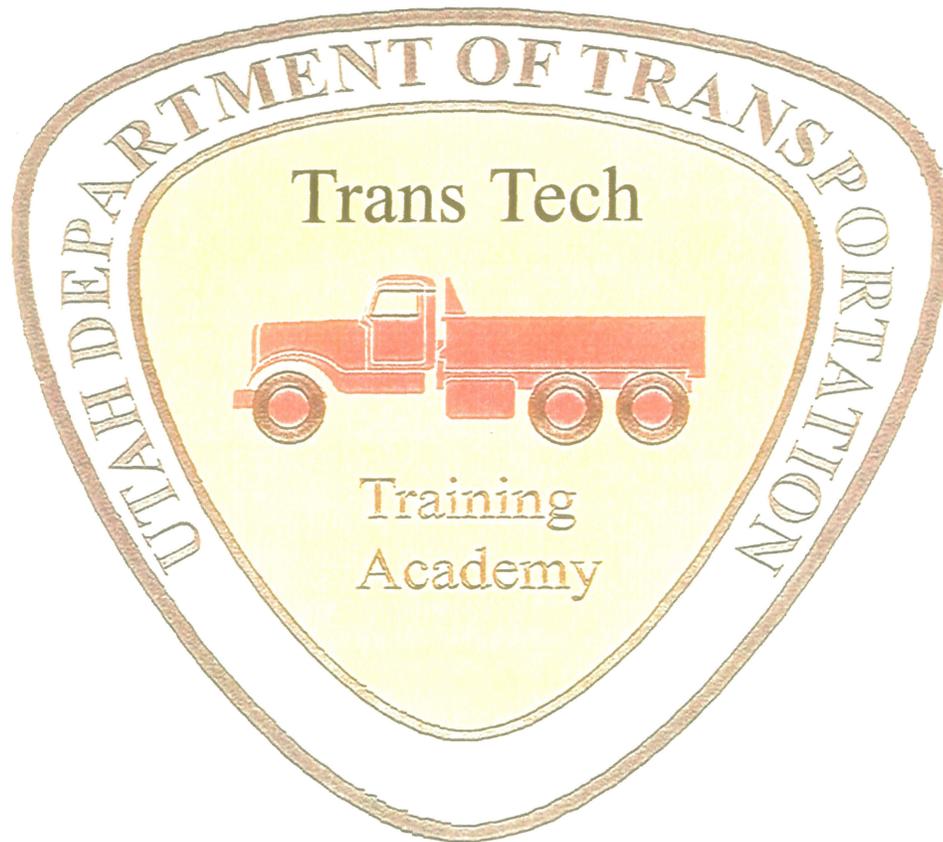


TRANSPORTATION TECHNICIAN  
TRAINING MANUAL





# **Code of Ethics**

# Transportation Technician Training Academy

Dress Code  
Code of Ethics

## Class Room

Attention: Staff, Instructors and Visitors you must have the following

Neat, clean, casual cloths. No Tank tops. Shoes (No Sandals)(No Shorts)

## Field Work

Attention: Staff, Instructors and Visitors you must have the following for Field activities.

Work Clothes (No Shorts)

UDOT orange shirt and hat.

Steele Toe Boots

Gloves (Optional)

Safety Vest (Optional)

Employees are expected to abide by all policies and procedures of the Department. Remember you are all professionals, so lets dress and act like it. Obscene language and gestures **will not be tolerated.**

## Academy Field Trainers Fall 2006

### Region 1 Trainers

Troy Bruner  
Loyd Muhlestein

Loader  
Air Brakes

### Region 2 Trainers

Dave Stallworth  
Jerold Willoughby

Backhoe  
Truck & Pup

### Region 3 Trainers

Gunner Steele  
Troy Johnson  
Roland Ivie

Truck & Pup  
Transport/Loader  
Backhoe

### Price Trainers

Tim Turner  
Dan Allred

Loader  
Tractor Mower  
Truck & Pup

### Richfield Trainers

Dallas Barnhurst  
Brent Jessen  
Jeff Olsen

Truck & Pup  
Transport/Loader  
Tractor Mower

### Cedar Trainers

Rance Bess  
Grant Bagley

Truck & Pup  
Loader

### Central Equipment

District Trainer  
District Trainer

Tractor Mower  
Backhoe

# **A General Safety**

# UDOT RISK MANAGEMENT

## Call List

Office (801) 965-4096

Office Cell: (801) 633-4994

Fax: (801) 965-4838

4701 South 2700 West, Box 148430, Salt Lake City, Utah 84114-8430

### **Warren Grames**

Office..... 965-4272

Cell.....870-1380

### **Sandra Halladay**

Office.....964-4556

Cell.....633-4808

### **Cindy Borland**

Office.....965-4961

Cell.....633-5444

### **Fara Williams**

Office.....965-4715

Cell.....633-4994

### **Garr Ovard**

Office.....965-3858

Cell.....870-1382

### **Reini Ruf**

Office.....965-4267

Cell.....870-1382

### **REGION 1**

Area code (801)

#### **Keith Bladen**

Office.....620-1603

Cell.....791-2412

Fax.....620-1665

#### **Judy McDermott**

Office.....620-1621

### **REGION 2**

#### **Cathy Overstreet**

Office.....975-4909

Cell.....910-2030

Fax.....975-4944

#### **Travis Bair**

Office.....975-4093.

Cell.....910-2031

Fax.....

### **REGION 3**

Area Code: (801)

#### **Steve Bonner**

Office.....227-8015

Cell.....830-9505

Fax.....227-8061

#### **Pat Lowe**

Office.....227-3450

### **REGION 4**

### **PRICE**

Area code: (435)

#### **George Leighton**

Office.....637-1403

Pager... (800) 902-5998

Fax.....636-1471

### **RICHFIELD**

Area code: (435)

#### **Carl Johnson**

Office.....896-1303

Cell.....979-4552

Fax.....896-1308

### **CEDAR**

Area code: (435)

#### **Dan Webster**

Office.....865-5503

Cell.....691-1758

Fax.....865-5564

#### **Teri Peterson**

Office.....865-5521

### **STATE RISK MGT.**

Office. (801)...538-9560

Fax.....538-9597

#### **Jim Christensen**

Office.....538-9574

Pager.....241-1603

#### **Jim Sefandonakis**

Office.....538-9560

#### **Lee Bennion**

Office.....538-9578

Cell.....597-9916

#### **Tim Villnave**

Office.....538-9592

## General Safety Orientation

Reinhard Ruf CCS, UDOT - Safety Director

OSHA considers a "construction work site" to be an exceptionally dangerous work place. While about 5% of the nation's work force is engaged in construction, almost 25 percent of all work place fatalities and serious injuries occur in construction sites. Construction jobs that are around moving traffic are among the most dangerous of all construction sites. OSHA's classification of "construction" includes:

- Site Preparation
- Excavation and Actual Construction
- Maintenance and Alteration
- Demolition and Remediation

Pretty much everything we do at the Utah Department of Transportation falls under the *OSHA 29 CFR 1926 Construction Safety Standard*.

1. **Right To Know - Material Safety Data Sheets (MSDS)** - Supervisors are personally responsible to make certain that MSDS forms are available for any materials used by workers. The workers must know the potential effects of any chemical compound that they may be exposed to in the performance of their work. MSDS sheets detail exposure limits, toxicity, degree of flammability, spill cleanup requirements and more. All workers are entitled to have a safe work place. "Failure to know" makes supervisors potentially liable for civil and criminal penalties and large judgments if such ignorance causes a worker injury.

Do not mislabel products, for example, placing gasoline into a fuel container marked "Diesel." Use only original marked containers for all products to be used or at a minimum place accurate markings on containers.

OSHA/UDOT requires daily job safety analysis and training that teaches or reviews the dangers faced while performing the work planned for that day.

2. **Personal Protective Equipment (PPE)**
  - Safety Toed Footwear - leather with minimum 5" upper permanent side shields

- Hard Hats
- Safety Glasses for normal use
- Face Shields for cutting, grinding, chipping, sawing, etc. in addition to safety glasses
- Goggles - required for applying or using caustic or acidic substances.
- Respiratory protection must be used whenever MSDS dictates, or any time that good judgment by a competent person dictates so.
- Chain saw or cut off saw use additionally requires face shields and also Kevlar® leggings.
- Gloves of leather or rubber may also be required as specified by MSDS.
- Hearing protection shall be used when working around noise levels of 85 dba or more.
- Orange outer clothing and reflective vests are required for any work near moving vehicles.
- Additional PPE such as protective suits may be required for specific risks.

3. **Exposure to Vehicular Traffic** - Employees exposed to moving equipment or vehicles of any kind (traffic, construction pickups, cement or gravel trucks, or moving heavy equipment) shall be provided with and shall wear orange warning vests or other suitable orange garments marked with or made of reflective or high visibility orange materials.

- 4(a). **Fall Protection**. OSHA mandates this is *not optional*. No worker will be exposed to a potential fall of 6 feet or greater without approved fall protection. Fall protection for a fall of six feet or more must include a fitted properly sized safety harness, shock absorbing lanyards, and a tie off point keeping the worker from striking the ground or other obstructions. Again, this is non-negotiable! Fall protection must be provided.

- 4(b). **Scaffold Safety** - Fall protection at 6 foot vertical, and 6 foot horizontal applies to scaffolds. Scaffolds must be constructed on a carefully structured flat base with feet secured to a wood pad or mud sill that is 10" x 18" and made of high quality planks. Scaffolds must have a screw jack on the base and must be squared and plumbed before frames or other scaffold components are added. Workers must use fall protection for work above 6 feet unless the scaffold sides are enclosed with solid footing, side rails at 42 inches and, mid rails and kick plates on any exposed sides.
- 4.(c) **Ladder Safety** - "A" frame ladders must be used locked in an "A". Do not use top two steps to work from. Extension ladders must be placed on a 4 to 1 ratio (four vertical to one horizontal). Ladders are to be placed on even footing that is clear of clutter especially around the base. The ladder must be secured at the top to keep it from sliding. Until the ladder is secured, it must be held in place until it is tied off at the top. Fall protection is required for work performed from a ladder.
5. **Trench Safety** - Rule of thumb; do not enter a dirt excavation deeper than four feet if the trench sides are not shored with an approved trench box, or certified shoring, unless the sides are cut back a minimum of 1 and ½ foot horizontal by 1 foot vertical. Slopes must be evaluated at least daily by a competent geo-technical individual.
6. **Confined Spaces** - OSHA defines a "confined space" as any place not designed for extended human occupation. It is a place with restricted access or entry, generally requiring the use of your hands to climb into.

### **Always Air Test the Environment Before Entering**

Areas of concern are: sumps, vaults, vessels such as tanks or pipes, trenches over four feet deep (especially around waste water), chemical lines and areas near sewers or organic substances which may break down and generate unknown hazards. Risks may include oxygen displacement

by heavier than air gases and explosive or toxic environments to name a few. Seventy-five percent of confined space fatalities occur in environments which were hazardous when entered but not tested. About sixty percent of confined space fatalities occur to rescuers who start rescues without proper PPE or training. In case of an emergency in a confined space — unless you are part of a designated rescue team . . . alert emergency rescue team or 911 for help. **Do not attempt a rescue on your own.**

7. **Respiratory Protection** - If a worker is required to use a respirator, including a two elastic dust mask, the worker must first complete an OSHA approved medical evaluation form which allows medical personnel to determine if a pulmonary function test must be administered to ascertain sufficient pulmonary capacity. Respirator use must also be preceded with testing to fit the respiratory to the user along with instruction for cleaning and storage. **CAUTION: Cartridge filters DO NOT manufacture oxygen.** Working in an environment containing less than 19.5% oxygen content could easily lead to permanent injury or death.
8. **Construction Equipment** - Beware of blind spots. Operators on large equipment have obstructed visibility and may not see you. Dozers, blades, loaders or haul trucks have blind spots extending 20 to 30 feet away from the equipment. Track hoes or mobile cranes have no reverse visibility. A tail spin from hoes results in frequent injuries or damage to equipment. Do not park near equipment. Do not walk around the back of equipment even if it is stationary. Make eye contact with equipment operators before walking into work areas. Construction equipment always has the right-of-way. You are responsible for your own self preservation.
9. **Vehicle Safety** - Seat belts are required and must be used in all motorized vehicles. Passengers are not allowed on vehicles - except

where sufficient seat belts are provided and used. Do not ride in pickup beds, in buckets of loaders or on the steps of equipment. Ground contacting tools must be down before leaving the equipment unattended. Trucks which are rated one ton or larger and hydraulic cranes must use wheel chocks when running and unattended. Equipment without Rollover Protective Structures (ROPS) are not allowed on UDOT projects. All equipment must be equipped with approved fire extinguishers.

10. **Backup Alarms** - No employer shall permit any equipment which has an obstructed rear view to be used in reverse gear unless the equipment has in operation a backup alarm. The alarm must be distinguishable above the surrounding noise level. As an alternative, an employee can signal that it is safe to backup. This includes vehicles and all heavy equipment.
11. **High Lift Use** - Workers operating any equipment must be properly trained in such use. Fork lifts are not to be used to elevate people. High lift or boom truck use requires that anyone in the basket be tied off with both a safety harness and shock absorbing lanyards connected to the equipment tie off loop (not the hand rail) before starting or moving the equipment.
12. **Housekeeping** - Construction sites must be kept clean of clutter and waste. Trash (including food waste, empty boxes, wrappers, bottles, cans, etc.) must be promptly disposed of as per MSDS instructions. Used boards shall have nails removed before being placed where workers can be exposed to injury. Refuse and trash shall promptly be placed in appropriate trash bins and regularly removed from the work area.
13. **Horse Play** - Under no circumstances shall any worker or support person on any construction job engage in horse play, goofing around, practical joking, giving false alarms, etc. Horse play will likely result in personal liability from injury occurring to individuals or damage to equipment. The construction site is an extremely dangerous environment under even the best conditions. OSHA expressly prohibits horse play at construction sites.
14. **Impalement Protection** - Workers shall be protected from exposed rebar and embedded bar, bolts and other protruding metal parts. Particularly rebar and all bar left in such a way as to be a potential impalement hazard shall be capped with covers designated to withstand direct impact. OSHA approved protection is limited to those caps which contain metal plates, or by metal or two inch lumber trays completely covering the exposed bar.
15. **Electrical Safety** - All temporary power must have a GFCI on each live 110 volt outlet. An assured grounding plan is always required. All cords and power tools are required to be inspected daily before use. Documentation is required for all electric cord and tool inspections.
16. **Fire Extinguishers on Fuel Trucks** - Any truck having an external fuel tank must have a minimum 20 BC capacity fire extinguisher. This applies even to trucks hauling fuel cans to fuel powered equipment. Any place where fuel containers are used to fuel equipment must have a minimum 20 BC extinguisher. Hot work such as welding or cutting must have a fire extinguisher at the immediate work area.
17. **Use Only Construction Approved Metal Gas Containers**. On construction sites OSHA requires use of metal containers that provide spring shut equipped spill protection in case of tip overs. They must have spark arrest capacity in the pouring spout. Plastic fuel cans are not allowed on construction projects.

**DISCLAIMER:** You have primary responsibility for your own safety and for the safety of workers you may supervise.

- Do not accept assignments you do not understand. Do not give assignments unless you are certain you and your workers understand the safe way to perform a given task.
- Do not exaggerate your level of knowledge and experience.
- Do not automatically assume your workers have adequate training without your having independent knowledge of their training and ability.
- Ask for clarification and training if you are asked to perform work you feel that you are not trained to safely perform.

**SUPERVISORS: . . . inspect, do not just expect!**

### Individual Checklist

Please Print Name: \_\_\_\_\_

Date: \_\_\_\_\_

Initial each line below **ONLY** after all of your questions have been answered.

1. \_\_\_\_\_ Right to Know - MSDS
2. \_\_\_\_\_ Personal Protective Equipment
3. \_\_\_\_\_ Exposure to Vehicular Traffic - Use of orange vests or orange outer wear.
4. \_\_\_\_\_ Fall Protection: OSHA Standard for 100% tie off
5. \_\_\_\_\_ Trench Safety
6. \_\_\_\_\_ Confined Spaces
7. \_\_\_\_\_ Respiratory Protection Standard
8. \_\_\_\_\_ Construction Dangers
9. \_\_\_\_\_ Vehicle Safety: Seat Belts, Wheel Chocks
10. \_\_\_\_\_ Use of backup alarms
11. \_\_\_\_\_ High Lift Use: Training required to operate equipment
12. \_\_\_\_\_ Housekeeping
13. \_\_\_\_\_ Horse play is expressly forbidden
14. \_\_\_\_\_ Rebar Impalement Protection
15. \_\_\_\_\_ Electrical safety requires GFCI for all temporary power
16. \_\_\_\_\_ Fire extinguishers required on trucks with exterior tanks or those hauling fuel
17. \_\_\_\_\_ OSHA Construction Standards require approved metal gas cans

**Radio**

## RADIO CHECKLIST

### Basic Operation:

Transmits and receives signals. Radio communication can be from vehicle to vehicle, handheld to handheld, vehicle to handheld, or handheld to vehicle.

Read operators manual. The mic must be hung up to scan channels. Radios must be inside the effective range of the other radio. Mounted radios have greater range than handheld radios.

We need to communicate in the mountains and behind them. The simplex just can't do the job effectively. By using repeaters, we can get rid of dead spots. The duplex system places repeaters at various locations, such as mountain tops, and on the tops of buildings. This eliminates the dead spots.

Take some time to look over your radio, and familiarize yourself with the controls and functions.

### General Operating Techniques:

Treat all airwaves with respect. Courtesy, which begins before you even pick up the microphone, is vital. If a channel is being used for emergency purposes, delay your non-emergency communication or switch to another channel.

Decide what you are going to say before you pick up the mic.

Remember, you are sharing this frequency with other people.

Listen before keying the mic.

Never break into a conversation unless your interruption is important.

Use ten-codes and standard phonetics whenever possible.

**General Information:**

Channels one (1) through six (6) correspond to six D.O.T. districts.

Channels seven (7) through ten (10) are variables. And channel eleven (11) is the statewide coordinating channel.

Never use these channels for vehicle to vehicle communication. Instead use channels twelve (12) and (13). These are designated for that purpose.

Channel fourteen (14) and fifteen (15) are "Flagger" channels, to be used by handheld radios.

**Safety Precautions:**

Always turn off your radio while fueling , or parking near gas pumps. Radio transmissions can ignite fumes and trigger an explosion.

Never use radios within 500 ft. of Blasting Caps.

Avoid using the radio when someone is touching or is within a couple of feet of the antenna.

When Jump starting your vehicle, you should always unplug your radio. An electrical system can seriously damage a connected radio.

Never put water or liquids on or near a radio. This can damage your radio if it is spilled on it.



DEPARTMENT OF PUBLIC SAFETY

OFFICIAL ASSOCIATED PUBLIC SAFETY  
COMMUNICATIONS OFFICERS "TEN SIGNALS"

10-0	Caution	10-26	Estimated Time of Arrival	10-53	Traffic Control	10-80	Chase in Progress
10-1	Signal Weak	10-27	License/Permit Information	10-54	Change to Channel _____	10-81	Breathalyzer Report
10-2	Signal Good	10-28	Ownership Information	10-55	Intoxicated Driver	10-82	Prisoner in Custody
10-3	Stop Transmitting	10-29	Records Check	10-56	Intoxicated Pedestrian	10-83	Confidential Information
10-4	Affirmative (OK)	10-30	Danger/ Caution	10-57	Hit and Run (F, PI, PD)	10-84	Visitors Present
10-5	Relay (To)	10-31	Pick Up _____	10-58	Airplane Crash	10-85	Victims Condition
10-6	Busy unless Urgent	10-32	Units Needed	10-59	Reckless Driver		A. Fair C. Critical
10-7	Out of Service	10-33	Help Me Quick	10-60	Out of Car on Violator at _____		B. Poor D. Possible Fatality E. Obvious Fatality
10-8	In Service	10-34	Time	10-61	Motor Impaction	10-86	Crime In Progress
10-9	Say Again	10-35	Reserved	10-62	Request Permission Car to Car	10-87	Abandoned Car
10-10	Negative	10-36	Security Check	10-63	Prepare to Make Written Copy	10-88	Man with Gun
10-11	On Duty	10-37	Reserved	10-64	Vandalism	10-89	Bomb Threat
10-12	Stand By	10-38	Reserved	10-65	Juvenile Problem	10-90	Bomb Alarm At _____
10-13	Existing Conditions	10-39	Urgent Use Light and Siren	10-66	Major Crime Alert	10-91	Bank Alarm At _____
10-14	Information	10-40	Silent Run, No Lights	10-67	Hot Message	10-92	Burglary
10-15	Message Delivered	10-41	Beginning Tour of Duty	10-68	Runaway Juvenile	10-93	Thell
10-16	Reply to Message	10-42	Ending Tour of Duty	10-69	Missing Person	10-94	Unnecessary Use of Radio
10-17	Enroute	10-43	Shuttle	10-70	Fire Alarm	10-95	Contact Your Home
10-18	Urgent	10-44	Permission to Leave	10-71	Nature of Fire	10-96	Out at Home
10-19	In Contact	10-45	Animal Carcass at _____	10-72	Progress Report on Fire	10-97	Mental Subject
10-20	Location	10-46	Assist Motorist	10-73	Rape	10-98	Test Signal
10-21	Call (____) by Phone	10-47	Investigate Suspicious Vehicle	10-74	Civil Disturbance	10-99	Prison Break
10-22	Disregard	10-48	Disturbing the Peace	10-75	Domestic Problem		Wanted/Status Indicated
10-23	Arrived at Scene	10-49	Traffic Light out at _____	10-76	Meat Complaintant		
10-24	Assignment Completed	10-50	Accident (F, PI, PD)	10-77	Return to _____		
10-25	Report to _____ (Meet)	10-51	Wrecker Needed	10-78	Back Up _____		
		10-52	Ambulance Needed	10-79	Notify Coroner		

# Trucks

# DRIVER'S VEHICLE INSPECTION REPORT

AS REQUIRED BY THE D.O.T. FEDERAL MOTOR CARRIER SAFETY REGULATIONS

DATE: \_\_\_\_\_ TIME: \_\_\_\_\_ A.M. \_\_\_\_\_ P.M.

