Rev. 8/2017

STEPP MFG™

ASPHALT MAINTENANCE EQUIPMENT

SPHD

Dump Discharge

STEPP PREMIX HEATERS

OPERATIONS/MAINTENANCE/PARTS MANUAL

Diesel Burner Systems

12325 River Road North Branch MN 55056 ~ Phone: 651-674-4491 ~ Fax: 651-674-4221
www.steppmfg.com

Warranty

Stepp Manufacturing Company Inc. hereby warrants to the original purchaser that products manufactured by Stepp Mfg. will be free from defects in material and workmanship for a period of one (1) year from the date of purchase.

Stepp Mfg., at its discretion, will provide for the repair or replacement of any part found upon examination by Stepp Mfg. to be defective, except as noted below. Such repair or replacement will be free of charge to the original purchaser for a period of one (1) year from the date of purchase, except as noted below.

No warranty is extended to cover:
•Product pump wear or damage caused by foreign objects.
•Routine maintenance, cleaning, and adjustments.
•Parts/components that have been altered, misused, or improperly adjusted or maintained.
•Transportation to and from the place of warranty repair.
•Removal of material from equipment.

The following items are covered solely by their manufactures warranty:
•Engines
•Hydraulic components
•Burners
•Pumps
•Tires
•Other component parts

The following items are covered by a pro-rata warranty:
•Hoses that carry heated materials.
•Heating elements for hoses and wands.

Disclaimer of further warranty:
Stepp Mfg. makes no warranty, expressed or implied, other than this warranty. The implied warranties of merchantability and fitness for particular purpose are hereby disclaimed. Repair or replacement of products or parts proving to be defective in material or workmanship shall be the exclusive remedy for breach of this warranty.
Stepp Mfg shall not be liable for incidental or consequential damages including but not limited to: damages for inconvenience, rental or purchase of replacement equipment, for loss of profits, loss of material, or other loss resulting from breach of this warranty.
Stepp Mfg reserves the right to incorporate any changes in design into its products without obligation to make such changes on products previously manufactured.
Please see Warranty section for more details.

Stepp Manufacturing Co., Inc.
12325 River Road
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SPHD Stepp Hot Pack Dump Style Trailer

Introduction

Thank you for selecting Stepp highway maintenance equipment. We are confident you will be satisfied with the Stepp Hot Pack Dump Style Trailer. Stepp Manufacturing is backed by over 80 years of experience in the design and manufacture of highway maintenance equipment. This experience, along with our innovative design and unique features, make the Stepp Hot Pack Dump Style Trailer the fastest and most efficient hot box available. Continued research and development, along with input from you, the user, help make this possible.

To assure safe operation of this equipment, the operator must read and understand all operating procedures and safety notices contained in this manual. In addition, the operator must receive instruction from their supervisor, or the manufacturer, on how to safely operate the Stepp Hot Pack Dump Style Trailer. Contact the manufacture if any questions arise or if you desire training for additional staff members.

Operating instructions, adjustments, and periodic maintenance procedures are given so you, the operator, can keep your unit working like new and expect many years of dependable service from it. Remember, any machine, regardless of design or type, will perform only in relation to the way it is operated and the maintenance it receives.

Read this manual carefully and observe all Warnings and Cautions. If you have any recommendations or comments regarding this manual, please send them attention to: Brad Stepp in the Parts & Service Dept., Stepp Manufacturing Co. Inc., 12325 River Road, North Branch MN. 55056-6225 or call 651-674-4491 brad@steppmfg.com All comments we receive are reviewed and may be incorporated into future manuals.

When ordering parts or making any inquiry about the Stepp Hot Pack Dump Style Trailer, be sure to include the model number and VIN found on the data plate attached to the frame.
Brad Stepp 952-698-8121 brad@steppmfg.com
Zach Chafee 952-698-8129 zack@steppmdg.com

Description

The SPHD uses a tank, surrounded by an oil jacket. filled with heat transfer oil. The heat transfer oil is heated by a diesel fired burner. The temperature of the product and the heat transfer oil is automatically maintained by electronic temperature controls located at the operators station.

An optional tack tank is available to pre-heat the tack oil being used when making road repairs. The tack tank is heated with an independent diesel burner and controlled with a thermostat located at the operators station.

A pump may be installed on the tack tank to pump the tack material through dispensing equipment, such as a hose and wand. The pump is driven by the hydraulic system. The plumbing is purged of tack material when finished to prevent plumbing freeze-up. This is done by reversing the pump to suck the material out of the system. An optional flush tank may also be installed to further flush the system of any remaining material.

The dump hopper offers controlled discharge of the contents onto a duel shoveling platform, or directly onto the road surface if desired. The dump hopper is hydraulically operated by a scissor hoist remote controller located near operators station.

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IMPORTANT NOTICE!
This manual contains cautions and warnings that alert you to potential safety issues.

WARNING is used to inform you of conditions or operations that could cause serious injury or death.

CAUTION is used to inform you of conditions or operations that could cause damage to the equipment

NOTE is used to provide you with additional information that may be helpful or useful for a particular situation.

This manual explains the basic operations, maintenance and use of the Stepp SPHD Premix Heater. The main objective of this equipment is to maintain heat in patching material in order to repair paved surfaces.

Before Starting or Operating this Machine

Understand and observe all the following Warnings, Cautions, and Notes.

⚠ WARNING

- This equipment contains mechanical and heating components that may cause serious injury or death if not handled or maintained properly. All personnel must be properly trained in the operation and maintenance of this equipment.
- Before refueling, shut off the burners and allow all flames in the burner and pilot light on LP burners to fully extinguish. Shut off the engine if equipped with.
- Check fuel lines, fuel line connections, and all other components for leaks. If any leaks are found, they must be repaired before using the unit.
- Know the temperature required for the material being used, and do not exceed this temperature. Avoid over heating, as this may cause equipment damage, personal injury, and/or death.
- Never check or change heated oil when moisture is present in the tank. Depending on the temperature of the hot oil, the moisture may instantly boil causing hot oil to foam up and out of the tank causing severe burns.
- Do not operate the tack tank burner when the amount of material in the tank is less than 4" above the flues. Allow 20 minutes cool-down time after the burner has been shut off before exposing the flues. Exposed flues will over-heat and cause an explosion and/or fire.
- The tack tank cover must be unlatched when operating the tack tank burner. This is provided for emergency venting, in the event of a flash, preventing the tank from exploding.

⚠ CAUTIONS

- Know the materials being used and know the proper handling, heating, application, clean-up, and storage procedures. Not all materials are compatible with each other. Many materials have a very limited shelf life. Most materials require special handling procedures to prevent personal injury and/or equipment damage. Contact your material supplier and/or manufacturer for proper handling instructions. Equipment malfunction or damage due to improper handling or use of the materials is not covered by warranty.
- Do not exceed the maximum heating temperature or storage time as recommended by the material manufacturer. This may cause emulsion type materials to separate and become difficult or impossible to remove from the machine. Consult with the material manufacturer for recommendations.
- Over-agitation or circulation may cause emulsion type materials to separate and become difficult or impossible to remove from the machine. Consult with the material manufacturer for recommendations.
- Do not mix *Anionic* and *Cationic* materials together, as the materials attach to each other and will become difficult or impossible to remove from the machine. If you are not sure consult your material supplier.

NOTICE

- Become familiar with the Material Safety Data Sheet (MSDS) for the material being used in the machine and take appropriate safety precautions. Wear the proper clothing and protective gear as recommended by the MSDS and your safety director.
- DO NOT use the equipment unless it is in good condition.
- In case of skin contact with hot materials, dip into **cool**, **clean water immediately**. Do not wipe the product, as this will spread the burn.
- Consult the MSDS and contact your safety director for proper extinguishing of petroleum based fires.
- Carry a fire extinguisher(s) as recommended by your safety director.
- Notify your supervisor or the manufacturer if any questions arise concerning the operation of this equipment.

Loading Main Hopper

WARNING: *Hydraulic equipment can crush any object with tremendous force, causing injury or death. Keep yourself and all other persons clear when raising and lowering hopper.*

Hydraulically Operated Doors

1. Shut OFF the heating system.
2. Check area for door clearance.
3. Use the switch on the control panel to open and close doors.
4. Check that no foreign material has entered the equipment.
5. Check that the proper material is being used. If desired use release agent in the hopper to help prevent sticking.
6. Fill the hopper box with the desired amount of material.
7. Close doors.

Manually Operated Doors

1. Shut OFF the heating system.
2. Check area for door clearance and unlatch door hold downs.
3. Use the door arm to open the doors. You will have to move the door arm from the transport position to the operation position, pull out on the door arm and swing up to the transport position.
4. Check that no foreign material has entered the equipment. If desired use release agent in the hopper to help prevent sticking.
5. Check that the proper material is being used. This unit runs best with hot mix(275-350 deg), cold mix(150-250 deg), or a high performance cold mix(70-150 deg).
6. Fill the hopper box with the desired amount of material. SPHD 2.0 is 2 cubic yards or 3 ton and a SPHD 3.0 is 3 cubic yards or 4 ton.
7. Use the door arm to close the doors. You will have to unlatch the safety latch allowing the door to close. To move the arm from the operation position to the transport position, pull out on the door arm and swing down in to the transport position.

Loading Tack Tank

WARNING: *DO NOT overheat bituminous or emulsion materials, strictly observe the recommendations of the material manufacturer for melting and pouring temperatures.*

CAUTION: *Never load a tank with heated material when moisture is present in the tank. Thoroughly clean tank and pumping equipment when changing materials that are not compatible.*

1. Burners must be OFF when loading tack tank.
2. Verify that the proper material is being loaded. Typical a water base emulsion.
3. Fill the tack tank with the desired amount of material, this is a 40 gallon tank.
4. When transporting the unit, shut off the burner.

Hydraulic Dump

⚠ **WARNING:** *Hydraulic equipment can crush any object with tremendous force causing injury or death. Keep yourself and all other persons clear when operating hydraulic equipment.*

1. Find the magnet remote mounted toward rear curbside of unit.
2. Firmly press the “Up” button until desired dump height is reached.
3. Firmly press the “Down” button until units weight is planted on the frame rail.

NOTICE: *This system incorporates a 12 volt burner and blower assembly and burns #2 diesel fuel. A 12 volt battery and charging circuit supply power to the burner, blower motor, and thermostat. The charging circuit may consist of an engine driven alternator (diesel engine) or a stator (gas engine) mounted on the unit, and a hook-up to the tow vehicles charging system. The thermostat will automatically control the burners to maintain the desired temperature. The temperature of the material is shown on LCD digital displays.*

Igniting Burner

1. Check fuel tank for proper fuel type and quantity.
2. Set thermostat to the product manufacturers recommended level.
3. Turn ON burner power switch and the burner will ignite.
4. Operate battery charging device.

