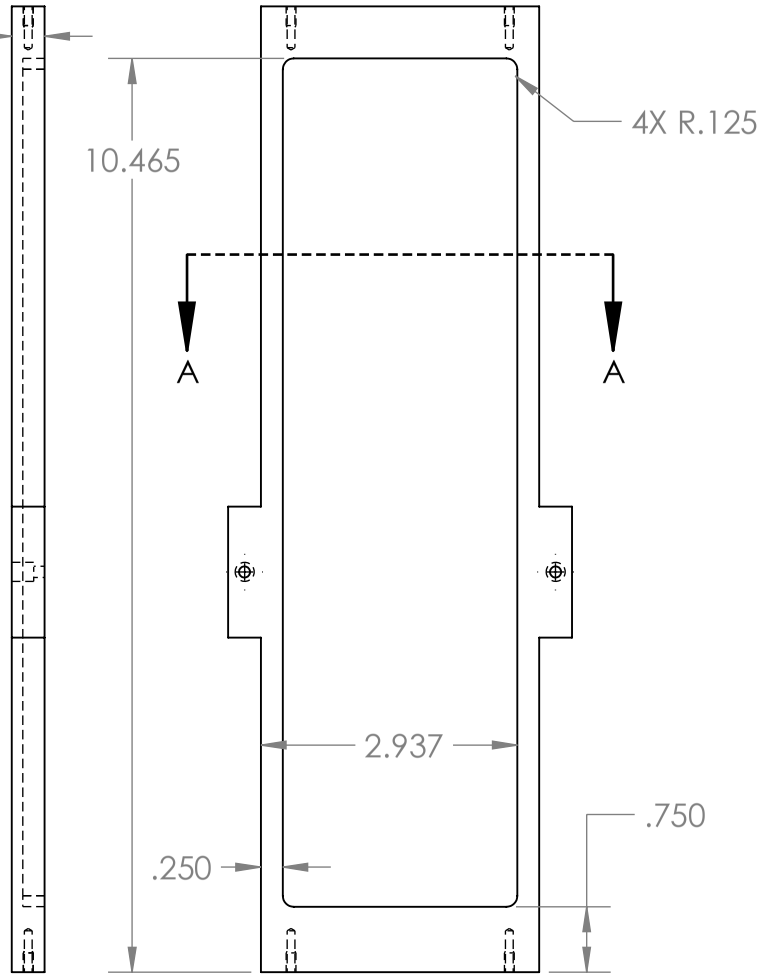
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NOTE: USE BLANK 25B9801 FOR CNC OPERATION









UNLESS OTHERWISE SPECIFIED:
DIMENSIONS IN INCHES

TOLERANCES:
.XX ±.01 .XXX ±.005
FRACTIONS ±1/64
ANGULAR MACHINED ±.5°
ANGULAR BEND ±1°
SURFACE FINISH 125
BREAK ALL EDGES .030

DO NOT SCALE

SHEET 1 OF 1

CASE ROCKET TEAM

CASE WESTERN RESERVE UNIVERSITY

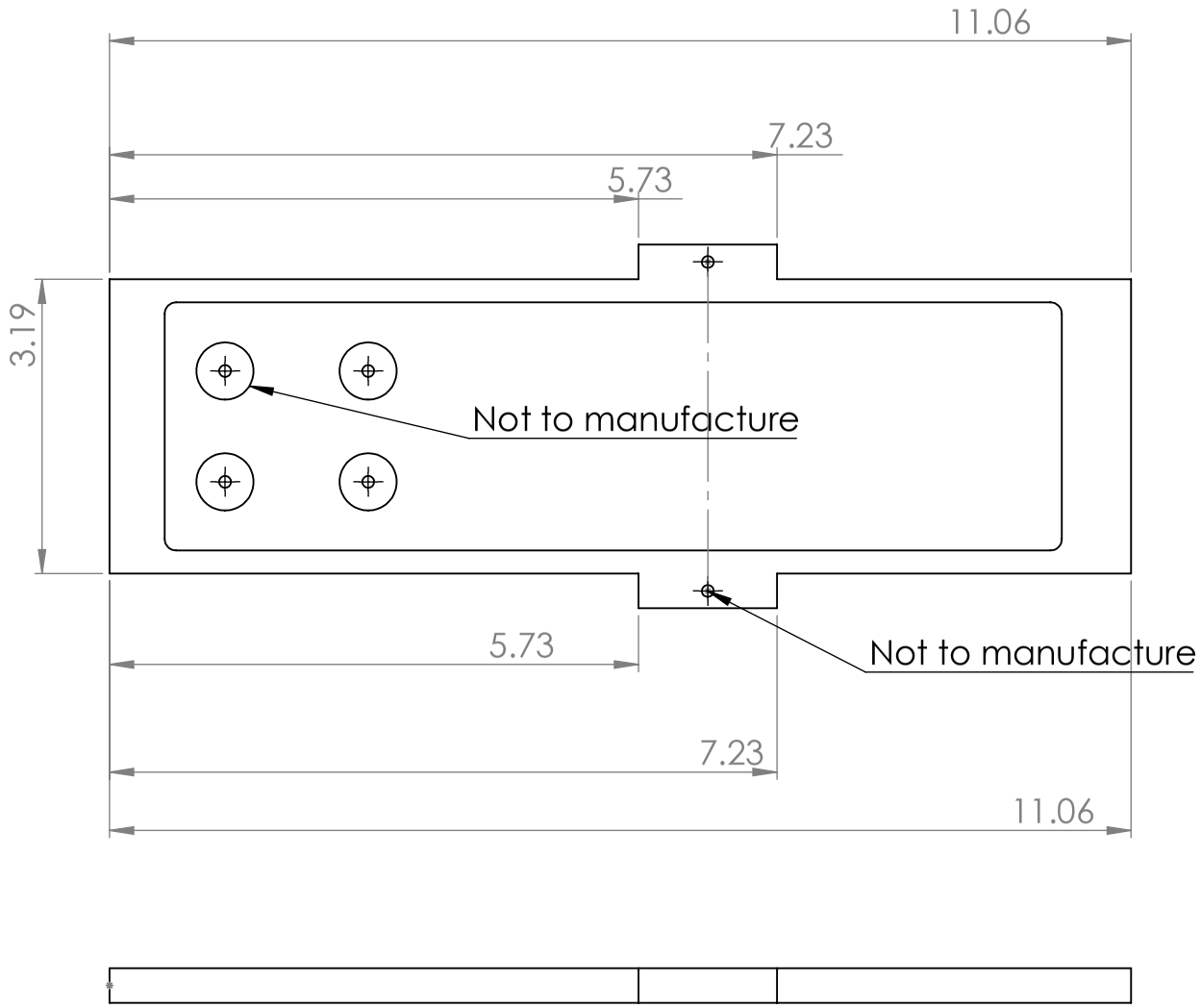
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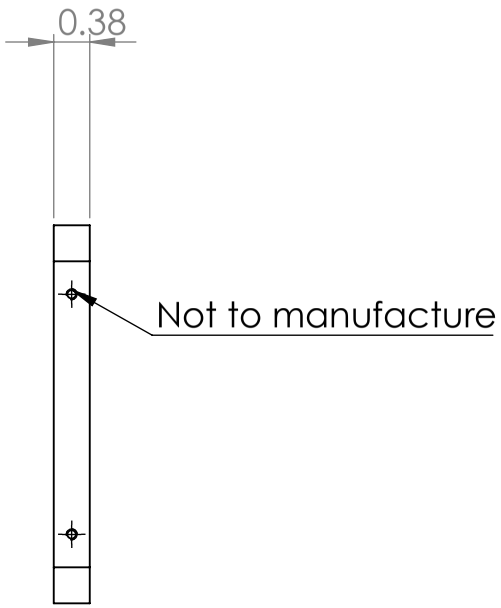
FRAME PLATE

SIZE:	DATE:	DRAWN BY:	QTY:
A	2/13/2025	MAT223	1

MATERIAL:	PART #:	REV:
6061 ALUMINUM	25B01005	B

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TOLERANCES:
.XX ±.01 .XXX ±.005
FRACTIONS ±1/64
ANGULAR MACHINED ±.5°
ANGULAR BEND ±1°
SURFACE FINISH 125
BREAK ALL EDGES .030