TRUCK NO. \_\_\_\_\_ ODOMETER READING: \_\_\_\_\_

CHECK ANY DEFECTIVE ITEM AND GIVE DETAILS UNDER "REMARKS"

- |  |   |  |
|--|---|--|
| <input type="checkbox"/> Air Compressor            | <input type="checkbox"/> Engine           | <input type="checkbox"/> Radiator          |
| <input type="checkbox"/> Air Lines                 | <input type="checkbox"/> Engine oil level | <input type="checkbox"/> Rear End          |
| <input type="checkbox"/> Battery                   | <input type="checkbox"/> Fifth Wheel      | <input type="checkbox"/> Reflectors        |
| <input type="checkbox"/> Body                      | <input type="checkbox"/> Frame Assembly   | <input type="checkbox"/> Safety Equipment  |
| <input type="checkbox"/> Brake Accessories / Tools | <input type="checkbox"/> Front Axle       | Fire Extinguisher                          |
| <input type="checkbox"/> Brakes, Parking           | <input type="checkbox"/> Front Hub oil    | Reflective Triangles                       |
| <input type="checkbox"/> Brakes, Service           | <input type="checkbox"/> Fuel Tanks       | <input type="checkbox"/> Suspension System |
| <input type="checkbox"/> Backup Alarm              | <input type="checkbox"/> Horn             | <input type="checkbox"/> Starter           |
| <input type="checkbox"/> Cab                       | <input type="checkbox"/> Hydraulic level  | <input type="checkbox"/> Steering          |
| Interior Clutter Free                              | <input type="checkbox"/> Lights           | <input type="checkbox"/> Tailgate          |
| <input type="checkbox"/> Charging System           | Head - Stop                               | <input type="checkbox"/> Tires             |
| <input type="checkbox"/> Clutch Adjustment         | Tail - Dash                               | <input type="checkbox"/> Transmission      |
| <input type="checkbox"/> Coolant Level             | Turn Indicators                           | <input type="checkbox"/> Wheels and Rims   |
| <input type="checkbox"/> Coupling Devices          | <input type="checkbox"/> Mirrors          | <input type="checkbox"/> Windows           |
| <input type="checkbox"/> Defroster / Heater        | <input type="checkbox"/> Muffler          | <input type="checkbox"/> Windshield Wipers |
| <input type="checkbox"/> Drive Line                | <input type="checkbox"/> Oil Pressure     | <input type="checkbox"/> Other:            |
| <input type="checkbox"/> Exhaust                   |   |  |

TRAILER NO. \_\_\_\_\_

- |  |   |  |
|--|---|--|
| <input type="checkbox"/> Brake Connections   | <input type="checkbox"/> Hydraulic Coupler  | <input type="checkbox"/> Tailgate        |
| <input type="checkbox"/> Brakes              | <input type="checkbox"/> Hydraulic Cylinder | <input type="checkbox"/> Tires           |
| <input type="checkbox"/> Coupling Devices    | <input type="checkbox"/> Landing Gear       | <input type="checkbox"/> Wheels and Rims |
| <input type="checkbox"/> Coupling (King) Pin | <input type="checkbox"/> Lights - All       | <input type="checkbox"/> Other:          |
| <input type="checkbox"/> Hitch               | <input type="checkbox"/> Suspension System  |  |

Remarks: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

THE CONDITION OF THE ABOVE VEHICLE IS SATISFACTORY

DRIVER'S SIGNATURE: \_\_\_\_\_ DATE: \_\_\_\_\_

ABOVE DEFECTS CORRECTED

ABOVE DEFECTS NEED NOT BE CORRECTED FOR SAFE OPERATION OF VEHICLE

SUPERVISOR'S SIGNATURE: \_\_\_\_\_ DATE: \_\_\_\_\_

DRIVER'S SIGNATURE: \_\_\_\_\_ DATE: \_\_\_\_\_



CHECK EACH SHIFT	PRODUCT #	NUMBER OF SERVICE POINTS	FILTERS		
OPERATORS RESPONSIBILITY			APPLICATION	COMMODITY	MFG. #
ENGINE COOLANT	83	1	OIL	78533415393	FLTGRD LF691A
ENGINE CRANKCASE OIL LEVEL	10	1	FUEL	78533415427	FLTGRD FF3319
ENGINE AIR CLEANER		1	FUEL	08042913425	FLTGRD FS1001
DRAIN WATER FROM AIR TANKS		3	AIR PRIMARY	78533415373	FLTGRD AF25489
OIL HUBS (WHEEL BEARINGS)	40		AIR SECONDARY	78533415390	FLTGRD AF25470
CHECK HYDRAULIC OIL LEVEL	30	1	COOLANT	NOTE #8	
			HYDRAULIC	08042396590	FLTGRD HF6721
WALK AROUND			TRANSMISSION	78533415452	ALLISON 22540494

SERVICE INTERVALS	REFILL CAP.	NUMBER OF SERVICE POINTS	LUBRICATION PRODUCTS			
WEEKLY (LUBE AND/OR INSPECTION)			10	15	22	30
NOTE #1 AND #3		50	15W/40	50W	ATF	FHF
SPRING SHACKLES		50	FLEET	FLEET	AUTO-TRANS	FLEET
KING PINS, TIE ROD ENDS AND DRAG LINK		50	CRANKCASE	CRANKCASE	FLUID	HYDRAULIC
DRIVE LINE "U" JOINTS AND SPLINES		50	OIL	OIL	DEXRON III	FLUID
SLACK ADJUSTER AND "S" CAMS		50				
TAIL GATE LATCH		50				
ROLL TARPS		50				
DUMP BODY HINGE AND PIVOT POINTS		50				
STEERING COLUMN AND CLUTCH LINKAGE/BEARING		50				
			40	50		83
			GL	MPG		EXT/EG
			GEAR	MULTIPLE		ANTI-FREEZE
			LUBE	PURPOSE		EXTENDED
			80W/90	GREASE # 2		LIFE
MONTHLY NOTE #1 THRU #8						
CHECK ALL FLUID LEVELS INCLUDING						
AXLE OIL HUBS (STEERING AND TAG AXLES)		40				
POWER STEERING		22				
HYDRAULIC	30 GAL.	30				
TRANSMISSION (ALLISON)	48 QT.	22				
TRANSMISSION (FULLER)	23 PT.	15				
DIFFERENTIAL (FRONT)	30 PT.	40				
DIFFERENTIAL (REAR)	32 PT.	40				
FIRST 1000 MILES OR 25 HOURS						
CHANGE HYDRAULIC FILTER, BOTH ( see note #7)		2				
FIRST 5000 MILES OR 125 HOURS						
CHANGE TRANS FILTER ( see note #8 )		1				
EVERY 10,000 MILES (250 HR.) OR YEARLY						
TAKE OIL SAMPLES						
CHANGE ENGINE OIL	33 QT.	10				
CHANGE ENGINE OIL FILTER		1				
EVERY 20,000 MILES (500 HR.) OR YEARLY						
NOTE #1 THRU #8						
CHANGE FUEL FILTERS		2				
CHANGE HYDRAULIC FILTER (SPIN-ON)		1				
CLEAN OR REPLACE HYDRAULIC FILTER (PRESSURE)		1				
SAMPLE ALL OILS						
CHANGE TRANSMISSION OIL (ALLISON)		22				
CHANGE TRANSMISSION FILTERS (ALLISON)		15				
EVERY OTHER YEAR						
NOTE #8						
COOLING SYSTEM (CLEAN AND FLUSH)		83				
CHANGE ENGINE COOLANT		83				
SERVICE AIR DRYER						

<b>VENDOR</b> STERLING TRUCKS OF UTAH WARNER TRUCK CENTER (801) 886-4747	<b>VENDOR (DUMP BEDS)</b> TESCO WILLIAMSEN (801) 973-9400 (HYDRAULICS) FORCE AMERICA (435) 858-8345
--	--



TIRES			
FRONT	315/80R/22.5	130 psi	MAX
REAR	11R/22.5	105 psi	MAX

WIPERS		
FRONT	20"	06097275699

SAFETY ITEMS	
FIRST AID KIT	34532000711
FIRE GUN 5 LB.	34028361504
TRIANGLE KIT	34532000716
HAND FLARES	55020440344
GLOW STICKS	55020550101

MUD FLAPS	
24"X36"	92804001581

WASHER FLUID	
GAL.	'07566457789

FORMS
ACCIDENT REPORT
SAFETY INSPECTION
PROOF OF INSURANCE
STATE REGISTRATION
WARRANTY FORM
OPERATORS MANUALS

CHECK EACH SHIFT	PRODUCT #	NUMBER OF SERVICE POINTS	FILTERS			
OPERATORS RESPONSIBILITY			APPLICATION	COMMODITY	MFG.	MFG. #
ENGINE COOLANT	83	1	AIR PRIMARY	NON-STOCKING	FLTGRD	AF26103
ENGINE CRANKCASE OIL LEVEL	10	1	AIR SECONDARY	NON-STOCKING	INTERNAT.	633181801
ENGINE AIR CLEANER		1	ENGINE OIL	NON-STOCKING	FLTGRD	LF9001
DRAIN WATER FROM AIR TANKS			FUEL	06042313418	FLTGRD	FS1000
OIL HUBS (WHEEL BEARINGS) FRONT & TAG AXLES	40		COOLANT	SEE FOOT NOTE #8		
			HYD (SPIN-ON)	06042393890	FLTGRD	HF6721
			HYDRAULIC		FLTGRD	HF26761
			TRANS (ALLISON)	73333415452	ALLISON	23340494
WALK AROUND						

SERVICE INTERVALS	REFILL CAP.	NUMBER OF SERVICE POINTS	LUBRICATION PRODUCTS			
WEEKLY (LUBE AND/OR INSPECTION)			10	22	30	40
NOTE #1 AND #3			15W/40	ATF	PHF	GL
SPRING SHACKLES	50		FLEET	AUTO-TRANS	FLEET	GEAR
KING PINS, TIE ROD ENDS AND DRAG LINK	50		CRANKCASE	FLUID	HYDRAULIC	LUBE
DRIVE LINE "U" JOINTS AND SPLINES	50		OIL	DEXRON III	FLUID	80W/90
SLACK ADJUSTER AND "S" CAMS	50					
TAIL GATE LATCH	50		15	50	70	83
ROLL TARPS	50		50W	MPG	P/S	EXT/EG
DUMP BODY HINGE AND PIVOT POINTS	50		FLEET	MULTIPLE	POWER	ANTI-FREEZE
STEERING COLUMN AND CLUTCH LINKAGE/BEARING	50		ENGINE	PURPOSE	STEERING	EXTENDED
			OIL	GREASE # 2	FLUID	LIFE
MONTHLY						
NOTE #1 THRU #3						
CHECK ALL FLUID LEVELS INCLUDING						
POWER STEERING	70	1				
HYDRAULIC	30	1				
TRANSMISSION (ALLISON)	22	1				
TRANSMISSION (FULLER)	15	1				
DIFFERENTIAL (FRONT)	40	1				
DIFFERENTIAL (REAR)	40	1				
<b>FIRST 1000 MILES OR 25 HOURS</b>						
CHANGE HYDRAULIC FILTER (SPIN-ON)		1				
<b>FIRST 5000 MILES OR 125 HOURS</b>						
CHANGE TRANS FILTER (ALLISON MAIN FILTER ONLY)	22	1				
<b>EVERY 10,000 MILES (250 HR.) OR YEARLY</b>						
CHANGE ENGINE OIL	10	1				
CHANGE ENGINE OIL FILTER		1				
TAKE OIL SAMPLES						
<b>EVERY 20,000 MILES (500 HR.) OR YEARLY</b>						
NOTE #1 THRU #3						
CHANGE ENGINE COOLANT FILTER	83	1				
CHANGE FUEL FILTERS		1				
CHANGE HYDRAULIC FILTER (SPIN-ON)	30	1				
CLEAN OR REPLACE HYDRAULIC FILTER (PRESSURE)	30	1				
SAMPLE ALL OILS						
CHANGE TRANSMISSION OIL (ALLISON)	22	1				
CHANGE TRANSMISSION FILTERS (ALLISON)		2				
<b>EVERY OTHER YEAR</b>						
NOTE #1 THRU #3						
COOLING SYSTEM (CLEAN AND FLUSH)	83	1				
CHANGE ENGINE COOLANT	83	1				
SERVICE AIR DRYER		1				

<b>VENDOR</b> LAKE CITY INTERNATIONAL (801) 972-5320	<b>VENDOR (DUMP BEDS)</b> TESCO WILLIAMSEN (801) 973-9400 <b>(HYDRAULICS)</b> FORCE AMERICA (435) 783-2724
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TIRES			
FRONT	615/80R/22.5	130 psi	MAX
REAR	11R/22.5	105 psi	MAX

SAFETY ITEMS	
FIRST AID KIT	34532000711
FIRE GUN 5 LB.	34028861504
TRIANGLE KIT	34532000716
HAND FLARES	55020440344
GLOW STICKS	55020550101

FORMS
ACCIDENT REPORT
SAFETY INSPECTION
PROOF OF INSURANCE
STATE REGISTRATION
WARRANTY FORM
OPERATORS MANUALS



## Equipment Operations: Tag Axle Guidelines



### **WARNING:**

- Tag Axle will automatically rise when backing-up to prevent tire scuffing.
- Improperly inflated tires or suspension that is incorrectly loaded can result in poor fuel economy, poor handling and over-stressed chassis components. Vehicle loading affects tire inflation pressure and the load carried by each axle.
- Truck axle configuration styles will require different loading procedures.
- Improperly inflated or overloaded tires can cause a blowout. An overloaded axle can cause a component failure of the suspension system. Tire blowouts or broken suspension components can lead to loss of vehicle control resulting in property damage, personal injury or death.

### **CAUTION:**

- **If actual weight carried by any tire is below the tire specification, then a minimum tire pressure of at least 90 psi. must be maintained. Tire pressure below 90 psi. can overheat and damage the tire casing leading to premature tire failure or blowout.**
- **Note- that any tire on the vehicle can affect the handling of the truck.**

### ***Inspecting & Pressure***

Check the tire pressure regularly. If a tire is punctured by a nail or screw, creating a slow leak, it may eventually be spotted if it is a front tire or an outside rear dual. However, if there is a leak on an inside dual, the chances of spotting it without an air pressure check are very slim. If you begin driving unaware that an inside dual tire has a low air pressure or is flat, very quickly (in most cases a few miles) the outside rear tire (next to the low air pressure tire) will heat up from carrying double the load, leading to failure of the outside dual tire. The Truck will end up with two tires flat on the same side on the same axle.

The air pressure should be checked every two weeks or at least once a month and before any major trip. The TRUCK tire air pressure should be checked every "drive" morning on both long and short trips (driving a day or less). The tires should be checked before leaving on a trip and again before you start your trip home. If the Truck is stored for any length of time the air pressure should be checked prior to storage. More importantly, check the tire pressure when it is pulled out of storage. Check the tire pressure when the



tires are “cold” and have not been driven for more than one mile. The stated load capacity for a given cold inflation pressure is based on ambient outside temperature. If you must check the tires when they are warm or hot, allow for a slight increase in air pressure and make sure they are within a couple of pounds of each other on the same axle (does not apply to slide-out equipped Trucks). Never let air out of a hot tire. To check or maintain the inflation pressure in the tires, use a quality truck tire air gauge which has an angle dual head. This type of gauge will allow you to check inflation of the inner dual wheel which has the valve stem pointing outward. The outer wheel which has the valve stem pointing inward. Nothing should restrict the ability to check the tire’s air pressure daily when

Optimum tire performance is achieved with proper inflation pressures for the loads being carried. The air pressure of all tires should be checked and corrected prior to travel, or daily if in full time use. Tires of different patterns should not be mixed on the same axle. The difference in tractive force could cause rear end gear fight and mechanical damage to the drive train. Tires of different size or construction must never be mixed on the same axle.

**Higher than recommended pressure can cause:**

- Hard ride.
- Tire bruising or carcass damage.
- Rapid tread wear at center of tire.

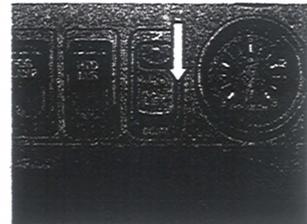
**Lower than recommended pressure can cause:**

- Tire squeal on turns.
- Rapid and uneven wear on the edges of the tread.
- Tire rim bruises and rupture.
- Tire cord breakage.
- High tire temperatures.
- Reduced handling.
- High fuel consumption

**Unequal tire pressures on same axle can cause:**

- Uneven braking, acceleration of truck may cause load to sift.
- Steering lead, torque steer.
- Reduced handling.

Tag Axle  
Lock Switch

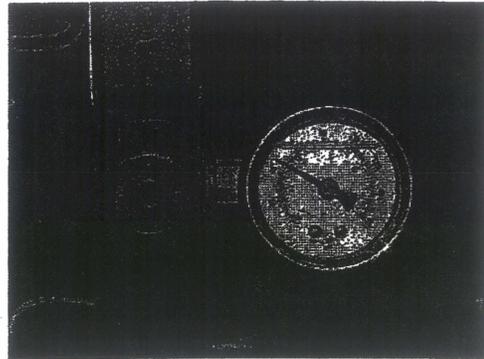


Lock: The switch is a push style located in the dash. That will not release without pull-down the top section of the switch (note: picture of switch – axle lift.) Releasing the lock allowing it to move into down position when pushed.



Truck equipped with a tag axle will require adjustment to the air pressure regulator for the tag axle. Adjustment of the regulator helps maintain proper axle weight distribution ratios. The adjustable regulator and gauge package is located in the engine compartment on the driver side. The regulator controls the amount of air pressure in the tag axle air bags. Increasing the regulator air pressure gauge reading increases the amount of air pressure in the tag axle air bags, which increases the downward force of the axle. **Applying more downward force to the tag axle increases the weight carried by the tag axle. Increasing the weight carried by the tag axle decreases the weight carried by the drive axle and slightly increases the weight applied to the front steering axle.**

## Tag Axle Regulator Adjustment:



The pressure regulator adjustment knob has a positive lock. Pull up on the knob to unlock, push down on the knob to lock. Tighten or turn the knob clockwise to increase air pressure. Loosen or turn the knob counterclockwise to decrease air pressure. When decreasing regulator air pressure, the regulator will release excess air through the regulator discharge port. Each time an increase or decrease of air pressure to the regulator is made an air pressure stabilization procedure will also be performed. The stabilization procedure equalizes the regulator to hold a constant air pressure setting. To perform the stabilization procedure:

- Start the Truck and allow the air system to reach a full charge, indicated by the release of air by the air gauge.
- Raise the tag axle using the tag axle switch on the shift panel. Allow approximately 20 seconds for the system to discharge air from the tag axle air bags.
- Lower the tag axle. The regulator will now hold the new air pressure setting.
- Push down on the regulator adjustment knob to lock the setting.

*Pull knob up to unlock.  
Push knob down to lock.*

### Scales:

Weight scale types and weighing methods will affect the procedure used to determine proper inflation pressure and axle loading. The size of some scales will allow the entire Truck to fit on the scale, which will read the GVW with only one scale recording required. Other scales are designed to weigh only one axle at a time, which may require two or three scale readings to determine the GAW or GVW total. Some scales will read only one wheel position at a time due their physical size. Several scale readings may be required to determine the GAW or GVW total. Slide out equipped Trucks will require each wheel position to be weighed. This is referred to as a four corner weigh.



Trucks with a Tag Axle will require a six position weigh. This type of weighing procedure will accurately determine what the correct inflation pressure should be. Depending on the type of scale being used, several different scale readings may be required.

**NOTE: The most accurate method to determine proper tire pressure is a four corner weigh. Weighing an axle will net the total weight carried by that axle. When calculating the drive axle dual tire pressure using a independent corner weigh method, divide the total weight by two to determine the weight carried by each tire. When weighing the entire drive axle, divide the total weight by four to determine the approximate weight carried by each tire.**

**An Example:**

The Truck must be weighed fully loaded to obtain accurate scale readings and to determine the proper tire pressure.

- Take the rear axle gross axle weight rating (GAWR) and divide it by two. Record the figure next to scale B  $GAWR \div 2$ .

Example: If rear axle GAWR is 34,000 lbs.  $GAWR \div 2$  would be 17,000 lbs.

- Weigh the driver's side rear corner (scale B) and record the scale reading next to gross axle weight (GAW) for scale B.

**NOTE: Scale readings and gross axle weight ratings are fictitious. Actual scale readings and gross axle weight ratings will vary with model and options.**

- If necessary, adjust the payload so the GAWR is not exceeded. Total combined weights must not exceed the GVWR 56,500. (Rear - 42,500)

**GUIDELINES.**

**WARNING: DO NOT EXCEED THE GVWR, GCWR AND/OR GAWR AFTER LOADING YOUR TRUCK WITH, PASSENGERS AND CARGO. GAWR (Gross Axle Weight Rating) means the maximum permissible load weight a specific axle is designed to carry.**

O:\equipment Operations\2004-tagaxle



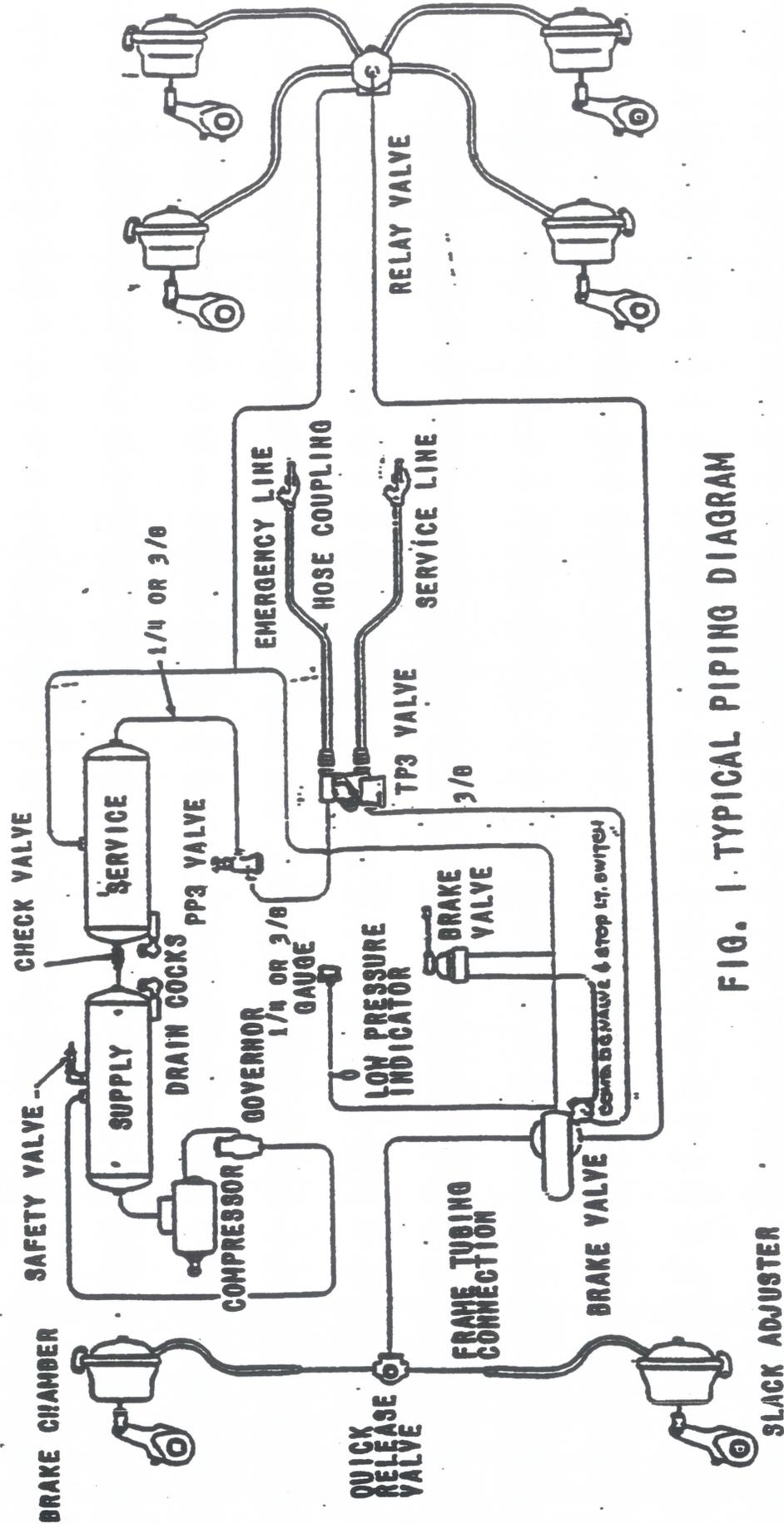
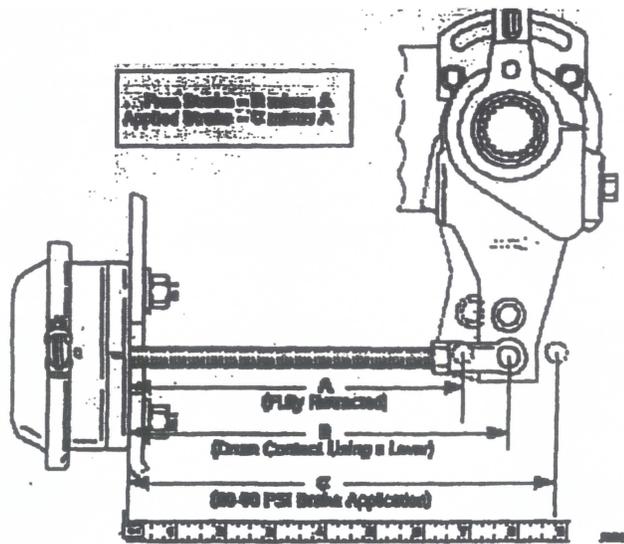


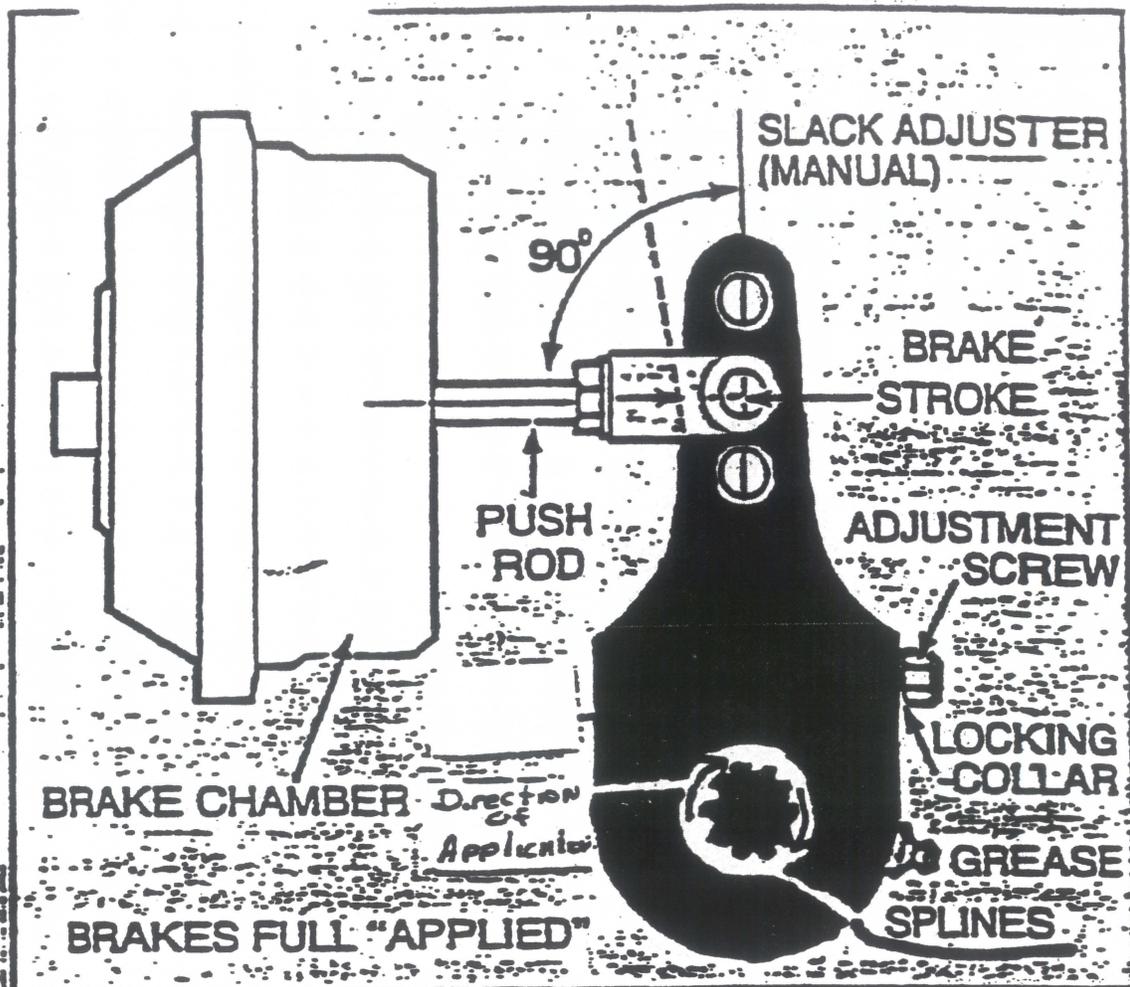
FIG. 1. TYPICAL PIPING DIAGRAM



**Figure 18 Stroke Measurements**

## Applied Stroke Adjustment

1. Apply and hold an 80-90 psi brake application.
2. Measure distance between face of air chamber and clevis pin centerline. Record distance as dimension C.
3. Subtract dimension A from dimension C. The difference is applied stroke. Compare applied stroke to maximum value in table.
4. If applied stroke equals or exceeds maximum applied stroke shown, adjust brakes. If less than the maximum, no adjustment is required.