To Shut Off Burner

1. Set thermostat to the lowest setting, allow fan to run for 10 min.
2. Turn OFF burner power switch.

⚠ **CAUTION:** *The burner requires a minimum of 12 volts for proper operation. Lower voltag will cause poor combustion with excessive smoke and lack of heat and or burner malfunction will result. Assure the battery is fully charged and the charging circuit is operating properly for maximum performance. Confirm that your tow vehicle is supplying adequate voltage to the isolator. Should have 12 plus volts on the a pin of the isolator.*

Tack Tank (optional)

An optional tack tank is available to pre-heat the tack oil used to obtain better repairs. The tack tank incorporates its own heating system similar to the systems used to heat the Pre-Mix Heater. Burner operating instructions for the tack tank are included with the burner instructions for the Pre-Mix Heater main hopper on the previous pages.

Pumping System (optional w/ tack tank)

An optional pump may be installed on the tack tank to pump the tack material through dispensing equipment, such as a hose and wand. The pump may be driven by a gas or diesel engine, or by an electrical or hydraulic system. The plumbing must be purged of tack material when finished to prevent plumbing freeze-up. This is done by reversing the pump to suck the material out of the system. An optional flush tank may also be installed to further flush the system of any remaining material.

1. **Circulate.** In this operation the contents of the tack tank are pumped through the wand pressure control valve and directed back to the tank to aid in heating and mixing.
    a. Set wand pressure control valve to "Recirculate" position.
    b. Set valve on top of tank to "Product" position.
    c. Engage pump in “Forward” direction.
2. **Spray Wand.** In this operation the contents of the tank are pumped to the spray wand for application to the road surface.
    a. Set wand pressure control valve to "Wand" position.
    b. Set valve on top of tank to "Product" position.
    b. Engage pump in “Forward” direction.
    c. Open valve on spray wand to apply tack material.
3. **System Purge.** (suck back) In this operation the pump is “Reversed” to purge the product from the system.
    a. Disengage pump.
    b. Set wand pressure control valve to "Wand" position.
    c. Set valve on top of tank to "Product" position.
    d. Open valve on wand, then engage pump in “Reverse” for two minutes.
    e. Close valve and disengage pump.

1. **System Flush.** (optional) Flushing solvent is pumped through the pump and wand to clean material from the system. ⚠ **WARNING:** *Do not allow flushing solvent to contaminate the contents of the tack tank.*

   a. Disengage pump.

   b. Set wand pressure control valve to "Wand" position.

   c. Set valve on top of tank to "Flush" position.

   d. Place end of wand into suitable container. **NOTICE:** *Do not allow flushing solvent to splash out of container.*

   e. Engage pump in “Forward” position, then open the wand valve to flush.

   f. When complete, disengage pump and close valves.

   g. Dispose of flushing solvent in accordance with local, state, and federal laws.

Tack Tank- Low Level Shut Down (optional)

This system incorporates a float in the tack tank that is hooked to a switch. When the tack material reaches a level several inches above the flues, the burner or heater will be shut off to prevent equipment damage. This eliminates the need of someone continuously monitoring the level in the tack tank. The function of the low level shut down must be checked on a daily basis by the equipment operator and the calibration should be checked every six months and adjusted as necessary by a qualified technician.

1. **Operational Check (daily)**

   a. Ignite burner following the appropriate instructions.

   b. Manually trip the low level shut down switch located on the float shaft. This should cause the burner to shut down. If the burner does not respond correctly, contact a qualified service technician or call the manufacturer.

2. **Calibration Check (every 6 months)**

   a. Verify that the burner shuts down when the product reaches a level no less than 4" above the flues.

   b. Adjust by loosening the set screw on the switch cam and rotating the cam as necessary.

   c. Tighten set screw and verify adjustment.

Overnight Heaters (optional)

The overnight heaters are designed to pre-heat, or maintain the temperature of the heat transfer oil up to the capacity of the heating elements. This will decrease the amount of time necessary to bring the materials up to the recommended application temperatures.

The burner is automatically disconnected from the system and the electric heating elements are activated when the power cord is plugged in. The thermostats are set by the operator to prevent overheating.

1. **To Activate Overnight Heaters**
   a. Plug electrical cord into an outlet with a minimum 20 amp capacity and 240 volts.
   b. Set thermostats to recommended temperature provided by the material manufacturer, then turn on the heating control power switch. System operation is now automatic.

⚠ **CAUTION:** *Do not exceed the material manufacturers recommended heating cycles or heating times (pot life).*

Washdown Pump (optional)

The wash down pump is used to spray solutions on the shovel platform and your tools for clean-up, and to reduce sticking of the asphalt material.

To reduce the risk of fire, the burner is automatically disconnected from the system when the washdown selector switch is activated. However, the operator should verify that the burner is actually off for increased safety, in case of a malfunction in the system.

⚠ **WARNING:** *Washdown solutions may be extremely flammable, use caution and avoid spraying solution near any hot components, sparks, or flame. DO NOT smoke while operating the Washdown pump.*

1. **To Activate Washdown Pump**
   a. Place washdown selector switch in the "Washdown Pump" position.
   b. Verify burner has extinguished.
   c. Spray solution as needed. Avoid heated components, sparks, or flame.

PRE-MIX HEATER MAINTENANCE SCHEDULE

ITEM	OPERATION TO PERFORM	DAILY	EVERY WEEK	EVERY MONTH	EVERY 3MO	EVERY 6MO	EVERY YEAR
Burner Diffuser	Inspect burner diffuser for damage and deterioration.				X		
Burner Diffuser	Replace burner diffuser. Refer to parts list for P/N						X
Burner Fuel Nozzle	Replace fuel nozzle. Refer to parts section for P/N						X
Door Hinges And Slides	Lubricate with high temperature grease. Inspect for worn or damag-es components.				X		
Hose Assembly On Spray Wand	Inspect for cracks, fraying, or deterioration. Replace if needed with original equipment hose.		X				
Hose Assembly On Spray Wand	Replace with original equipment hose						X
Main Hopper	Clean out and inspect for cracks or other damage. Weld or repair as needed						X
Tack Tank (if equipped)	Cleanout and inspect for leaks, cracks or other damage.						X
Fuel Filter for Burner	Install new filter for diesel burner. Install new strainer for LP burner.					X	
Thermostats	Check for proper calibration, adjust as needed.	X					
Fuel Lines	Check for security, damage, and leaks. Replace with oem type hose as needed	X					
Fuel Tanks	Check for damage and leaks.	X					
Lights	Check for proper operations	X					

PRE-MIX HEATER MAINTENANCE RECORD

DATE	MAINTENANCE PERFORMED	HOUR METER	SERVICED BY

All maintenance items must be performed according to the maintenance schedules and documented for warranty coverage to be effective.

TROUBLE SHOOTING

REPLACEMENT PARTS

Light Package– Incandescent

Burner Rain Cover

Burner Rain Cover

Burner Rain Cover

Burner Enclosure

Battery Box w/ Charger

Battery Box w/ Charger

Control Box

Control Box

Recessed Strobe Light– Street Side

Recessed Strobe Light– Curb Side

Beacon Style Strobe Light

Pumping System for Tack Tank

Spray Wand for Pumping System

Washdown Assembly w/ Hose Reel

Compactor Plate Carrier

Shovel Cleaning Compartment

Consumer Warranty Guide

12325 River Road, North Branch, MN 55056~ Phone: 651-674-4491~ Fax: 651-674-4221 www.steppmfg.com

Introduction

Congratulations on your purchase of equipment built by Stepp Manufacturing for your asphalt maintenance needs. Your equipment has been designed and constructed to give you the most in performance, ease of use, and reliability. It is our desire that you will find operating the equipment both productive and profitable.

Warranty Procedures Through A Dealer

If your equipment requires repair, or needs parts for repair, please contact your area dealer. For repairs, the unit must be brought to the dealer for warranty. The dealer will require purchase date information, where the machine was purchased, and the Vehicle Identification Number (VIN) of the equipment. This information is needed so the dealer can submit a warranty claim. The dealer will repair your equipment, once warranty is approved, at no charge to you under the provisions of the warranty policy.

Warranty Procedures Direct Through The Factory *(when no servicing dealer is available in your area)*

Contact Stepp Manufacturing's Customer Service Department at (651) 674-4491.

In this situation, it may be advantageous for you to repair the machine and be reimbursed direct from the factory for warranty repairs. If you do not have the facilities, or the technicians, to perform the repair, the unit can be brought to a local repair facility. In either case, Stepp Manufacturing ***MUST*** be contacted and authorize the warranty repair ***PRIOR*** to any work being performed. If work is done prior to authorization, the warranty will not be honored.

If parts are required for the warranty repair, contact Customer Service at Stepp Manufacturing for replacements. When warranty replacement parts are shipped to you, a Warranty Authorization Number will be issued. If asked to return the defective parts, "tag" the defective parts with the Warranty Authorization Number, then package them in the same box the new parts were shipped in. Ten (10) business days will be allowed for return of the defective parts. If the defective part is not received back at the factory within this allotted time, the warranty will not be honored.

You will be billed for all parts shipped that require returning of defective parts. However, when the defective parts are returned and evaluated, you will receive credit for the cost of the part only. Thus, it is important that all defective parts are turned to Stepp Manufacturing in the allotted ten (10) day period.

Engine Warranty Claims

When a warranty issue develops with the engine, bring the unit to the engine manufacturer nearest authorized service center for repair. Be prepared to supply them with proof of purchase information with purchase dates.

Stepp Manufacturing cannot process engine warranty claims. However, we will be happy to offer assistance in locating the nearest service center.

Equipment Owner Responsibilities

As the equipment owner, you are responsible for:

- Using the equipment in accordance with the correct operating procedures as shown in the operators manual.
- Assuring all maintenance items are completed in accordance with the operators/maintenance manuals.
- Transporting the equipment to the place where warranty repairs can be completed.
- Supplying purchase date and VIN information to establish warranty coverage.

General Warranty Statement
Stepp Manufacturing's One (1) Year Limited Warranty

Stepp Manufacturing Co., Inc. hereby warrants, to the original purchaser of new equipment, that products manufactured by Stepp Manufacturing will be free from defects in material and workmanship for a period of one (1) year from the date of purchase from Stepp Manufacturing.

Stepp Manufacturing, at is discretion, will provide for the repair or replacement of any part found, upon examination by Stepp Manufacturing, to be defective, except as noted below. Such repair or replacement shall be free of charge to the original purchaser of new equipment for a period of one (1) year from the date of purchase, except as noted below.

No warranty is extended to cover:

- Product pump wear or damage caused by foreign objects.
- Routine maintenance, cleaning, and adjustments.
- Parts or components that have been altered, misused, improperly adjusted, or improperly maintained.
- Transportation to and from the place of warranty repair.
- Removal of materials from equipment.