DO NOT SCALE

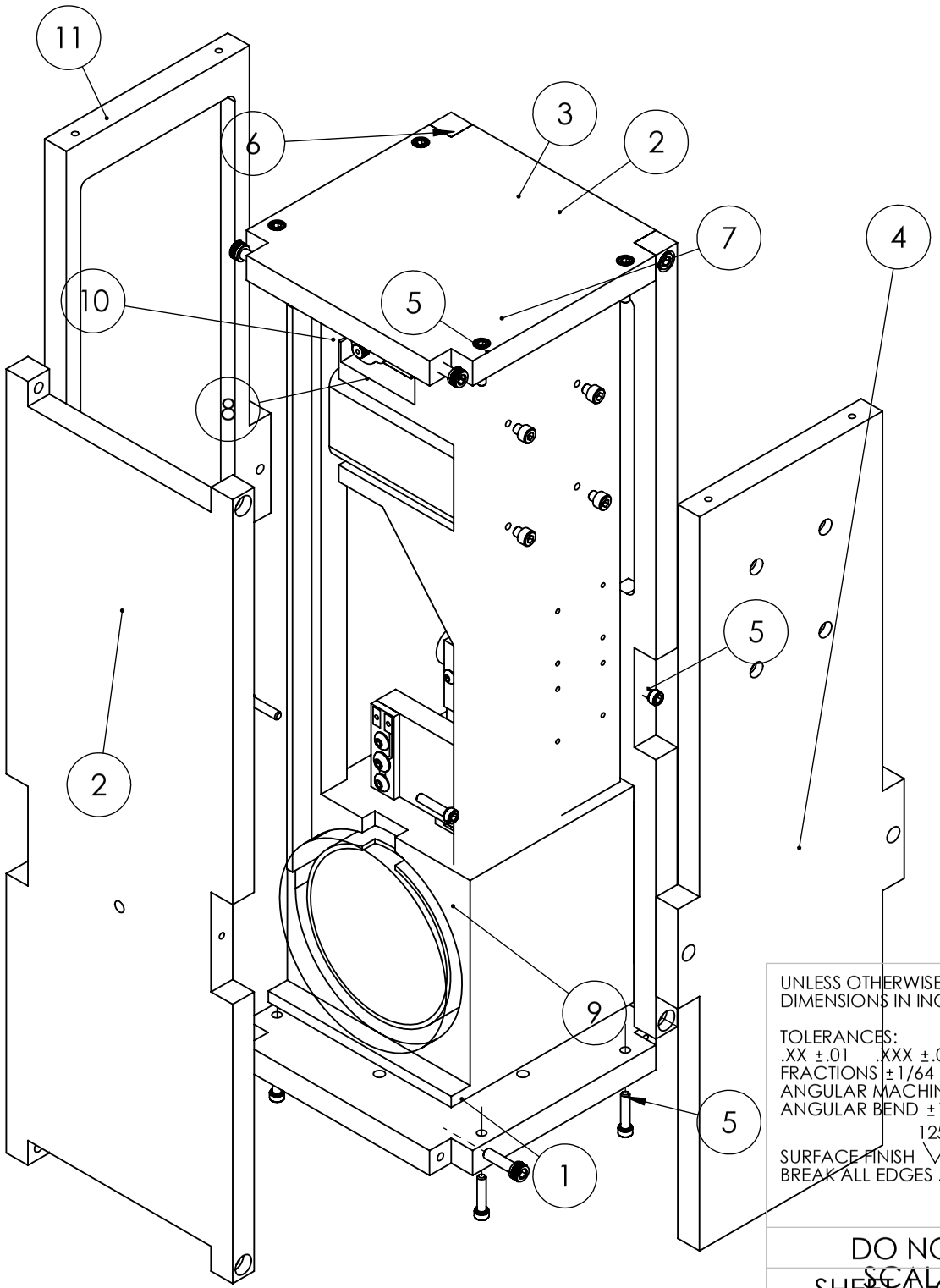
SHEET 1 OF 1

CASE ROCKET TEAM

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TITLE: FRAME PLATE			
SIZE: A	DATE: 2/11/2025	DRAWN BY:	
MATERIAL: 6061-T6 ALUMINUM		PART #: 25B01003	REV: A

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ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	25B01002	BOTTOM BULKEAD	1
2	25B01004	SIDE FRAME PLATE	2
3	25B01001	TOP BULKHEAD	1
4	25B01003	SIDE FRAME PLATE	1
5	96006A216	BLACK OXIDE 18-8 STAINLESS STEEL SOCKET HEAD SCREW	12
6	91251A148	BLACK-OXIDE ALLOY STEEL SOCKET HEAD SCREW	8
7	25B004	ESLED	1
8	25B005	UPRIGHT GLASS	1
9	25B03005	ROLLED GLASS	1
10	25B03006	GLASS RETAINER	1
11	25B01005	FRAME PLATE	1
12	HX-SHCS 0.138-40x0.188x0.188-N	SCREWS ESLED	6

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS IN INCHES

TOLERANCES:
.XX ±.01 .XXX ±.005
FRACTIONS ±1/64
ANGULAR MACHINED ±.5°
ANGULAR BEND ±1°

SURFACE FINISH 125
BREAK ALL EDGES .030

DO NOT SCALE

SHEET 1 OF 1

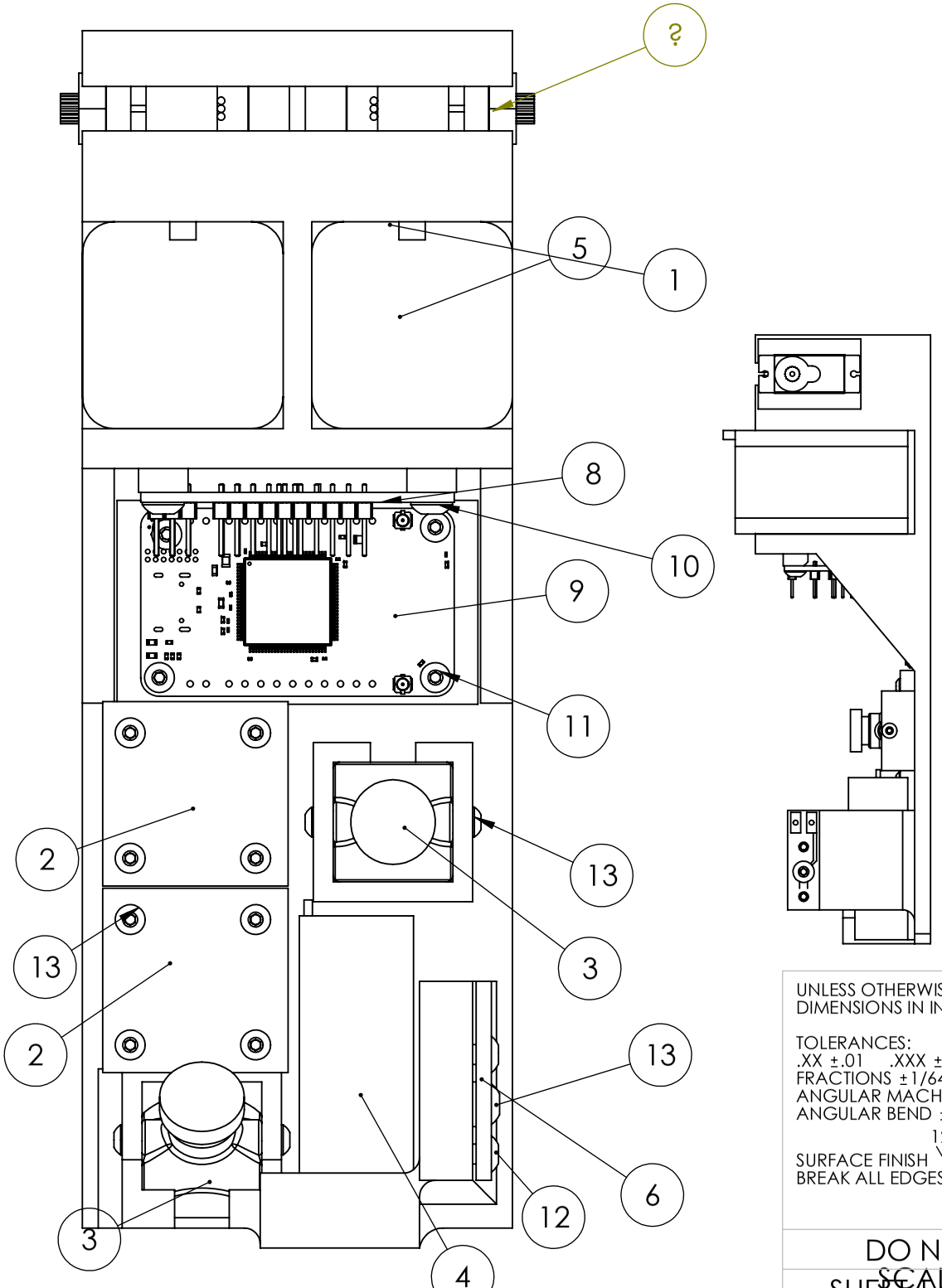
CASE ROCKET TEAM

CASE WESTERN RESERVE UNIVERSITY

TITLE: MAIN ASSEMBLY

SIZE:	DATE:	DRAWN BY:	
A	2/14/2025	MAT223	
MATERIAL:		PART #: 25B001	REV: A

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ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	25B02014	Electronics Sled	1
2	25B02005	RunCam Board	2
3	25B02003	RunCam Split 3	2
4	25B02015	500 mAh Battery	1
5	25B02016	2000 mAh Battery	2
6	25B02004	Screw switch	1
8	25B02024	PDB	1
9	25B02026	SIRIN	1
10	SBHCSCREW 0.138-32x0.188-HX-N	Screw PDB	4
11	SBHCSCREW 0.099-48x0.188-HX-N	Screw SIRIN	4
12	SBHCSCREW 0.125-40x0.188-HX-N	Screw Screwswitch	2
13	SBHCSCREW 0.099-56x0.188-HX-N	Screw RunCams	12
13	SBHCSCREW 0.138-40x0.25-HX-N	Screwswitch screw	1
14	25B02027		2

