



UAH Propulsion Research Center
Standard Operating Procedure For:
Tail Cone Compression Test

SOP #: PRC-SOP-USLI-014
Revision: A
Version: 0
Operation: Tail Cone Compression Testing
Test Location: Johnson Research Center

Test Date: _____

Test Time Start: _____ Finish: _____

Test Team

NAME	ROLE

Notes: _____

This Procedure Contains the Following Hazards

- | | |
|---|--|
| <input type="checkbox"/> Radioisotopes or X-rays | <input type="checkbox"/> Lasers |
| <input type="checkbox"/> Carcinogenic/mutagenic/teratogenic chemicals | <input type="checkbox"/> Microbial and viral agents |
| <input type="checkbox"/> Pressurized gases | <input type="checkbox"/> Recombinant DNA/RNA molecules |
| <input type="checkbox"/> Propellants/Combustion | <input type="checkbox"/> Animal subjects |
| <input type="checkbox"/> High electrical voltage and or current | |



REVISION BLOCK

Version increments are allowed for minor changes to incorporate redlines, or to add experienced personnel to the Red Team. Version Increments only require a single approval from PRC Staff. Version Approval Signature approves all Red Team members signed on the previous version for this version. If additional red team members are being authorized for this procedure, member approval on the signature page is required.

VERSION #	REASON FOR REVISION	VERSION APPROVAL	DATE	DEV. HOURS
A	New SOP for 2016-2017 USLI Team	N/A: See Signature Page		20

ACTIVE WAIVERS

The following waivers have been reviewed by the procedure approval team and are accepted based on assessment of additional mitigations put into effect for conducting the test.

#	DESCRIPTION	MITIGATION	EXPIRES	RESPONSIBILITY
	No active waivers affect this SOP.			



PROCEDURE APPROVAL:

I have personally reviewed each of the operational steps of the SOP and have no questions that the operation can be performed safely and efficiently. I approve all red team personnel assigned in this document and verify that they have proper training to act in the prescribed test roles outlined in this procedure.

Summer Roden: _____ Date: _____
Author

Vivian Braswell: _____ Date: _____
Safety Officer

Tony Hall: _____ Date: _____
PRC Facility Engineer

Dr. David Lineberry: _____ Date: _____
CRW Faculty Advisor

Jason Winningham: _____ Date: _____
CRW Team Mentor

Dr. Robert Frederick: _____ Date: _____
PRC Director

Reviewed By:
Bryce Morgan: _____ Date: _____
Director UAH OEHS



AUTHORIZED RED TEAM MEMBERS

Individuals identified below are authorized to participate in test operations as *Red Team Members* through the SOP approval signatures. By signing the document below, the individuals acknowledge that they have reviewed the procedure and understand the general and specific safety requirements, personnel limits, and work descriptions necessary to accomplish their part of the operation.

Additional Red Team Members may be added to this document without a procedure revision pending approval of the PRC Director or Laboratory Supervisor or Facility Engineer prior to participating in the experiment. Additional members require signatures of both the individual to be added and the approver.

Authorized test individuals agree to abide by and follow the procedure outlined in this document for conducting the described experiment. Any individual not following procedure during testing in a manner which jeopardizes other test members will be immediately removed from the red team and reported to the PRC director.

RED TEAM MEMBERS	AFFILIATION	FIRST AID/CPR- AED CERTIFICATION DATES	SIGNATURE	STAFF APPROVAL
<i>Vivian Braswell</i>	<i>MAE 490 Student</i>	<i>9/16/2016</i>		
<i>William Jordan Tuten</i>	<i>MAE 490 Student</i>	<i>10/14/2016</i>		
<i>Evan Tingley</i>	<i>GTA</i>	<i>1/29/2016</i>		
<i>David Lineberry</i>	<i>PRC Staff</i>	<i>09/11/2015</i>		
<i>Daniel Ireland</i>	<i>MAE 490 Student</i>	<i>10/14/2016</i>		
<i>Jacob Eaton</i>	<i>MAE 490 Student</i>	<i>10/14/2016</i>		
<i>William Carlton</i>	<i>MAE 490 Student</i>	<i>10/14/2016</i>		
<i>Robert Jacoby</i>	<i>MAE 490 Student</i>	<i>10/14/2016</i>		
<i>Holly Strutzenberg</i>	<i>MAE 490 Student</i>	<i>10/14/2016</i>		
<i>Michael Williams</i>	<i>MAE 490 Student</i>	<i>10/14/2016</i>		
<i>Harpreet Singh</i>	<i>MAE 490 Student</i>	<i>9/2016</i>		



DECLARATIONS

Objective

This SOP establishes procedures and defines safety precautions that will be used to verify structural integrity of tail cone assembly.

Test Location

The recommended location for this testing is inside of the Johnson Research Center on the UAH campus. The test setup will mirror the image shown in Figure 1. This location provides a secured/controlled access area. For all testing, personnel must be behind specified protective barriers.