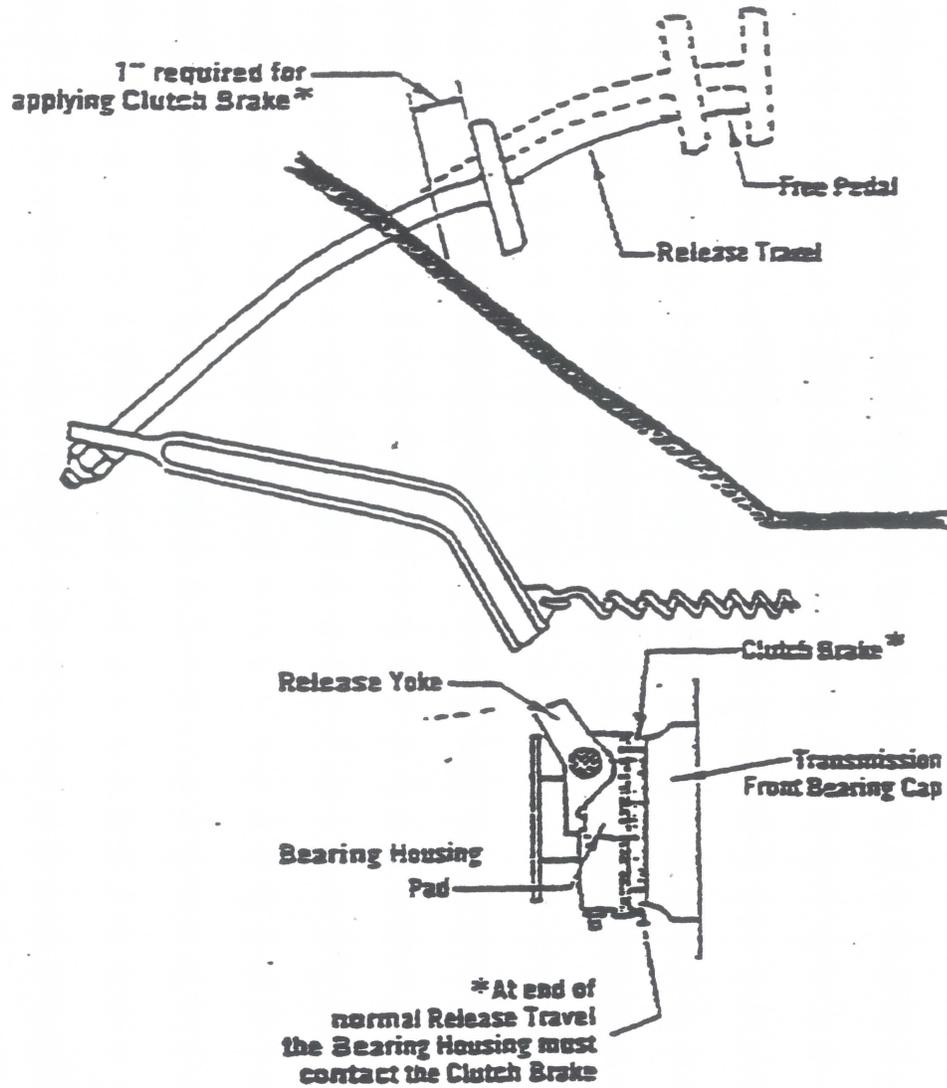
Action of chamber on slack adjuster. With chamber pushed fully extended, properly adjusted slack adjuster forms 90° angle with pushrod.

## A D J U S T I N G   P R O C E D U R E

- 1) Depress locking collar.
- 2) Turn adjusting screw, splines on scan shaft must rotate in the direction of application turn screw until splines stop turning slack adjuster should not turn.
- 3) Turn adjusting screw back (In opposite direction) 1/4 to
- 4) Be sure locking collar locks adjusting screw.



**CLUTCH IN DISENGAGED POSITION APPLYING CLUTCH BRAKE**





## MILES TO HOURS CONVERSION CHART

MILES	IS EQUAL TO	HOURS
40	IS EQUAL TO	1
320	IS EQUAL TO	8
400	IS EQUAL TO	10
1,600	IS EQUAL TO	40
2000	IS EQUAL TO	50
4000	IS EQUAL TO	100
8000	IS EQUAL TO	200
10,000	IS EQUAL TO	250
20,000	IS EQUAL TO	500
40,000	IS EQUAL TO	1000

EQUIPMENT THAT HAS BOTH ODOMETER AND HOUR METERS IS TO BE SERVICED BY MILEAGE OR THE HOUR METER EQUIVALENT WHICH EVER COMES FIRST

ALL EQUIPMENT MUST HAVE FULL SERVICE AND INSPECTION YEARLY REGARDLESS OF MILES OR HOURS





# Heavy Duty Maintenance Vocational Market

## Cooling

### Routine Maintenance Recommendations

Change filter at EVERY oil drain interval  
Use Fleetguard service filter sized for appropriate oil drain interval

or

Add correct number of units of liquid SCA and use plain filter

Oil Drain Interval	# of SCA Units	Fleetguard part
M11/N14 250-500hrs	4	WF-2071
<250hrs	2	WF-2070
CL3 <250hrs	2	WF-2070

If an SCA other than Fleetguard is used, follow mfg. specs.  
Drain and flush system every 2 years and refill with heavy duty coolant - 50/50 mix of water and antifreeze and 1.5 units of SCA/gal of coolant. Topoffs should be done with heavy duty coolant - 50/50 mix of water and antifreeze and 1.5 units of SCA/gal of coolant

### Heavy Duty Coolant

A combination of 50/50 water and low silicate antifreeze  
1.5 units SCA per gallon of coolant  
Protects to -34F  
Antifreeze must meet ASTM D4985 (GM6036M) specs

### Why Are SCAs Needed?

Normal piston slap causes liner to vibrate at high frequency  
Vapor bubbles are created in coolant as liner moves away from coolant (a phenomenon known as cavitation... localized boiling)  
Bubbles collapse as liner moves back into coolant  
Implosion of bubble removes material from liner surface leading to pitting  
Proper amount of SCA forms an oxide film on liner surface  
Vapor bubbles still form, but remove oxide film rather than liner material  
This is why SCA level depletes and must be continually replenished

### SCA Concentration Limits

Must be maintained between 1.2 and 3.0 units/gallon of coolant  
Levels below 1.2 don't adequately protect against liner pitting  
Levels above 3.0 can lead to premature failure of water pump seals due to deposits being formed on seal faces

### Water Quality

Calcium/Magnesium	Max. 170ppm as CaCO <sub>3</sub> + MgCO <sub>3</sub>
Chloride	Max. 40ppm as Cl
Sulfur	Max. 100ppm as SO <sub>4</sub>

### When To Test?

Test twice a year under "normal" conditions  
If SCA between 1.2-3.0 Replace coolant filter at every oil change  
SCA < 1.2 Precharge with liquid SCA and replace service filter  
SCA > 3.0 Do not replace service filter and test at each oil change until level is below 3.0. Then start changing service filter at oil changes

### How To Test

Antifreeze- Refractometer Fleetguard #CC2800 is recommended vs floating ball because it is more accurate  
SCA - Fleetguard kit #CC2802  
Dip ONE STRIP in coolant for 1 sec, shake off drips, wait 45 sec. and compare two patches on scale to determine SCA level. Follow these directions EXACTLY

Perception of M11/L10/CL3 Resistance to Liner Pitting  
Perception exists that M11/L10/CL3 are "bullet-proof" to liner pitting

**- NOT TRUE -**

Increased lip and design changes to the liner to reduce oil consumption on newer engines have made cooling system maintenance equally important on all engines

## Quick Reference Guide

## Lube Oil

### Oil Change Intervals

Use the following oil change intervals for these applications:

	L10/M11/N14		CL3	
Refuse Truck	250hrs	6mos	250hrs	3mos
Mixed/Dump	250hrs	6mos	250hrs	3mos
Delivery Truck	250hrs	6mos	250hrs	6mos
Truck Crane	250hrs	6mos	250hrs	3mos
Logging Truck	250hrs	6mos	-	-
Fire Truck	480hrs	3mos	250hrs	3mos

### Multigrade vs. Straight Weight

Recommendation High quality 15W40 oil  
L10/M11/N14 - API CE, CF-4, CG-4  
CL3 - API CE/SG

Reasoning Reduced deposit formation  
Improved cranking in low ambient temperatures  
Shortens time-to-block pressure in low ambients  
Improved lubrication during high temperature operation  
Multigrade shown to provide 30% reduction in oil consumption compared to straight weight  
Should be used to ensure engines meet EPA standards

SG rating for CL3 required for lubrication of sliding tappets

### Synthetic Oils

Recommended for use in ambient temperatures consistently below -13F (-25C) for improved engine cranking and cold flowability  
Should NOT BE USED to extend oil drain intervals. Ability to hold soot in suspension is no better than petroleum based oils

### Engine Break-In

FE2000 is not to be used on a new or rebuilt engine to "break-in"

### Oil Analysis

Cummins recognizes that some customers use oil analysis to monitor trends in wear metals  
Oil analysis as a method to extend drain intervals is not recommended  
Oil drain intervals are primarily driven by the sooting rate of an engine model. Different methods of measuring soot and the lack of correlation among testing labs is the basis for the recommendation

## Starting Aids

### Ether

A mechanical or electrical ether metering device is required whenever ether is used. Manual application of ether is PROHIBITED. Metering devices can be supplied by OEMs or through upfit with Fleetguard equipment.  
DO NOT USE ETHER on CL3 engines with intake air preheaters

## Overhead Set

### Adjustment Interval

1994 Certification Level M11 and N14 Engines  
Current Adjustment Interval 1,500hrs/yr  
Upcoming 1995 New Adjustment Interval 3,000hrs/2yrs  
CL3 Initially 1,000hrs/yr  
Thereafter 2,000hrs/2yrs



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## Component Maintenance

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### Fuel System

CELECT injectors do not require maintenance  
Clean/calibrate at STC injectors at 6,000hrs/3yrs  
Clean/calibrate PT fuel pump at 6,000hrs/3yrs

### Turbocharger

Inspection required at 6,000hrs/3yrs which includes visual inspection of compressor and turbine blades and check of radial and axial bearing clearances (refer to Section 7 of O&M Manuals)

### Air Compressor

Inspection required at 6,000hrs/3yrs which includes clean/inspect of cylinder head, valve assembly, discharge line, air driers, spiter valves, pressure relief valves, and alcohol injectors. High duty cycle applications (>25%) must inspect more frequently. C&S inspection at 2,000hrs/2yrs (refer to Section 7 of O&M Manuals)

### Water Pump

Inspection required at 6,000hrs/3yrs which includes visual inspection of weep hole for coolant leak and/or plugging of hole with debris (refer to Section 5 of O&M Manuals)

### Vibration Damper

Inspection required at 6,000hrs/3yrs which includes visual inspection of damper for deformation or fluid loss. C&S inspection at 2,000hrs/2yrs. (refer to Section 7 of O&M Manuals)

### Fan Idler Pulley and Fan Hub

Inspection required at 6,000hrs/3yrs which includes visual inspection of end clearance of both components. C&S inspection at 2,000hrs/2yrs. (refer to Section 7 of O&M Manuals)

### Automatic Belt Tensioner (Bus appl. with alternator drive belt)

Inspection required at 6,000hrs which includes visual inspection of tensioner arm, pulley, body, and removal of belt and inspection of stops for breakage or wear (refer to Section 7 of O&M Manuals)

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## Idle/Warmup/Cooldown

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### Excessive Idle

Unless using engine for cab heat, cab cooling, pump-off operation, etc., excessive engine idling should be avoided to reduced fuel usage and component wear.

### Engine Warmup/Cab Heat

**Cold Start:** Do not operate at full speed/load until coolant temperature reaches 160F  
Do not operate above low idle until oil pressure is indicated

**Cab Heat:** Higher engine rpm may be required for additional cab heat in extremely cold ambients. Engine speed should be set at the minimum required for cab comfort and to maintain a 140F coolant temperature. In most cases, 140F coolant temperature will provide adequate cab heat.

### Engine Cooldown

**Recommendation:** Prior to shut down, an engine should be idled 3-5 minutes after full throttle or high power operation such as climbing a steep grade or high vehicle speeds. However, under normal driving conditions, enough time is generally taken at light load getting the truck positioned and stopped, that a 3-5 minute cooldown is not necessary.

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## Fuel

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### Fuel Additives

**Recommendation:** Based on nationwide testing for lubricity, cloud points, pour points, etc. use of additives is NOT recommended to improve fuel lubricity for any Cummins engine when operated on commercially available low-sulfur #2 diesel fuel or #1/#2 winter blend diesel fuel  
When use of fuels with historically low lubricity (JP8 Jet A, P50, etc.) is necessary, use of Cummins Premium Plus Diesel Fuel Additive is recommended to improve fuel lubricity. This is the only recommended additive for use with fuels that do not meet lubricity specs in Bulletin #3379001

### Fuel/Lube Oil Blending

Blending of used lube oil with diesel fuel is allowed, except on those engines equipped with a catalytic converter. However, as a result of the 10/1/83 law requiring the use of low sulfur fuel in North America, blended fuel must also meet the .055% maximum sulfur by weight specification. Consult Bulletin #3379001 for the procedure to determine blend ratios for on-highway applications

### Fuel Temperature

Maximum fuel inlet temperature (CELECT Engines) - 158F (70C)  
OEMs have resolved problems encountered during 1991 product launch and this no longer appears to be a problem

### Fuel/Water Separators

#### REQUIRED ON ALL CELECT ENGINES

Fuel-water separator or fuel filter/water separator combination must remove a minimum of 94% of free water and 88% of emulsified water and must be drained daily and changed at oil drain interval

**Recommended Filters:** H.D. Fleetguard FS-1212, FS-1242  
M.D. Fleetguard FS-1226, FS-1240

Customers with a history of water in fuel or trouble with drivers not draining filters daily, should use Fleetguard FS-1242 (w/ warning light)

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## Hour Meters

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### Use of Hour Meters

Cummins recommends the use of hour meters in applications where extended idle, low average MPH, or varying MPH conditions exist. Benefit is more accurate determination of maintenance intervals and scheduling of rebuilds

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## Bulletin #'s

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M11 O&M Manual 3656072-02 Oil Recommendation 3610344  
N14 O&M Manual 3656061-02 Fuel Recommendations 3379001  
C&S O&M Manual 3610248-09 Charge Air Cooling Recs 3610466  
Fleetguard Cooling System Maintenance 3367910

## Recommended Operation and Maintenance Practices for Maximum Engine Life

**NOTE:** This engine operation and maintenance summary is intended to serve as an overview of the critical engine operations and maintenance practices that appear in your Operation and Maintenance Manual. It does not supersede any information found in that manual. Refer to your Operation and Maintenance manual for greater details.

### 1. Starting

- A. Do not crank the engine for more than 30 seconds continuously. If the engine does not start within the first 30 seconds, wait one to two minutes before re-cranking. Continuous cranking will damage the electric cranking motor and fuel pump (B and C series only).
- B. Start the engine with the throttle in the idle position. (Note: Some B and C engines are started in the full throttle position; reference your O&M Manual for the correct starting procedure).
- C. Engine oil pressure must be indicated on the gauge within 15 seconds after starting the engine. A minimum 69 kPa (10 psi) at idle is required for B, C, L, and N series engines. A minimum of 138 kPa (20psi) at idle is required for K, V, and KV engines.
- D. When starting a cold engine, increase the engine speed (RPM) slowly to allow adequate lubrication to the bearings and to allow the oil pressure to stabilize. High speed engine operation before oil film is established will cause engine damage.
- E. During cold weather starting, do not use ether excessively. This can result in cracked pistons and/or over-speeding resulting in bearing failure.

### 2. Engine Operation

- A. Cummins engines are designed to operate at full throttle under transient conditions down to peak torque engine speed. Engine operation below torque peak engine speed can elevate oil temperature and cause oil film thickness to decrease thus causing premature wear of critical engine components. Peak torque varies depending on rated engine speed from 1100 to 1500 rpm.
- B. Allow the engine to idle 3 to 5 minutes before shutting it off after a full load operation. This allows the lubrication oil and coolant to carry heat away from the combustion chamber, bearings, shafts, and turbocharger and helps prevent carboning the engine oil.
- C. **CAUTION:** Do not idle the engine for excessively long periods (i.e. greater than 10 minutes). During long idle periods the temperature in the combustion chamber can drop so low the fuel will not burn completely. This raw, unburnt fuel can wash away the lubricating oil off the cylinder walls and dilute the crankcase oil. Premature engine wear will result.
- D. **CAUTION:** Never operate the engine beyond high idle speed under any circumstances. When descending a steep grade, use a combination of transmission gears and engine or service brakes to control the vehicle and engine speed to less than governor RPM. Failure to do this can cause engine damage.

### 3. Coolant System - Coolant Recommendations

- A. Supplemental Coolant Additives (SCA's) must be used in your coolant system to obtain optimum engine life. SCA's must be maintained between 1.2 and 3.0 units per gallon of coolant. SCA's must be added to the coolant system at each oil change interval due to natural depletion.
- B. Leaks must be prevented. Uncontrolled leakage with improper topping off will severely deplete SCA levels. Topping off must be done with heavy duty antifreeze (50/50 mix of antifreeze/water and 1.2 units of SCA). Note: The B series engine requires only 50/50 mix of water and antifreeze with no SCA required. For additional information on coolant system treatment, maintenance, testing, etc., contact Fleetguard Technical Service on 1-800-521-4005 or Cummins Engine Co., Inc. on 1-800-Diesels.

### 4. Engine Lubricating Oil Recommendations

- A. It is critical to engine life to use a high quality SAE 15W-40 heavy duty engine oil such as Premium Blue which meets API performance classification CE or CF-4. Mid-range engines require SG classification due to sliding cam followers.
- B. **CAUTION:** Under no circumstances can the oil drain interval extend beyond specified period. Extending oil drain intervals with synthetic oils or missing one oil drain interval will decrease engine life due to such factors as corrosion, deposits, and wear.
- C. **CAUTION:** Fill the oil filters with clean lubricating oil when changing the engine oil to ensure immediate bearing lubrication when restarting engine. Failure to pre-lube oil filter may cause bearing damage.
- D. Do not allow dirt or any debris to enter oil system during oil change. Ring and bearing failures can be caused by the fine dirt particles entering the oil system.
- E. Wait 10 minutes after shutting down the engine before checking the oil level. This will allow the oil to drain back to the oil pan and allow you to get a more accurate reading.

### 5. Air Intake System

- A. **CAUTION:** Never operate engine without an air cleaner or allow unfiltered or poorly filtered intake air to enter the engine. Leaks in the air intake system will allow dirt and debris to enter the engine causing scratched cylinder liners and piston rings resulting in increased oil consumption. Poor engine response, low boost pressure, exhaust smoke, and high exhaust temperatures will also be caused by leaks in the air intake system.
- B. Cummins used/dirty filter maximum restriction is 510mm H<sub>2</sub>O (20 in. H<sub>2</sub>O) for naturally aspirated midrange engines (B and C series) and 635mm H<sub>2</sub>O (25 in. H<sub>2</sub>O) for all turbocharged midrange, heavy-duty, and high horsepower engines. Excessive air intake restriction can result in black smoke under load, poor fuel consumption, low power, and increased soot levels.

### 6. Fuel System Recommendations

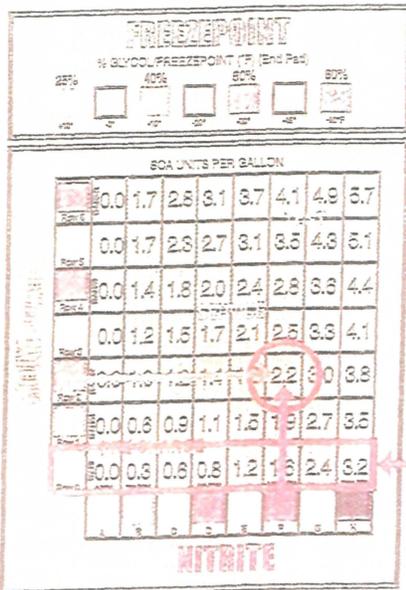
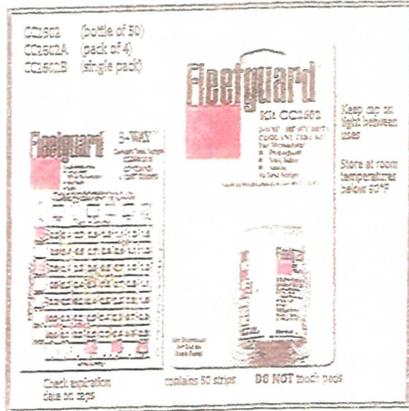
- A. Cummins recommends the use of ASTM No. 2D fuel. Under no circumstances should gasoline, gasohol or alcohol be blended with diesel fuel. At operating temperatures below 0°C (32°F), acceptable performance can be obtained by using blends of No. 2 and No. 1D. Select fuel based on 40 minimal Cetane number and a maximum 1.0 percent sulfur.
- B. Cummins recommends a maximum fuel inlet temperature of 160°F.
- C. Cummins requires that a fuel-water separator be used with all 91N14 and L10 electronic engines. Cummins recommends that a fuel-water separator be installed in the fuel supply on all other engine series. Fuel-water separators will remove water in diesel fuel, preventing damage to the fuel system.
- D. Cummins requires that a fuel pre-filter be installed before the lift pump on B and C series Midrange Engines.