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS IN INCHES

TOLERANCES:
.XX ±.01 .XXX ±.005
FRACTIONS ±1/64
ANGULAR MACHINED ±.5°
ANGULAR BEND ±1°
SURFACE FINISH 125
BREAK ALL EDGES .030

DO NOT SCALE

SHEET 1 OF 1

CASE ROCKET TEAM

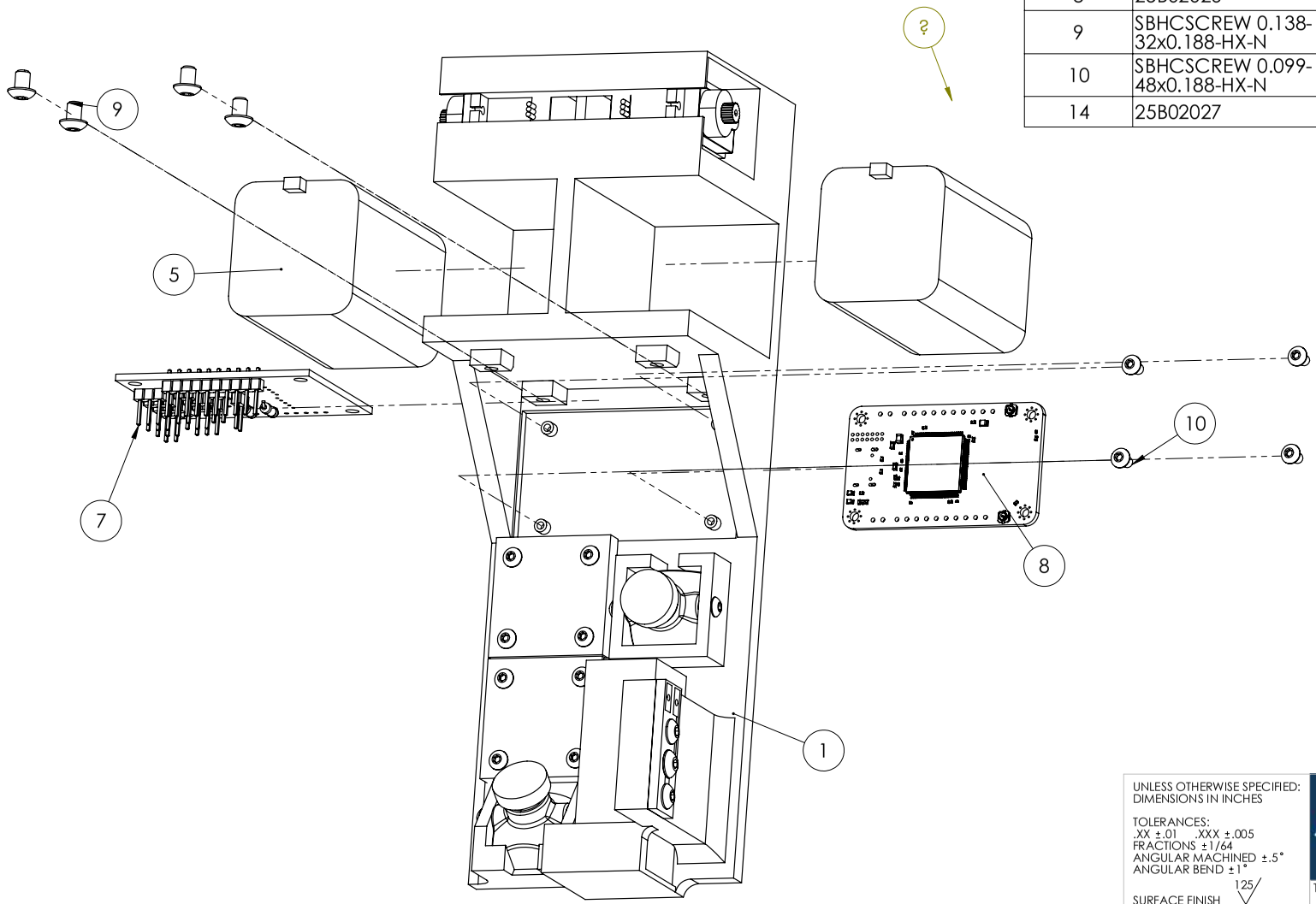
CASE WESTERN RESERVE UNIVERSITY

TITLE:
E-SLED LOWER EXPLODED VIEW

SIZE:	DATE:	DRAWN BY:	
A	2/11/2025	MAT223	
MATERIAL:		PART #: 25B004	REV: A

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ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	25B02014	ELECTRONICS SLED	1
5	25B02016	2000 MAH BATTERY	2
7	25B02024	PDB	1
8	25B02026	SIRIN	1
9	SBHCSCREW 0.138-32x0.188-HX-N	SCREW PDB	4
10	SBHCSCREW 0.099-48x0.188-HX-N	SCREW SIRIN	4
14	25B02027		2



UNLESS OTHERWISE SPECIFIED:
DIMENSIONS IN INCHES

TOLERANCES:
.XX ±.01 .XXX ±.005
FRACTIONS ±1/64
ANGULAR MACHINED ±.5°
ANGULAR BEND ±1°

SURFACE FINISH 125
BREAK ALL EDGES .030

DO NOT SCALE

SHEET 1 OF 1

CASE ROCKET TEAM

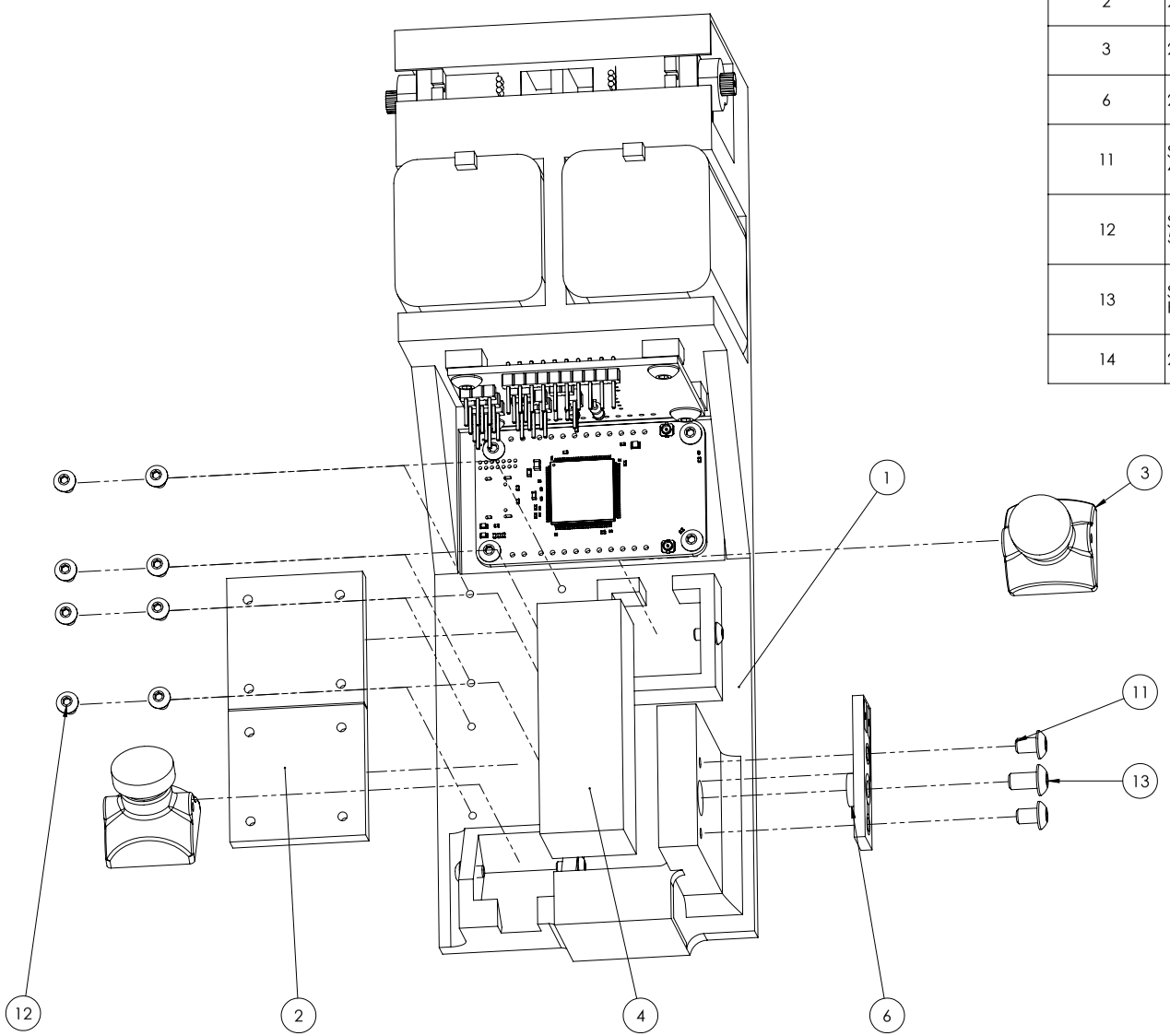
CASE WESTERN RESERVE UNIVERSITY

TITLE:
E-SLED LOWER EXPLODED VIEW

SIZE:	DATE:	DRAWN BY:	
B	2/18/2025	PAQ4	
MATERIAL:		PART #:	REV: A

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ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	25B02014	ELECTRONICS SLED	1
2	25B02005	RunCam Board	2
3	25B02003	RunCam Split 3	2
6	25B02004	SCREW SWITCH	1
11	SBHCSCREW 0.125-40x0.188-HX-N		4
12	SBHCSCREW 0.099-56x0.188-HX-N		2
13	SBHCSCREW 0.138-40x0.25-HX-N		12
14	25B02027	SCREW SCREWSWITCH	1