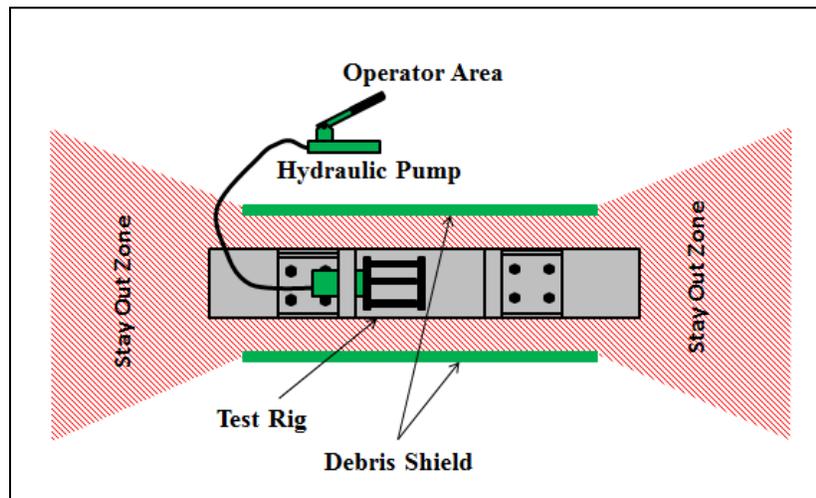


Figure 1: Set-up

Roles and Responsibilities

This procedure requires a minimum of 2 test operators. At least one PRC Staff member must be present in the JRC. This person may serve as one of the two test operators. One of the operators will be designated as the Safety Monitor and will read procedures during testing. The Safety Monitor will be identified on the front page of procedure.

Observer Policy

Observers will be allowed under this test procedure pending approval of the PRC Staff. The occupation limitations of the test area apply to observers as well as test participants. Any observer must be briefed on the experiment hazards, emergency procedures prior to test operations, and listed on the title page of the procedure. An observer is required to remain behind remote physical caution boundaries at all times during red team only operations.

Before operations commence, an observer must be briefed on the potential hazards of the operation, including:

- High Pressure Hydraulic Fluid
- Debris

Additionally, an observer must be provided personal safety equipment and advised of its use as defined in Table 1.



Safety Policy

All PRC test operations require a minimum of two operators with First Aid, CPR, and AED training. Test operations are carried out according to the PRC Facility Usage Policy outlined in PRC-SOP-001-R01 and supplied in Appendix C. A copy of the facility usage policy will be provided upon request or may be found on the PRC website <http://UAH.edu/prc>. In addition to standard safety requirements the following special requirements apply for this procedure: All personnel involved with this operation have been empowered to stop any portion of this operation at any time if they feel it is not proceeding in a safe manner. The PRC Director, PRC Research Engineer/Laboratory Supervisor, PRC Facility Engineer, and other required personnel will be notified and a decision on whether to continue the operation will be made at that time. No safety interlock will be modified, bypassed, or defeated unless the test team has concurred and are aware of the inherent risks associated with the change. Otherwise, the offender will be permanently expelled from the PRC and all of its facilities.

Personal Protective Equipment (PPE)

Test personnel must wear safety glasses at all times during test operations. Long pants and close toed shoes are required for testing. Cotton clothing is recommended. The following PPE are approved through the procedure and **Table 1** show when PPEs are necessary:

Table 1 Personal Safety Equipment

Equipment	Period
Approved eye protection	All Times
Closed-toed footwear	All Times
Approved hearing protection (Optional)	Testing

Weather/Emergency

Testing will not be conducted during severe weather that could jeopardize the safety of personnel and/or equipment. In the event of non-weather related emergency, test operations must be stood down so test personnel can evacuate test facility. If time does not permit safe mitigation of hazards, any immediate hazards should be identified to PRC Staff and emergency response personnel.

Procedure Deviations

At any point during the execution of this SOP any team member may call for a stand down of test operations to discuss any concern related to safety. Additionally, during the execution of the SOP any deviation to the procedures outlined in this document must be noted on the procedure and it must be identified on the cover page that deviations were conducted. Revisions to the procedure may be required prior to the next test operation. Prior to each test, verify that the procedures do not require modification due to specific test plan requirements. In the event that redlines are required during execution, ensure that redlines present no safety, efficiency, or environmental concerns.



Materials Needed

Test Stand

Assembled Lower Rocket Airframe

Safety Glasses

Ear plugs

Fire Extinguisher (verify availability at site)

First Aid Kit (includes bottled water)

Nitrile Gloves

Debris Shielding

C-Clamps (x2)

Hydraulic pump

Pressure Transducer

Camera (optional)

TEST PROCEDURES

PRETEST LABORATORY PREPARATION

- 1 Inform all guests of emergency exits and other pertinent safety information.
- 2 Identify nearest AED location to team and guests.
- 3 Place all jewelry and electronic devices, including cell phones, tablets, and radios in an approved location.
- 4 **Make sure all personnel and observers are wearing the proper PPE, e.g., safety glasses, goggles, face shield, hearing protection (if needed).**
- 5 If testing at the JRC,
 - Setup 'Debris Shield' per Figure 1.
- 6 Conduct pre-test inspection of tail cone and body tube
 - Take pictures and record any observations
 - If cracks are detected, the component is not fit for testing
- 7 Setup camera to record test (optional).