# 3-Way™ Coolant Test Strips Instructions

## For Heavy Duty Diesel Engines



COOLANT SYSTEM ADDITIVES		
DCA2	SIZE	DCA4
DCA30L	Pint	DCA60L
DCA35L	1/2 Gallon	DCA65L
DCA40L	Gallon	DCA70L
DCA45L	5 Gallon	DCA75L
DCA50L	55 Gallon	DCA80L

### Pre-Test Instructions

**Recommended Testing Frequency** - At every lube service.

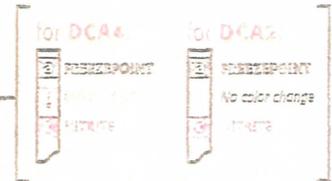
- Collect coolant sample from the radiator or petcock. **DO NOT** collect from the coolant recovery or overflow system. Coolant must be between 50°F and 130°F when tested. Room temperature is best.
- For accurate results—test must be completed within 75 seconds. Follow recommended test times. Use a stopwatch.
- Record and track results.

### Test Instructions

- Remove one strip from bottle and replace cap immediately. **DO NOT** touch the pads on the end of the strip. **DISCARD KIT** if Nitrite test pads of unused strips have turned brown.

- Dip strip for **1 SECOND** in coolant sample, remove, and *shake strip briskly* to remove excess liquid.

- 15 SECONDS** after dipping strip, compare results to color chart and record in the following order:



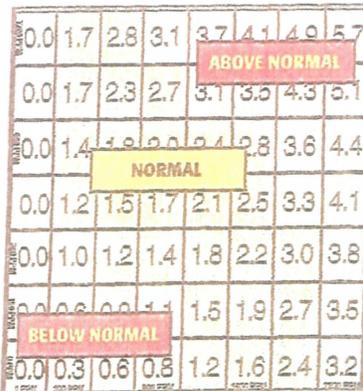
- All three readings must be completed **NO LATER THAN 75 SECONDS** after dipping strip.

- If uncertain about the color match, pick the **LOWER** numbered block (ex: if nitrite color is not F, use column E).

- The amount of coolant additive units per gallon in the cooling system is given where the following occurs:

for DCA4: the **FREEZEPOINT** level intersects the **FREEZEPOINT** level  
 for SCA: the **NITRITE** column intersects Row 0

### Maintenance Actions Based on Results



- ABOVE NORMAL** Replace the coolant filter with a non-charged filter until the additive concentration falls below 3 units per gallon when tested at every subsequent oil drain interval.
- NORMAL** Continue to replace the coolant filter at your normal interval.
- BELOW NORMAL** Replace the coolant filter and add 1 pint of additive per each 4 gallons of coolant (equals 1.2 units per gallon).

## MAINTAINING A 50/50 COOLANT/WATER MIX

### CHART FOR MAINTAINING A 50/50 ETHYLENE GLYCOL COOLANT

FREEZE POINT DEG. F. VS. PERCENT CONCENTRATE

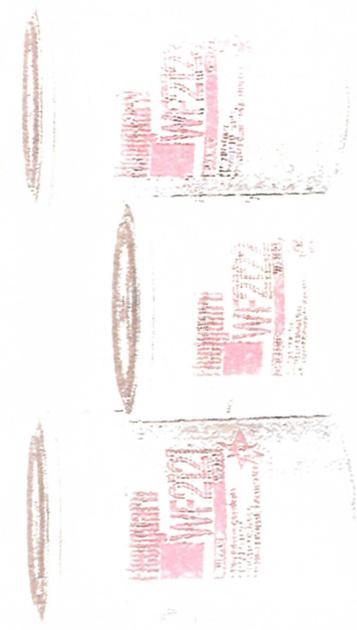
SYSTEM CAPACITY	UNICE-CONCENTRATED													SYSTEM CAPACITY						
	GALLON																			
GALLON	FREEZE POINT DEG. F. VS. PERCENT CONCENTRATE													GALLON						
	+32F	+25F	+20F	+15F	+10F	+5F	-5F	-12F	-23F	-34F	-50F	-65F	-75F		-84F	-70F	-55F	-43F	-30F	-6F
10	4	4	4	4	3	3	2	2	1	0	1	2	2	3	3	4	4	4	5	10
12	5	5	5	4	4	3	3	2	1	0	1	2	3	3	4	5	5	5	6	12
14	6	6	6	5	5	4	3	2	1	0	1	2	3	4	5	5	6	6	7	14
16	7	7	7	6	5	5	4	3	1	0	1	3	4	5	5	6	7	7	8	16
18	8	8	8	7	6	5	4	3	2	0	2	3	4	5	6	7	7	8	9	18
20	9	9	9	8	7	6	5	3	2	0	2	3	5	6	7	8	8	9	10	20

DRAIN COOLANT, ADD WATER / GALLONS

DRAIN COOLANT, ADD CONCENTRATE / GALLONS

### COOLANT FILTERS

BOCART	PROGRAM	QUANTITIES	APPLICATIONS
WF2107	WF2107	BLANK	Cummins/Universal
WF2050	WF2070	2	Cummins/Universal
WF2051	WF2071	4	Cummins/Universal
WF2052	WF2072	6	Cummins/Universal
WF2053	WF2073	8	Cummins/Universal
WF2067	WF2074	12	Cummins/Universal
WF2054	WF2075	15	Cummins/Universal
WF2055	WF2076	23	Cummins/Universal
WF2078	WF2078	BLANK	Black
N/A	WF2083	4	Black
N/A	WF2082	6	Black
N/A	WF2015	8	Black
N/A	WF2022	11	Black
WF2109	WF2109	BLANK	Volvo
WF2096	N/A	4	Volvo
N/A	WF2108	8	Volvo
WF2131	WF2131	1yr	Navcool WF2088



\*Quik-Check C2607B will check coolant stability  
 \*\*Water-Check C2609 will check to see if your shop water meets DMG specs

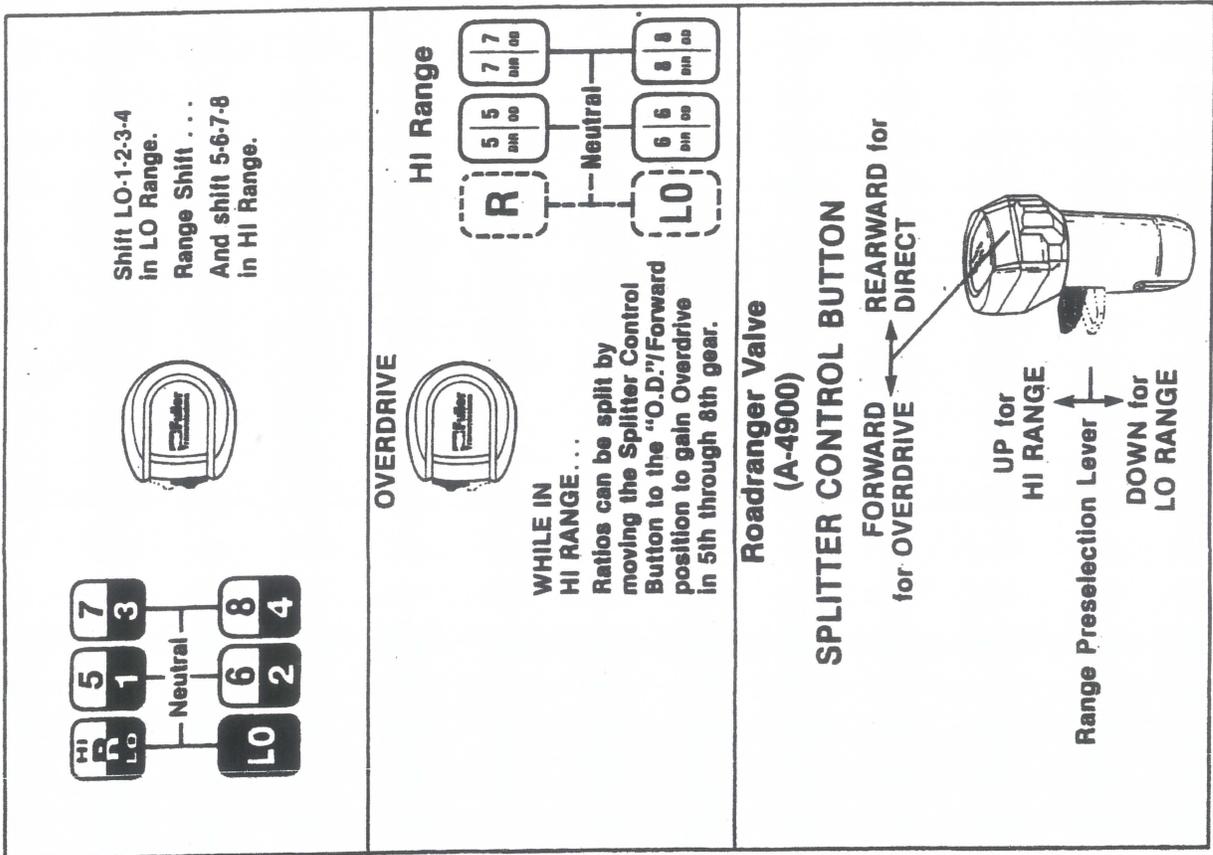


Check Fleetguard Product Guide or web catalog at [www.fleetguard.com](http://www.fleetguard.com)  
 for full water filter coverage

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 Printed in U.S.A.

FOR MORE INFORMATION, CALL OUR ASSEMBLY ASSISTANT AT 1-800-22-FILTER (1-800-223-4583)  
 OR VISIT US AT [www.fleetguard.com](http://www.fleetguard.com)

## Shift Lever Patterns and Shifting Controls



## "F" Models

The letter "F" appearing in the model designation, such as RTLOF 14613, simply indicates a forward mounted position of the gear shift lever housing on the transmission and does not affect the shift pattern.

## General Information

The 13-speed transmission has thirteen forward speeds and two reverse, consisting of a five-speed front section and a three-speed auxiliary section. The auxiliary section contains LO and HI Range ratios, plus an overdrive Splitter gear.

One ratio in the front section (LO) is used only as a starting ratio; it is never used when the transmission is in HI Range.

The other four ratios in the front section are used once in LO Range and once again in HI Range. However, each of the 4 ratios in HI Range can be split with the overdrive splitter gear. Low Range ratios cannot be split.

## Range Shifting

The Range Preselection Lever selects LO or HI Range. It is used once during an upshift sequence and once during a downshift sequence.

## Split Shifting

When in HI Range the ratios can be split by using the Splitter Control Button. The REARWARD (Direct) position provides for the LO through 8th speed direct gear ratios; the FORWARD (Overdrive) position is used to split any of the HI Range gear ratios. Thus, thirteen progressive ratios can be obtained.

## Preselection

**IMPORTANT:** Always preselect all Range or Splitter shifts when upshifting or downshifting. Preselection requires that the Range Preselection Lever or Splitter Button is moved to the needed position before completing the shift. Preselected Range shifts are completed automatically as the lever is moved through neutral and into the next gear.

Preselected Split shifts are completed automatically as torque is released from the transmission. Preselecting all Range and Splitter shifts prevents damage to the transmission and provides for smoother shifts.

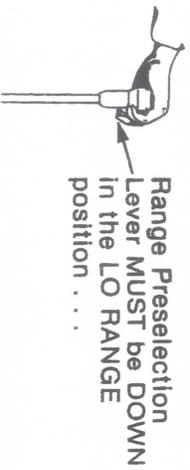


## Detailed Shifting Instructions

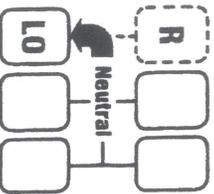
In the following instructions, it is assumed that the driver is familiar with operating heavy-duty trucks and tractors, and can coordinate the movement of the shift lever and clutch pedal to make smooth gear engagements while upshifting or downshifting. Always double-clutch when making lever shifts (see procedure on Page 11). Always single clutch split shifts.

### Upshifting

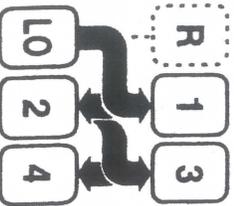
1. Move the gear shift lever into neutral.
2. Start engine and wait for the vehicle's air system to reach normal air system pressure.
3. Make sure the Range Preselection Lever is DOWN in the LO Range position and the Splitter Control Button is in the REARWARD (DIRECT) position.



4. With the clutch disengaged, move the shift lever to the LO speed gear position. Release the clutch pedal to start vehicle moving.



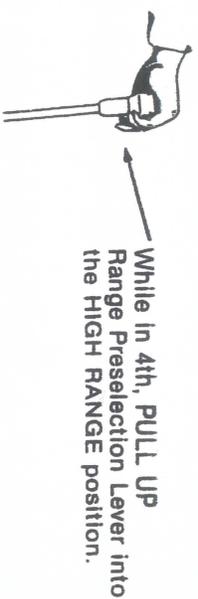
5. Upshift, double-clutching, from LO through 1st, 2nd and 3rd to 4th while in Low Range.



4

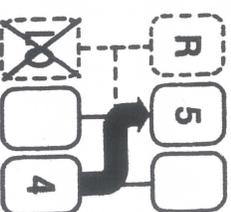
### Range shift from Low Range to 5th Direct in High Range...

6. While in 4th and ready for the next upshift, preselect High Range by pulling UP the Range Preselection Lever.



7. Complete shift by moving the shift lever, double-clutching, to the 5th speed gear position. As the shift lever passes through neutral, the transmission will automatically shift from Low Range to High Range.

**CAUTION** Never move the Splitter Control Button or the Range Preselection Lever with the shift lever in neutral while the vehicle is moving.



Upshift from (5th) Direct to (5th) Overdrive in the same gear shift lever position...

8. Move the Splitter Control Button into the FORWARD (OVERDRIVE) position.



9. Then, IMMEDIATELY release accelerator, depress clutch pedal once to break torque, release pedal to re-engage clutch, and accelerate engine. Transmission will shift from Direct to Overdrive when synchronous is reached.



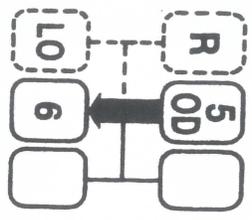
Release accelerator ... Single-clutch ... and accelerate.

**Upshift from (5th) Overdrive to (6th) Direct...**

10. Move the Splitter Control Button into the REARWARD (DIRECT) position.



11. Move the shift lever, double-clutching, to the 6th speed gear position.

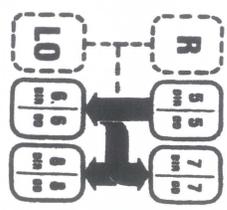


12. If splitter selection to Direct is not made, the transmission will be in 6th Overdrive once the final clutch engagement has been made.

**CAUTION**

Never move the Splitter Control Button or the Range Preselection Lever with the shift lever in neutral while the vehicle is moving.

13. Continue upshifting through the shift pattern. Double-clutch during lever shifts; single-clutch during split shifts with the shift lever in the same position.



**Downshifting**

Downshift from (8th) Overdrive to (8th) Direct in the same gear shift lever position...

1. Move the Splitter Control Button into the REARWARD (DIRECT) position.



2. Then, IMMEDIATELY release accelerator, depress clutch pedal once to break torque, release pedal to re-engage clutch, and accelerate engine. Transmission will shift from Overdrive to Direct when synchronous is reached.



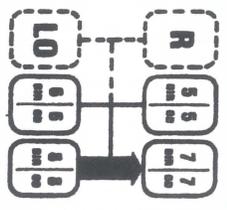
Release accelerator ... Single-clutch ... and accelerate.

Downshift from (8th) Direct to (7th) Overdrive...

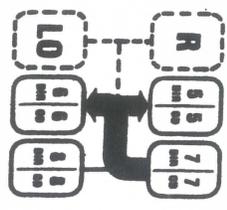
3. Move the Splitter Control Button into the FORWARD (OVERDRIVE) position.



4. Then, IMMEDIATELY move the shift lever from 8th, double-clutching, to the 7th speed gear position. If the splitter selection to Overdrive is not made, the transmission will be in 7th Direct once final clutch engagement has been made.



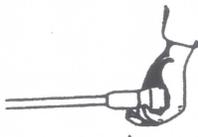
5. Continue downshifting from 7th Overdrive to 5th Direct while in High Range. Double-clutch when making lever shifts; single-clutch when split-shifting in the same gear lever position.



Range shift from (5th) Direct to Low Range (4th) . . .

6. While in 5th Direct and ready for the next downshift, preselect **Low Range by pushing the Range Preselection Lever DOWN.**

**CAUTION:** When downshifting from High Range to Low Range, the Splitter Control Button **MUST** be in the REARWARD (DIRECT) position and shift to direct completed, before making the range selection. The shift to Low Range cannot be made with the Splitter Control Button in the FORWARD (OVERDRIVE) position.

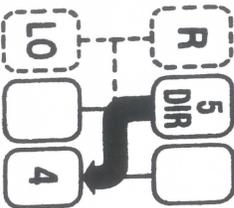


While in 5th DIRECT, PUSH DOWN Range Preselection Lever into the LOW RANGE position.

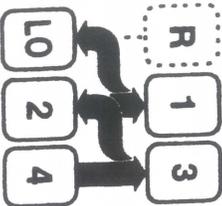


Splitter Control Button **MUST** be REARWARD.

7. Complete downshift from 5th Direct by moving the shift lever, double-clutching, to the 4th speed gear position. As the shift lever passes through neutral, the transmission will automatically shift from High Range to Low Range.



8. Continue downshifting, double-clutching, from 4th through 3rd, 2nd and 1st to LO.



## Skip-Shifting

After becoming proficient in shifting, you may want to skip some of the ratios. This may be done **ONLY** when operating conditions permit, depending on the load, terrain, and road speed.

## Optional Equipment—The Clutch Brake

For easier and faster gear engagement, some Eaton Fuller transmissions may be equipped with a Clutch Brake. This brake is used to make initial gear engagement into LO or reverse while the vehicle is standing still.

The brake is applied by fully depressing the clutch pedal to the floor board. When applied the brake slows down the transmission gearing. It is a disc-type brake incorporated into the clutch and transmission drive gear assemblies.

Never use the Clutch Brake when upshifting, downshifting, or as a brake to slow the vehicle.



## Driving Tips

- For a smooth start, always select an initial starting gear that provides sufficient reduction for the load and terrain.
- Always use normal double-clutching procedures when making lever shifts. (See Page 11.)
- Never slam or jerk the shift lever to complete gear engagement.
- Never coast with the gearshift lever in the neutral position.
- Never move the shift lever to the LO speed gear position while operating in HI Range.
- Never move the Range Preselection Lever or the Splitter Control Button with the gear shift lever in neutral while the vehicle is moving.
- Never make a range shift while moving in reverse.
- When making a Splitter shift, move (preselect) the Splitter Control Button and IMMEDIATELY complete the shift.
- Never downshift at too high of a road speed.
- In most cases, depending on the engine and axle ratios, you can save valuable fuel by operating the vehicle as less than governed RPM while cruising in 8th Overdrive.

## Double-Clutching Procedures

### When ready to make a shift:

1. Depress pedal to disengage clutch.
2. Move gear shift lever to neutral.
3. Release pedal to engage clutch.\*
  - A. Upshifts—decelerate engine until engine RPM and road speed match.
  - B. Downshifts—accelerate engine until engine RPM and road speed match.
4. Quickly depress pedal to disengage clutch and move gear shift lever to next gear speed position.
5. Release pedal to engage clutch.

\*By engaging the clutch with the gear shift lever in the neutral position, the operator is able to control the RPM of the mainshaft gears since they are regulated by engine RPM. This procedure enables the operator to match the RPM of the mainshaft gears with those of the mainshaft driven by the vehicle's rear wheels.

# Lubrication

## Proper Oil Level

Make sure oil is level with the filler opening. Because you can reach oil with your finger does not mean oil is at the proper level. (One inch of oil level is about one gallon of oil.)

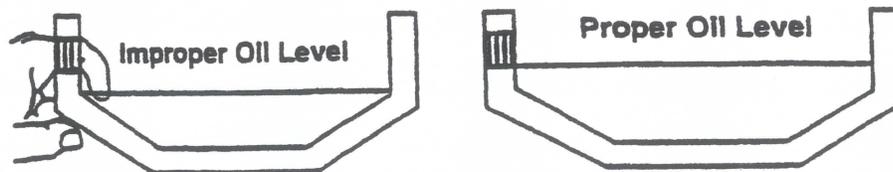
## Draining Oil

Drain transmission while oil is warm. To drain oil remove the drain plug at case bottom. Clean the drain plug before re-installing.

## Refilling

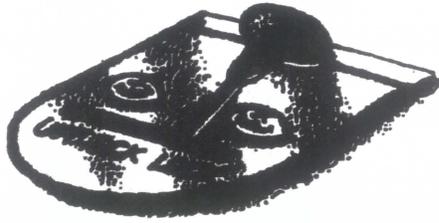
Clean case around filler plug and remove plug from case side. Fill the transmission to the level of the filler opening. If the transmission has two filler openings, fill to the level of both openings.

The exact amount of oil depends on the transmission inclination and model. Do not over fill—this causes oil to be forced out of the case through the front bearing cover.



When adding oil, types and brands of oil should not be mixed because of possible incompatibility.

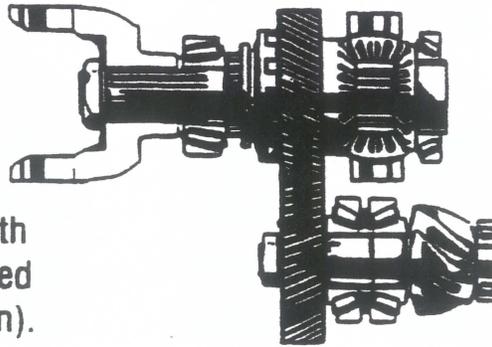
2. Flip the lockout selector valve to lock (engage) or unlock (disengage) the lockout..



**Remember:**

- Engage lockout at any speed with accelerator released. **Never engage lockout when wheels are slipping.**
- Use only under poor traction. Do not operate truck with lockout "engaged" on dry pavement.

**How the lockout works.**



Power flow with lockout engaged (LOCK position).

Tandem axles will rotate at different speeds when cornering, driving over uneven road surfaces or when equipped with different tire sizes.

The inter-axle differential is simply a mechanism that lets one axle rotate faster or slower than the other. Under normal conditions it splits the torque evenly between the 2 axles.

When extra traction is needed under adverse road conditions, you can lock out the inter-axle differential. With the lockout engaged (LOCK position), the inter-axle differential acts as a solid shaft and does not compensate for differences in axle speed, but directs the torque to the axle with the most traction.

With the lockout disengaged (UNLOCK position), the inter-axle differential operates normally.

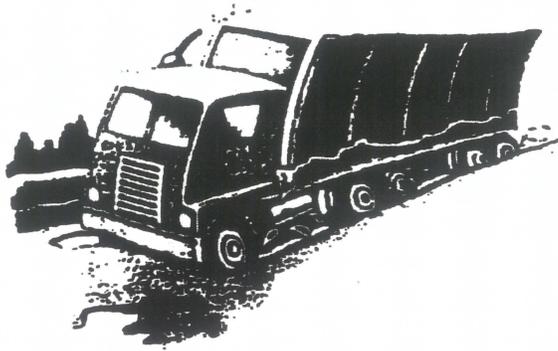
A lockout selector valve, located in the truck cab, controls the inter-axle differential lockout.

For Dual Range Tandem Lockout Instructions, refer to Eaton Booklet AXDR-0117

## When to engage lockout.

(Selector Valve in LOCK position.)

When approaching:  
**ice, snow or wet  
surfaces. . .**



in mud. . .

in loose terrain.



## How to operate lockout.

1. Temporarily release the accelerator pedal. This interrupts the torque applied to the inter-axle differential allowing easy engagement or disengagement at any speed.



## CARGO TIE-DOWN REQUIREMENTS

The Department of Transportation amended its Cargo Securement Requirements on August 5, 1994, to adopt the use of working load limits in specifying the minimum strength of all cargo securement devices. This action was in response to a petition from the Commercial Vehicle Safety Alliance (C.V.S.A.).