UNLESS OTHERWISE SPECIFIED:
DIMENSIONS IN INCHES

TOLERANCES:
.XX ±.01 .XXX ±.005
FRACTIONS ±1/64
ANGULAR MACHINED ±.5°
ANGULAR BEND ±1°
SURFACE FINISH 125
BREAK ALL EDGES .030

DO NOT SCALE

SHEET 1 OF 1

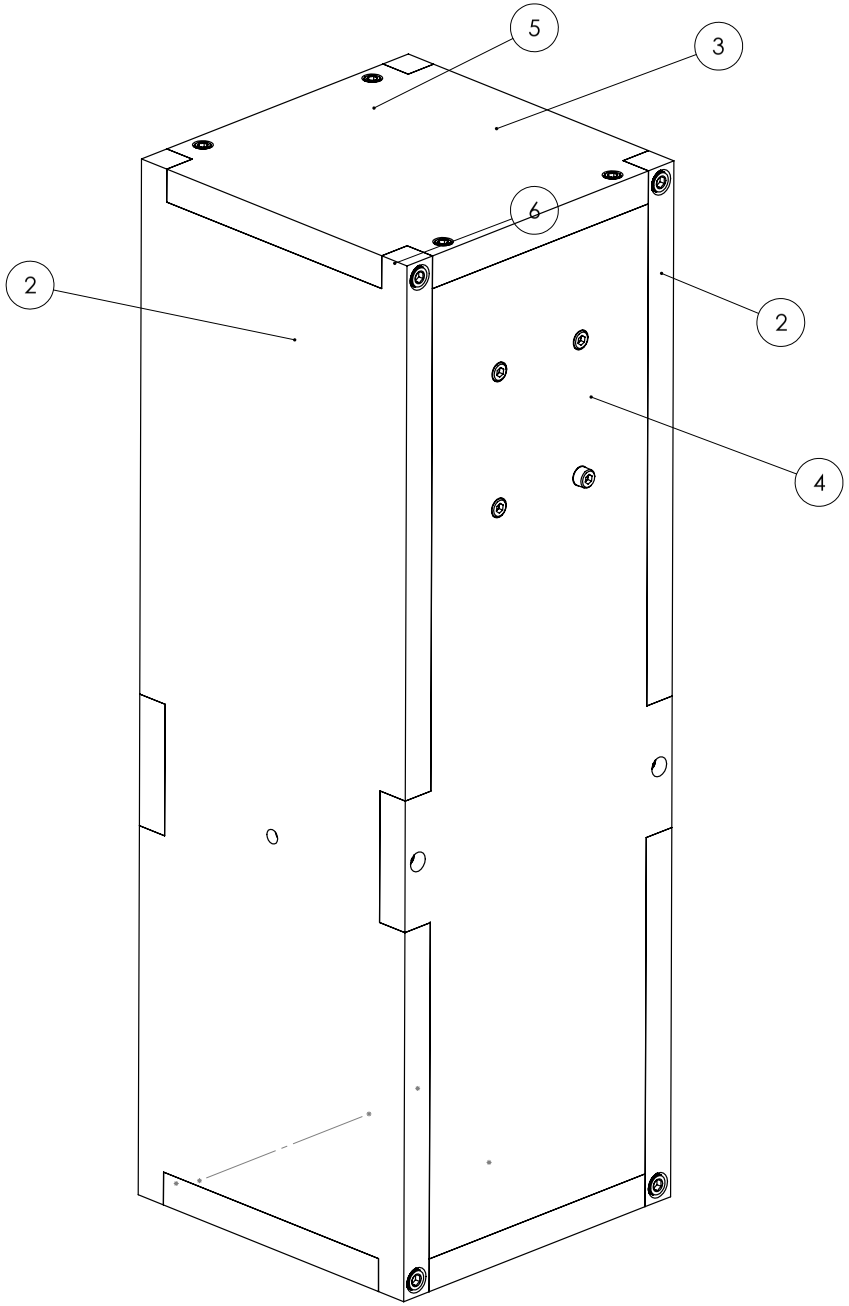
CASE ROCKET TEAM

CASE WESTERN RESERVE UNIVERSITY

TITLE: E-SLED LOWER EXPLODED VIEW

SIZE:	DATE:	DRAWN BY:	
C	2/18/2025	PAQ4	
MATERIAL:		PART #: 25B004	REV: A

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ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
2	25B01004	FRAME PLATE	2
3	25B01001	TOP BULKHEAD	1
4	25B01003	FRAME PLATE	1
5	96006A216	Black Oxide 18-8 Stainless Steel Socket Head Screw	12
6	91251A148	Black-Oxide Alloy Steel Socket Head Screw	8

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS IN INCHES

TOLERANCES:
.XX ±.01 .XXX ±.005
FRACTIONS ±1/64
ANGULAR MACHINED ±.5°
ANGULAR BEND ±1°

SURFACE FINISH 125
BREAK ALL EDGES .030

DO NOT SCALE

SHEET 1 OF 1

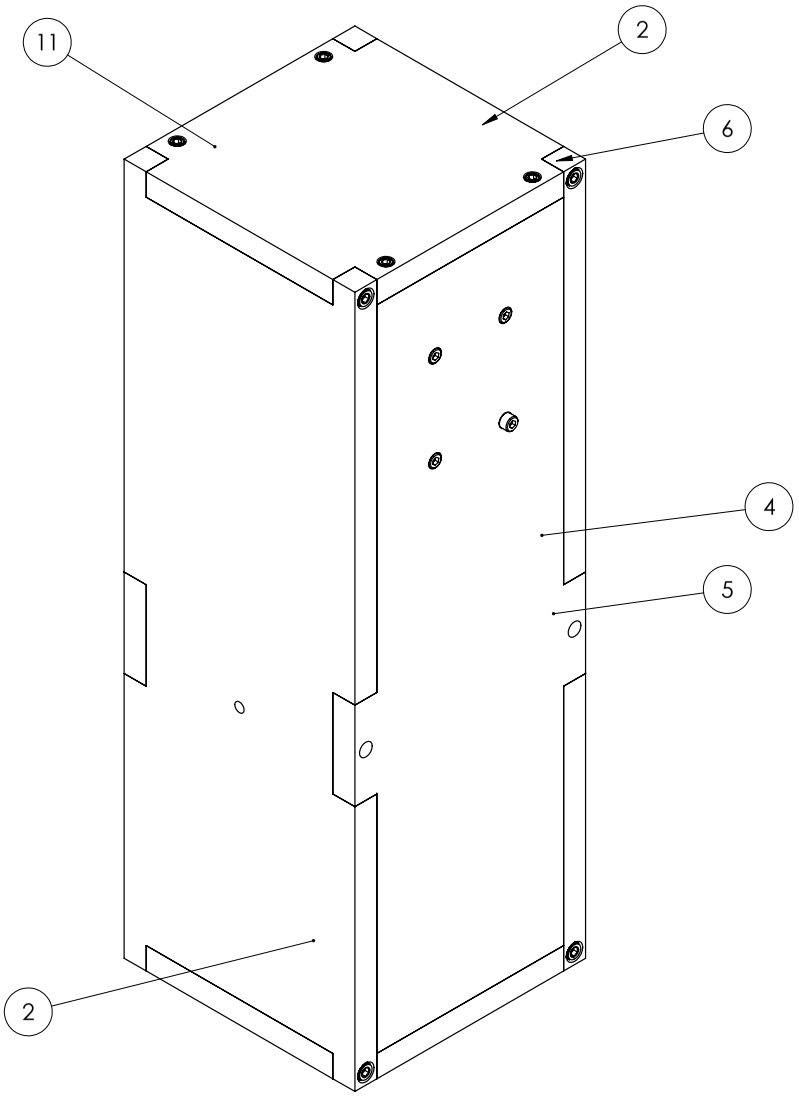
CASE ROCKET TEAM

CASE WESTERN RESERVE UNIVERSITY

TITLE: MAIN ASSEMBLY

SIZE:	DATE:	DRAWN BY:	
B	2/18/2025		
MATERIAL:		PART #:	REV: A

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ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
2	25B01004	FRAME PLATE	2
4	25B01003	FRAME PLATE	1
5	96006A216	Black Oxide 18-8 Stainless Steel Socket Head Screw	12
6	91251A148	Black-Oxide Alloy Steel Socket Head Screw	8
11	25B01005	Frame Plate	1