TEST STAND SETUP

- 8 **Ensure all personnel and observers are wearing safety glasses**
- 9 Secure and support standoff to the hydraulic actuator with provided one inch bolt
 - NOTE: The pressure of trapped fluid can penetrate the skin and could cause serious injury, therefore, tighten all connectors before applying pressure**
- 10 Connect hydraulic piston to hydraulic actuator
- 11 Position test article with the aft oriented at the static plate on the test stand and the forward fixture on the test stand standoff
- 12 C- clamp forward fixture of lower airframe assembly to the standoff
- 13 **Ensure all personnel and observers are in the Safe Zone**
- 14 If needed, slowly adjust standoff position using hydraulic piston to ensure that the lower airframe assembly is slightly in compression
 - Tighten valve on hydraulic pump to increase pressure
 - Slowly move hydraulic pump lever arm to advance the piston
- 15 C-clamp the aft fixture of the lower airframe assembly to the fixed frame on the test stand
- 16 Initiate DAQ
- 17 Verify data collection
- 18 Start camera (optional)

TEST PROCEDURES

- 19 Verify all personnel are in the Safe Zone and wearing specified PPE**
 - 20 Tighten valve on hydraulic pump to increase pressure
 - 21 Slowly increase pressure with the hydraulic pump up to desired proof-pressure load of 447 PSI (1000 lbf) or until test article fails
 - Max Pressure achieved _____ psi
 - Equivalent Max Force _____ lbf
 - 22 Once test is completed untighten valve on hydraulic pump to decrease pressure
- NOTE: Hydraulic of trapped fluid can penetrate the skin and could cause serious injury; therefore, ensure that the release valve is completely untightened and allow the fluid to bleed out of the line before continuing**
- 23 Remove C-clamp from aft fixture of the lower airframe assembly
 - 24 Remove C-clamp from forward fixture of the lower airframe assembly
 - 25 Remove lower airframe assembly from test area
 - 26 Stop camera (as required)
 - 27 Inspect test article and document results
 - 28 Take pictures of test article

OBSERVATION NOTES:

SHUTDOWN AND PROCEDURE CLOSEOUT

- 29 Verify all personnel are wearing specified PPE**
- 30 Disconnect hydraulic piston from hydraulic actuator
- 31 If testing at the JRC,
 - Remove 'Debris Shield'
- 32 Return test equipment to approved location/s as required
- 33 Upon completion, the SOP needs to be signed by the participating Red Team members,

scanned, and emailed to the Team Safety Officer.

APPENDIX A: CROSS REFERENCED PROCEDURES

The following procedures are referenced in this SOP and are required for verification purposes.

#	SOP Doc #	Description
	PRC-SOP-001	UAH Propulsion Research Center – Facility Usage Policy, 1-Apr-2012.
2	CRW-Safety Regulations-RevB	Charger Rocket Works – Team Safety Regulations, Jan-2017

APPENDIX B: RISK ASSESSMENT

Frequency of Occurrence	Hazard Categories			
	1 Catastrophic	2 Critical	3 Serious	4 Minor
(A) Frequent	1A	2A	3A	4A
(B) Probable	1B	2B	3B	4B
(C) Occasional	1C	2C	3C	4C
(D) Remote	1D	2D	3D	4D
(E) Improbable	1E	2E	3E	4E

XX Unacceptable
 XX Acceptable for Remote Operations
 XX Acceptable for Remote/Attended Operations
 XX Acceptable for Attended Operations with Approval

Hazard Categories	Implementation Criteria	
	Remote	Attended
1A, 1B, 1C, 2A, 2B, 3A	Implement immediately	Implement immediately
1D, 2C, 2D, 3B, 3C	Implementation should be seriously considered	Implement as soon as possible
1E, 2E, 3D, 3E, 4A, 4B	Implementation should be seriously considered	Implementation should be seriously considered
4C, 4D, 4E	Consideration should be given	Consideration should be given

Frequency Definitions		
Description	Category	Mishap Definition
Frequent	A	Likely to occur frequently
Probable	B	Will occur several times in life of an item
Occasional	C	Likely to occur sometime in life of an item
Remote	D	Unlikely but possible to occur in life of an item
Improbable	E	So unlikely, it can be assumed occurrence may not be experienced

Category Definitions		
Description	Category	Mishap Definition
Catastrophic	1	Death or system loss
Critical	2	Severe injury, severe occupational illness, or major system damage
Serious	3	Injury requiring medical attention, illness, or system damage
Minor	4	Possible minor injury, or minor system damage

Item #: (number and letter) The number indicates the failure mode and the letter indicates a unique Cause for that failure mode. Each failure mode is a unique number and each cause is a unique letter

Failure Mode: Specific hazard (Inadvertent Ignition, Spill, Over pressurization, etc.)