This amendment requires that the Aggregate Static Working Load Limit (W.L.L.) of the tie-down assemblies used to secure an article against movement in any direction be at least 1/2 (.5) times the weight of the article secured. Beyond these strength requirements, at least two chains are required every eight feet for certain metal articles, and every ten feet for other articles.

CM offers a number of components including chain that conforms with the National Association of Chain Manufacturers' (N.A.C.M.) Welded Steel Chain Specifications, and the American Society of Testing and Materials Specifications.

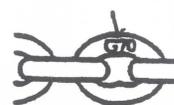
Standard binder chain assemblies are available in Grade 30 (Proof Coil), Grade 43 (High Test), and Grade 70 (Transport); with Grade 80 (Alloy) assemblies available on a special basis.

Load binders are typically used to take up slack and apply tension to a tie-down system. Designed primarily for use with the graded chains (Grade 30, Grade 43, Grade 70), they can also be used with cable, steel strap or fiber webbing. They are available in two general configurations (e.g. Lever type - over the center and Ratchet Configuration). They are rated by Working Load Limit and are provided with hooks of various styles that will accept chain size and grade consistent with the load rating.

C.V.S.A. includes tables of Working Load Limits of chains and their designating markings used by members of the N.A.C.M. Chart No. 1 is the same as included in the F.M.C.S.R.'s.

**CHART NO. 1 - CHAIN GRADE IDENTIFICATION**

Working Load Limits in Lbs.							
Chain Size (inches)	G30	Chain Size (inches)	G43	Chain Size (inches)	G70	Chain Size (inches)	G80
1/4	1,300	1/4	2,600	1/4	3,150	1/4	3,500
5/16	1,900	5/16	3,900	5/16	4,700	5/16	4,500
3/8	2,650	3/8	5,400	3/8	6,600	3/8	7,100
1/2	4,500	1/2	9,200	1/2	11,300	1/2	12,000



**Proof Coil Grade 30**  
 CM Embossing G30  
 Other Embossing PC,  
 3, 30, C, C3, M3

**High Test Grade 43**  
 CM Embossing G43  
 Other Embossing HT,  
 PH, M, MHT, H, M4, 4,  
 43, C4, G4, G40

**Transport Grade 70**  
 CM Embossing G70  
 Other Embossing 7, 70,  
 G7, M7, C7

**Alloy Grade 80**  
 CM Embossing HA 800  
 Other Embossing A8A,  
 C8, 8, TC8, CA8, G80

Based on D.O.T. requirements and C.V.S.A. guidelines, Chart No. 2 below lists the minimum number of binder chains required to secure an article against movement in any direction. Refer to Cargo Tie-down Requirements for additional requirements.

**CHART NO. 2 - MINIMUM NUMBER OF CHAINS REQUIRED TO SECURE AN ARTICLE AGAINST MOVEMENT IN ANY DIRECTION BASED ON U.S. D.O.T. REQUIREMENTS AND C.V.S.A. GUIDELINES\***

Wgt. of Article in Lbs.		5,000	10,000	15,000	20,000	25,000	30,000	35,000	40,000	45,000	50,000
Binding G70	1/4"	1	2	3	4	4	5	6	7	8	8
	5/16"	1	2	2	3	3	4	4	5	5	6
	3/8"	1	1	2	2	2	3	3	4	4	4
Alloy G80	3/8"	1	1	2	2	2	3	3	3	4	4
Hi-Test G43	5/16"	1	2	2	3	4	4	5	6	6	7
	3/8"	1	1	2	2	3	3	4	4	5	5
Proof Coil G30	3/16	2	3	4	6	7	8	10	11	12	14
	3/8"	1	2	3	4	5	6	7	8	9	10

\* - U.S. D.O.T. requirements and C.V.S.A. guidelines state the aggregate Working Load Limit (W.L.L.) of the tie-down assemblies used to secure an article against movement in any direction must be equal to at least 1/2 (.5) times the weight of the article. Beyond these strength requirements, at least two chains are required every 8 feet for certain metal articles and every 10 feet for other articles.

The load binder is an integral component of the tie-down assembly. They are rated by Working Load Limit and ultimate strength to comply to the chain size and grade of Chart No. 1.

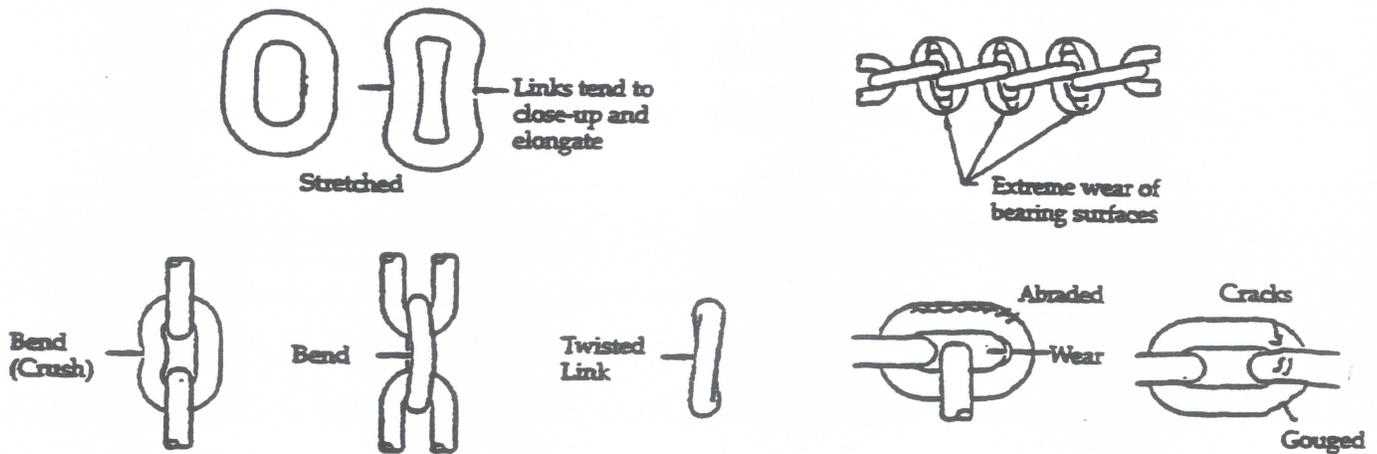
Grades	Chain		Load Binders	
	Trade Size (in.)	Working Load Limit (Lbs.)	Lever Type Model	Ratchet Type Model
CM Grade 30 Proof Coil Chains	1/4	1,300	D48314, 320104	D48365
	5/16	1,900	M105, M105C	D48365
	3/8	2,650	D49405, D48311, M105, D48315, 320105	D48366
	1/2	4,500	M106, D48365, D48316	D48366, D4836
CM Grade 43 High Test Chains	1/4	2,600	M104, 320104	D48365
	5/16	3,900	M105, M105C	D48365
	3/8	5,400	D49405, D48311, M105, M105C, 320105	D48365, D4836
	1/2	9,200	M106, D48306	D48366
	5/8	11,500	D48367	
CM Grade 70 Binder Chains	1/4	3,150	M105, M105C	D48365
	5/16	4,700	D48405, D48311, M105, M105C, 320105	D48365
	3/8	6,600	M106, D48306	D48365, 48666
	1/2	11,300	D48367	

Of equal importance after selection is the use, care and inspection of the chain and binders.

To insure safe operation when using chain, always observe the following criteria:

- Do not exceed the working load limit according to D.O.T. requirements and C.V.S.A. guidelines.
- Free all knots, twists, kinks and protect the chain from sharp corners.
- Attachments such as load binders must match the grade, size and working load limit of chain.
- Inspect the chain before use. Twists, bends, nicks, gouges, excessive wear at the bearing points (inner link area), elongation of links, corrosion or other obvious damage will affect the chain performance and/or reduce the working load limit. *Chains containing any of these conditions should be removed from service.*

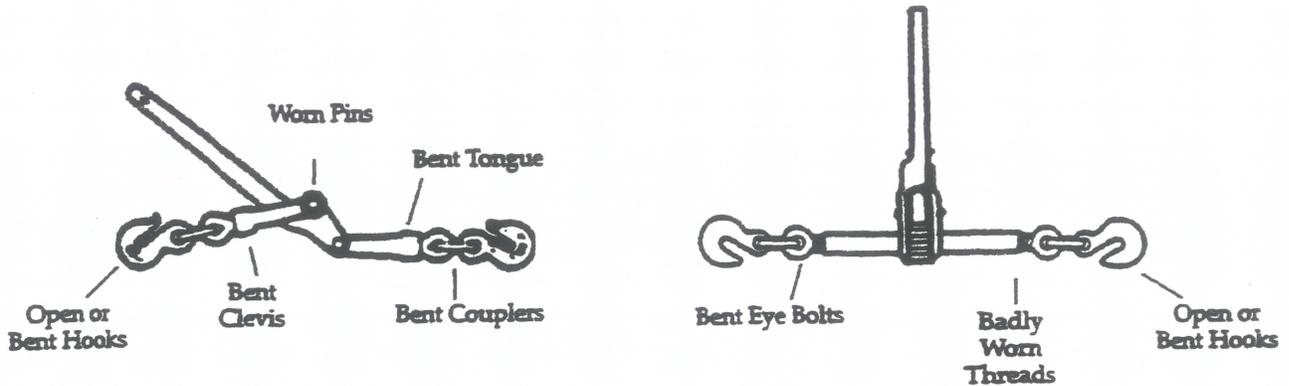
Examples of out-of-service criteria:



To insure safe operation of load binders, always operate using the following criteria:

- Always follow safe work practices and take precautions in use of binders. Particular attention is called to the following sections of the Federal Motor Carrier Regulations: S392.9 (relating to safe loading); S393.100 (relating to protection against shifting or falling cargo); and S393.102 (relating to securement systems). Comply with these regulations.
- Visually inspect binders before use for the following: bending or any distortion of any feature in any plane more than 10 degrees, distorted or elongated connecting links, wear of connecting links of more than 10% of the original stock, yoke distortion or unseating of the yoke from the pins, nicks, gouges not to exceed 10% of the original stock. *Binders containing any of the conditions noted should be removed from service.*
- Operate only by hand from a firm standing position. Do not operate with anyone on the load. Always apply binder in a straight line so that handle goes down when securing load.
- Do not use a handle extension. Extensions can dangerously overload the binder system and may result in serious injury. A substantial hand effort will tighten the binder to a sufficient load. Use a ratchet type binder if sufficient leverage is difficult to develop.
- Make certain that the lever of the lever type binder is over center and locked. Always secure the handle in a locked position with a positive retaining method. The handle must be secured since there is a possibility of relaxation of the load which may result in the lever moving from the locked over center position to a relaxed mode resulting in loss of tension in the system.
- Be sure no one is in a position to be struck by the handle when releasing the lever type binder. Handle may whip suddenly. Use open palm under handle and push up.
- Re-tighten binders periodically.

Examples of out-of-service criteria:



The use, care and inspection of chain binders and load binders including their component parts, hooks and coupling links.

To insure safe operations of chain binders and load binders, always operate using the following criteria:

- Do not apply load to hook latches.
- Hooks and attachments applied to the chain should be selected to match the size and working load limit of the chain.
- Protect from sharp corners and objects. Do not subject to bending.
- Inspect hooks, coupling links and chain before use. Look for the following: wear of more than 10% of the original dimension, 15 increase in hook or slot opening, bent or twisted more than 10% from original plane, damaged load pins or cotter pins, damaged hook latches, excessive wear at bearing point (inner link area), elongation, corrosion or other obvious damage. Binder assemblies or load binders containing any of the noted conditions should be removed from service.

**Remember, chain binders and load binders are only as strong as their weakest link**

 <h1 style="display: inline;">Warning</h1>	
	<p><b>Death/Injury can occur from improper use or maintenance of tie-down equipment.</b></p>
	<p><b>To Avoid Injury:</b></p> <ul style="list-style-type: none"><li>• Inspect before use - remove from service if cracked, worn or deformed.</li><li>• Do not overload. (Load binders develop sufficient load with hand effort).</li><li>• Do not use handle extender on load binder(s).</li><li>• Do not use binder components for overhead lifting.</li></ul>



## Warranty Claims Process

### **MECHANIC or Person Doing Repair ALL CLAIMS MUST GO THROUGH REGION SHOPS SUPERVISOR**

- Determine if the repair is legitimate warranty claim
- Verify that the unit or vehicle is still eligible for warranty through parts card or U.D.O.T. Warranty Dept.
- Determine the most cost efficient way to have the warranty performed, Either in-house or dealer.
- Assign a warranty repair order number in cars with a brief Explanation of break down, Date of break down, Cause and correction of break down.
- Make sure you have the truck VIN number, mileage and hour meter readings at time of repair.
- Do repairs as to get vehicles back on the road.
- Prepare invoice using CARS making certain instructions and corrective action is completed.
- Fill out UDOT warranty claims form complete as soon as possible.
- Notifies Shop Supervisor when job is complete and entered in Cars.
- Tag parts with repair order number and warranty claim form, (parts should be returned in their original box or container as much as possible)
- Send copies of parts invoices and old parts if applicable to Equipment Operations (Warranty Dept. at complex)
- Makes certain that claim is submitted for every job that has potential for reimbursement!
- Checks accuracy and prints CARS Work Order
- Checks accuracy of warranty form.
- Delivers claim, parts and invoice copies to UDOT Warranty Dept at complex.
- Complex Warranty Dept. Processes claim sent in from regions to appropriate vendor for reimbursement of parts and labor.
- Assures that credits are received and applied properly to Vehicle.

Any Questions or problems , contact Complex Equipment Operations  
(Warranty Department)

Boyd Wright	Office Phone (801) 965-3891
4501 So. 2700 W.	Cell Phone (801) 244-8708
Salt Lake City	Fax (801) 965-3850
Utah 84119	E-Mail BoydWright@Utah.Gov
PO Box 145350	

Bw2003



# WARRANTY CLAIM FORM

( FOR UDOT USE ONLY)

Today's Date  / /  Date Of Repair  / /   
 Vehicle Serial Number    
 D.O.T. Vehicle Number  - - -   
 Make   Model   Year    
 Miles   Hours   Region Org.    
 Work Order Number   Mechanic Repair    
 Vendor Invoice of parts#   Attach Invoice For All Parts  
 Part Number   Parts Cost    
 Part Number   Parts Cost    
 Part Number   Parts Cost    
 Total Of All Parts \$    
 Labor Charges (@hr)   Travel Time    
 Complete Damage Code   Labor Hrs.    
 Complete SRT Code

## BASIC DETAIL OF REPAIR

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Send All Old Parts With Warranty Claim To

**BOYD WRIGHT**  
 4501 So. 2700 West  
 Salt Lake City , Utah 84119  
 Equipment Operations (Warranty Dept)  
 PO Box 145350

Office Phone (801) 965-3891  
 Cell Phone (801) 244-8708  
 Fax (801) 965-3850  
 E-Mail [BoydWright@utah.gov](mailto:BoydWright@utah.gov)

All Parts Are At  complex  vendor (Check one)

Total Of Claim Submitted \$

**OIL ANALYSIS FORM**

**All Field Required \***

**The Oil Analysis Lab, Inc**

PO Box 3928  
East 1514 Sprague Ave  
Spokane WA 99202  
Ph (509) 535-9791 Fax (509) 535-1537

**Customer Account Number 92392**

*Note:* You must assign Unit Number or Serial Number and circle **Component Sampled** in order for this sample to Be analyzed

**Sample information Form**

**Mail Report To: Utah Dept of Transportation**

**District: (\*REQUIRED)** \_\_\_\_\_

**Unit work Site: (\*REQUIRED)** \_\_\_\_\_

**REASON FOR SAMPLING:**

(\*)  Routine  Requested by Lab

**Equip Make & Model** \_\_\_\_\_

(\*)  Diessel  Gas

**Mfg 7 Model of Comp(\*Required)** \_\_\_\_\_

1) Unit Number **(\*REQUIRED)** \_\_\_\_\_

2) Component Sampled (Circle one): (\*)  
Engine Trans HYD Diff Compressor  
Planetary Other: **(\*REQUIRED)** \_\_\_\_\_

3) Component Location – Circle Applicable Location(s)  
(\*) Front Rear Left Right  
Center Upper Lower

4) **Date of Sampling: (\*REQUIRED)** \_\_\_\_\_

5) Miles Since New/OH: (If Know) \_\_\_\_\_

6) Miles Since Oil Change: (IF Know) \_\_\_\_\_

7) Oil Mfg & Tradename: (IF Know) \_\_\_\_\_

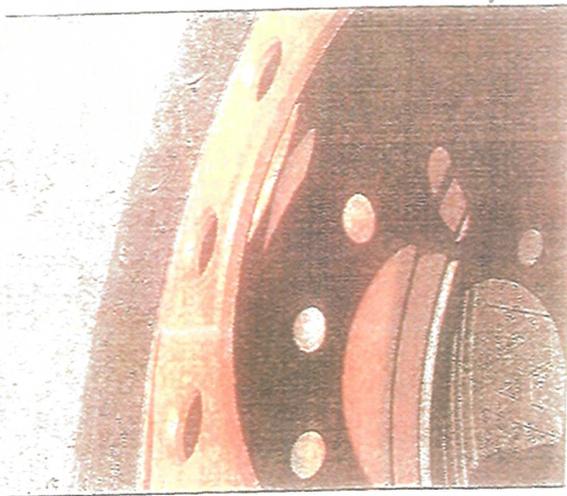
Comments:

**BASIC**

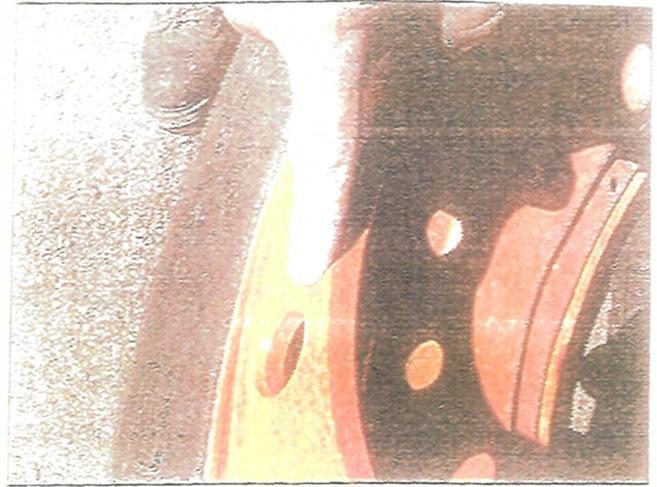
Lab Use Only

Sample No. \_\_\_\_\_ Date \_\_\_\_\_

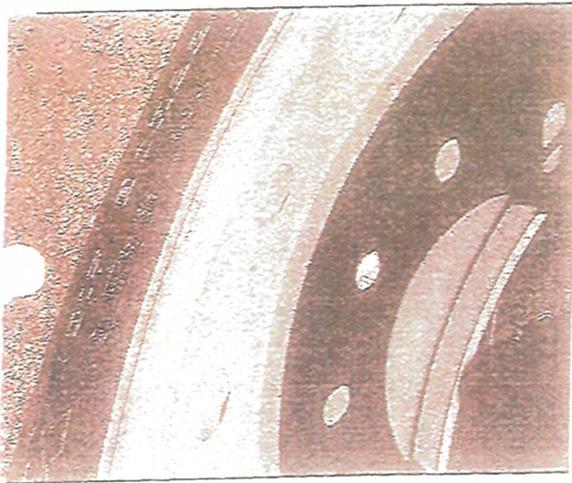
**XXXXX**



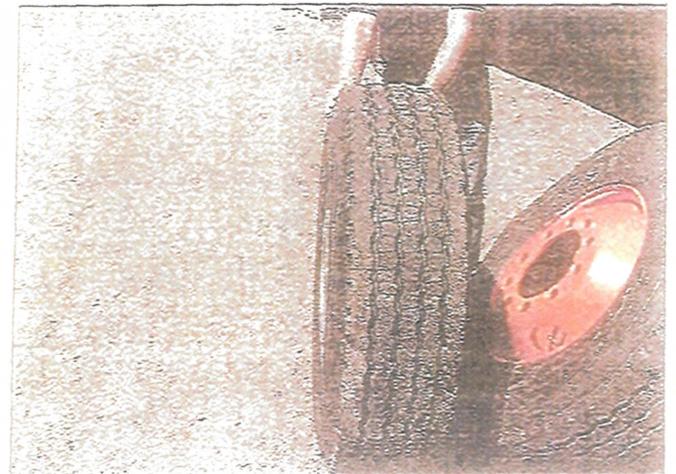
This is a Rear Bud Wheel. It has chamfered bolt holes. Look at the flange it is "thinner" than the front wheel. (Not to be installed on the front of truck.)



This is a Front Bud Wheel. It has chamfered bolt holes with a "thick" flange. (Not to be installed on rear of truck.)



This is a Steering Front Wheel. The existing Metric Hub Pilot Wheel has a thicker flange than the steering. The existing Metric Hub Pilot has a 1 1/2" larger offset. As you can see in the pictures to the right. (On the Sterling Trucks for emergency you can use the existing Front Metric Hub Pilot Wheel.)



Always look at the flange of the wheel.  
 If it has thick or heavier flange it goes on the FRONT.  
 If it has a thin or light flange, it goes on the REAR.  
 This wheel is **Not** interchangeable from front to rear.