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS IN INCHES

TOLERANCES:
.XX ±.01 .XXX ±.005
FRACTIONS ±1/64
ANGULAR MACHINED ±.5°
ANGULAR BEND ±1°

SURFACE FINISH 125
BREAK ALL EDGES .030

DO NOT SCALE

SHEET 1 OF 1

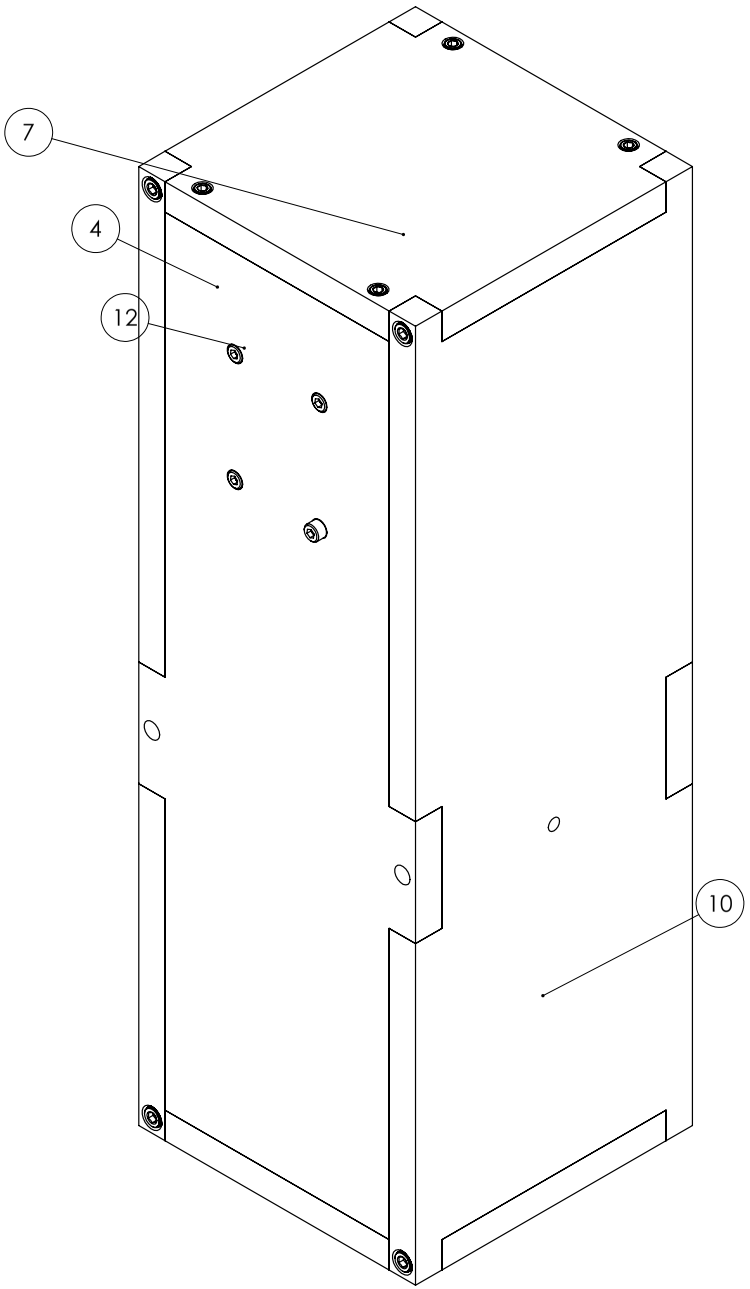
CASE ROCKET TEAM

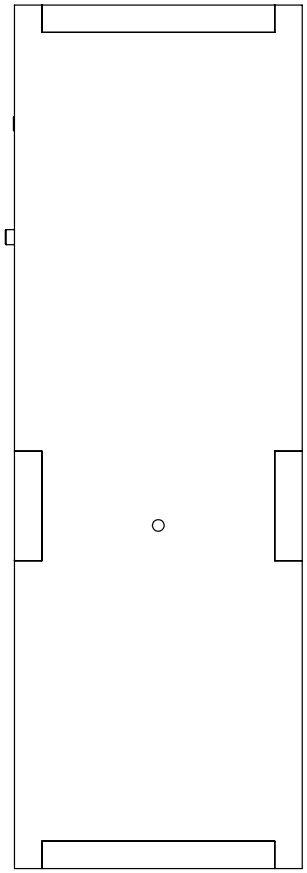
CASE WESTERN RESERVE UNIVERSITY

TITLE: MAIN ASSEMBLY

SIZE:	DATE:	DRAWN BY:	
B	2/18/2025	MAT223	
MATERIAL:		PART #:	REV: A

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ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
4	25B01003	FRAME PLATE	1
7	25B004	ELECTRONICS SLED	1
10	25B03006	GLASS RETAINER	1
12	HX-SHCS 0.125-44x0.125x0.125-N	SCREW	4

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS IN INCHES

TOLERANCES:
.XX ±.01 .XXX ±.005
FRACTIONS ±1/64
ANGULAR MACHINED ±.5°
ANGULAR BEND ±1°

SURFACE FINISH 125
BREAK ALL EDGES .030

DO NOT SCALE

SHEET 1 OF 1

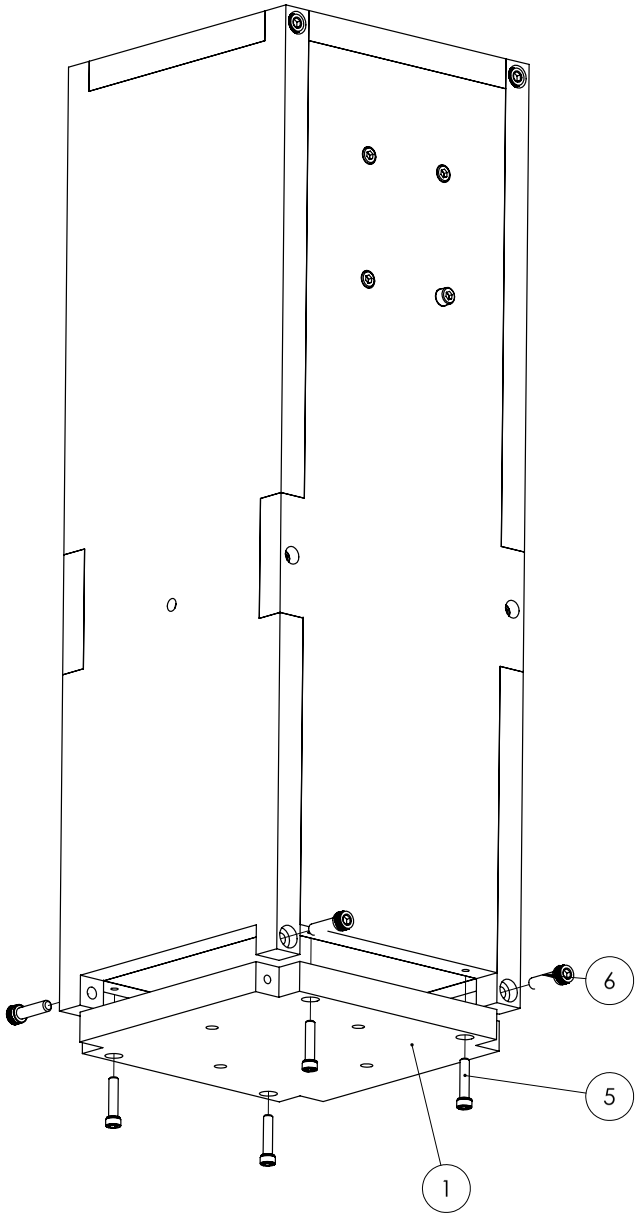
CASE ROCKET TEAM

CASE WESTERN RESERVE UNIVERSITY

TITLE: MAIN ASSEMBLY

SIZE:	DATE:	DRAWN BY:	
B	2/18/2025	MAT223	
MATERIAL:		PART #:	REV: A

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ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	25B01002	BOTTOM BULKHEAD	1
5	96006A216	Black Oxide 18-8 Stainless Steel Socket Head Screw	4
6	91251A148	Black-Oxide Alloy Steel Socket Head Screw	4