The following items are covered solely by their manufacturer's warranty:

- Engines
- Hydraulic components
- Burners
- Pumps
- Axles
- Tires
- Other component parts not solely manufactured by Stepp Manufacturing

The following items are covered by a pro-rata warranty:

- Hoses that carry heated materials
- Heating elements for material hoses and wands

Disclaimer of further warranty:

Stepp Manufacturing makes no warranty, expressed or implied, other than this warranty. The implied warranties of merchantability and fitness for a particular purpose are hereby disclaimed. Repair or replacement of products or parts proving to be defective in material or workmanship shall be the exclusive remedy for breach of this warranty.

Stepp Manufacturing shall not be liable for incidental or consequential damages. Including, but not limited to, damages for inconvenience, rental or purchase of replacement equipment, loss of profits, or other loss resulting from breach of this warranty.

Stepp Manufacturing reserves the right to incorporate any changes in design into its products without obligation to make such changes on products previously manufactured.

Twelve (12) Month Pro-Rata Limited Warranty
Heated Asphalt Hose and Heating Elements

Effective for Equipment Delivered After 5/1/2012

Stepp Manufacturing Co., Inc. hereby warrants to the original purchaser, on a pro-rated basis, that the heated asphalt hose and heating elements installed on NEW Stepp Manufacturing's equipment shall be free from defects in material and workmanship for period of twelve (12) months for the heated asphalt hose and six (6) months for the heating element.

In the event that a heated asphalt material hose or a heating element fails under normal use during the warranty period, Stepp Manufacturing will supply a replacement heated asphalt hose or heating element, along with one-half (0.5) hour for installation labor on a pro-rated adjustment basis.

- If the failure occurs under normal use within the first three (3) months from date of purchase, Stepp Manufacturing will supply a replacement, and provide for one-half (0.5) hour installation labor at no charge to the customer.
- If the failure occurs under normal use within the fourth (4th) through twelfth (12th) months, Stepp Manufacturing will supply a replacement, and provide for one-half (0.5) hour installation labor on a pro-rata basis.

The pro-rated adjustment is based on the total number of months elapsed since the purchase date of the new equipment from Stepp Manufacturing. This rate is then applied to the one-half (0.5) hour labor rate and the current suggested retail price of the proper replacement heated asphalt hose or heating element supplied by Stepp Manufacturing. This is the amount the customer will have to pay. Freight will not be included in the reimbursement. If a new heated asphalt hose or heating element is needed prior to warranty inspection, you will be billed for all parts shipped that require returning of defective parts. However, when the defective parts are returned and evaluated, you will receive credit for the cost of the part only. **Thus, it is important that all defective parts are turned in to Stepp Manufacturing in the allotted ten (10) day period, or warranty will be denied.**

In no case will the warranty coverage extend beyond the six (6) month period for the heating element or the twelve (12) month period for the heated asphalt hose, from the original purchase date of the new equipment from Stepp Manufacturing. *Physical damage is not covered by this warranty*. Physical damage may include, but is not limited to:

- Broken heating element (typically caused by repeated bending to less than a one (1) foot radius).
- Heated asphalt hoses burnt from the inside (typically caused by operating the heating element in an empty hose).
- External cuts or abrasions on the heated asphalt hose (typically caused by dragging on the ground).

The chart below shows the pro-rated amount, by percentage, that will be allowed by warranty, pending examination of the heated asphalt hose or heating element.

Heated Asphalt Hose		
Failure Date	**Warranty's Responsibility**	**Customer's Responsibility**
0-3 Months *0-90 Days*	100%	0%
3-6 Months *91-180 Days*	70%	30%
6-7 Months *181-211 Days*	60%	40%
7-8 Months *212-242 Days*	50%	50%
8-9 Months *243-273 Days*	40%	60%
9-10 Months *274-304 Days*	30%	70%
10-11 Months *305-335 Days*	20%	80%
11-12 Months *336-365 Days*	10%	90%
After 12 Months	0%	100%

Heating Element		
Failure Date	**Warranty's Responsibility**	**Customer's Responsibility**
0-3 Months *0-90 Days*	100%	0%
3-4 Months *91-121 Days*	60%	40%
4-5 Months *122-152 Days*	40%	60%
5-6 Months *153-180 Days*	20%	80%
After 6 Months	0%	100%

Warranty Claim Authorization Number: _____

Call Customer Service at 651-674-4491 to obtain prior approval or warranty will be denied.

Date of Authorization Request _____

Equipment Owner		Warranty to be Performed by	
Customer Name		Company Name	
Street Address		Address	
City/State/Zip		City/State/Zip	
Equipment Model #		Contact Name	
Equipment VIN		Contact Phone #	
Hour Meter Read			
Purchase Date		Date of Malfunction	
Dealer Purchased Form		Date of Repair	

Warranty Authorization		Signature for Authorization
Date of Malfunction		X
Date of Repair		

Symptoms / Diagnostics / Action

Symptoms	Diagnostics	Action
Describe the symptoms in detail, be as specific as possible. Ex: Burner ignites and runs for 35 seconds, then goes out.	*Describe issues found, be as specific as possible. Ex: Part failed due to loose connection, resulting in misalignment and premature wear.*	*Describe action taken, be as specific as possible. Ex: Removed damaged section of wire harness, soldered new leads in place, and insulated splices w/ heat shrink tubing.*

Parts and Labor

Labor Time to Correct Problem (reimbursed at $55/hour)		Parts Used to Correct Problem		
Labor Time (in hours)	Repair Made	Part Number	Description	Qty

Parts Return

All parts returned must be tagged with the warranty authorization number and a copy of this claim. Retain all parts until credit is received from the factory. When requested, return the parts, along with this claim, to:

Stepp Manufacturing Co., Inc.
Attn: Warranty Department
12325 River Road
North Branch MN 55056

***Note**: If defective parts are not returned within 10 days, or this warranty claim does not accompany the returned parts, the claim will be denied.

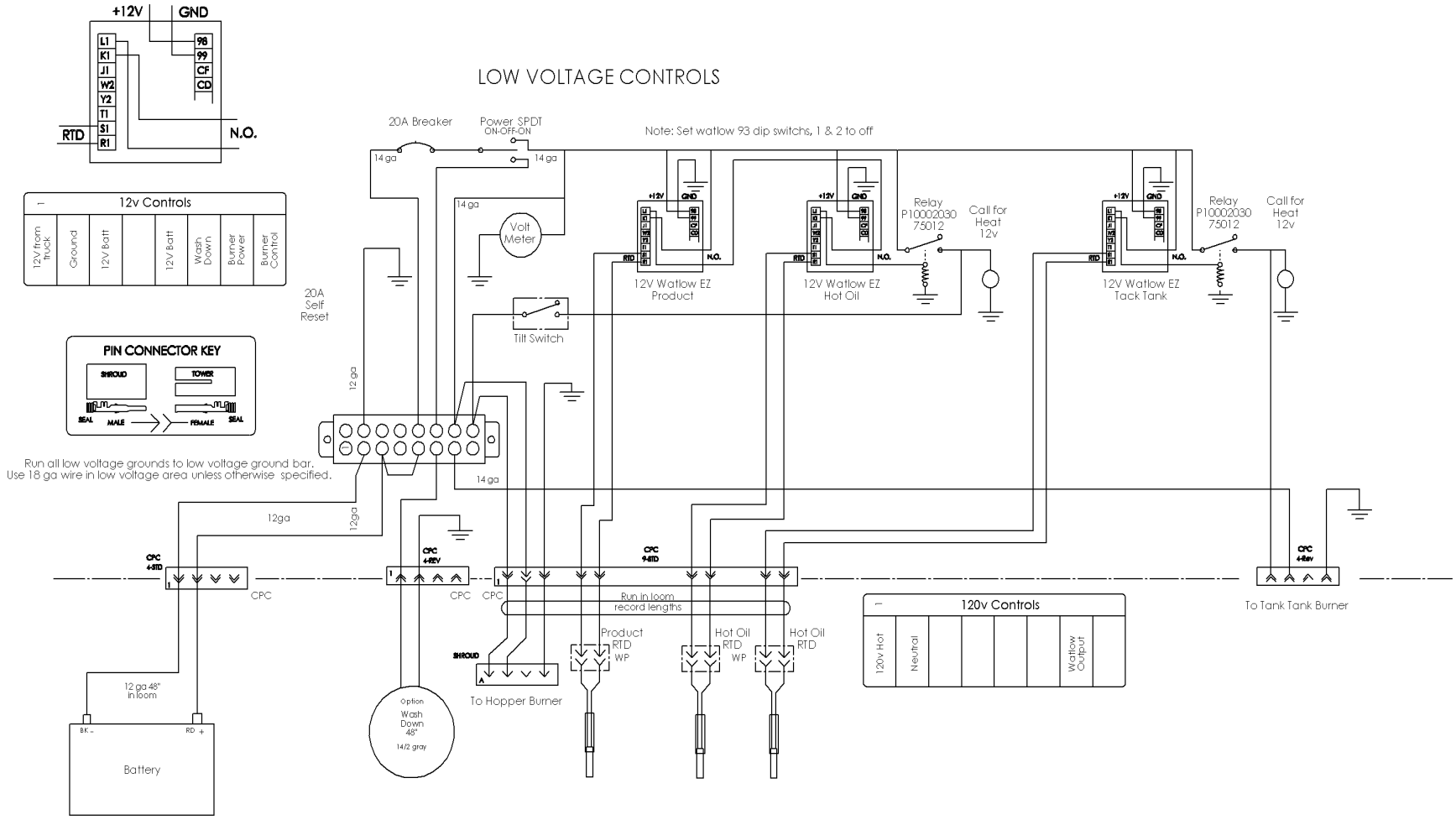
Office Use Only

Date Claim/Parts Received?		Is this a warrantable claim?	Yes	No
Claim Reviewed By:		Original Invoice # for Parts		
Date of Review:				

Warranty Totals

REVISIONS			
REV.	DESCRIPTION	DATE	APPROVED
B01	RELEASED FOR PROTOTYPE	09/24/2010	

LOW VOLTAGE CONTROLS



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ROUTINGS			TITLE: HEATING CONTROL SCHEMATIC SPHD
SCALE: 2:3	WEIGHT:	REF#	PART NO. S10007790 REV B01
		DO NOT SCALE DRAWING	SHEET 1 OF 1

HEAT TRANSFER OIL MSDS

MATERIAL SAFETY DATA SHEET

SECTION 1	PRODUCT AND COMPANY IDENTIFICATION

PRODUCT

Product Name: **TERESSTIC 460**
Product Description: Base Oil and Additives
Product Code: 201560305570, 604496-00, 97P933
Intended Use: Circulating/gear oil

COMPANY IDENTIFICATION

Supplier: **EXXON MOBIL CORPORATION**
3225 GALLOWS RD.
FAIRFAX, VA. 22037 USA

24 Hour Health Emergency	609-737-4411
Transportation Emergency Phone	800-424-9300
ExxonMobil Transportation No.	281-834-3296
MSDS Requests	713-613-3661
Product Technical Information	800-662-4525, 800-947-9147
MSDS Internet Address	http://www.exxon.com, http://www.mobil.com

SECTION 2	COMPOSITION / INFORMATION ON INGREDIENTS

No Reportable Hazardous Substance(s) or Complex Substance(s).