# Trailers

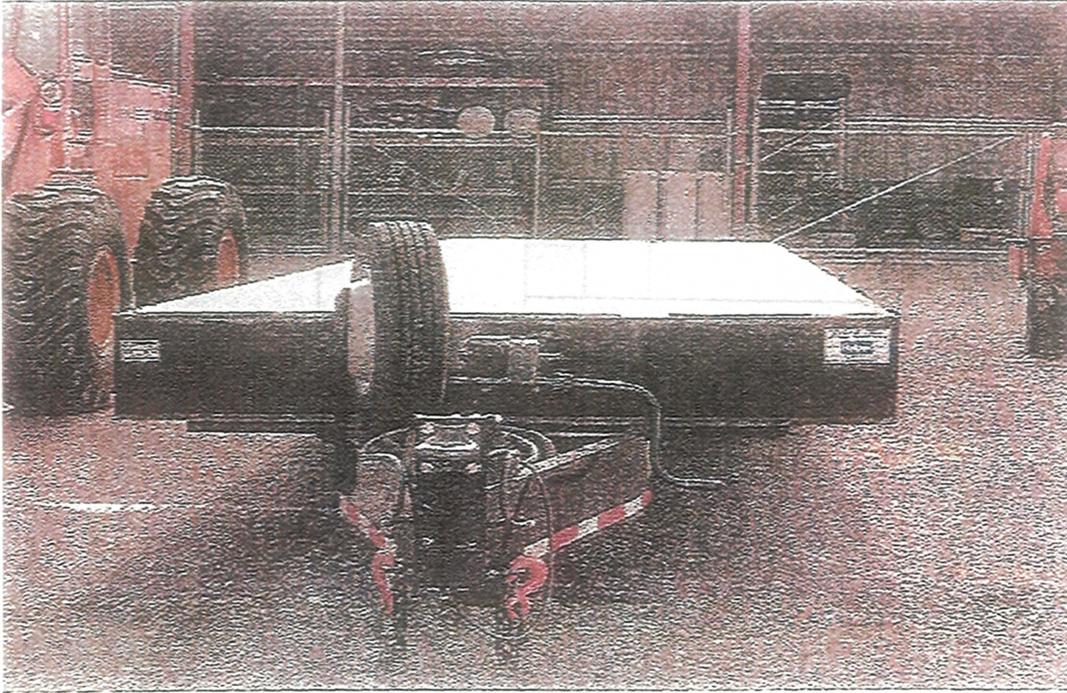
CHECK EACH SHIFT	PRODUCT #	NUMBER OF SERVICE POINTS	FILTERS			
OPERATORS RESPONSIBILITY			APPLICATION	COMMODITY	MFG.	MFG. #
ELECTRICAL CONNECTOR						
TRAILER HITCH (AND SAFETY CHAINS)						
TIRES						
LAMPS						
DRAIN WATER FROM AIR TANK						
WALK AROUND						

SERVICE INTERVALS	REFILL CAP.	NUMBER OF SERVICE POINTS	LUBRICATION PRODUCTS			
WEEKLY (LUBE AND/OR INSPECTION)			40	50		
NOTE #1 #3			GL	MPG		
CHECK LUBE IN WHEEL BEARINGS		40	GEAR	MULTIPLE		
		6	LUBE	PURPOSE		
			80W/90	GREASE # 2		
MONTHLY						
NOTE #1 #3						
COMPLETE LUBE JOB		60				
YEARLY						
NOTE #1 #3						
CHECK BRAKE SYSTEM						

**NOTE # 1**  
 SERVICE INTERVALS MAY BE ALTERED BY EQUIPMENT SHOP SUPERVISOR DURING UNUSUAL OPERATING CONDITIONS

**NOTE # 3**  
 EACH SERVICE INTERVAL PROGRESSION INCLUDED ALL PREVIOUS SERVICE INTERVAL OPERATIONS.

VENDOR  
 TODD WELDING AND MACHINE CO  
 301) 972-8825



<b>TIRES</b>			
ALL	215/75R/17.5	125 PSI	MIN

<b>CHECK EACH SHIFT</b>	PRODUCT #	NUMBER OF SERVICE POINTS	<b>FILTERS</b>			
OPERATORS RESPONSIBILITY			<b>APPLICATION</b>	<b>COMMODITY</b>	<b>MFG.</b>	<b>MFG. #</b>
SAFETY CHAINS						
HITCH						
TIRES (PRESSURE) (WEAR/DAMAGE)						
AIR LEAKS						
HYDRAULIC LEAKS						
AXLE OIL HUBS	40	8				
WALK AROUND						

<b>SERVICE INTERVALS</b>	REFILL CAP.		<b>LUBRICATION PRODUCTS</b>			
<b>MONTHLY</b> LUBE AND/OR INSPECT			40	50		
NOTE #1#3		50	GL	MPG		
TONGUE JACK		50	GEAR	MULTIPLE		
*S* CAMS		50	LUBE	PURPOSE		
SLAKE ADJUSTERS		50	80W/90	GREASE # 2		
COMPLETE LUBE JOB						
<b>YEARLY</b>						
NOTE #1 #3						
CHECK BRAKE LINING						

**NOTE # 1**  
 SERVICE INTERVALS MAY BE ALTERED BY EQUIPMENT SHOP SUPERVISOR DURING UNUSUAL OPERATING CONDITIONS

**NOTE # 3**  
 EACH SERVICE INTERVAL PROGRESSION INCLUDED ALL PREVIOUS SERVICE INTERVAL OPERATIONS.

**VENDOR**  
 TESCO WILLIAMSEN  
 801) 973-8400 (800) 928-9847



<b>TIRES</b>
385/65R/22.5      100 PSI    MAX

## MAINTENANCE ACADEMY TRAILER SCORE SHEET

Operator \_\_\_\_\_

Ore. \_\_\_\_\_ Date: \_\_\_\_\_

Scorer \_\_\_\_\_

**TRUCK COUPLING SYSTEM-**

- pintle hitch \_\_\_\_\_ 0
- mounting bolts \_\_\_\_\_ 0
- safety latch/locking jaws \_\_\_\_\_ 0
- platform/fifth wheel plate \_\_\_\_\_ 0
- release arm \_\_\_\_\_ 0
- king pin, glide plate, gap \_\_\_\_\_ 0
- sliding 5th wheel locking pins \_\_\_\_\_ 0
- TOTAL (7 pass) \_\_\_\_\_**

**TRAILER-FRONT:**

- electrical connections \_\_\_\_\_ 0
- air connection/glad hands \_\_\_\_\_ 0
- hitch, safety chains/hooks \_\_\_\_\_ 0
- landing gear/jack \_\_\_\_\_ 0

**SIDE OF TRAILER:**

- clearance lights \_\_\_\_\_ 0
- reflectors \_\_\_\_\_ 0
- frame \_\_\_\_\_ 0
- decking \_\_\_\_\_ 0
- ties, hooks \_\_\_\_\_ 0

**REAR OF TRAILER:**

- clearance lights \_\_\_\_\_ 0
- tail lights \_\_\_\_\_ 0
- turn signals \_\_\_\_\_ 0
- brake lights \_\_\_\_\_ 0
- hazards (4 way) \_\_\_\_\_ 0
- reflectors \_\_\_\_\_ 0
- tail gate/ties \_\_\_\_\_ 0
- mud flaps \_\_\_\_\_ 0
- TOTAL (17 pass) \_\_\_\_\_**

**WHEELS, SUSPENSION-**

- rims (type/condition) \_\_\_\_\_ 0
- tires (inflation, condition, depth) \_\_\_\_\_ 0
- axle hub seals \_\_\_\_\_ 0
- lug nuts \_\_\_\_\_ 0
- leaf springs \_\_\_\_\_ 0
- hangers/shackles \_\_\_\_\_ 0
- air ride/torsion bars \_\_\_\_\_ 0
- spring mounts \_\_\_\_\_ 0
- TOTAL (8 pass) \_\_\_\_\_**

**BRAKES-**

- slack adjusters \_\_\_\_\_ 0
- air chambers/pots \_\_\_\_\_ 0
- brake lines/hoses \_\_\_\_\_ 0
- brake drums \_\_\_\_\_ 0
- brake linings \_\_\_\_\_ 0
- TOTAL (5 pass) \_\_\_\_\_**

**OTHER-**

**MOTORIZED LOW BOY TRANSPORT TRAILER (TYMCO type):**

- engine oil (level/condition) \_\_\_\_\_ 0
- air cleaner/dust bowl \_\_\_\_\_ 0
- fuel \_\_\_\_\_ 0
- battery (if equipped) \_\_\_\_\_ 0
- belt/drive clutch (if equipped) \_\_\_\_\_ 0

**MOTORIZED AND TILT DECK:**

- hydraulic oil (level/condition) \_\_\_\_\_ 0
- hydraulic lines/hoses \_\_\_\_\_ 0
- hydraulic rams \_\_\_\_\_ 0
- check chains (grade and wear) \_\_\_\_\_ 0
- check hooks (grade and wear) \_\_\_\_\_ 0
- check binders (grade and wear) \_\_\_\_\_ 0
- TOTAL (11 pass) \_\_\_\_\_**

**FIELD OPERATION:**

Rate the operator on the following skills:  
(circle one number, 0-not tested, 1-unsuccessful, 3-successful, 5-excellent. NOTE-failure to load a piece of equipment onto the designated trailer ends the field operation with no score)

HOOK UP TRAILER TO TRUCK _____	0	1	2	3	4	5
PROPERLY ATTACH SAFETY CHAINS _____	0	1	2	3	4	5
CONNECT ELECTRICAL LINES _____	0	1	2	3	4	5
CONNECT AIR LINES _____	0	1	2	3	4	5
TEST TRAILER BRAKES _____	0	1	2	3	4	5
LOAD A PIECE OF EQUIPMENT ON TRAILER _____	0	1	2	3	4	5
UN-LOAD TRAILER _____	0	1	2	3	4	5
DISCONNECT TRAILER FROM TRUCK _____	0	1	2	3	4	5
<b>TOTAL (40 pass) _____</b>						

**85 points possible - TOTAL SCORE: \_\_\_\_\_**

62 points needed for 70% minimum passing score

**COMMENTS:**

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**Snow/Ice**

**UTAH DEPARTMENT OF TRANSPORTATION  
MAINTENANCE DIVISION  
PERFORMANCE STANDARDS**

**ACTIVITY NO. :** 7S78

**ACTIVITY DESC :** Snow and Ice Control

**DESCRIPTION :** To plow snow and/or apply ice control materials on all highways maintained by the Department of Transportation. Each highway on the State System is to be provided a designated type of snow removal service.

**TYPE I SERVICE -**

**Highway Systems Affected** include: (1) Urban interstate, (2) all rural interstate and other highways, generally of 4000 average daily traffic or greater during the snow removal season.

**General Treatment:** (1) Application of ice control materials; (2) plowing frequency to avoid a snow accumulation not to exceed 1 ½ inches, if practical.

**TYPE II SERVICE -**

**Highway Systems Affected** include all rural interstate and other highways less than 4000 average daily traffic during the snow removal season.

**General Treatment** (1) Plowing frequency to avoid a snow accumulation not to exceed 2 inches, if practical, (2) application of ice control materials to hills, curves and severely icy areas.

**TYPE III SERVICE -**

**Highway Systems Affected** include highways where isolation, traffic volume or type, or normal snow conditions demand special treatment not to exceed type allowed as classified for I and II.

**General Treatment** planned on an individual basis with treatment pertinent to each situation.



TYPE IV SERVICE -

Highway Systems Affected include those highways which because of their non-critical access nature are closed to traffic during the winter months.

General Treatment closed in the fall when snow depth requires, and opened as soon in the spring as feasible.

SPECIAL TREATMENT -

Ice and snow pack requiring concentrated effort may exceed TYPE I or TYPE II service.

RSPNSBLTY : Station Supervisor

CALENDAR : JUL AUG SEP OCT NOV DEC JAN FEB MAR APR MAY JUN

SCHD CONS :

LABOR : QTY            TYPE  
5                    People

EQUIPMENT : QTY            TYPE                    EQUIPMENT #  
5                    Truck, Tandem Axle, SRE            0104  
5                    Snow Plow, Straight Blade            0301  
1                    Loader, FE up to 2 Yard            0902  
5                    Spreader, Hyd Drive, 7.5 cu. yds.    1304  
1                    Lease Truck, Pickup, 3/4 Ton            3002

MATERIAL : QTY            TYPE                    INVENTORY #  
50                    Salt Premixed                    77545770310  
1                    Salt                                77545770308  
1                    Deslicking Grit for Snow Oper        75054257359

ACCOMP UNIT: Manhours

AVE. DAILY        QTY            WORK MEASUREMENT UNIT  
PRODUCTION:    40                    Man Hours

OTHER :



**MEASURE OF  
QUALITY :**

1. Snow pushed off shoulders and gore areas.
2. Concrete barrier, bridges and attenuators cleared of snow.
3. Apply materials to proper location.
4. Limit over-application of deslicking material.
5. Clean equipment after snow removal operation.

**METHOD/  
PROCEDURE :**

1. The ice control materials, as a general rule, will consist of an abrasive-salt mixture made up with two (2) parts abrasive to one (1) part salt. Straight salt may be used when deemed necessary to avoid clogging drainage systems in urban areas or when conditions dictate the use of straight salt to obtain the desired ice control. Straight abrasive may also be used to provide reasonable traction when conditions are such that salt usage is causing a snow pack to develop.

Abrasive-salt mixture leaner than two (2) parts abrasive to one (1) part salt may be used when deemed appropriate by the Regions/Districts.

**TYPE I SERVICE -**

1. Apply 0.25 cubic yards per 2 lane mile of straight salt when appropriate or 0.50 cubic yards of an abrasive-salt mix per 2 lane mile after about ½ inch of snow has accumulated on the road surface. Repeat materials application as needed to provide reasonable traction and ice control. Refer to spreader control setting chart for recommended discharge rates.
2. Plow traveled lanes attempting to avoid snow accumulation exceeding 1 ½ inches.
3. As the storm subsides extend plowing to include shoulder, turnout and storage lane areas.



4. **Clean-up operations following the storm are to include: winging back shoulders, removal of snow and ice control materials from structures, signs, delineators, and the opening of drainage ways.**



### TYPE II SERVICE -

1. Plow traveled lanes attempting to avoid snow accumulation exceeding 2 inches and apply ice control materials to hills, curves and severely icy areas at a spreader discharge rate of 0.50 cubic yards per 2 lane mile. Repeat materials application as needed to provide reasonable traction and ice control. Refer to spreader control setting chart for recommended discharge rate.
2. As storm subsides extend plowing to include shoulder, turnout and storage lane areas and continue material application where needed.
3. Clean-up operations following the storm are to include: winging back shoulders, removal of snow and ice control materials from structures, signs, delineator posts and the opening of drainage ways.

### TYPE III SERVICE -

1. The procedures for this type of service will be developed on an individual road basis.

### TYPE IV SERVICE -

1. Close when snow depths require.
2. Notify Region/District Director, Engineer for Maintenance, and Community Relations. Notify and coordinate with pertinent organizations and adjacent Region/District and erect signs to advise traffic. Ascertain that no one is stranded in the closed area, if possible.
3. Engineer for Maintenance will send out a Winter Restrictive Order.
4. Open in the spring as soon as feasible. Notification and coordination as in 2 and 3 above.

### SPECIAL TREATMENT -

1. Ice and snow pack requiring concentrated effort may exceed Type I or II services.
2. For canyon areas, develop a Canyon Safety Plan, where needed, in conjunction with the United States Forest Service, the local law enforcement agency, ski resorts, and other vital organizations.



<b>CHECK EACH SHIFT</b>	PRODUCT #	NUMBER OF SERVICE POINTS	FILTERS		
OPERATORS RESPONSIBILITY			APPLICATION	COMMODITY	MFG.
MOUNTING LATCH SYSTEM					
CUTTING EDGE					
COMPRESSION SPRINGS (MOUNTING ADJUSTMENT ETC.)					
HYDRAULIC LEAKS ( CYLINDERS, HOSES, FITTINGS )					
CHECK LIFT CHAIN/CABLE					
WALK AROUND					

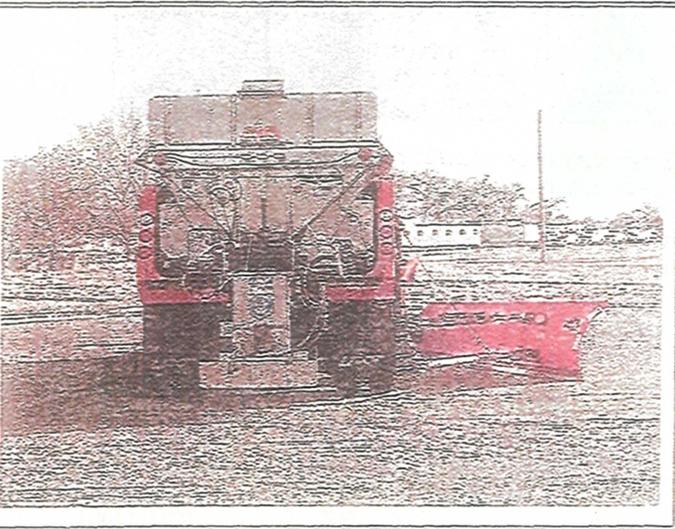
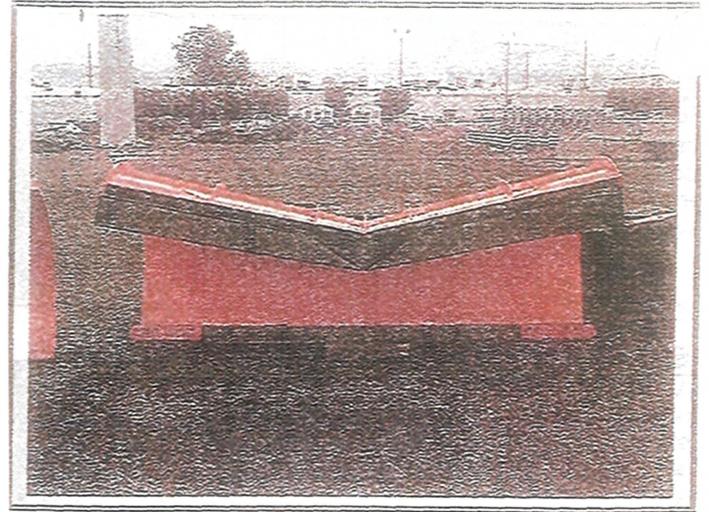
<b>SERVICE INTERVALS</b>	REFILL CAP.			
<b>AFTER EACH SHIFT/STORM</b>				
NOTE #1#3				
GREASE CENTER PIVOT (FRONT PLOWS)	50			
GREASE PIVOT POINTS (LEFT WING )	50			
GREASE WING POST (RIGHT WING)	50			
			LUBRICATION PRODUCTS	
<b>END OF SEASON</b>				
NOTE #1#3				
CLEAN UNIT				
CLEAN AND COVER HYDRAULIC COUPLES				
COAT HYDRAULIC RAMS (TO PREVENT CORROSION)	50		50 MPG MULTIPLE PURPOSE GREASE # 2	

**NOTE # 1**  
 SERVICE INTERVALS MAY BE ALTERED BY EQUIPMENT SHOP SUPERVISOR DURING UNUSUAL OPERATING CONDITIONS

**NOTE # 3**  
 EACH SERVICE INTERVAL PROGRESSION INCLUDED ALL PREVIOUS SERVICE INTERVAL OPERATIONS.

**VENDOR**  
 H%K TRUCK EQUIPMENT (MONROE)  
 (801) 886-3000

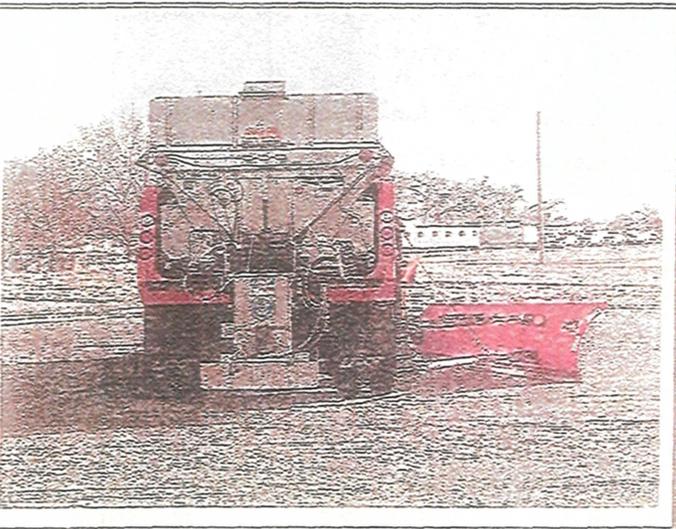
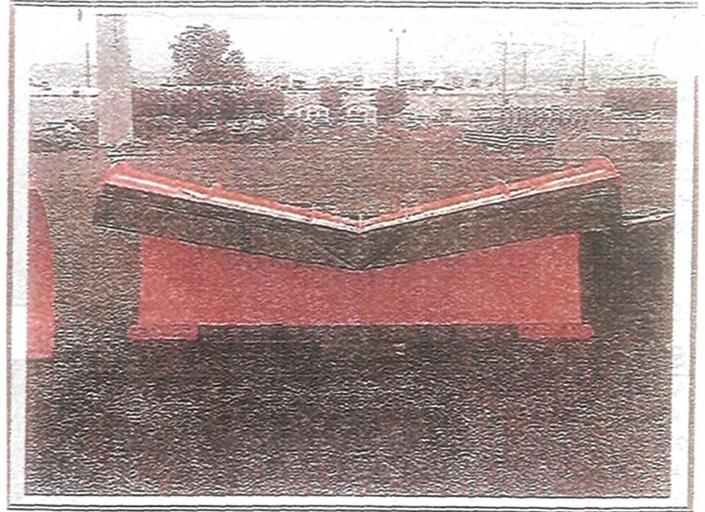
**VENDOR**  
 HOLLAND EQUIPMENT (JENSEN)  
 (801) 972-1601



CHECK EACH SHIFT		PRODUCT #	NUMBER OF SERVICE POINTS	FILTERS			
OPERATORS RESPONSIBILITY				APPLICATION	COMMODITY	MFG.	MFG. #
MOUNTING LATCH SYSTEM CUTTING EDGE COMPRESSION SPRINGS (MOUNTING ADJUSTMENT ETC.) HYDRAULIC LEAKS ( CYLINDERS, HOSES, FITTINGS ) CHECK LIFT CHAIN/CABLE  WALK AROUND							
SERVICE INTERVALS		REFILL CAP.		LUBRICATION PRODUCTS			
<b>AFTER EACH SHIFT/STORM</b> NOTE #1#3 GREASE CENTER PIVOT (FRONT PLOWS) GREASE PIVOT POINTS (LEFT WING ) GREASE WING POST (RIGHT WING)			50 50 50				
<b>END OF SEASON</b> NOTE #1#3 CLEAN UNIT CLEAN AND COVER HYDRAULIC COUPLES COAT HYDRAULIC RAMS (TO PREVENT CORROSION)			50		50 MPG MULTIPLE PURPOSE GREASE # 2		
				<b>NOTE # 1</b> SERVICE INTERVALS MAY BE ALTERED BY EQUIPMENT SHOP SUPERVISOR DURING UNUSUAL OPERATING CONDITIONS <b>NOTE # 3</b> EACH SERVICE INTERVAL PROGRESSION INCLUDED ALL PREVIOUS SERVICE INTERVAL OPERATIONS.			

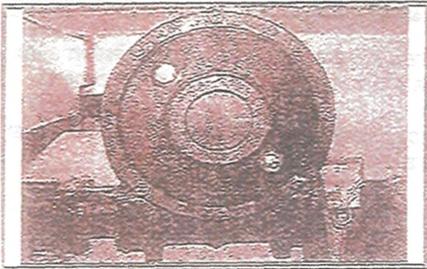
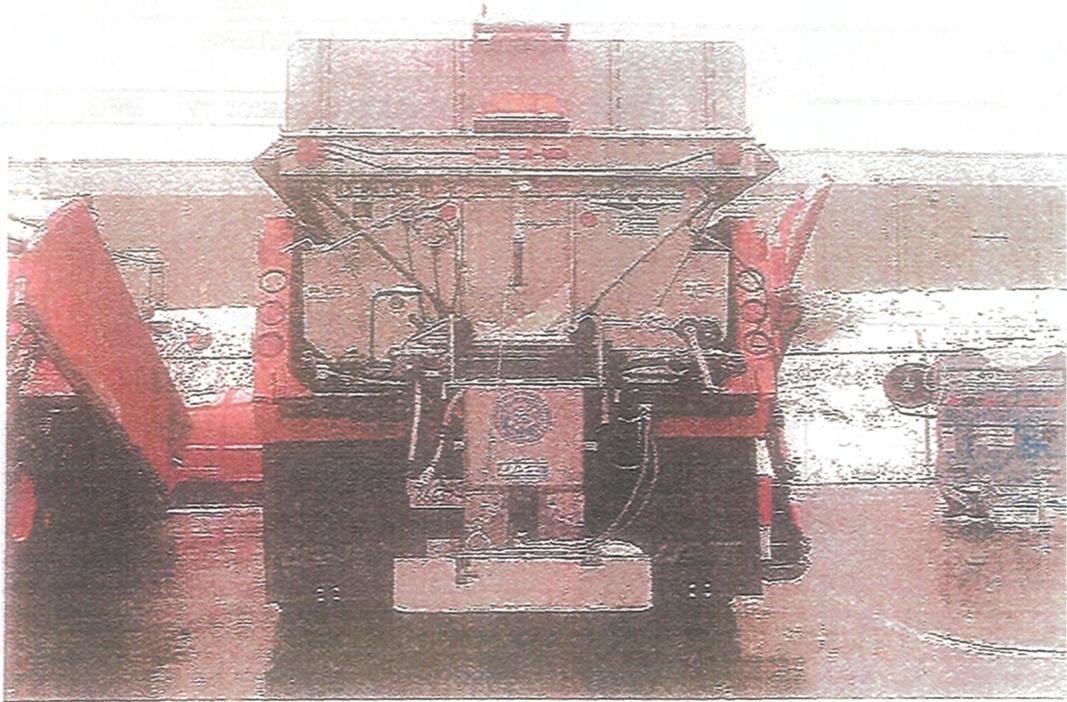
VENDOR  
 H%K TRUCK EQUIPMENT (MONROE)  
 (801) 888-3000

VENDOR  
 HOLLAND EQUIPMENT (JENSEN)  
 (801) 972-1601



<b>CHECK EACH SHIFT</b>	<b>PRODUCT #</b>	<b>NUMBER OF SERVICE POINTS</b>	<b>FILTERS</b>			
<b>OPERATORS RESPONSIBILITY</b>			<b>APPLICATION</b>	<b>COMMODITY</b>	<b>MFG.</b>	<b>MFG. #</b>
TIE DOWNS TAIL GATE LATCH PINS ALL LIGHTS OIL LEAKS DRIVE CHAIN (DAMAGE AND/OR ADJUSTMENT)						
WALK AROUND						
<b>SERVICE INTERVALS</b>	<b>REFILL CAP.</b>					
<b>AFTER EACH SHIFT/STORM</b>			<b>LUBRICATION PRODUCTS</b>			
NOTE #1 #3						
LUBE BOTH FRONT BEARINGS	50	2				
LUBE LEFT REAR BEARING	50	1				
WASH UNIT COMPLETE						
CLEAN AND FLUSH PRE-WET SYSTEM						
INSTALL R.V. ANTI-FREEZE (AS NEEDED)	82	1				
LUBE GATE JACK	50	1				
<b>EVERY 30 DAYS</b>			40	50	82	
NOTE #1 #3			GL	MPG	RV	
CHECK FLUID LEVEL IN CHAIN DRIVE BOX	40	1	GEAR	MULTIPLE	ANTI-FREEZE	
LIGHTLY OIL DRIVE CHAINS		2	LUBE	PURPOSE	RV	
CHECK AND ADJUST DRIVE CHAIN AS NEEDED			80W/90	GREASE #2		
<b>EVERY YEAR</b>			<b>NOTE # 1</b>			
NOTE #1 #3			SERVICE INTERVALS MAY BE ALTERED BY EQUIPMENT SHOP SUPERVISOR DURING UNUSUAL OPERATING CONDITIONS			
CHANGE OIL IN CHAIN DRIVE BOX	40	1	<b>NOTE # 3</b>			
			EACH SERVICE INTERVAL PROGRESSION INCLUDED ALL PREVIOUS SERVICE INTERVAL OPERATIONS.			