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS IN INCHES

TOLERANCES:
.XX ±.01 .XXX ±.005
FRACTIONS ±1/64
ANGULAR MACHINED ±.5°
ANGULAR BEND ±1°

SURFACE FINISH 125
BREAK ALL EDGES .030

DO NOT SCALE

SHEET 1 OF 1

CASE ROCKET TEAM

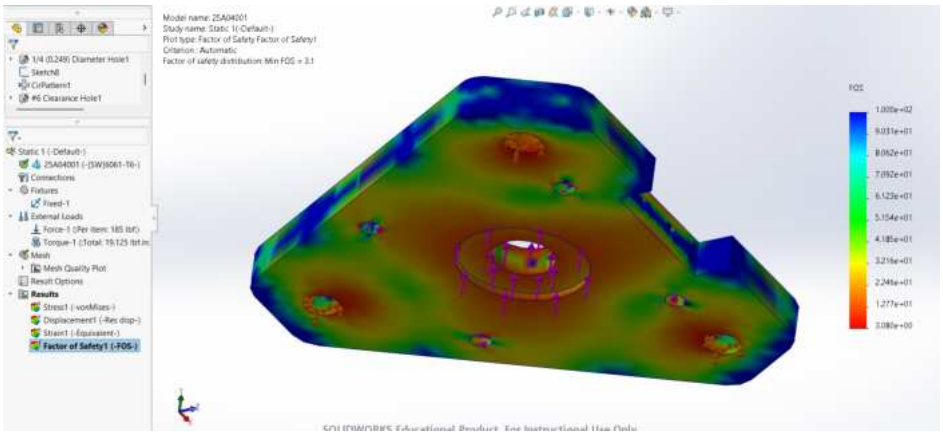
CASE WESTERN RESERVE UNIVERSITY

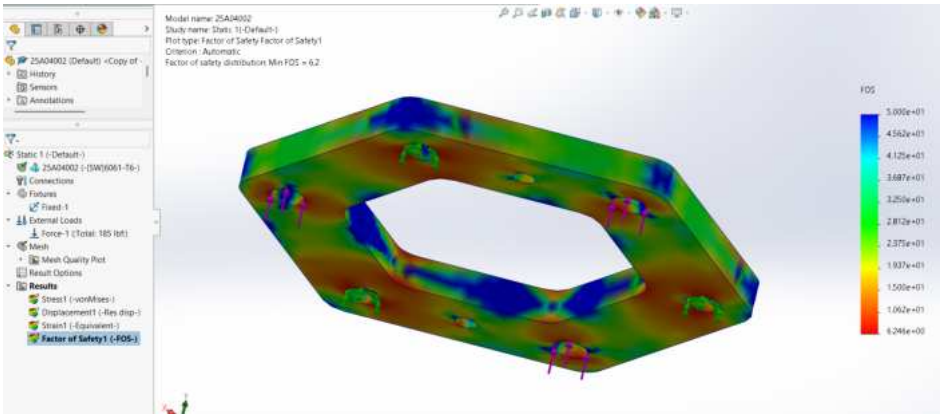
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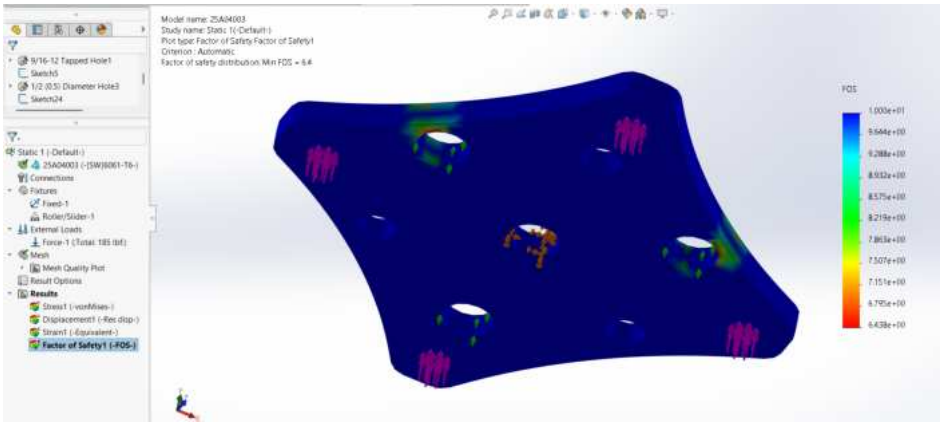
SIZE:	DATE:	DRAWN BY:	
B	2/18/2025	MAT223	
MATERIAL:		PART #:	REV: A

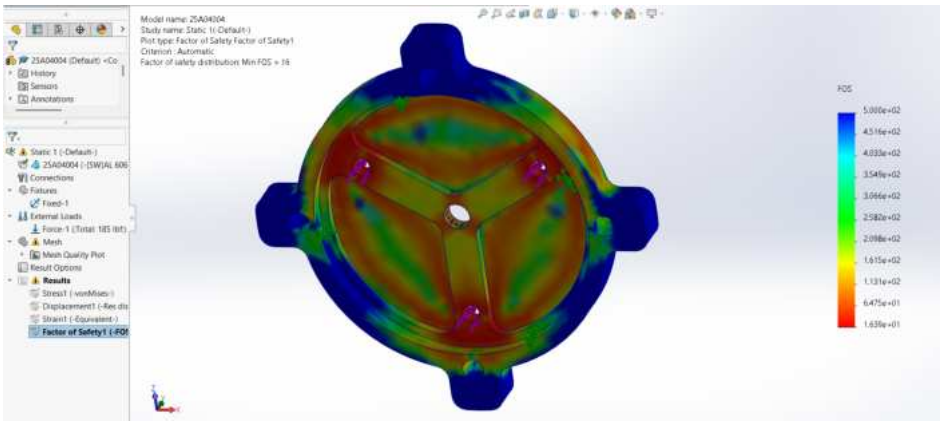
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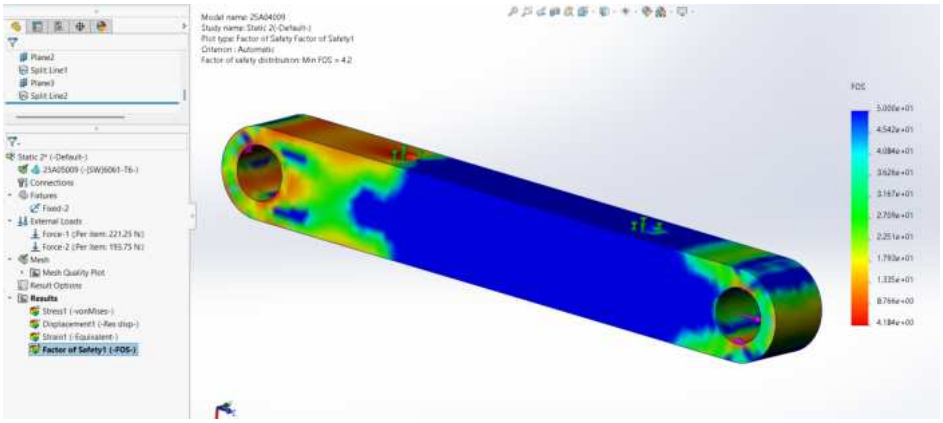
G. Finite Element Analysis Appendix