SECTION 3	HAZARDS IDENTIFICATION

This material is not considered to be hazardous according to regulatory guidelines (see (M)SDS Section 15).

POTENTIAL HEALTH EFFECTS

Low order of toxicity. Excessive exposure may result in eye, skin, or respiratory irritation. High-pressure injection under skin may cause serious damage.

NFPA Hazard ID:	Health: 0	Flammability: 1	Reactivity: 0
HMIS Hazard ID:	Health: 0	Flammability: 1	Reactivity: 0

NOTE: This material should not be used for any other purpose than the intended use in Section 1 without expert advice. Health studies have shown that chemical exposure may cause potential human health risks which may vary from person to person.

SECTION 4	FIRST AID MEASURES

INHALATION

Remove from further exposure. For those providing assistance, avoid exposure to yourself or others. Use adequate respiratory protection. If respiratory irritation, dizziness, nausea, or unconsciousness occurs, seek immediate medical assistance. If breathing has stopped, assist ventilation with a mechanical device or use

mouth-to-mouth resuscitation.

SKIN CONTACT

Wash contact areas with soap and water. If product is injected into or under the skin, or into any part of the body, regardless of the appearance of the wound or its size, the individual should be evaluated immediately by a physician as a surgical emergency. Even though initial symptoms from high pressure injection may be minimal or absent, early surgical treatment within the first few hours may significantly reduce the ultimate extent of injury.

EYE CONTACT

Flush thoroughly with water. If irritation occurs, get medical assistance.

INGESTION

First aid is normally not required. Seek medical attention if discomfort occurs.

SECTION 5	FIRE FIGHTING MEASURES

EXTINGUISHING MEDIA

Appropriate Extinguishing Media: Use water fog, foam, dry chemical or carbon dioxide (CO_2) to extinguish flames.

Inappropriate Extinguishing Media: Straight Streams of Water

FIRE FIGHTING

Fire Fighting Instructions: Evacuate area. Prevent runoff from fire control or dilution from entering streams, sewers, or drinking water supply. Firefighters should use standard protective equipment and in enclosed spaces, self-contained breathing apparatus (SCBA). Use water spray to cool fire exposed surfaces and to protect personnel.

Hazardous Combustion Products: Incomplete combustion products, Oxides of carbon, Smoke, Fume, Sulfur oxides, Aldehydes

FLAMMABILITY PROPERTIES

Flash Point [Method]: >288C (550F) [ASTM D-92]
Flammable Limits (Approximate volume % in air): LEL: 0.9 UEL: 7.0
Autoignition Temperature: N/D

SECTION 6	ACCIDENTAL RELEASE MEASURES

NOTIFICATION PROCEDURES

In the event of a spill or accidental release, notify relevant authorities in accordance with all applicable regulations. In the event of a spill or accidental release, notify relevant authorities in accordance with all applicable regulations. US regulations require reporting releases of this material to the environment which exceed the applicable reportable quantity or oil spills which could reach any waterway including intermittent dry creeks. The National Response Center can be reached at (800)424-8802.

SPILL MANAGEMENT

Land Spill: Stop leak if you can do it without risk. Recover by pumping or with suitable absorbent.

Water Spill: Stop leak if you can do it without risk. Confine the spill immediately with booms. Warn other shipping. Remove from the surface by skimming or with suitable absorbents. 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.

ENVIRONMENTAL PRECAUTIONS

Large Spills: Dike far ahead of liquid spill for later recovery and disposal. Prevent entry into waterways, sewers, basements or confined areas.

SECTION 7	HANDLING AND STORAGE

HANDLING

Prevent small spills and leakage to avoid slip hazard.

Static Accumulator: This material is a static accumulator.

STORAGE

Do not store in open or unlabelled containers.

SECTION 8	EXPOSURE CONTROLS / PERSONAL PROTECTION

Exposure limits/standards for materials that can be formed when handling this product: When mists / aerosols can occur, the following are recommended: 5 mg/m³ - ACGIH TLV, 10 mg/m³ - ACGIH STEL, 5 mg/m³ - OSHA PEL.

NOTE: Limits/standards shown for guidance only. Follow applicable regulations.

ENGINEERING CONTROLS

The level of protection and types of controls necessary will vary depending upon potential exposure conditions. Control measures to consider:

No special requirements under ordinary conditions of use and with adequate ventilation.

PERSONAL PROTECTION

Personal protective equipment selections vary based on potential exposure conditions such as applications, handling practices, concentration and ventilation. Information on the selection of protective equipment for use with this material, as provided below, is based upon intended, normal usage.

Respiratory Protection: If engineering controls do not maintain airborne contaminant concentrations at a level which is adequate to protect worker health, an approved respirator may be appropriate. Respirator

selection, use, and maintenance must be in accordance with regulatory requirements, if applicable. Types of respirators to be considered for this material include:

No special requirements under ordinary conditions of use and with adequate ventilation.

For high airborne concentrations, use an approved supplied-air respirator, operated in positive pressure mode. Supplied air respirators with an escape bottle may be appropriate when oxygen levels are inadequate, gas/vapor warning properties are poor, or if air purifying filter capacity/rating may be exceeded.

Hand Protection: Any specific glove information provided is based on published literature and glove manufacturer data. Work conditions can greatly affect glove durability; inspect and replace worn or damaged gloves. The types of gloves to be considered for this material include:

No protection is ordinarily required under normal conditions of use.

Eye Protection: If contact is likely, safety glasses with side shields are recommended.

Skin and Body Protection: Any specific clothing information provided is based on published literature or manufacturer data. The types of clothing to be considered for this material include:

No skin protection is ordinarily required under normal conditions of use. In accordance with good industrial hygiene practices, precautions should be taken to avoid skin contact.

Specific Hygiene Measures: Always observe good personal hygiene measures, such as washing after handling the material and before eating, drinking, and/or smoking. Routinely wash work clothing and protective equipment to remove contaminants. Discard contaminated clothing and footwear that cannot be cleaned. Practice good housekeeping.

ENVIRONMENTAL CONTROLS

See Sections 6, 7, 12, 13.

SECTION 9	PHYSICAL AND CHEMICAL PROPERTIES

Typical physical and chemical properties are given below. Consult the Supplier in Section 1 for additional data.

GENERAL INFORMATION

Physical State: Liquid
Color: Brown
Odor: Characteristic
Odor Threshold: N/D

IMPORTANT HEALTH, SAFETY, AND ENVIRONMENTAL INFORMATION

Relative Density (at 15 C): 0.903
Flash Point [Method]: >288C (550F) [ASTM D-92]
Flammable Limits (Approximate volume % in air): LEL: 0.9 UEL: 7.0
Autoignition Temperature: N/D
Boiling Point / Range: > 316C (600F)
Vapor Density (Air = 1): > 2 at 101 kPa
Vapor Pressure: < 0.013 kPa (0.1 mm Hg) at 20 C
Evaporation Rate (n-butyl acetate = 1): N/D
pH: N/A
Log Pow (n-Octanol/Water Partition Coefficient): > 3.5
Solubility in Water: Negligible

Viscosity: 460 cSt (460 mm2/sec) at 40 C | 30.5 cSt (30.5 mm2/sec) at 100C
Oxidizing Properties: See Sections 3, 15, 16.

OTHER INFORMATION
Freezing Point: N/D
Melting Point: N/A
Pour Point: -6°C (21°F)
DMSO Extract (mineral oil only), IP-346: < 3 %wt

SECTION 10	STABILITY AND REACTIVITY

STABILITY: Material is stable under normal conditions.

CONDITIONS TO AVOID: Excessive heat. High energy sources of ignition.

MATERIALS TO AVOID: Strong oxidizers

HAZARDOUS DECOMPOSITION PRODUCTS: Material does not decompose at ambient temperatures.

HAZARDOUS POLYMERIZATION: Will not occur.

SECTION 11	TOXICOLOGICAL INFORMATION

ACUTE TOXICITY

Route of Exposure	Conclusion / Remarks
Inhalation	
Toxicity (Rat): LC50 > 5000 mg/m3	Minimally Toxic. Based on test data for structurally similar materials.
Irritation: Data available.	Negligible hazard at ambient/normal handling temperatures. Based on assessment of the components.
Ingestion	
Toxicity (Rat): LD50 > 2000 mg/kg	Minimally Toxic. Based on test data for structurally similar materials.
Skin	
Toxicity (Rabbit): LD50 > 2000 mg/kg	Minimally Toxic. Based on test data for structurally similar materials.
Irritation (Rabbit): Data available.	Negligible irritation to skin at ambient temperatures. Based on test data for structurally similar materials.
Eye	
Irritation (Rabbit): Data available.	May cause mild, short-lasting discomfort to eyes. Based on test data for structurally similar materials.

CHRONIC/OTHER EFFECTS
For the product itself:
Repeated and/or prolonged exposure may cause irritation to the skin, eyes, or respiratory tract.
Contains:
Base oil severely refined: Not carcinogenic in animal studies. Representative material passes IP-346, Modified Ames test, and/or other screening tests. Dermal and inhalation studies showed minimal effects; lung non-specific infiltration of immune cells, oil deposition and minimal granuloma formation. Not sensitizing in test animals.

Additional information is available by request.

The following ingredients are cited on the lists below: None.

--REGULATORY LISTS SEARCHED--

1 = NTP CARC	3 = IARC 1	5 = IARC 2B
2 = NTP SUS	4 = IARC 2A	6 = OSHA CARC

SECTION 12	ECOLOGICAL INFORMATION

The information given is based on data available for the material, the components of the material, and similar materials.

ECOTOXICITY

Material -- Not expected to be harmful to aquatic organisms.

MOBILITY

Base oil component -- Low solubility and floats and is expected to migrate from water to the land. Expected to partition to sediment and wastewater solids.

PERSISTENCE AND DEGRADABILITY

Biodegradation:

Base oil component -- Expected to be inherently biodegradable

BIOACCUMULATION POTENTIAL

Base oil component -- Has the potential to bioaccumulate, however metabolism or physical properties may reduce the bioconcentration or limit bioavailability.

SECTION 13	DISPOSAL CONSIDERATIONS

Disposal recommendations based on material as supplied. Disposal must be in accordance with current applicable laws and regulations, and material characteristics at time of disposal.

DISPOSAL RECOMMENDATIONS

Product is suitable for burning in an enclosed controlled burner for fuel value or disposal by supervised incineration at very high temperatures to prevent formation of undesirable combustion products.

REGULATORY DISPOSAL INFORMATION

RCRA Information: The unused product, in our opinion, is not specifically listed by the EPA as a hazardous waste (40 CFR, Part 261D), nor is it formulated to contain materials which are listed as hazardous wastes. It does not exhibit the hazardous characteristics of ignitability, corrositivity or reactivity and is not formulated with contaminants as determined by the Toxicity Characteristic Leaching Procedure (TCLP). However, used product may be regulated.