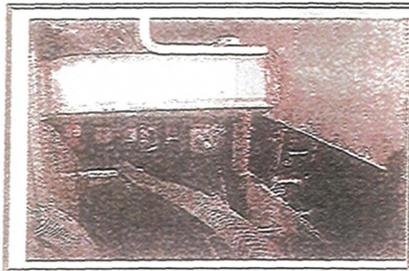
VENDOR  
AG BODY  
(801) 975-0400



GEAR LUBE (80W/90)



LUBE FRONT BEARINGS  
and GATE JACK



LUBE LEFT REAR BEARING

2005

**CHECK EACH SHIFT**

OPERATORS RESPONSIBILITY

PRODUCT #

NUMBER OF SERVICE POINTS

**FILTERS**

TIE DOWNS  
TAIL GATE LATCH PINS  
ALL LIGHTS  
OIL LEAKS  
SPRAY SYSTEM

APPLICATION	COMMODITY	MFG.	MFG. #
-------------	-----------	------	--------

WALK AROUND

**SERVICE INTERVALS**

REFILL CAP.

AFTER EACH SHIFT/STORM  
NOTE #1 #3  
CLEAN AND FLUSH SPRAY SYSTEM

WHEN IN STORAGE  
INSTALL R.V. ANTI-FREEZE

82

**LUBRICATION PRODUCTS**

82 RV ANTI-FREEZE RV
-------------------------------

**NOTE # 1**

SERVICE INTERVALS MAY BE ALTERED BY EQUIPMENT SHOP SUPERVISOR DURING UNUSUAL OPERATING CONDITIONS

**NOTE # 3**

EACH SERVICE INTERVAL PROGRESSION INCLUDED ALL PREVIOUS SERVICE INTERVAL OPERATIONS.

VENDOR  
HOLLAND EQUIPMENT  
801) 972-1801



2005

PAGE NUMBER

2005  
13 03

**CHECK EACH SHIFT**

OPERATORS RESPONSIBILITY

PRODUCT #

NUMBER OF SERVICE POINTS

**FILTERS**

- TIE DOWNS
- TAIL GATE LATCH PINS
- ALL LIGHTS
- OIL LEAKS
- DRIVE CHAIN (DAMAGE AND/OR ADJUSTMENT)
- SPRAY SYSTEM
- WALK AROUND

APPLICATION

COMMODITY

MFG.

MFG. #

**SERVICE INTERVALS**

REFILL CAP.

**AFTER EACH SHIFT/STORM**

NOTE #1 #3

- LUBE BOTH FRONT BEARINGS
- LUBE LEFT REAR BEARING
- WASH UNIT COMPLETE
- CLEAN AND FLUSH SPRAY SYSTEM
- LUBE GATE JACK

50

2

50

1

50

1

**LUBRICATION PRODUCTS**

**EVERY 90 DAYS**

NOTE #1 #3

- CHECK FLUID LEVEL IN CHAIN DRIVE BOX
- LIGHTLY OIL DRIVE CHAINS
- CHECK AND ADJUST DRIVE CHAIN AS NEEDED

40

1

2

82  
RV  
ANTI-FREEZE  
RV

**EVERY YEAR**

NOTE #1 #3

- CHANGE OIL IN CHAIN DRIVE BOX

40

1

**NOTE # 1**

SERVICE INTERVALS MAY BE ALTERED BY EQUIPMENT SHOP SUPERVISOR DURING UNUSUAL OPERATING CONDITIONS

**NOTE # 3**

EACH SERVICE INTERVAL PROGRESSION INCLUDED ALL PREVIOUS SERVICE INTERVAL OPERATIONS.

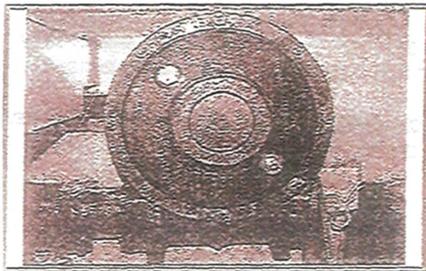
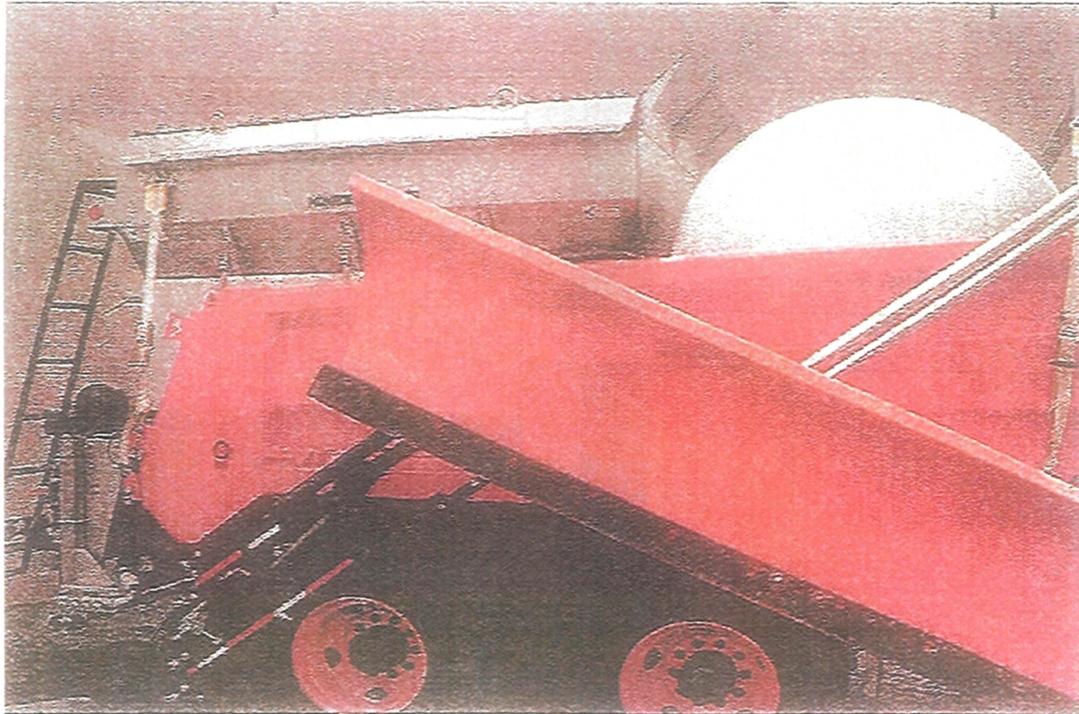
**WHEN IN STORAGE**

- INSTALL R.V. ANTI-FREEZE

82

**VENDOR**

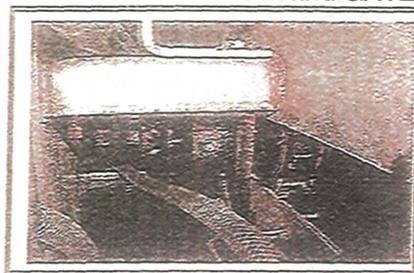
H&K TRUCK EQUIPMENT  
'801) 888-3000



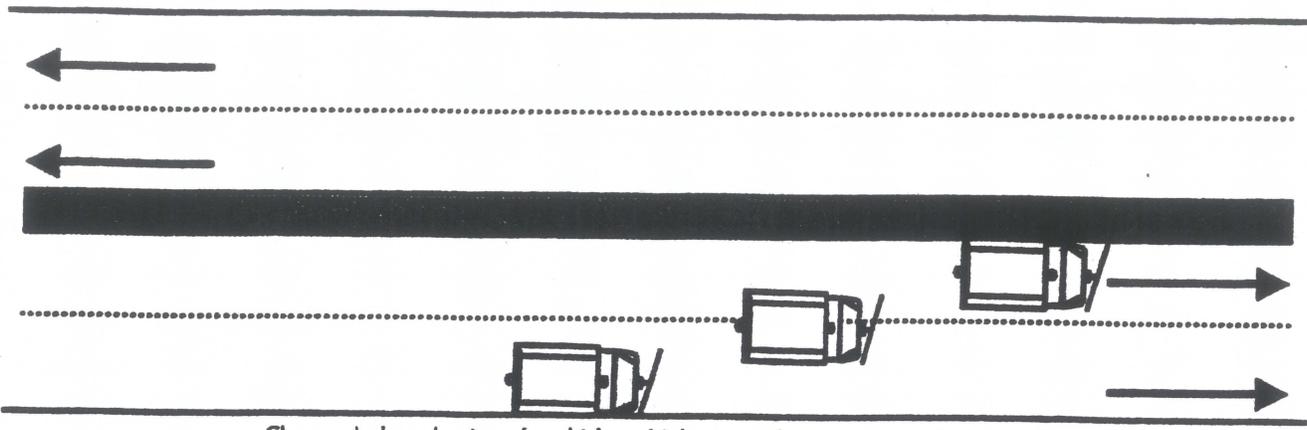
GEAR LUBE (80W/90)



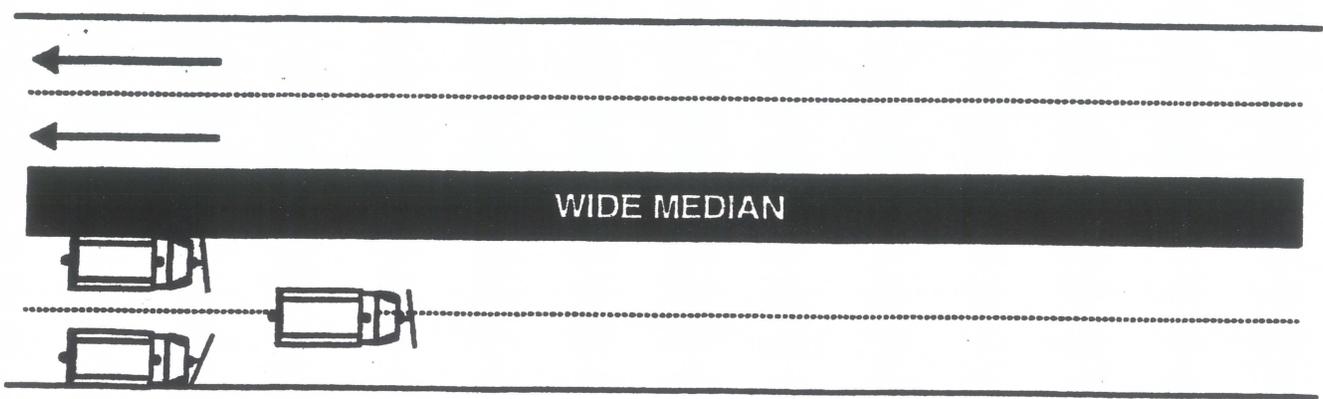
LUBE FRONT BEARINGS  
and GATE JACK



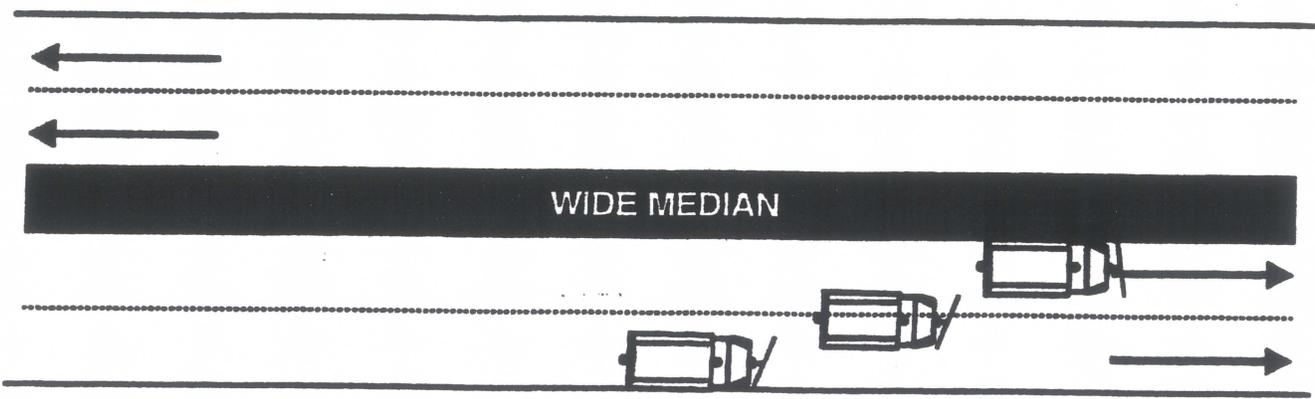
LUBE LEFT REAR BEARING



a. Close echelon plowing of multi-lane highway with a narrow median or barrier.



b. Close echelon plowing of a multi-lane highway with a wide median, variation 1.

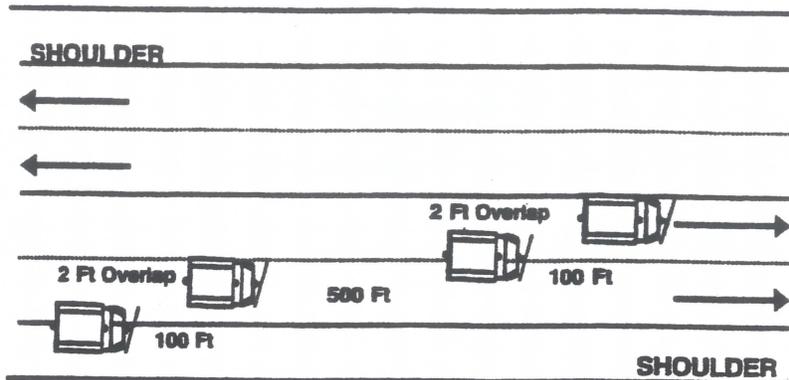


c. Close echelon plowing of a multi-lane highway with a wide median, variation 2.

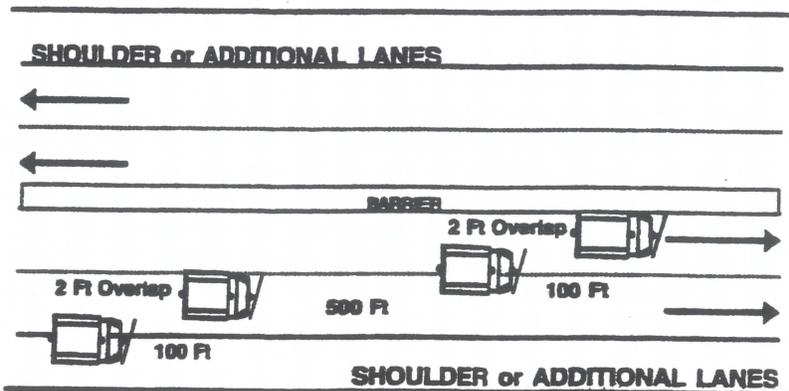
Figure 12. Examples of Close Echelon Plowing Patterns.



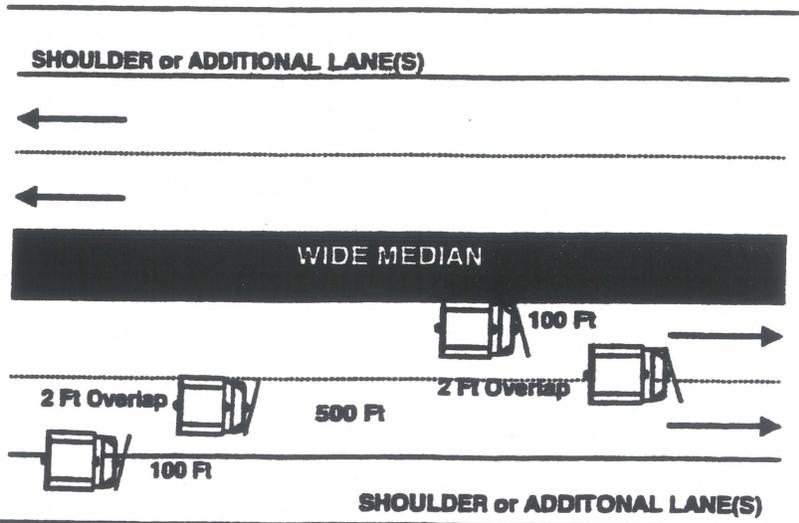




a. Tandem plowing, undivided multi-lane highway.  
 Note: There will be a windrow of snow that traffic has to traverse.



b. Tandem plowing, undivided multi-lane highway divided by a barrier.  
 Note: There will be a windrow of snow that traffic has to traverse.

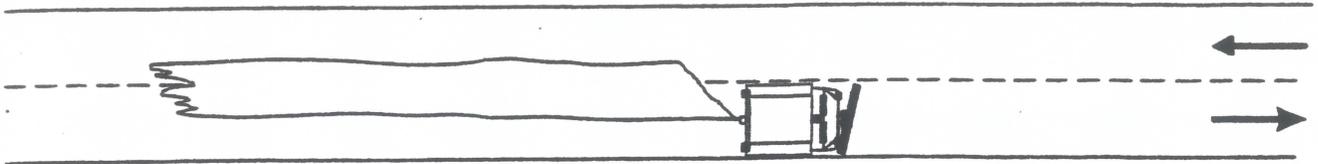


c. Tandem plowing, multi-lane highway with median storage capacity.

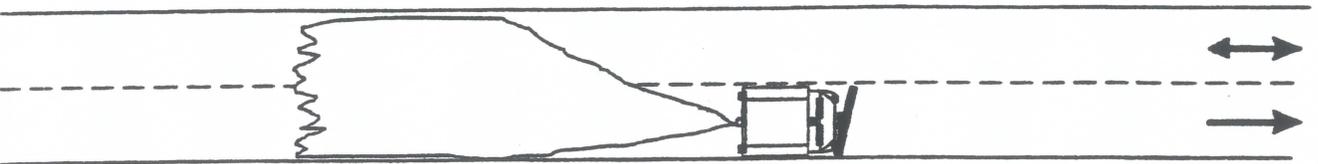
Figure 13. Examples of Tandem Plowing Patterns.



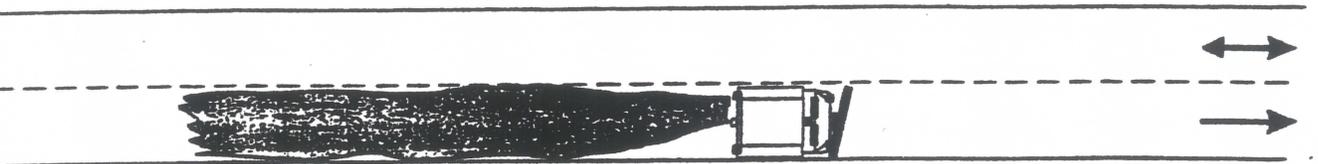




**SALT  
TWO WAY TRAFFIC**



**SALT OR ABRASIVES  
ONE OR TWO WAY TRAFFIC**



**SALT OR ABRASIVES  
ONE OR TWO WAY TRAFFIC**

Figure 16. Examples of spreading (not plowing) patterns for two-lane roads.





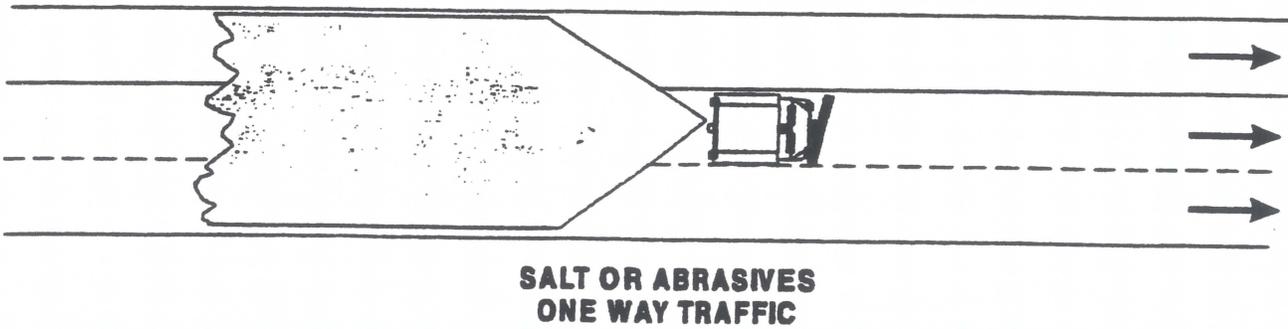
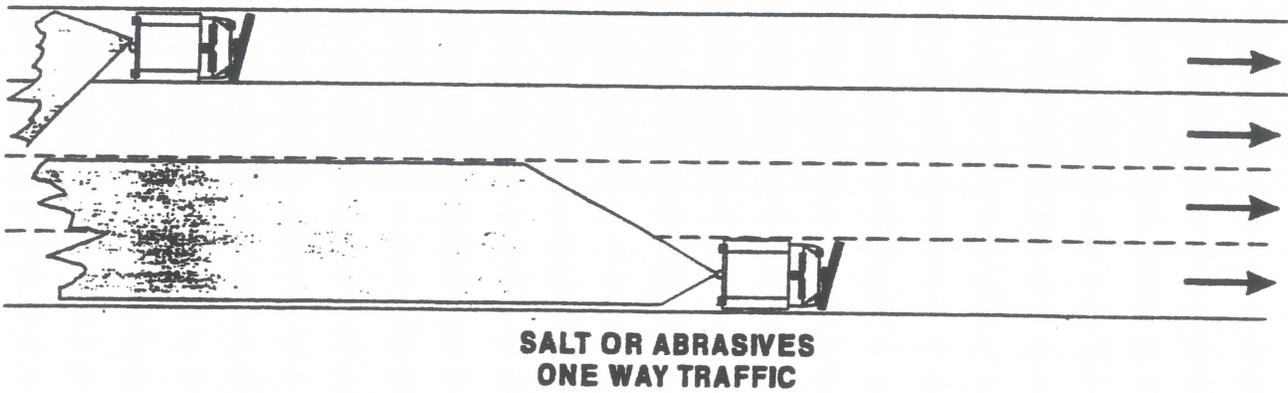
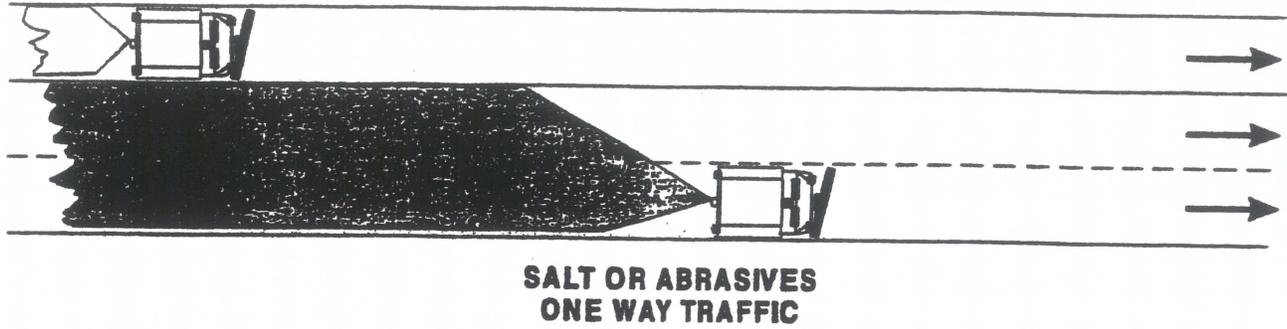


Figure 17. Examples of spreading (not plowing) patterns for multi-lane roads.