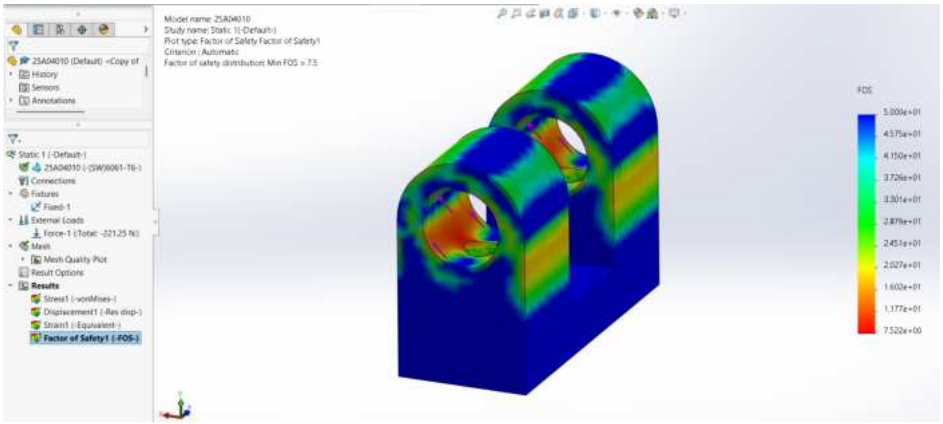


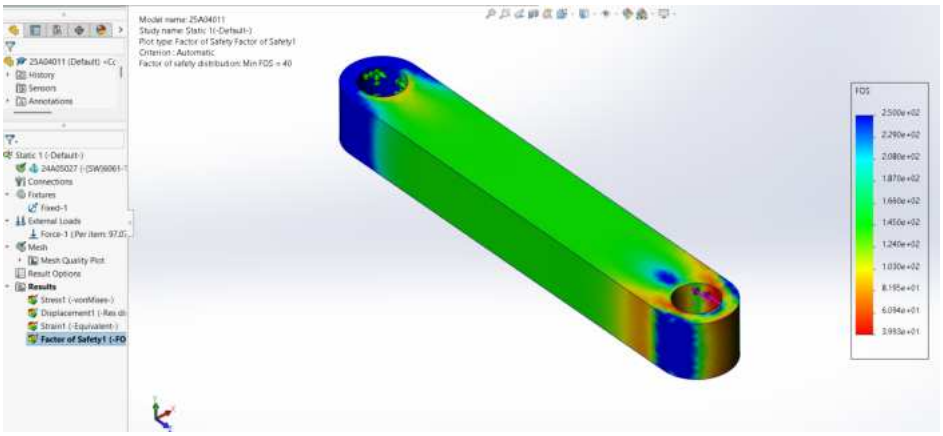


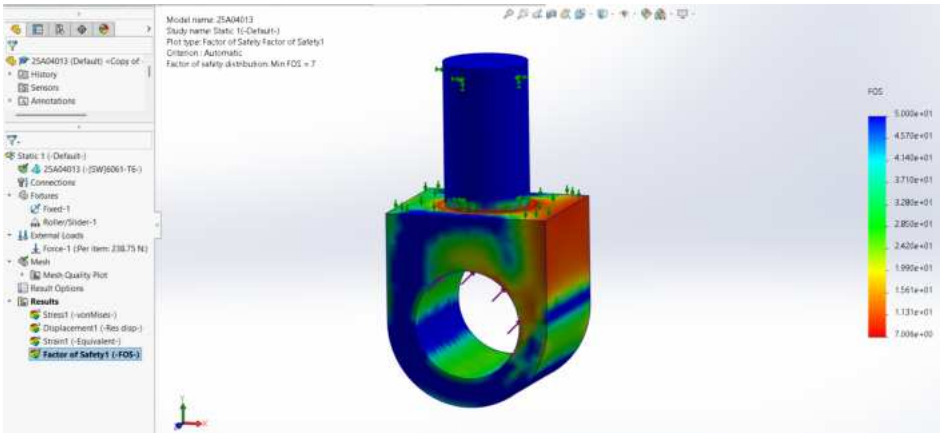


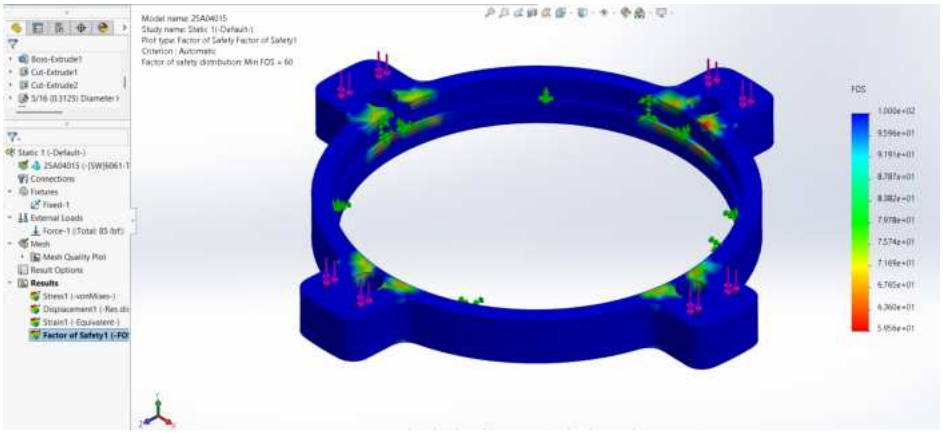

Model name: 25A04004
Study name: Static 1(-Default-)
Plot type: Factor of Safety Factor of Safety1
Criterion : Automatic
Factor of safety distribution: Min FOS = 16
FOS

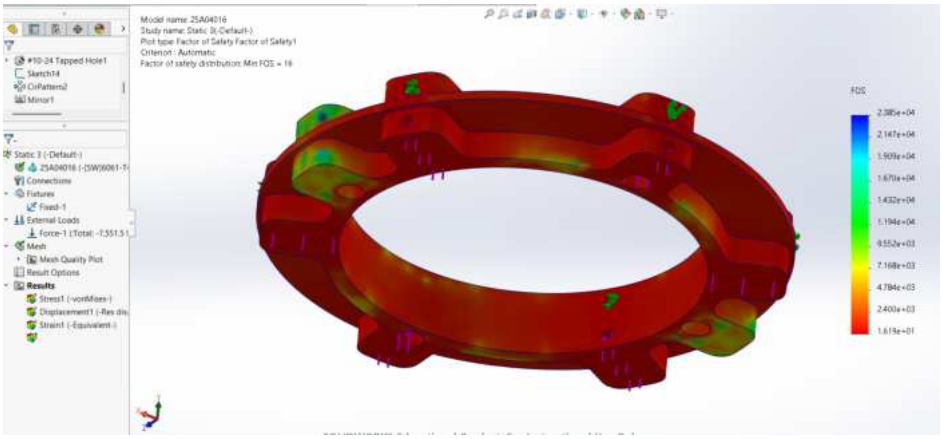

Model name: 25A04009
Study name: Static 2(-Default-)
Plot type: Factor of Safety Factor of Safety1
Criterion : Automatic
Factor of safety distribution: Min FOS = 4.2
FOS

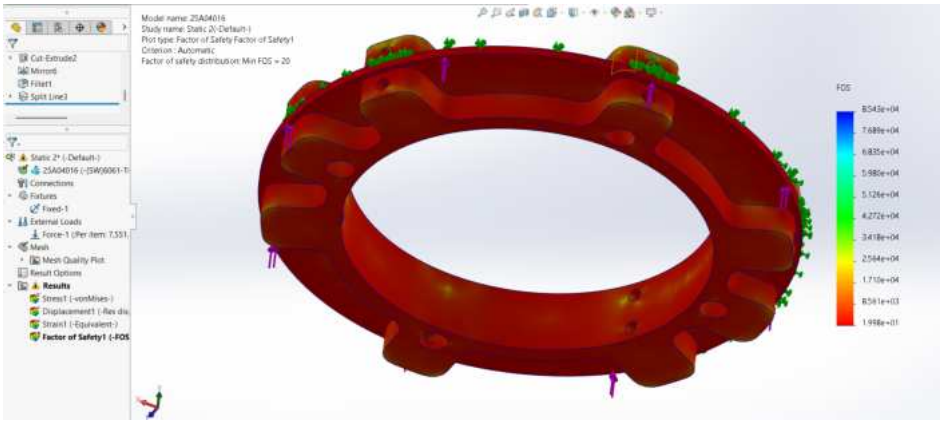

Model name: 25A04010
Study name: Static 1(-Default-)
Plot type: Factor of Safety Factor of Safety1
Criterion : Automatic
Factor of safety distribution: Min FOS = 7.5
FOS

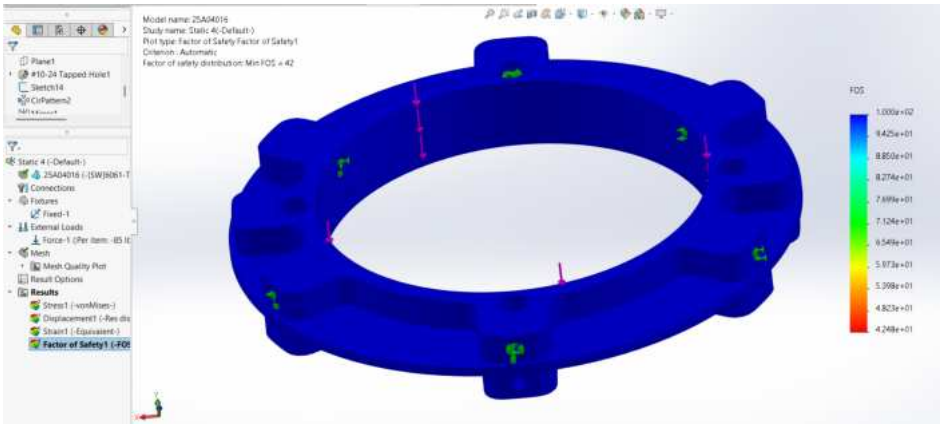

Model name: 25A04011
Study name: Static 1(-Default-)
Plot type: Factor of Safety Factor of Safety1
Criterion : Automatic
Factor of safety distribution: Min FOS = 40
FOS

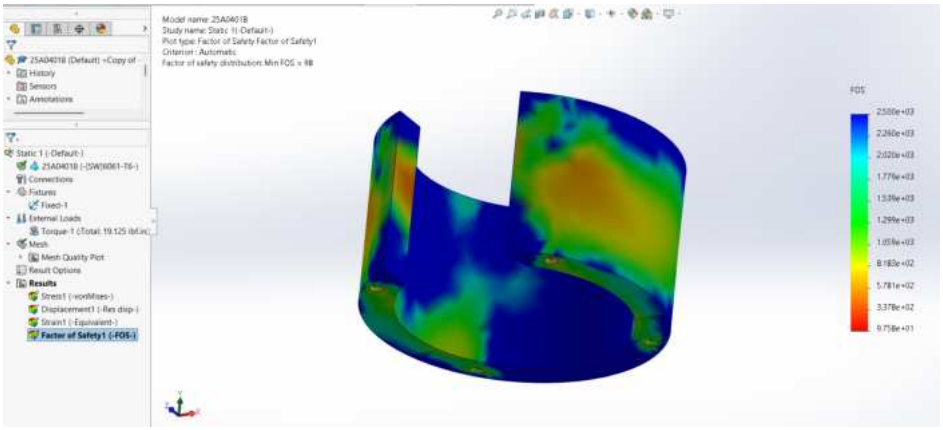

Model name: 25A04013
Study name: Static 1(-Default-)
Plot type: Factor of Safety Factor of Safety1
Criterion : Automatic
Factor of safety distribution: Min FOS = 7
FOS