Empty Container Warning Empty Container Warning (where applicable): Empty containers may contain residue and can be dangerous. Do not attempt to refill or clean containers without proper instructions. Empty drums should be

completely drained and safely stored until appropriately reconditioned or disposed. Empty containers should be taken for recycling, recovery, or disposal through suitably qualified or licensed contractor and in accordance with governmental regulations. DO NOT PRESSURISE, CUT, WELD, BRAZE, SOLDER, DRILL, GRIND, OR EXPOSE SUCH CONTAINERS TO HEAT, FLAME, SPARKS, STATIC ELECTRICITY, OR OTHER SOURCES OF IGNITION. THEY MAY EXPLODE AND CAUSE INJURY OR DEATH.

SECTION 14	TRANSPORT INFORMATION

LAND (DOT) : Not Regulated for Land Transport

LAND (TDG) : Not Regulated for Land Transport

SEA (IMDG) : Not Regulated for Sea Transport according to IMDG-Code

AIR (IATA) : Not Regulated for Air Transport

SECTION 15	REGULATORY INFORMATION

OSHA HAZARD COMMUNICATION STANDARD: When used for its intended purposes, this material is not classified as hazardous in accordance with OSHA 29 CFR 1910.1200.

NATIONAL CHEMICAL INVENTORY LISTING: KECI, EINECS, IECSC, PICCS, TSCA, ENCS, AICS, DSL

EPCRA: This material contains no extremely hazardous substances.

SARA (311/312) REPORTABLE HAZARD CATEGORIES: None.

SARA (313) TOXIC RELEASE INVENTORY: This material contains no chemicals subject to the supplier notification requirements of the SARA 313 Toxic Release Program.

The Following Ingredients are Cited on the Lists Below:

Chemical Name	CAS Number	List Citations
DIPHENYLAMINE	122-39-4	5
XYLENES	1330-20-7	5

--REGULATORY LISTS SEARCHED--

1 = ACGIH ALL	6 = TSCA 5a2	11 = CA P65 REPRO	16 = MN RTK
2 = ACGIH A1	7 = TSCA 5e	12 = CA RTK	17 = NJ RTK
3 = ACGIH A2	8 = TSCA 6	13 = IL RTK	18 = PA RTK
4 = OSHA Z	9 = TSCA 12b	14 = LA RTK	19 = RI RTK
5 = TSCA 4	10 = CA P65 CARC	15 = MI 293	

Code key: CARC=Carcinogen; REPRO=Reproductive

SECTION 16	OTHER INFORMATION

N/D = Not determined, N/A = Not applicable

THIS SAFETY DATA SHEET CONTAINS THE FOLLOWING REVISIONS:
No revision information is available.

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DGN: 2026174XUS (548955)

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HYDRAULIC OIL MSDS

MATERIAL SAFETY DATA SHEET

SECTION 1	PRODUCT AND COMPANY IDENTIFICATION

PRODUCT

Product Name: **UNIVIS N 32**
Product Description: Base Oil and Additives
Product Code: 8259
Intended Use: Hydraulic fluid

COMPANY IDENTIFICATION

Supplier: **Canada Imperial Oil Limited, An Affliate of Exxon Mobil Corporation**
P.O. Box 4029, Station A
Calgary, ALBERTA. T2P 3M9 Canada

24 Hour Health Emergency	519-339-2145
Transportation Emergency Phone	519-339-2145
Supplier General Contact	1-800-567-3776

SECTION 2	COMPOSITION / INFORMATION ON INGREDIENTS

Reportable Hazardous Substance(s) or Complex Substance(s)

Name	CAS#	Concentration*
HYDROTREATED LIGHT NAPHTHENIC DISTILLATE (PETROLEUM)	64742-53-6	20 - 30%

* All concentrations are percent by weight unless material is a gas. Gas concentrations are in percent by volume.

SECTION 3	HAZARDS IDENTIFICATION

This material is not considered to be hazardous according to regulatory guidelines (see (M)SDS Section 15).

POTENTIAL HEALTH EFFECTS

Low order of toxicity. Excessive exposure may result in eye, skin, or respiratory irritation. High-pressure injection under skin may cause serious damage.

NFPA Hazard ID:	Health: 0	Flammability: 1	Reactivity: 0
HMIS Hazard ID:	Health: 0	Flammability: 1	Reactivity: 0

NOTE: This material should not be used for any other purpose than the intended use in Section 1 without expert advice. Health studies have shown that chemical exposure may cause potential human health risks which may vary from person to person.

SECTION 4	FIRST AID MEASURES

INHALATION

Remove from further exposure. For those providing assistance, avoid exposure to yourself or others. Use adequate respiratory protection. If respiratory irritation, dizziness, nausea, or unconsciousness occurs, seek immediate medical assistance. If breathing has stopped, assist ventilation with a mechanical device or use mouth-to-mouth resuscitation.

SKIN CONTACT

Wash contact areas with soap and water. If product is injected into or under the skin, or into any part of the body, regardless of the appearance of the wound or its size, the individual should be evaluated immediately by a physician as a surgical emergency. Even though initial symptoms from high pressure injection may be minimal or absent, early surgical treatment within the first few hours may significantly reduce the ultimate extent of injury.

EYE CONTACT

Flush thoroughly with water. If irritation occurs, get medical assistance.

INGESTION

First aid is normally not required. Seek medical attention if discomfort occurs.

SECTION 5	FIRE FIGHTING MEASURES

EXTINGUISHING MEDIA

Appropriate Extinguishing Media: Use water fog, foam, dry chemical or carbon dioxide (CO2) to extinguish flames.

Inappropriate Extinguishing Media: Straight Streams of Water

FIRE FIGHTING

Fire Fighting Instructions: Evacuate area. Prevent runoff from fire control or dilution from entering streams, sewers, or drinking water supply. Firefighters should use standard protective equipment and in enclosed spaces, self-contained breathing apparatus (SCBA). Use water spray to cool fire exposed surfaces and to protect personnel.

Unusual Fire Hazards: Pressurized mists may form a flammable mixture.

Hazardous Combustion Products: Smoke, Fume, Sulfur oxides, Aldehydes, Oxides of carbon, Incomplete combustion products

FLAMMABILITY PROPERTIES

Flash Point [Method]: 165C (329F) [ASTM D-93]
Flammable Limits (Approximate volume % in air): LEL: 0.9 UEL: 7.0
Autoignition Temperature: N/D

SECTION 6	ACCIDENTAL RELEASE MEASURES

NOTIFICATION PROCEDURES

In the event of a spill or accidental release, notify relevant authorities in accordance with all applicable regulations. U.S. regulations require reporting releases of this material to the environment which exceed the reportable quantity or oil spills which could reach any waterway including intermittent dry creeks. The National Response Center can be reached at (800)424-8802.

SPILL MANAGEMENT

Land Spill: Stop leak if you can do it without risk. Recover by pumping or with suitable absorbent.

Water Spill: Stop leak if you can do it without risk. Confine the spill immediately with booms. Warn other shipping. Remove from the surface by skimming or with suitable absorbents. 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.

ENVIRONMENTAL PRECAUTIONS

Large Spills: Dike far ahead of liquid spill for later recovery and disposal. Prevent entry into waterways, sewers, basements or confined areas.

SECTION 7	HANDLING AND STORAGE

HANDLING

Prevent small spills and leakage to avoid slip hazard.

Static Accumulator: This material is a static accumulator.

STORAGE

Do not store in open or unlabeled containers.

SECTION 8	EXPOSURE CONTROLS / PERSONAL PROTECTION

Exposure limits/standards for materials that can be formed when handling this product: When mists / aerosols can occur, the following are recommended: 5 mg/m³ - ACGIH TLV, 10 mg/m³ - ACGIH STEL, 5 mg/m³ - OSHA PEL.

NOTE: Limits/standards shown for guidance only. Follow applicable regulations.

ENGINEERING CONTROLS

The level of protection and types of controls necessary will vary depending upon potential exposure conditions. Control measures to consider:

No special requirements under ordinary conditions of use and with adequate ventilation.

PERSONAL PROTECTION

Personal protective equipment selections vary based on potential exposure conditions such as applications, handling practices, concentration and ventilation. Information on the selection of protective equipment for use with this material, as provided below, is based upon intended, normal usage.

Respiratory Protection: If engineering controls do not maintain airborne contaminant concentrations at a level which is adequate to protect worker health, an approved respirator may be appropriate. Respirator selection, use, and maintenance must be in accordance with regulatory requirements, if applicable. Types of respirators to be considered for this material include:

No special requirements under ordinary conditions of use and with adequate ventilation.

For high airborne concentrations, use an approved supplied-air respirator, operated in positive pressure mode. Supplied air respirators with an escape bottle may be appropriate when oxygen levels are inadequate, gas/vapor warning properties are poor, or if air purifying filter capacity/rating may be exceeded.

Hand Protection: Any specific glove information provided is based on published literature and glove manufacturer data. Work conditions can greatly effect glove durability; inspect and replace worn or damaged gloves. The types of gloves to be considered for this material include:

No protection is ordinarily required under normal conditions of use.

Eye Protection: If contact is likely, safety glasses with side shields are recommended.

Skin and Body Protection: Any specific clothing information provided is based on published literature or manufacturer data. The types of clothing to be considered for this material include:

No skin protection is ordinarily required under normal conditions of use. In accordance with good industrial hygiene practices, precautions should be taken to avoid skin contact.

Specific Hygiene Measures: Always observe good personal hygiene measures, such as washing after handling the material and before eating, drinking, and/or smoking. Routinely wash work clothing and protective equipment to remove contaminants. Discard contaminated clothing and footwear that cannot be cleaned. Practice good housekeeping.

ENVIRONMENTAL CONTROLS

See Sections 6, 7, 12, 13.

SECTION 9	PHYSICAL AND CHEMICAL PROPERTIES

Typical physical and chemical properties are given below. Consult the Supplier in Section 1 for additional data.

GENERAL INFORMATION

Physical State: Liquid
Color: Yellow
Odor: Characteristic
Odor Threshold: N/D

IMPORTANT HEALTH, SAFETY, AND ENVIRONMENTAL INFORMATION

Relative Density (at 15 C): 0.87
Flash Point [Method]: 165C (329F) [ASTM D-93]
Flammable Limits (Approximate volume % in air): LEL: 0.9 UEL: 7.0
Autoignition Temperature: N/D
Boiling Point / Range: 229C (444F) - 512C (954F)
Vapor Density (Air = 1): N/D
Vapor Pressure: [N/D at 40 °C] | < 1 kPa (7.5 mm Hg) at 38C
Evaporation Rate (n-butyl acetate = 1): < 0.1
pH: N/A
Log Pow (n-Octanol/Water Partition Coefficient): > 3.5
Solubility in Water: Negligible
Viscosity: 32 cSt (32 mm2/sec) at 40 C
Oxidizing Properties: See Sections 3, 15, 16.