Failure Cause: Causes of the failure modes (plugged nozzle, electrostatic discharge, etc.)

Potential Effects: Effect on personnel safety or equipment. Potential for harm to personnel or damage to equipment.

Haz Cat: Initial hazard ranking of the hazard without any safeguards in place (From Table above)

Safeguards: Equipment, specifications, safety by design. Controls, Design, Procedures in place to prevent the Failure cause.

HazCat: Hazard ranking after Safeguards are inplace. (should be lower)

Recommendations/Emergency Actions: Mitigating Solution

Tail Cone Compression Test

PRC-SOP-USLI-014

ITEM #	FAILURE MODE	FAILURE CAUSE	POTENTIAL EFFECTS	HAZ CAT	SAFEGUARDS	HAZ CAT	RECOMMENDATIONS
1a	Exposure to flying debris	Test article failure	<ul style="list-style-type: none"> • Damage to facility • Injury from debris 	3B	<ul style="list-style-type: none"> • Debris shields will be used to prevent injury to personnel and/or facility • Access to test area is restricted when testing 	3D	
2a	Pinching/clamping hand	Unsafe work practices	<ul style="list-style-type: none"> • Damage to skin, tissue, and/or bone 	2D	<ul style="list-style-type: none"> • Safe operating procedures in place • Only trained personnel are allowed to participate in testing 	2E	
3a	Exposure to high pressure hydraulic oil	<ul style="list-style-type: none"> • Hydraulic actuator failure • Hydraulic pump or actuator tubing cracks 	<ul style="list-style-type: none"> • Serious risk to skin and/or eyes 	2D	<ul style="list-style-type: none"> • Safe operating procedures in place • Only trained personnel are allowed to participate in testing 	2E	
4a	Inadvertent damage to test article	<ul style="list-style-type: none"> • Accidental drop of test article • Overloading with hydraulic pump 	<ul style="list-style-type: none"> • Damage or fracture to test article • Test failure 	3C	<ul style="list-style-type: none"> • Only trained personnel are allowed to participate in testing • Safe work practices 	3D	

APPENDIX C: UAH PRC FACILITY USAGE POLICY

UAH Propulsion Research Center – Facility Usage Policy

The Propulsion Research Center (PRC) conducts research, produces publications, and mentors students in advanced propulsion technologies and their applications. The PRC connects the academic research community and propulsion community through interdisciplinary collaboration. Use of the facility requires prior written approval of the PRC Director.

The Propulsion Research Center laboratories were established to provide UAHuntsville faculty, staff, and students, state-of-the-art facilities for conducting basic and applied research on propulsion systems and related sciences. The PRC was established to provide students a “hands-on” education in propulsion. The facilities may be used for sponsored research projects, PRC staff and Graduate Student research projects, and approved UAHuntsville undergraduate research projects. The Propulsion Research Center acknowledges that hazards are inherent to the nature of the research conducted in the facilities that require strict adherence to facility rules and protocols for anyone engaged in research in the PRC laboratories. PRC facility protocol is as follows:

1. All PRC Test operations are under the authority of the PRC Director and UAH campus safety practices.
2. All personnel involved in testing are UAH employees, UAH students under PRC supervision, customers with an active contract with UAH, or those with other formal arrangements agreed to in writing by the University.
3. All tests involving pressures over 100 psi, high voltage, combustion, or other sources of possibly injury require a Standard Operating Procedure (SOP), reviewed and signed by the test Red Team (see below), and approved by the PRC Director.
4. The tests are conducted by a designated Red Team who has at least one UAH staff member and has at least two members who are Red Cross Safety and CPR/AED Certified.
5. After any major test anomaly, all PRC test operations are automatically suspended until a determination of the basic cause of the incident is determined and all active SOPs are reviewed in light of the findings of the incident before resuming testing. A verbal report of the incident will be given to the V.P. of Research and a representative of Campus Safety within 24 hours of the incident.



Robert
Interim Director PRC

4/1/2012
Frederick

APPENDIX D: EMERGENCY CONTACT INFORMATION

In the event of an emergency, respond in accordance with off-nominal procedures defined in this SOP and in accordance with the appropriate section in the UAH PRC Safety Program dated 22-Feb-2013.

Emergency contact numbers are provided below.

Emergency Phone Numbers	
Police	911 (256) 824-6911 (6911 from campus phone)
Fire Department	
Hazardous Materials Incident	
Utility Failure	
PRC Contacts	
Tony Hall	Office : (256) 824-2887
David Lineberry	Office : (256) 824-2888
Robert Frederick	Office : (256) 824-7200
PRC Main Office	(256) 824-7209
High Pressure Lab Phone	(256) 824-6031
JRC Test Stand	(256) 824-2857
Bryce Morgan/OEHS (Office of Environmental Health and Safety)	(256) 824-6053
Other Emergency Numbers of Interest	
UAH Campus Police Department	(256) 824-6911
Huntsville Police Department	(256) 722-7100
Madison County Sheriff's Office	(256) 722-7181
Alabama State Troopers	(334) 242-4371
Huntsville Hospital	(256) 265-1000

In the event of a non-emergency reportable incident call the numbers below in the following order.