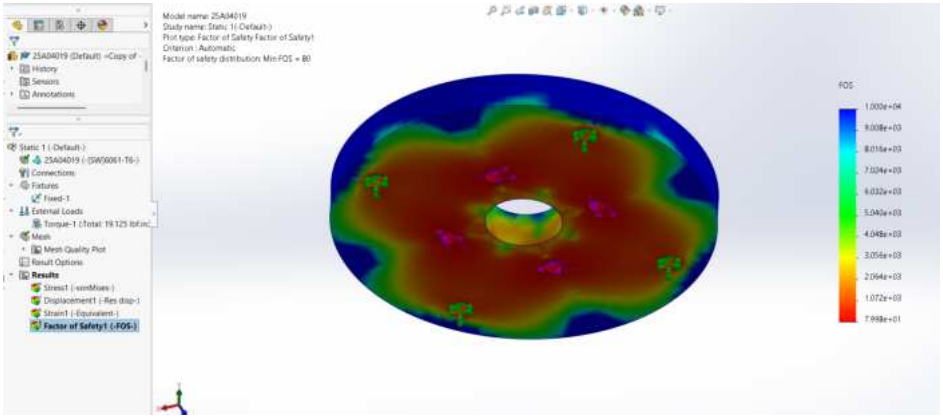

Model name: 25A04015
Study name: Static 1(-Default-)
Plot type: Factor of Safety Factor of Safety1
Criterion : Automatic
Factor of safety distribution: Min FOS = 60
FOS

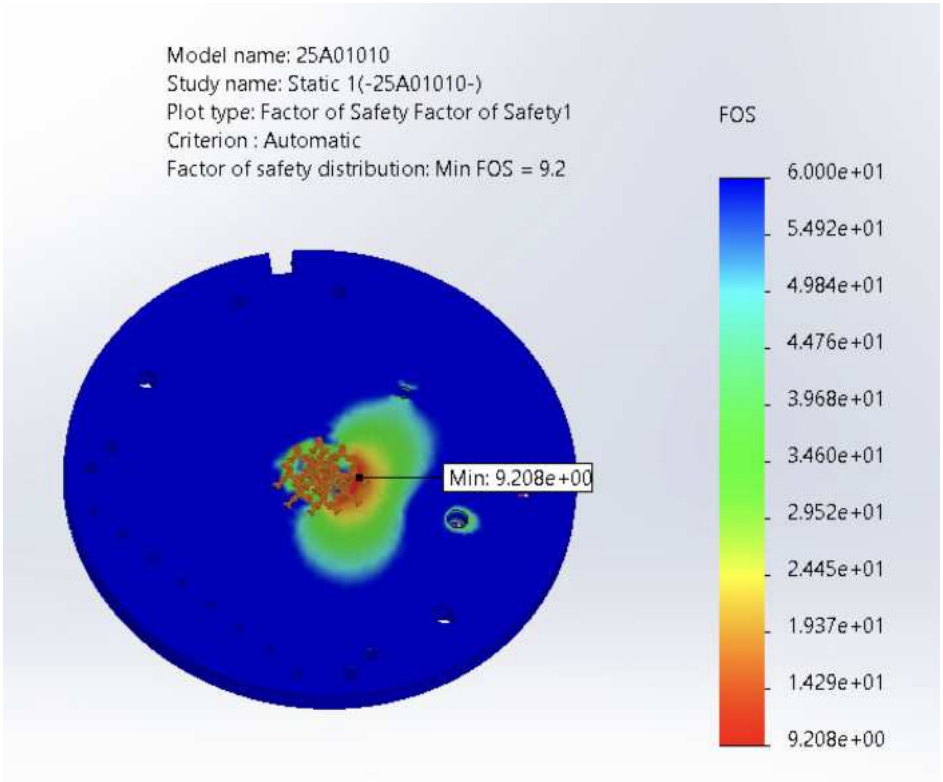

Model name: 25A04016
Study name: Static 3(-Default-)
Plot type: Factor of Safety Factor of Safety1
Criterion : Automatic
Factor of safety distribution: Min FOS = 16
FOS

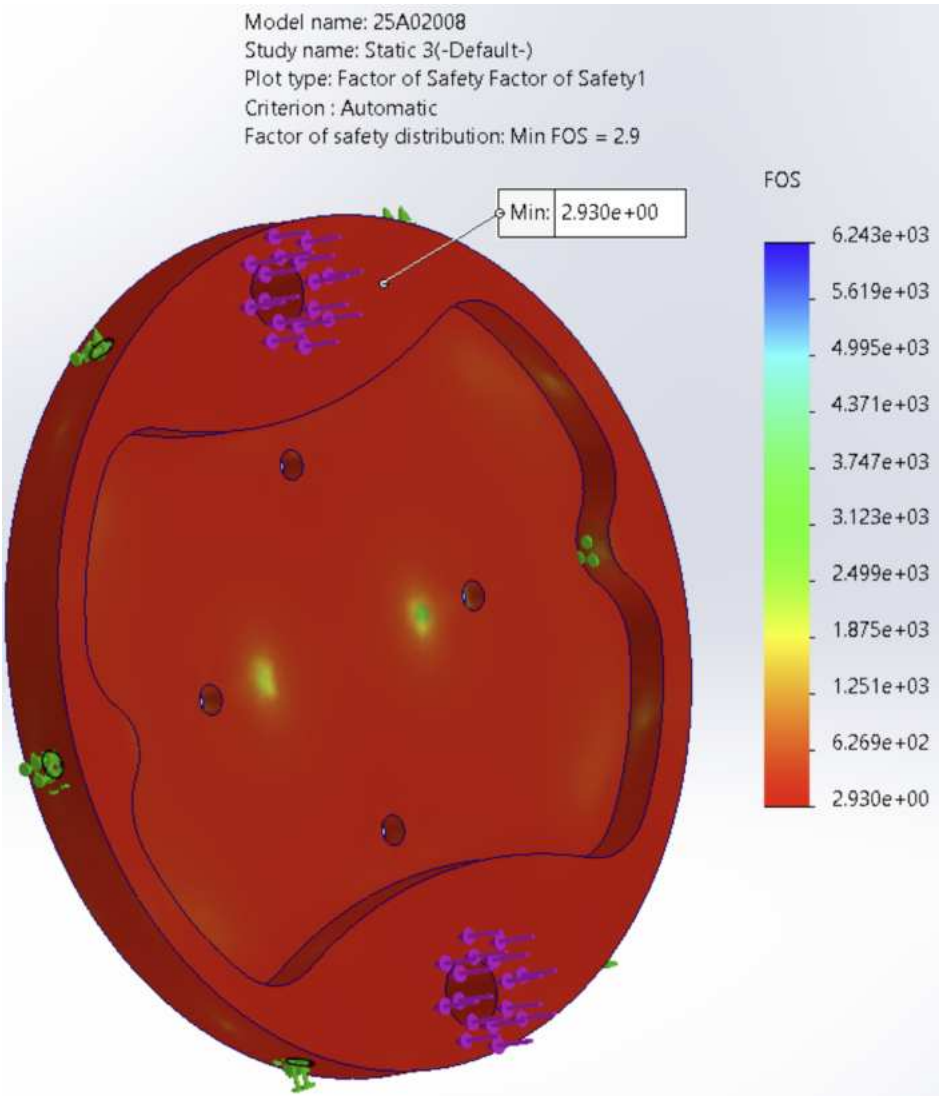

Model name: 25A04016
Study name: Static 2(-Default-)
Plot type: Factor of Safety Factor of Safety1
Criterion : Automatic
Factor of safety distribution: Min FOS = 20
FOS


Model name: 25A04016
Study name: Static 4(-Default-)
Plot type: Factor of Safety Factor of Safety1
Criterion : Automatic
Factor of safety distribution: Min FOS = 42
FOS






Model name: 25A01010
Study name: Static 1(-25A01010-)
Plot type: Factor of Safety Factor of Safety1
Criterion : Automatic
Factor of safety distribution: Min FOS = 9.2
FOS
6.000e+01
5.492e+01
4.984e+01
4.476e+01
3.968e+01
3.460e+01
2.952e+01
2.445e+01
1.937e+01
1.429e+01
9.208e+00
Min: 9.208e+00


Model name: 25A02008
Study name: Static 3(-Default-)
Plot type: Factor of Safety Factor of Safety1
Criterion : Automatic
Factor of safety distribution: Min FOS = 2.9
Min: 2.930e+00
FOS
6.243e+03
5.619e+03
4.995e+03
4.371e+03
3.747e+03
3.123e+03
2.499e+03
1.875e+03
1.251e+03
6.269e+02
2.930e+00

Acknowledgments

The Case Rocket Team would like to thank our university sponsors: Larry Sears and Sally Zlotnick Sears think[box], the Case Alumni Association, and the CWRU Undergraduate Student Government. We would like to thank our mentor and Flyer of Record, Ben Ault, for providing us with advice and a launch site for certification and test launches. Additionally, we would like to thank our advisor Dr. Stephen Hostler, the Mechanical and Aerospace Engineering Department faculty, and the Case School of Engineering for supporting and assisting the team. Finally, we would like to thank all of our sponsors for their contributions and support. Their information can be found on the team's website sponsor page, https://caserocketteam.org/sponsors.

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