OTHER INFORMATION

Freezing Point: N/D
Melting Point: N/A
Pour Point: -48°C (-54°F)
DMSO Extract (mineral oil only), IP-346: < 3 %wt

SECTION 10	STABILITY AND REACTIVITY

STABILITY: Material is stable under normal conditions.

CONDITIONS TO AVOID: Excessive heat. High energy sources of ignition.

MATERIALS TO AVOID: Strong oxidizers

HAZARDOUS DECOMPOSITION PRODUCTS: Material does not decompose at ambient temperatures.

HAZARDOUS POLYMERIZATION: Will not occur.

SECTION 11	TOXICOLOGICAL INFORMATION

ACUTE TOXICITY

Route of Exposure	Conclusion / Remarks
Inhalation	
Toxicity (Rat): LC50 > 5000 mg/m3	Minimally Toxic. Based on assessment of the components.
Irritation: No end point data.	Negligible hazard at ambient/normal handling temperatures. Based on assessment of the components.
Ingestion	
Toxicity (Rat): LD50 > 2000 mg/kg	Minimally Toxic. Based on test data for structurally similar materials.
Skin	
Toxicity (Rabbit): LD50 > 2000 mg/kg	Minimally Toxic. Based on test data for structurally similar materials.
Irritation (Rabbit): Data available.	Negligible irritation to skin at ambient temperatures. Based on assessment of the components.
Eye	
Irritation (Rabbit): Data available.	May cause mild, short-lasting discomfort to eyes. Based on assessment of the components.

CHRONIC/OTHER EFFECTS

Contains:

Base oil severely refined: Not carcinogenic in animal studies. Representative material passes IP-346, Modified Ames test, and/or other screening tests. Dermal and inhalation studies showed minimal effects; lung non-specific infiltration of immune cells, oil deposition and minimal granuloma formation. Not sensitizing in test animals.

Additional information is available by request.

The following ingredients are cited on the lists below: None.

--REGULATORY LISTS SEARCHED--

1 = NTP CARC	3 = IARC 1	5 = IARC 2B
2 = NTP SUS	4 = IARC 2A	6 = OSHA CARC

SECTION 12	ECOLOGICAL INFORMATION

The information given is based on data available for the material, the components of the material, and similar materials.

ECOTOXICITY

Material -- Not expected to be harmful to aquatic organisms.

MOBILITY

Base oil component -- Low solubility and floats and is expected to migrate from water to the land. Expected to partition to sediment and wastewater solids.

PERSISTENCE AND DEGRADABILITY

Biodegradation:

Base oil component -- Expected to be inherently biodegradable

BIOACCUMULATION POTENTIAL

Base oil component -- Has the potential to bio accumulate, however metabolism or physical properties may reduce the bio concentration or limit bioavailability.

SECTION 13	DISPOSAL CONSIDERATIONS

Disposal recommendations based on material as supplied. Disposal must be in accordance with current applicable laws and regulations, and material characteristics at time of disposal.

DISPOSAL RECOMMENDATIONS

Product is suitable for burning in an enclosed controlled burner for fuel value or disposal by supervised incineration at very high temperatures to prevent formation of undesirable combustion products.

REGULATORY DISPOSAL INFORMATION

RCRA Information: The unused product, in our opinion, is not specifically listed by the EPA as a hazardous waste (40 CFR, Part 261D), nor is it formulated to contain materials which are listed as hazardous wastes. It does not exhibit the hazardous characteristics of ignitability, corrositivity or reactivity and is not formulated with contaminants as determined by the Toxicity Characteristic Leaching Procedure (TCLP). However, used product may be regulated.

Empty Container Warning PRECAUTIONARY LABEL TEXT: Empty containers may retain residue and can be dangerous. DO NOT PRESSURIZE, CUT, WELD, BRAZE, SOLDER, DRILL, GRIND OR EXPOSE SUCH CONTAINERS TO HEAT, FLAME, SPARKS, STATIC ELECTRICITY, OR OTHER SOURCES OF IGNITION; THEY MAY EXPLODE AND CAUSE INJURY OR DEATH. Do not attempt to refill or clean container since residue is difficult to remove. Empty drums should be completely drained, properly bunged and promptly returned to a drum reconditioner. All containers should be disposed of in an environmentally safe manner and in accordance with governmental regulations.

SECTION 14	TRANSPORT INFORMATION

LAND (DOT) : Not Regulated for Land Transport

LAND (TDG) : Not Regulated for Land Transport

SEA (IMDG) : Not Regulated for Sea Transport according to IMDG-Code

AIR (IATA) : Not Regulated for Air Transport

SECTION 15	REGULATORY INFORMATION

OSHA HAZARD COMMUNICATION STANDARD: When used for its intended purposes, this material is not classified as hazardous in accordance with OSHA 29 CFR 1910.1200.

NATIONAL CHEMICAL INVENTORY LISTING: DSL, TSCA

EPCRA: This material contains no extremely hazardous substances.

SARA (311/312) REPORTABLE HAZARD CATEGORIES: Delayed Health.

SARA (313) TOXIC RELEASE INVENTORY: This material contains no chemicals subject to the supplier notification requirements of the SARA 313 Toxic Release Program.

The Following Ingredients are Cited on the Lists Below:*

Chemical Name	CAS Number	List Citations
HYDROTREATED LIGHT NAPHTHENIC DISTILLATE (PETROLEUM)	64742-53-6	13, 17, 18
PHOSPHORODITHOIC ACID, O,O-DI C1-14-ALKYL ESTERS, ZINC SALTS (2:1) (ZDDP)	68649-42-3	15

--REGULATORY LISTS SEARCHED--

1 = ACGIH ALL	6 = TSCA 5a2	11 = CA P65 REPRO	16 = MN RTK
2 = ACGIH A1	7 = TSCA 5e	12 = CA RTK	17 = NJ RTK
3 = ACGIH A2	8 = TSCA 6	13 = IL RTK	18 = PA RTK
4 = OSHA Z	9 = TSCA 12b	14 = LA RTK	19 = RI RTK
5 = TSCA 4	10 = CA P65 CARC	15 = MI 293	

Code key: CARC=Carcinogen; REPRO=Reproductive
* EPA recently added new chemical substances to its TSCA Section 4 test rules. Please contact the supplier to confirm whether the ingredients in this product currently appear on a TSCA 4 or TSCA 12b list.

SECTION 16	OTHER INFORMATION

N/D = Not determined, N/A = Not applicable

THIS SAFETY DATA SHEET CONTAINS THE FOLLOWING REVISIONS:
No revision information is available.

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1. Tire Safety Information

This portion of the user's manual contain tire safety information as required by 49 CFR 575.6.

Section 2.0 contains "Steps for determining correct load limit-trailer"

Section 2.2 contains " Steps for determining correct load limit-tow vehicle"

Section 2.3 contains a Glossary of Tire Terminology, including "cold" inflation pressure,"
" maximum inflation pressure" , recommended inflation pressure", and other non-technical terms.

Section 2.4 contains information from NHTSA brochure entitled " Tire Safety-Everything Rides On It".
This brochure as well as the preceding subsections, describes the following items:

- Tire labeling, including a description and explanation of each marking on the tires, and information about the DOT Tire Identification Number (TIN)
- Recommended tire inflation pressure, including description and explanation of :
  - A. Cold Inflation Pressure
  - B. Vehicle Placard and location of vehicle
  - C. Adverse safety consequences of under inflation (including tire failure)
  - D. Measuring and adjusting air pressure for proper inflation
- Tire Care, including maintenance and safety practices
- Vehicle load limits, including a description and explanation of the following items:
  - A. Locating and understanding the load limit information, total load capacity, and cargo capacity
  - B. Calculating total and cargo capacities with varying seating configurations including Quantitative Examples showing/ illustrating how the vehicles cargo and luggage capacity decreases as combined number and size of occupant increases. This item is also discussed in section 3
  - C. Determining compatibility of tire and vehicle load capabilities
  - D. Adverse Safety consequences of overloading on handling and stopping tires

1.1 Steps for Determining Correct Load Limit-Trailer

Determining the load limits of a trailer includes more than understanding the load limits of the tires alone. On all trailers there is a Federal Certification/ VIN label that is located on the forward half of the left (road) side of the unit. This certification/ VIN label will indicate the trailer's Gross Vehicle Weight Rating (GBWR). This is the most particular axle can weigh. If there are multiple axles, the GAWR of each axle will be provided.

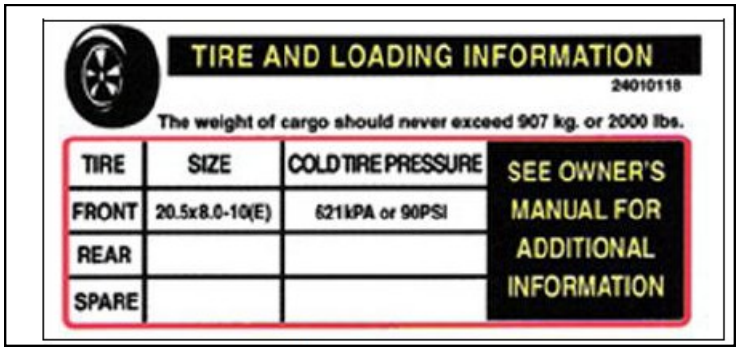
If your trailer has a GVWR of 10,000 pounds or less, there is a vehicle placard located in the same location as the Certification label described above. This placard provides tire and loading information. In addition, this placard will show a statement regarding maximum cargo capacity. Cargo can be added to the trailer, up to the maximum weigh specified on the placard. The combined weigh of the cargo is provided as a single number. In any case, remember: the total weight of a fully loaded trailer can not exceed the stated GVWR.

For trailers with living quarters installed, the weight of water and propane also need to be considered. The weight of fully filled propane containers is considered part of the weight of the trailer before it is loaded with cargo, and is not considered part of the disposable cargo load. Water however, is a disposable cargo weight about 800 pounds. If more cargo is being transported, water can be off-loaded to keep the total amount of cargo added to the vehicle with the limits of the GVWR so as not to overload the vehicle. Understanding this flexibility will allow you, the owner, to make choices that fit your travel needs.

When loading your cargo, be sure it is distributed evenly to prevent overloading front to back and side to side. Heavy items should be placed low and as close to the axle positions as reasonable. Too many items on one side may overload a tire. The best way to know the actual weigh of the vehicle is to weigh it at a public scale. Talk to our dealer to discuss the weighing methods needed toe capture the various weights related to the trailer. This would include the weight empty or unloaded, weights per axle, wheel, hitch or king-pin, and total weight.