1. Dr. Robert Frederick (Dr. David Lineberry as an alternate)
Office: (256) 824-7200
Cell: (256) 503-4909

2. UAHuntsville Police (Non-Emergency)
(256) 824-6596
6596 (from campus phone)

APPENDIX E: DEBRIS SHIELD PLACEMENT

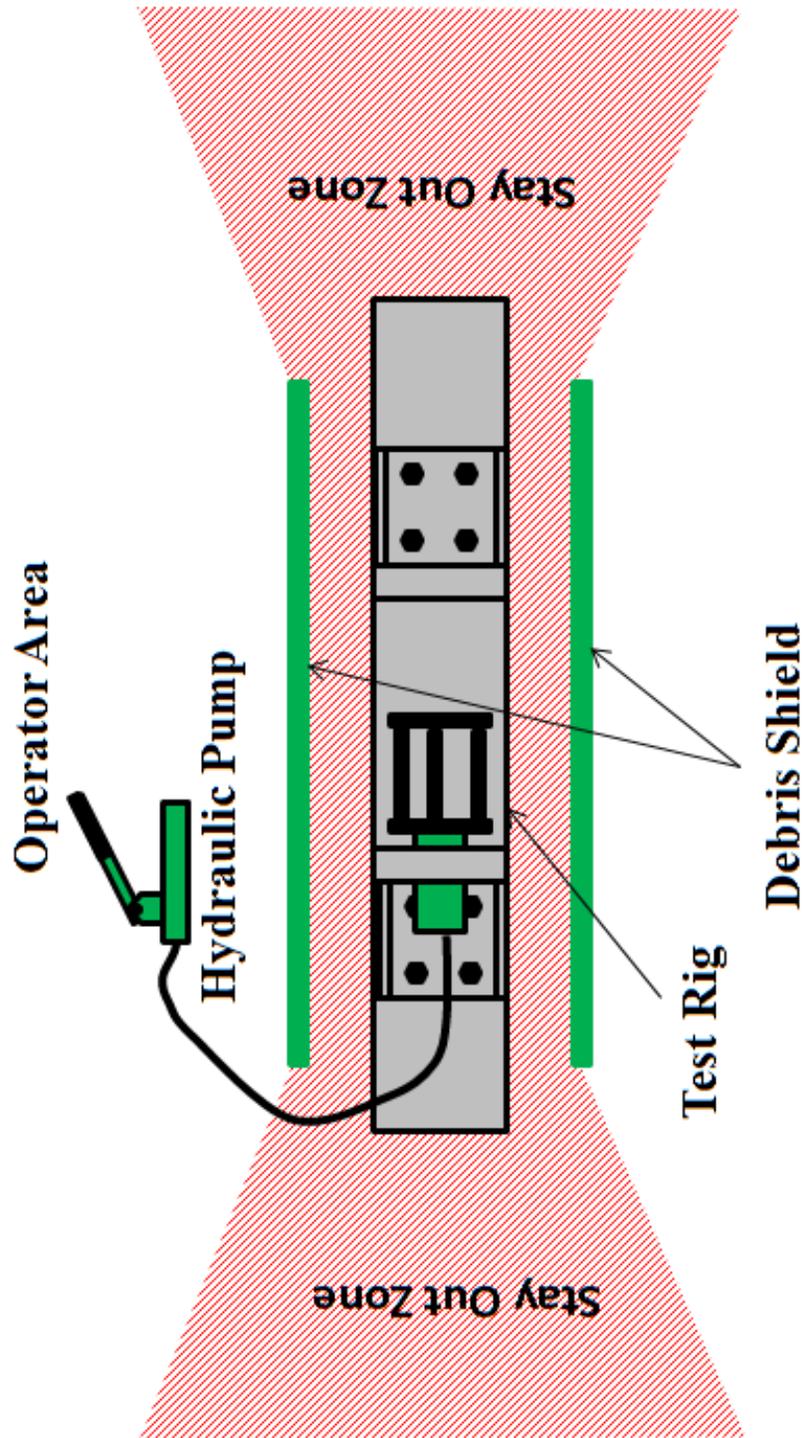


Figure 2: Warning Barricade Location Schematic

APPENDIX F: SAFETY TRAINING FOR HYDRAULIC SYSTEMS

AEX 192.1.62

 <p>T · H · E OHIO STATE UNIVERSITY EXTENSION</p>	<h1>Tailgate Safety Training for Landscaping and Horticultural Services</h1> <p>Agricultural Safety Program, 590 Woody Hayes Drive, Columbus, OH 43210</p>
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Safe Use of Hydraulic Systems

Objective: Describe the hazards in working with hydraulic equipment and how to prevent them.

How to Use This Module

Many implements use a hydraulic system. Understanding the system makes accidents less likely. For this module:

- Read the information below on hydraulic systems.
- Review hazards of working with hydraulic systems and how to prevent them.
- Ask your supervisor to demonstrate hooking up machinery to a hydraulic system.
- Ask your supervisor to observe while you practice hook-up.
- Review the important points.
- Take the True/False quiz to check your learning.

Background

Hydraulic systems can be dangerous. Fluid can escape when adjusting or removing equipment. Fluid can be trapped in the hydraulic system even when the engine and hydraulic pump are stopped. An implement in the raised position has trapped hydraulic fluid that might be pressurized — even if it is disconnected.

The pressure of trapped fluid can be more than 2,000 pounds per square inch (psi). Pressurized fluid can penetrate the skin. You would need surgery to remove the fluid. Penetration injuries may not appear serious. But if they are not properly cared for, gangrene may result. So you could lose a body part if you don't get prompt medical attention.

Tighten all connectors before applying pressure. Cracked hoses may have pinhole leaks. Keep hands and body away from leaks and nozzles that might eject fluid under high pressure. Use a piece of cardboard or paper to search for leaks. Relieve pressure before disconnecting a hydraulic line.

Do not cross hydraulic lines. If the lines are not coupled correctly, the implement will not rise and drop as expected. Tape or color-code lines to prevent an accident.

Heat causes the fluid to expand, increasing the pressure. Always relieve hydraulic pressure before loosening hydraulic fittings. The hot, high-pressure spray of the hydraulic fluid can cause injury.

Before Servicing Hydraulic-Powered or -Controlled Equipment

- Shut off the engine.
- Engage the brake.
- Shut off hydraulic pump power.
- Lower the implement to the ground.
- Move the hydraulic control lever back and forth several times to relieve pressure.
- Follow the instructions in the operator's manual. Specific procedures for servicing hydraulic systems provide safety guidelines.
- Stay away from cracked hoses, leaks, and nozzles that might eject fluid under pressure.
- Promptly seek medical attention if fluid is injected into the skin.

Review These Important Points

- Adjusting and removing equipment when hydraulic fluid is under pressure can be hazardous.
- Keep all body parts away from cracked hoses, leaks, and nozzles that might eject fluid under pressure.
- Never cross hydraulic lines on equipment.
- Always lower the implement to the ground and relieve pressure before servicing.
- Follow all instructions in the operator's manual.
- If you notice a lock or a hose in bad condition, tell your employer to have it replaced.

About These Modules

The author team for the training modules in the landscape and horticultural tailgate training series includes Dee Jepsen, Program Director, Agricultural Safety and Health, Ohio State University Extension; Michael Wonacott, Research Specialist, Vocational Education; Peter Ling, Greenhouse Specialist; and Thomas Bean, Agricultural Safety Specialist. Modules were developed with funding from the Occupational Safety and Health Administration, U.S. Department of Labor, Grant Number 46E3-HT09.

Any opinions, findings, conclusions, or recommendations expressed in this publication are those of the author(s) and do not necessarily reflect the views of the U.S. Department of Agriculture or the U.S. Department of Labor.

APPENDIX G: MATERIAL SAFETY DATA SHEET



Simplex, A Division of Actuant
N86 W 12500 Westbrook Crossing
Menomonee Falls, WI 53051
Phone: (262) 293-1500 Fax: (262) 293-7040

SAFETY DATA SHEET

Issue Date 11-Feb-2013

Revision Date 8-Jun-2015

1. IDENTIFICATION OF THE SUBSTANCE/PREPARATION AND OF THE COMPANY/UNDERTAKING

Product identifier

Product Name Simplex 150 Hydraulic
Simplex 18139, AO1 (Gallon), AO5 (5 Gallon), AO55 (Drums)

Other means of identification

Product Code 181
Revision Number 2882
Synonyms None

Recommended use of the chemical and restrictions on use

Recommended Use Lubricant.
Uses advised against No information available

Details of the supplier of the safety data sheet

Manufacturer Address
U.S. Lubricants A Division of U.S. Venture, Inc. 425 Better Way Appleton, WI 54915

Emergency telephone number

Company Phone Number 800-490-4900
24 Hour Emergency Phone Number 800-888-4005 DTCG84-01-A-900043

2. HAZARDS IDENTIFICATION

Classification

Serious eye damage/eye irritation Category 2B

Label elements

Emergency Overview

Warning
Hazard statements
Causes eye irritation
Appearance Viscous **Physical state** Liquid **Odor** Mild Petroleum

Precautionary Statements - Prevention

Wash face, hands and any exposed skin thoroughly after handling.