Excessive loads and/or under inflation cause tire overloading and, as a result abnormal tire flexing occurs. This situation can generate an excessive amount of heat within the tire. Excessive heat may lead to tire failure. It is the air pressure that enables as tire to support the load., so proper inflation is critical. The proper air pressure may be found on the

1.1.1 Trailers 10,000 Pounds GVWR or Less



Tire and Loading Information Placard-Figure 1

1. Locate the statement, "The weight of cargo should never exceed XXX kg or XXX lbs." on your vehicle's placard. See figure1-1
2. This figure equals the available amount of cargo and luggage load capacity
3. Determine the combined weigh of luggage and cargo being loaded on the vehicle. The weight may not safely exceed the available cargo and luggage load capacity.

The trailer's placard refers to the tire information placard attached adjacent to or near the trailer's VIN (certification) label at the left front of the trailer.

1.1.2. Trailers Over 10,000 LBS. GVWR (Note: These are not required to have a tire information placard on the vehicle

1. Determine the empty weight of your trailer by weighting the trailer using a public scale or other means.
   - This step does not have to repeated
2. Locate the GVWR (Gross Vehicle Weight Rating) of the trailer on your trailer's VIN (certification) label.
3. Subtract the empty weight of your trailer form the GVWR stated on the VIN label. That weight is the maximum available cargo capacity of the trailer and may not be safely exceeded.

1.2. Steps for Determining Correct Load Limit-Tow Vehicle

1. Locate the statement, " The combined wright of occupant and cargo should never exceed XXX LBS., ' on your vehicle's placard
2. Determine the combined weight of the driver and passengers from who will be riding in your vehicle.
3. Subtract the combined weight of the driver and passengers from XXX Kilograms or XXX LBS.
4. The resulting figure equals the available amount of cargo and luggage capacity. For example. If the "XXX" amount equals 1400 LBS. and there are five 150 LB. passengers in your vehicle, the amount of available cargo and luggage
capacity is 650 LBS. (1400-750 (5X150) = 650 LBS.)
5.Determine the combined weight of luggage and cargo being loaded on the vehicle. That weight may not safely exceed the available cargo and luggage capacity calculated in step #4
6. If your vehicle will be towing a trailer, load from your trailer will be transferred to your vehicle. Consult the tow vehicle' s manual to determine how this weight transfer reduces the available cargo and luggage capacity of your Vehicle.

1.3 Glossary Of Tire Terminology

Accessory Weight
The combined weight (in excess of those standard items which may be replaced) of automatic transmission, power steering ,power brakes, power windows, power seats radio and heater, to extent that these items are available as factory-installed equipment (whether installed or not)

Bead
The part of the tire is made of steel wires, wrapped or reinforced by ply cords and that is shaped to fit the rim

Blas ply tire
A pneumatic tire in which ply cords that extend to the beads are laid at alternate angles substantially less than 90 degrees to the centerline of the tread

Carcass
The tire structure, expect tread and sidewalk rubber which, when inflated, bears the load

Chunking
The breaking away of pieces of the tread or sidewall

Cold Inflation Pressure
The pressure in the tire before you drive

Cord
The strands forming the piles in the tire

Cord Separation
The parting of cords from adjacent rubber compounds

Cracking
Any parting within the tread, sidewall, or inner liner of the tire extending to cord material

CT
A pneumatic tire with an inverted flange tire and rim system in which the rim is designed with rim flanges pointed radially inward and the tire is designed to fit on the underside of the rim in a manner that encloses the rim flanges inside the air cavity of the tire

Curb Weight
The weight of a motor vehicle with standard equipment including the maximum capacity of fuel, oil, and coolant, and, if so equipped, air conditioning and additional weight optional engine

Extra Load Tire
A tire designed to operate a higher loads and at higher inflation pressures than the corresponding standard tire

Groove
The space between two adjacent tread ribs

Gross Axle Weight Rating
The maximum weight that any axle can support, as published on the certification/VIN label on front left side of the trailer. Actual weight determined by weighing each axle on public scale, with the trailer attached to the towing vehicle

Hitch Weight
The downward force exerted on the hitch ball by the trailer coupler

Interliner
The layer (s) forming the inside surface of a tubeless tire that contains the inflating medium within the tire

Innerliner Separation
The parting of the innerliner from cord material in the carcass

Intended Outboard Sidewall
The sidewall that contains a white-wall, bears white lettering or bears manufacturer, brand, and/or model name molding that is higher or deeper than the same molding on the other sidewall of the tire or the outward facing sidewall of an asymmetrical tire that has a particular side that must always face outward when mounted on a vehicle.

Light Truck (LT) Tire
A tire designated by its manufacturer as primarily intended for use on lightweight trucks or multipurpose passenger vehicles.

Load Rating
The maximum load that a tire is rated to carry for a given inflation pressure

Maximum Load Rating
The load rating for a tire at the maximum permissible inflation pressure for that tire

Maximum Loaded Vehicle Weight
The sum curb weight, accessory weight, vehicle capacity weight, and production options weight

Measuring Rim
The rim on which a tire is fitted for physical dimension requirements

Pin Weight
The downward force applied to the 5th wheel or gooseneck ball, by the trailer kingpin or gooseneck coupler

Non-Pneumatic Rim
A mechanical device which, when a non-pneumatic tire assembly incorporates a wheel, supports the tire, and attaches, either integrally or separably, to the wheel center member and upon which the tire is attached

Non-Pneumatic Spare Tire Assembly
A non-pneumatic tire assembly intended for temporary use in place of one of the pneumatic tires and rims that are fitted to a passenger car in compliance with requirement of this standard

Non-Pneumatic Tire
A mechanical device which transmits, either directly or through a wheel or wheel center member, the vertical load and tractive forces from roadway to the vehicle, generates the tractive forces that provide that directional control of the vehicle and does not rely on the containment of any gas or fluid or providing those functions

Non-Pneumatic Tire Assembly
A non-pneumatic tire, alone or in combination with a wheel or wheel center member, which can be mounted on a vehicle

Normal Occupant Weight
This means 68 kilograms (150 lbs.) time the number of occupants specified in the second column of Table 1 of 49 CFR 571.110.

Occupant Distribution
The distribution of occupants in a vehicle as specified in the third column of Table 1 of 49 CFR 571.110.

Open Splice
Any parting of any junction of tread, sidewall, or innerliner that extends to cord material

Outer Diameter
The overall diameter of an inflated new tire

Overall Width
The linear distance between the exteriors of the sidewalls of an inflated tire, including elevations due to labeling, decorations, or protective bands or ribs

Ply
A layer of rubber-coated parallel cords

Ply Separation
A parting of rubber compound between adjacent plies

Pneumatic Tire
A mechanical device made of rubber, chemicals, fabric and steel or other materials, that when mounted on an automotive wheel, provides the traction and contains the gas or fluid that sustains the load.

Production Options Weight
The combined weight of those installed regular production options weighing over 2.3 Kilograms (5lbs.) in excess of those standard items which they replace, not previously considered in curb weight or accessory weight, including heavy duty brakes, ride levelers, roof rack, heavy duty battery, and special trim.

Radial Ply Tire
A pneumatic tire in which the ply cords that extend to the beads are laid at substantially 90 degrees to the centerline of the tread

Recommended Inflation Pressure
This is the inflation pressure provided by the vehicle manufacture on the Tire Information Label and on the Certification/VIN tag.

Reinforced Tire
A tire designed to operate at higher loads and at higher inflation pressures than the corresponding standard tire.

Rim
A metal support for a tire or a tire and tube assembly upon which the tire beads are seated

Rim Diameter
This means the rim diameter and width

Rim Type Designation
This means the industry of manufacturer's designation for a rim by style or code

Rim Width
This means the normal distance between rim flanges

Section Width
The linear distance between the exteriors of the sidewalls of an inflated tire, excluding elevations due to labeling, decoration, or protective bands.

Sidewall
That portion of a tire between the tread and bead

Sidewall Separation
The parting of the rubber compound form the cord material in the sidewall

Special Trailer (ST) Tire
The "ST" is an indication the tire is for trailer use only

Test Rim
The rim on which a tire is fitted for testing and may be an rim listed as appropriate for use with that tire

Tread
That portion of a tire that comes into contact with the road

Tread Rib
A tread section running circumferentially around a tire

Treadwear Indicators (TWI)
The projections within the principal grooves designed to give a visual indication of the degrees of wear of the tread

Vehicle Capacity Weight
The rated cargo and luggage load plus 68 kilograms (150 lbs.) times the vehicle's designated seating capacity

Vehicle Maximum load On The Tire
The load on an individual tire that is determined by distributing to each axle its share of the curb weight, accessory weight, and normal occupant weight (distributed in accordance with Table 1 of CRF 49 571.110) and dividing by 2

Weather Side
The surface area of the rim not covered by the inflated tire

Wheel Center Member
In the case of a non-pneumatic tire assembly incorporating a wheel, a mechanical device which attaches, Either integrally or separably, to the non-pneumatic tire assembly not incorporating a wheel, a mechanical device which attaches, either integrally or separably, to the non-pneumatic tire and provides the connection between tire and the vehicle

Wheel Holding Fixture
The fixture used to hold the wheel and tire assembly securely during testing

1.4. Tire Safety-Everything Rides On It

The national Traffic Safety Administration (NHTSA) has published a brochure (DOT HS 809 361) that discusses all aspects of Tire Safety, as required by CFR 575.6 This brochure is reproduced in part below. It can be obtained and downloaded from NHTSA, free of charge, from the following website:

http:www.nhtsa.dot.gov/cars/rules/TireSafety/ridesonit/tireindex/ html

Studies of tire safety show that maintain proper tire pressure, observing tire and vehicle load limits (not carrying more weight in your vehicle than your tires or vehicle can safely handle), avoiding road hazards, and inspecting tires for cuts, slashes, and other irregularities are most important things you can do to avoid tire failure, such as tread separation or blowout and flat tires. These actions, along with other care and maintenance activities, can also:

- Improve vehicle handling
- Help protect you and others from avoidable breakdowns and accidents
- Improve fuel economy
- Increase the life of your tires

This booklet presents a comprehensive overview of tire safety, including information on the following topics:

- Basic tire maintenance
- Uniform Tire Quality Grading System
- Fundamental characteristics of tires
- Tire safety tips

Use this information to make tire safety a regular part of your vehicle maintenance routine. Recognize that the time you spend is minimal compared with inconvenience and safety consequences of a flat tire or other tire failure.

1.5. Safety First-Basic Tire Maintenance

Properly maintained tires improve the steering, stopping , traction and load-carrying capability of your vehicle underinflated tires and over loaded vehicles are a major cause of tire failure. Therefore as mentioned above, to avoid flat tires and other types of tire failure, you should maintain proper tire pressure, observe tire and vehicle load limits, avoid road hazards, and regularly inspect your tires.