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

- Harmful to aquatic life with long lasting effects
- Harmful to aquatic life

3. COMPOSITION/INFORMATION ON INGREDIENTS

Chemical Name	CAS No.	Weight-%	Trade Secret
Petroleum distillates, hydrotreated heavy paraffinic	64742-54-7	90-99	*
Zinc alkyldithiophosphate	4259-15-8	< 1	*

* The exact percentage (concentration) of composition has been withheld as a trade secret.

4. FIRST AID MEASURES

First aid measures

- Eye contact** Rinse thoroughly with plenty of water for at least 15 minutes, lifting lower and upper eyelids. Consult a physician.
- Skin Contact** If skin irritation persists, call a physician. Wash contaminated clothing before reuse. Wash with soap and water.
- Inhalation** Remove to fresh air.
- Ingestion** Do NOT induce vomiting. Get medical attention. Drink 1 or 2 glasses of water.

Most important symptoms and effects, both acute and delayed

Symptoms No information available.

Indication of any immediate medical attention and special treatment needed

Note to physicians Treat symptomatically.

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

No information available.

Explosion data

Sensitivity to Mechanical Impact None.
Sensitivity to Static Discharge None.

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.

UNUSUAL FIRE & EXPLOSION HAZARDS

Toxic Fumes may be evolved on burning or exposure to heat. Pressure may increase in overheated closed containers. Store below 120°F

6. ACCIDENTAL RELEASE MEASURES

Personal precautions, protective equipment and emergency procedures

Personal precautions Use personal protective equipment as required. Ensure adequate ventilation, especially in confined areas. Stop leak if you can do it without risk.

Environmental precautions

Environmental precautions See Section 12 for additional ecological information.

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. Prevent product from entering drains. Pick up and transfer to properly labeled containers.

Prevention of secondary hazards Clean contaminated objects and areas thoroughly observing environmental regulations.

7. HANDLING AND STORAGE

Precautions for safe handling

Advice on safe handling Handle in accordance with good industrial hygiene and safety practice. Avoid breathing fume/mist/vapors/spray.

Conditions for safe storage, including any incompatibilities

Storage Conditions Keep away from heat, sparks, flame and other sources of ignition (i.e., pilot lights, electric motors and static electricity). Keep containers tightly closed in a dry, cool and well-ventilated place. Store at temperatures not exceeding 120°F.

Incompatible materials Incompatible with oxidizing agents. Incompatible with strong acids and bases.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Control parameters

Exposure Guidelines This product, as supplied, does not contain any hazardous materials with occupational exposure limits established by the region specific regulatory bodies.

Appropriate engineering controls

Engineering Controls Showers
Eyewash stations
Ventilation systems.

Individual protection measures, such as personal protective equipment

Eye/face protection Wear safety glasses with side shields (or goggles).

Skin and body protection Wear protective nitrile or Neoprene™ 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.

General Hygiene Considerations Do not eat, drink or smoke when using this product.

9. PHYSICAL AND CHEMICAL PROPERTIES

Information on basic physical and chemical properties

Physical state	Liquid	Odor	Mild Petroleum
Appearance	Viscous	Odor threshold	No information available
Color	Light amber		

<u>Property</u>	<u>Values</u>	<u>Remarks • Method</u>
pH	Essentially Neutral	
Melting point/freezing point	No information available	
Boiling point / boiling range	No information available	
Flash point	400°F	
Evaporation rate	Less than 0.01 (@1ATM and 25°C. n-butyl acetate=1	
Flammability (solid, gas)	No information available	
Flammability Limit in Air		
Upper flammability limit:	10% (Estimated Value)	
Lower flammability limit:	1% (Estimated Value)	
Vapor pressure	Less than 0.01 mm HG	
Vapor density	Greater than 1 (Air=1)	
Specific Gravity	0.860 lbs/gal: 7.16	
Water solubility	Insoluble in water	
Solubility in other solvents	No information available	
Partition coefficient	No information available	
Autoignition temperature	No information available	
Decomposition temperature	No information available	
Kinematic viscosity	30-34 cSt@ 40°C	
Dynamic viscosity	No information available	
Explosive properties	No information available	
Oxidizing properties	No information available	

Other Information

Softening point	No information available
Molecular weight	No information available
VOC Content (%)	Negligible
Density	No information available
Bulk density	No information available

10. STABILITY AND REACTIVITY

Reactivity
Not Applicable

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

Strong oxidizing agents. Heat, flames and sparks.

Incompatible materials

Incompatible with oxidizing agents. Incompatible with strong acids and bases.

Hazardous Decomposition Products

Thermal decomposition can lead to release of irritating and toxic gases and vapors.

11. TOXICOLOGICAL INFORMATION

Information on likely routes of exposure

Product Information	No data available
Inhalation	Avoid breathing vapors or mists. Inhalation of vapors in high concentration may cause irritation of respiratory system.
Eye contact	Contact with eyes may cause irritation.
Skin Contact	Prolonged contact may cause redness and irritation.
Ingestion	Unlikely to cause harm if accidentally swallowed in small doses, though larger quantities may cause nausea and diarrhea.

Chemical Name	Oral LD50	Dermal LD50	Inhalation LC50
Zinc alkyldithiophosphate 4259-15-8	= 3100 mg/kg (Rat)	> 5000 mg/kg (Rabbit)	-

Information on toxicological effects

Symptoms No information available.

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Skin corrosion/irritation	Irritating to skin.
Serious eye damage/eye irritation	Irritating to eyes.
Irritation	May cause skin and eye irritation. PROLONGED OR REPEATED CONTACT MAY DRY SKIN AND CAUSE IRRITATION.
Sensitization	No information available.
Germ cell mutagenicity	No information available.
Carcinogenicity	No information available.

Chemical Name	ACGIH	IARC	NTP	OSHA
Petroleum distillates, hydrotreated heavy paraffinic 64742-54-7	A2	Group 1		X

Reproductive toxicity	No information available.
STOT - single exposure	No information available.
STOT - repeated exposure	No information available.
Aspiration hazard	No information available.

Numerical measures of toxicity - Product Information

12. ECOLOGICAL INFORMATION

Ecotoxicity

Harmful to aquatic life with long lasting effects

0.16% of the mixture consists of component(s) of unknown hazards to the aquatic environment

Chemical Name	Algae/aquatic plants	Fish	Toxicity to microorganisms	Crustacea
Petroleum distillates, hydrotreated heavy paraffinic 64742-54-7		5000: 96 h Oncorhynchus mykiss mg/L LC50		1000: 48 h Daphnia magna mg/L EC50
Zinc alkyldithiophosphate 4259-15-8	1.0 - 5.0: 96 h Pseudokirchneriella subcapitata mg/L EC50	10.0 - 35.0: 96 h Pimephales promelas mg/L LC50 semi-static 1.0 - 5.0: 96 h Pimephales promelas mg/L LC50 static		1 - 1.5: 48 h Daphnia magna mg/L EC50

Persistence and degradability

Chemical Name	Partition coefficient
Zinc alkyldithiophosphate 4259-15-8	2.86

Other adverse effects No information available

13. DISPOSAL CONSIDERATIONS

Waste treatment methods

Disposal of wastes Disposal should be in accordance with applicable regional, national and local laws and regulations.

Contaminated packaging Do not reuse container.

Chemical Name	California Hazardous Waste Status
Zinc alkyldithiophosphate 4259-15-8	Toxic

14. TRANSPORT INFORMATION

DOT Not regulated

ICAO (air) Not regulated

IATA Not regulated

15. REGULATORY INFORMATION

International Inventories

TSCA	All components of this material are on the US TSCA Inventory or are exempt.
DSL/NDSL	All components are in compliance with the Canadian Environmental Protection Act and are present on the Domestic Substances List.
EINECS/ELINCS	Complies
ENCS	Complies
IECSC	Complies
KECL	Complies
PICCS	Complies
AICS	Complies

Legend:

TSCA - United States Toxic Substances Control Act Section 8(b) Inventory
 DSL/NDL - Canadian Domestic Substances List/Non-Domestic Substances List
 EINECS/ELINCS - European Inventory of Existing Chemical Substances/European List of Notified Chemical Substances
 ENCS - Japan Existing and New Chemical Substances
 IECS - China Inventory of Existing Chemical Substances
 KECL - Korean Existing and Evaluated Chemical Substances
 PICCS - Philippines Inventory of Chemicals and Chemical Substances
 AICS - Australian Inventory of Chemical Substances

REACH Compliance

This product is not known to be hazardous per REACH 1907/2006, regulation 453/2010 and CLP 1272/2008

US Federal Regulations

SARA 313

Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 (SARA). This product does not contain any 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.	SARA 313 - Threshold Values %
Zinc alkylidithiophosphate - 4250-15-8	4250-15-8	1.0

SARA 311/312 Hazard Categories

Acute health hazard	No
Chronic Health Hazard	No
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
Zinc alkylidithiophosphate 4250-15-8		X		

CERCLA

This material, as supplied, does not contain any substances regulated as hazardous substances under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) (40 CFR 302) or the Superfund Amendments and Reauthorization Act (SARA) (40 CFR 355). There may be specific reporting requirements at the local, regional, or state level pertaining to releases of this material

US State Regulations

California Proposition 65

This product does not contain any Proposition 65 chemicals

U.S. State Right-to-Know Regulations

Chemical Name	New Jersey	Massachusetts	Pennsylvania
Zinc alkylidithiophosphate 4250-15-8	X		X

U.S. EPA Label Information

EPA Pesticide Registration Number Not Applicable

16. OTHER INFORMATION

NFPA	Health hazards 1	Flammability 1	Instability 0	Physical and Chemical Properties -
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161 Simplex 150 Hydraulic

Revision Date 8-Jun-2015

HMIS Health hazards 1 Flammability 1 Physical hazards 0 Personal protection X

Issue Date 11-Feb-2013

Revision Date 8-Jun-2015

Revision Note

No information available

Disclaimer

The information provided in this Material 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