1.5.1 Finding you vehicle's recommended tire pressure and load limits

Tire information placards and vehicle certification labels contain information on tires and load limits. These limits indicate the vehicle manufacturer's information including:

- Recommended tire size
- Recommended tire inflation pressure
- Vehicle capacity weight (VCW-the maximum occupant and cargo weight a vehicle is designed to carry)
- Front and rear gross axle weight ratings (GAWR-the maximum weight the axle systems are designed to carry)

Both placards and certification labels are permanently attached to the trailer near the left front

1.5.2. Understanding Tire Pressure and Load Limits

Tire inflation pressure is the level of air in the tire that provides it with load-carrying capacity and affects the overall performance of the vehicle. The tire inflation pressure is a number that indicates the amount of air Pressure-measured in pounds per square inch (psi) -a tire requires to be properly inflated. (you will also find this number on the vehicle information placard expressed in kilopascals (kpa), which is the metric measure used internationally)

Manufacturers of passenger vehicles and light truck determined this number based on the vehicle's design load limit, that is , the greatest amount of weight a vehicle can safely carry and the vehicles tire size. The proper tire pressure for your vehicle is referred to as the " recommended cold inflation pressure" (As you will read below, it is difficult to obtain the recommended tire pressure if your tires are not cold) because tires are designed to be used on more than one type of vehicle, tire manufactures list the "maximum" permissible inflation pressure" on the tire sidewall. This number is the greatest amount of air pressure that should ever be put in the tire under normal driving conditions.

1.5.3. Checking Tire Pressure

It is important to check your vehicle's tire pressure at least once a month for the following reasons:

- Most tire may naturally lose air over time
- Tire can lose air suddenly if you drive over pothole or other object or if you strike the curb when parking.
- With radial tires, it is usually not possible to determine underinflation by visual inspection

For convenience, purchases a tire pressure gauge to keep in your vehicle. Gauges can be purchased at tire dealerships, auto supply stores, and other retail outlets.

The recommended tire inflation pressure that vehicle manufacturers provide reflects the proper psi when a tire is cold. The term cold does not relate to the outside temperature. Rather, a cold tire is one that has not been driven on for at least three hours. When you drive, your tires get warmer, causing the air pressure within them to increase. Therefore, to get and accurate tire pressure reading, you must measure tire pressure when the tires are cold or compensate for extra pressure in warm tires.

1.5.4. Steps For Maintaining Proper Tire Pressure

- **Step 1:** Locate the recommended tire pressure on the vehicle's tire information placard, certification label, or the owner's manual.
- **Step 2:** Record the tire pressure of all tires
- **Step 3:** If the tire pressure is to high in any of the tires, slowly release air by gently pressuring on the tire valve stem with the edge of your tire gauge until you get to the correct pressure
- **Step: 4:** If the tire pressure is too low, note the difference between the measured and the correct tire pressure. These "missing" pounds of pressure are what you will need to add
- **Step 5:** At a service station, add the missing pounds of air pressure (except in cases in which the front and rear tires are supposed to have different amounts of pressure)

If you have been driving your vehicle and think that a tire is underinflated, fill it to the recommended cold inflation pressure indicated on your vehicle's tire information placard or certification label. While your tire may still be slightly underinflated due to the extra pounds of pressure in the warm tire, it is safer to drive air pressure that is slightly lower than the vehicle manufacturer's recommended cold inflation pressure than to drive with a significantly underinflated tire. Since this is a temporary fix, don't forget to recheck and adjust the tire's pressure when you can obtain a cold reading.

1.5.5. Tire Size

To maintain tire safety, purchase new tires that are the same size as the vehicle's original tires or another size recommended by the manufacturer. Look at the tire information placard, the owner's manual, or the sidewall of the tire you are replacing to find this information. If you have any doubt about the correct size to choose, consult with the tire dealer.

1.5.6. Tire Tread

The tire tread provides the gripping action and action traction that prevent your vehicle from slipping or sliding, especially when the road is wet or icy. In general, tires are not safe and should be replaced when the tread is worn down to 1/16 of an inch. Tire have built-in tread wear indicators that let you know when it is time to replace your tires. These indicators are raised sections spaced intermittently in the bottom of the tread grooves. When they appear "even" with the outside of the tread with Lincoln's head upside down and facing you. If you can see the top of Lincoln's head, you are ready for new tires.

1.5.7. Tire Balance and Wheel Alignment

To avoid vibration or shaking of the vehicle when a tire rotates, the tire must be properly balanced. This balance is achieved by positioning weights on the wheel to counterbalance heavy spots on the wheel-and-tire assembly. A wheel alignment adjusts the angles of the wheels so that they are positioned correctly relative to the vehicle's frame. This adjustment maximizes the life of your tires. These adjustments require special equipment and should be performed by a qualified technician.

1.5.8. Tire Repair

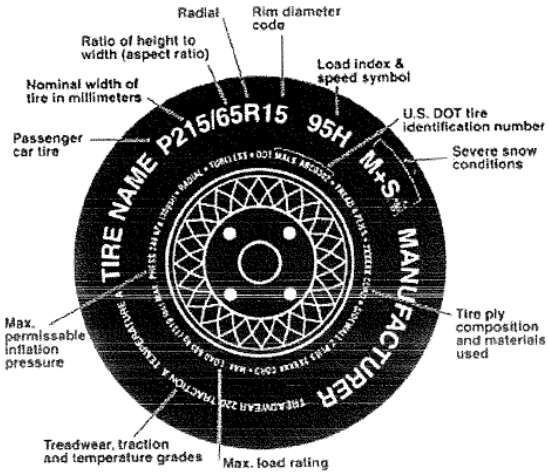
The proper repaid of a punctured tire requires a plug for the hole and a patch for the area inside the tire that surrounds the puncture hole. Punctures through the tread can be repaired if they are not too large, but punctures to the sidewall should be repaired. Tires must be removed from the rim to be properly inspected before being plugged and patched.

1.5.9. Tire Fundamentals

Federal Law requires tire manufactures to place standardized information on the sidewall of all tires. This information identifies and describes the fundamental characteristics of the tire and also provides a tire identification number for safety standard certification and in case of a recall.

1.5.9.1. Information on Passenger Vehicle Tires

Please Refer to the Diagram Below



P
The "P" indicates the tire is for passenger vehicles

Next Number
This three-digit number gives the width in millimeters of the tire from sidewall edge to sidewall edge. In general, the larger the number, the wider the tire.

Next Number
This two digit number, known as the aspect ratio, gives the tire's ration of height to width. Numbers of 70 or lower indicate a short sidewall for improved steering response and better overall handling on dry pavement.

R
The "R" stands for radial. Radial ply construction of tires has been the industry standard for the past 20 years

Next Number
This two-digit number is the wheel or rim diameter in inches. If you change your wheel size, you will have to purchase new tires to match the new wheel diameter.

Next Number
This two-or three digit number is the tire's load index. It is a measurement of how much weight each tire can support. You may find this information in your owner's manual.

M + S
The " M + S" or "M/S" indicates that the tire has some mud and snow capability. Most radial tires have these markings; hence they have some mud and snow capability.

Speed Rating
The speed rating denotes the speed at which a tire is designed to be driven for extended periods of time. The ratings range from 99 miles per hour (mph) to 186 mph. These ratings are listed below. Note: You many not find this information on all tires because it not required by law.

Tire Safety Information

Letter Rating	Speed Rating
Q	99 Mph
R	106 Mph
S	112 Mph
T	118 Mph
U	124 Mph
H	130 Mph
V	149 Mph
W	168* Mph
Y	186* Mph

* For tires with a maximum speed capability over 149 mph, tire manufacturers sometimes use the letters ZR. For those with a maximum speed capability over 186 mph, tire manufacturers always use the letters ZR

U.S. DOT Tire Identification Number
This begins with the letters " DOT" and indicates that the tire meets all federal standards. The next two numbers or letters re the plant code where it was manufactured, and the last four numbers represent the week and year the tire was built. For example, the numbers 3197 means the 31st week of 1997. The other numbers are marketing codes used at the manufacture's discretion. This information is used to contact consumers if a tire defect requires a recall.

Tire Ply Composition and Materials Used
The number of plies indicates the number of layers of rubber-coated fabric in tire. In general, the greater the number plies, the more weight a tire can support. Tire manufactures also must indicate the materials in the tire, which include steel, nylon, polyester, and others

Maximum Load Rating
This number indicated the maximum load in kilograms and pounds that can be carried by the tire

Maximum Permissible Inflation Pressure
This number is the greatest amount of air pressure that should ever be put in the tire under normal driving conditions

1.5.9.2. UTQGS Information

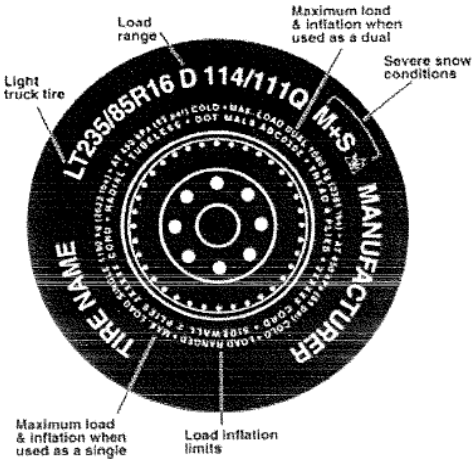
Treadwear Number
This letter indicated the tire's wear rate. The higher the treadwear number is, the longer it should take for tread wear down. For example, a tire graded 400 should last twice as long as a tire graded 200.

Traction Letter
This letter indicates a tire's ability to stop on wet pavement. A higher graded tire should allow you to stop your car on wet roads in a shorter distance than a tire with lower grade. Traction is graded form highest to lowest as "AA", "A","B", and "C".

Temperature Letter
This letter indicates a tire's resistance to heat. The temperature grade is for a tire that is inflated properly and not overloaded. Excessive speed, udnerinflation or excessive loading, either separately or in commination, can cause heat build-up and possible tire failure. From highest to lowest, a tire's resistance to heat is graded as "A", "B", or "C"

1.5.9.3. Additional Information on Light Truck Tires

Please refer to the following diagram



Tire for light trucks have other markings besides those found on the sidewalls of passenger tires.

LT
The "LT" indicates the tire is for light truck or trailers.

ST
An "ST" is an indication the tire is for trailer use only

Max. Load Dual KG (lbs.) at kPa (psi) Cold
This information indicates the maximum load and tire pressure when the tire is used as a dual, that is, when four tires are put on each rear axle (a total of six or more tires on the vehicle)

Max. Load Single KG (lbs.) at kPa (psi) Cold
This information indicates the maximum load and tire pressure when the tire is used as a single

Load Range
This information identifies the tire's load-carrying capabilities and it inflation limits

1.6. Tire Safety Tips

Preventing Tire Damage

- Slow down if you have to go over a pothole or other objects in the road
- Do not run over curbs or other foreign objects in the roadway, and try not to strike the curb when parking.

Tire Safety Checklist

- Check tire pressure regularly (at least once a month), including the spare
- Inspect tires for uneven wear patterns on the tread, cracks, foreign objects, or other signs of wear or trauma
- Remove bits of glass and foreign objects wedges in the tread
- Make sure your tire valves have valve caps
- Check tire pressure before going on a long trip
- Do no overload your vehicle. Check the tire information and loading placard or user's manual of the maximum recommended load for the vehicle