# How to Use Liquid Anti-Icers

## How Do Ice Control Products Work?

All ice control products work the same. Their function is to lower the freeze point temperature of water. This ability is dependent upon the percentage of chemical in solution and is expressed as the "Eutectic Temperature" of the solution. *The Eutectic Temperature is the freeze point temperature of a solution based on the percentage of material in solution, not volume.*

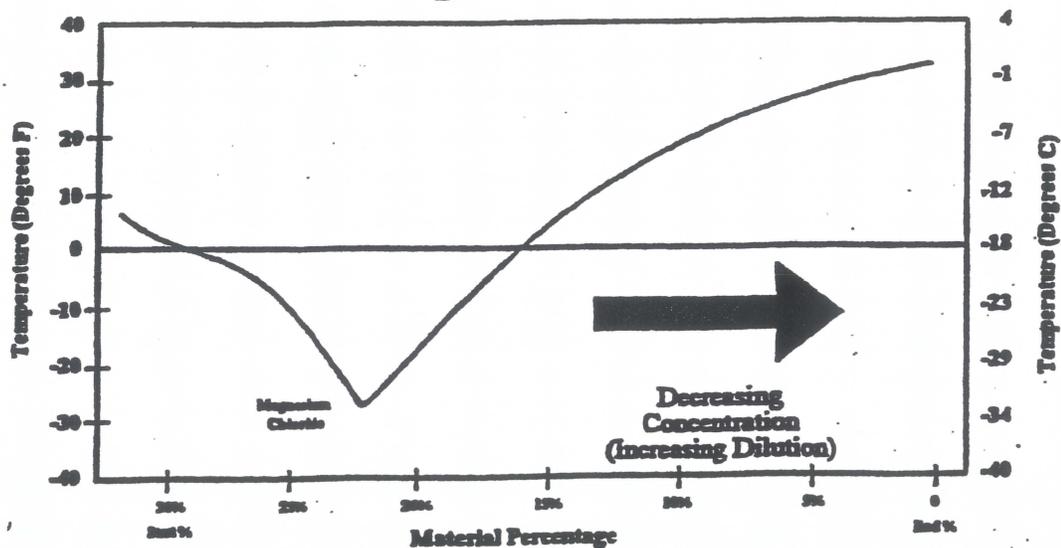
While this may seem complex, the freeze chart on an anti-freeze container is an example.

For example, let's say you have a 12-quart capacity radiator system. You fill it with 6 quarts of anti-freeze and the remainder with water. This is a 50% solution that provides protection down to -34 deg. However, if you fill the system with 4 quarts anti-freeze and the remainder water, the volume of material is the same, but the 25% concentration protects only down to +10 deg.

The same holds true for all ice control products. These products melt snow, which creates water and dilutes the concentration. *As the concentration changes, so does melting temperature of the material.* The chart below illustrates the freeze point curve for magnesium chloride.

Magnesium chloride actually becomes more effective (melts at lower temperature) as it dilutes down to 22% solution from higher concentrations.

### Freezing Point Curve



*As product concentrations change,  
so does the melting temperature.*



# How to Use Liquid Anti-Icers

## Basic Strategies

 **Anti-icing** is a snow and ice control strategy for prevention of a strong bond between frozen precipitation or frost and a pavement surface by timely application of a chemical freezing point depressant.

 **Deicing** is an operation where a treatment of a deicer is applied to the top of an accumulation of snow, ice, or frost that is already bonded to the pavement surface.

**Anti-icing = Proactive**

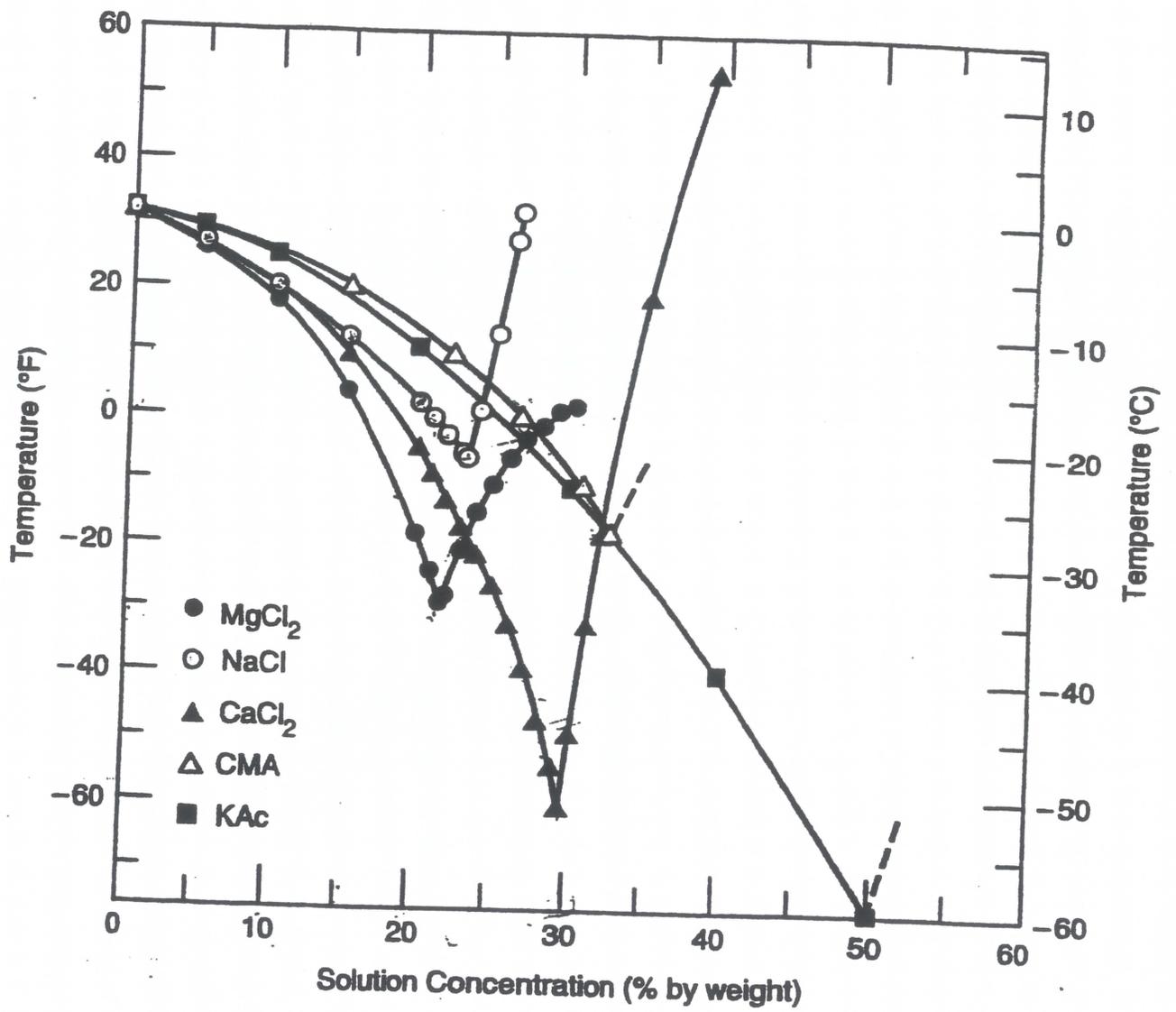
**Deicing = Reactive**

### *ANTI-ICING*

- Improve service levels
- Reduce maintenance costs
- Improve air quality
- Apply during better road conditions

***Both Anti-icing and Deicing are needed for effective winter storm management.***







### Snow and Ice Chemical Application Guide

Temperature (F)	Precip. Type:		Rain		Light Snow		Heavy Snow		Frost/Black Ice	
	Anti-icing	De-icing	Anti-icing	De-icing	Anti-icing	De-icing	Anti-icing	De-icing	Anti-icing	De-icing
32 & Rising	none	none	none	none	none	none	none	none	none	none
32 & Falling	Salt @ 100	Salt @ 100	Brine @ 100	Salt+Brine @ 100	Brine @ 100	Salt+Brine @ 100	Brine @ 100	Salt+Brine @ 100	Brine @ 50	Salt+Brine @ 50
31			Brine @ 100	Salt+Brine @ 100	Brine @ 100	Salt+Brine @ 100	Brine @ 100	Salt+Brine @ 100	Brine @ 50	Salt+Brine @ 50
30			Brine @ 100	Salt+Brine @ 100	Brine @ 100	Salt+Brine @ 100	Brine @ 100	Salt+Brine @ 100	Brine @ 50	Salt+Brine @ 50
29			Brine @ 100	Salt+Brine @ 100	Brine @ 100	Salt+Brine @ 100	Brine @ 200	Salt+Brine @ 200	Brine @ 50	Salt+Brine @ 50
28			Brine @ 100	Salt+Brine @ 100	Brine @ 100	Salt+Brine @ 100	Brine @ 200	Salt+Brine @ 200	Brine @ 50	Salt+Brine @ 50
27			Brine @ 100	Salt+Brine @ 100	Brine @ 100	Salt+Brine @ 100	Brine @ 200	Salt+Brine @ 200	Brine @ 50	Salt+Brine @ 50
26			Brine @ 100	Salt+Brine @ 100	Brine @ 100	Salt+Brine @ 100	Brine @ 200	Salt+Brine @ 200	Brine @ 100	Salt+Brine @ 100
25			Brine @ 100	Salt+Brine @ 100	Brine @ 100	Salt+Brine @ 100	Brine @ 200	Salt+Brine @ 200	Brine @ 100	Salt+Brine @ 100
24			Mag @ 100	Mag+Salt @ 100	Mag @ 100	Mag+Salt @ 100	Mag @ 200	Mag+Salt @ 250	Mag @ 100	Mag+Salt @ 100
23			Mag @ 100	Mag+Salt @ 100	Mag @ 100	Mag+Salt @ 100	Mag @ 200	Mag+Salt @ 250	Mag @ 100	Mag+Salt @ 100
22			Mag @ 100	Mag+Salt @ 100	Mag @ 100	Mag+Salt @ 100	Mag @ 200	Mag+Salt @ 250	Mag @ 100	Mag+Salt @ 100
21			Mag @ 100	Mag+Salt @ 100	Mag @ 100	Mag+Salt @ 100	Mag @ 200	Mag+Salt @ 250	Mag @ 100	Mag+Salt @ 100
20			Mag @ 100	Mag+Salt @ 100	Mag @ 100	Mag+Salt @ 100	Mag @ 200	Mag+Salt @ 250	Mag @ 100	Mag+Salt @ 100
19			Mag @ 200	Mag+Salt @ 200	Mag @ 200	Mag+Salt @ 200	Mag @ 200	Mag+Salt @ 250	Salt @ 100	Mag+Salt @ 100
18			Mag @ 200	Mag+Salt @ 200	Mag @ 200	Mag+Salt @ 200	Mag @ 200	Mag+Salt @ 250	Salt @ 170	Mag+Salt @ 170
17			Mag @ 200	Mag+Salt @ 200	Mag @ 200	Mag+Salt @ 200	Mag @ 200	Mag+Salt @ 250	Salt @ 170	Mag+Salt @ 170
16			Mag @ 200	Mag+Salt @ 200	Mag @ 200	Mag+Salt @ 200	Mag @ 200	Mag+Salt @ 250	Salt @ 170	Mag+Salt @ 170
15 & Rising			Flow Only	Flow Only	Flow Only	Flow Only	Flow Only	Flow Only	Apply	Abrasives
15 & Falling			Flow Only	Flow Only	Flow Only	Flow Only	Flow Only	Flow Only	Apply	Abrasives

**MAX SPREAD SPEED 35 MPH**

Old rates

**DO NOT SPREAD MATERIAL**

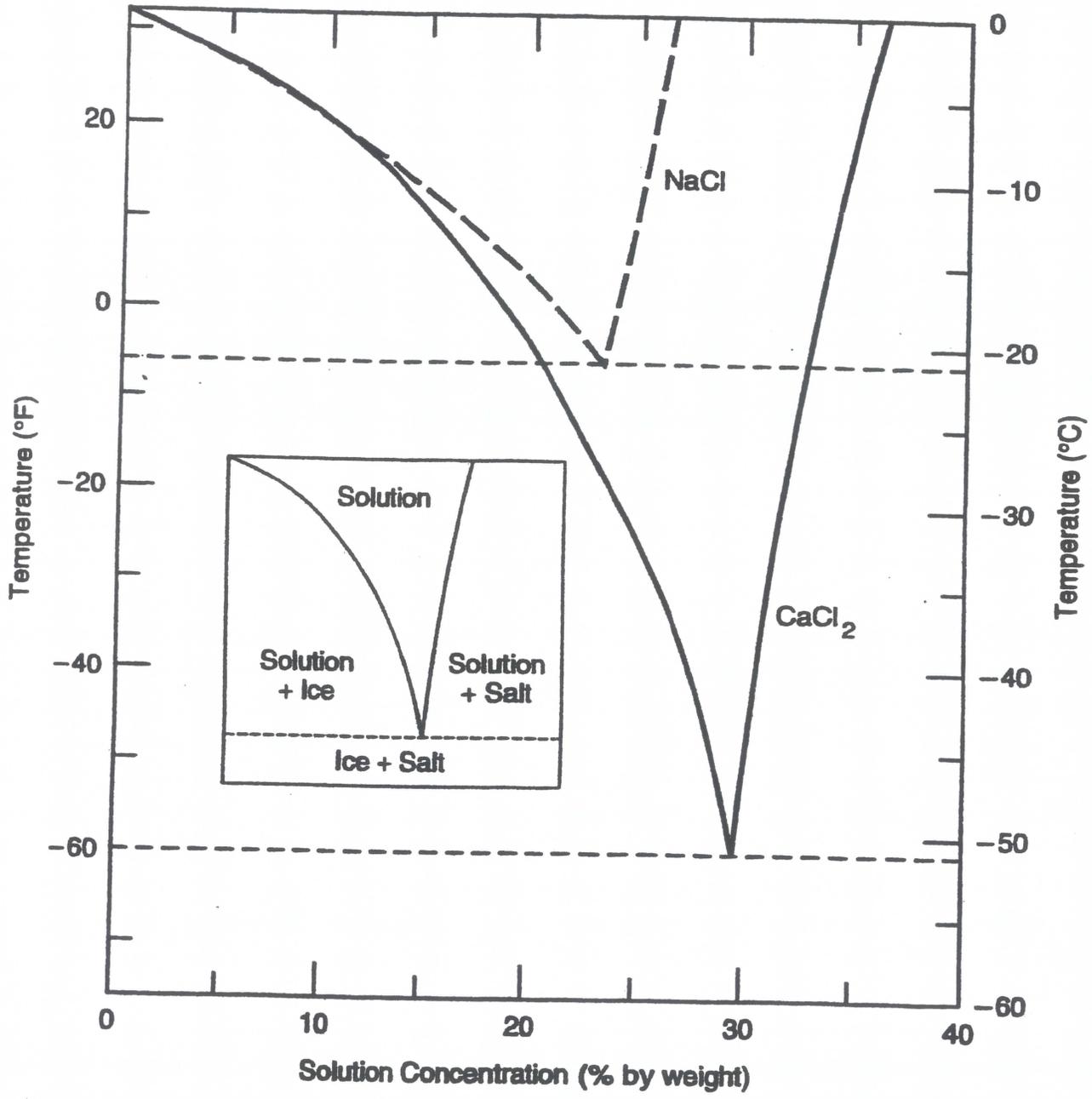
Salt 1/8 cu.yd. per lane mile = 250 lbs.

**BEYOND WHEEL TRACK OF**

Pre-mix 1/4 cu. yd per lane

**TRUCK**







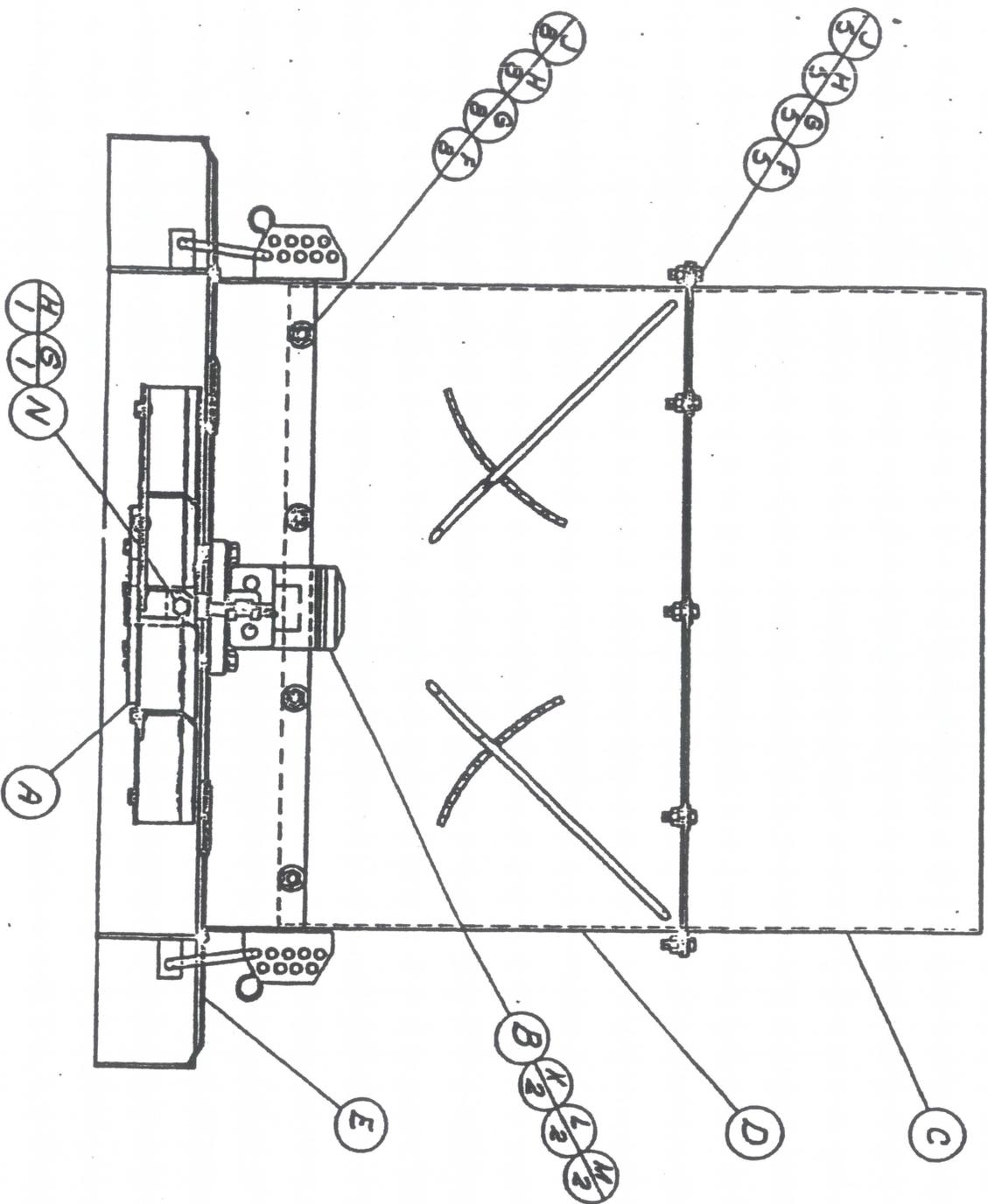
Chemical	Eutectic temperature °C (°F)	Eutectic concentration %
calcium chloride (CaCl <sub>2</sub> )	-51 (-60)	29.8
sodium chloride (NaCl)	-21 (-5.8)	23.3
magnesium chloride (MgCl <sub>2</sub> )	-33 (-28)	21.6
calcium magnesium acetate (CMA)	-27.5 (-17.5)	32.5
potassium acetate (KAc)	-60 (-76)	49

Table 1. Pure salt concentration and corresponding specific gravity (measured by a hydrometer) at 15°C (59°F).

Percent salt	Specific gravity at 15°C (59°F)	Percent of saturation	*Weight of salt kg/m <sup>3</sup> (lb/gal)
0	1.000	0	0 (0)
5	1.035	20	51.8 (0.432)
6	1.043	24	62.7 (0.523)
7	1.050	28	73.5 (0.613)
8	1.057	32	84.6 (0.706)
9	1.065	36	95.9 (0.800)
10	1.072	40	107.2 (0.895)
11	1.080	44	118.9 (0.992)
12	1.087	48	119.8 (1.000)
13	1.095	52	131.8 (1.100)
14	1.103	56	154.7 (1.291)
15	1.111	60	166.8 (1.392)
16	1.118	63	178.9 (1.493)
17	1.126	67	191.5 (1.598)
18	1.134	71	204.3 (1.705)
19	1.142	75	217.2 (1.813)
20	1.150	79	230.1 (1.920)
21	1.158	83	243.4 (2.031)
22	1.166	87	256.8 (2.143)
23	1.175	91	270.3 (2.256)
24	1.183	95	284.1 (2.371)
25	1.191	99	293.3 (2.448)
25.2	1.200	100	

\*Note: Weight of commercial salt required = (weight of pure NaCl from table) ÷ (purity in percent)

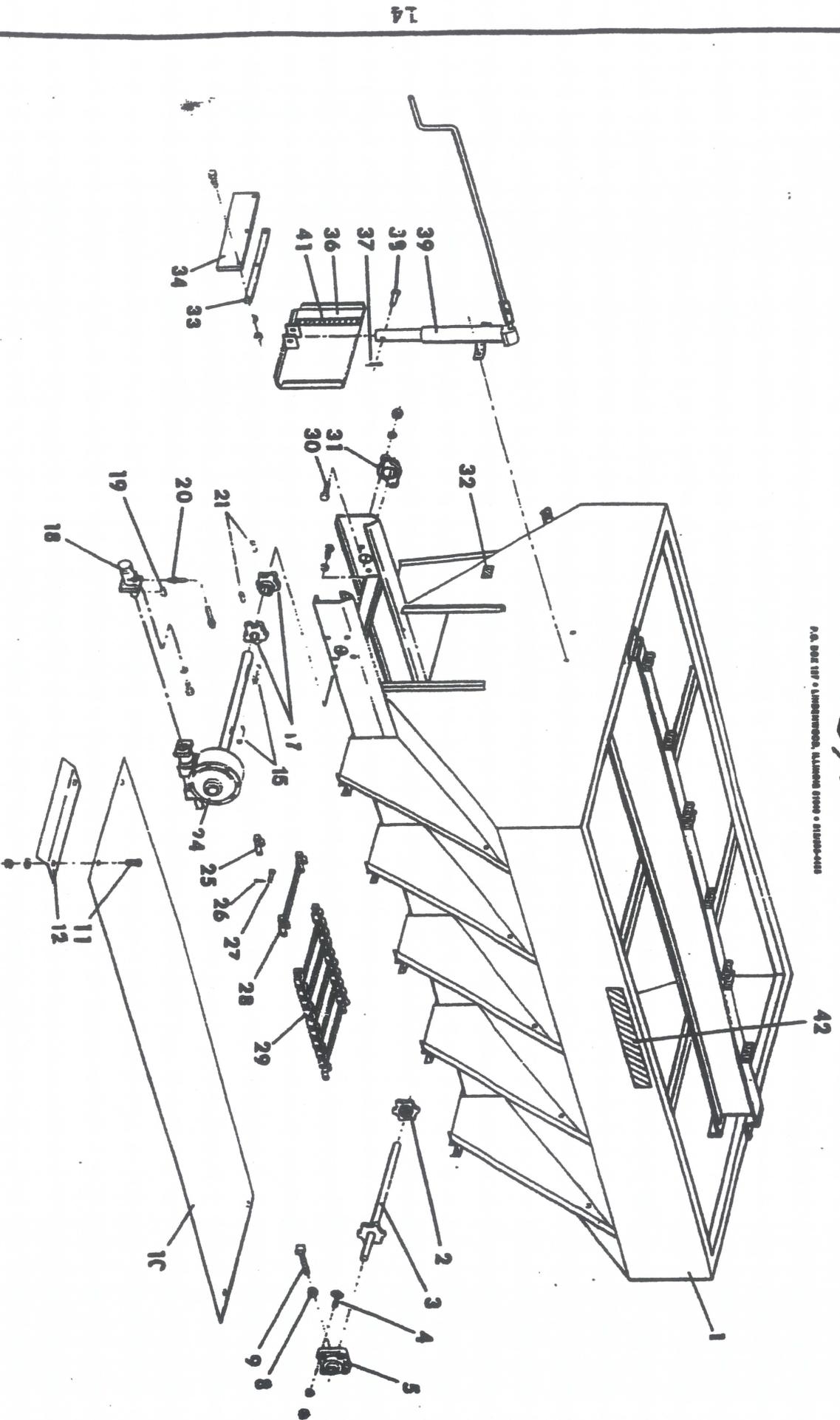




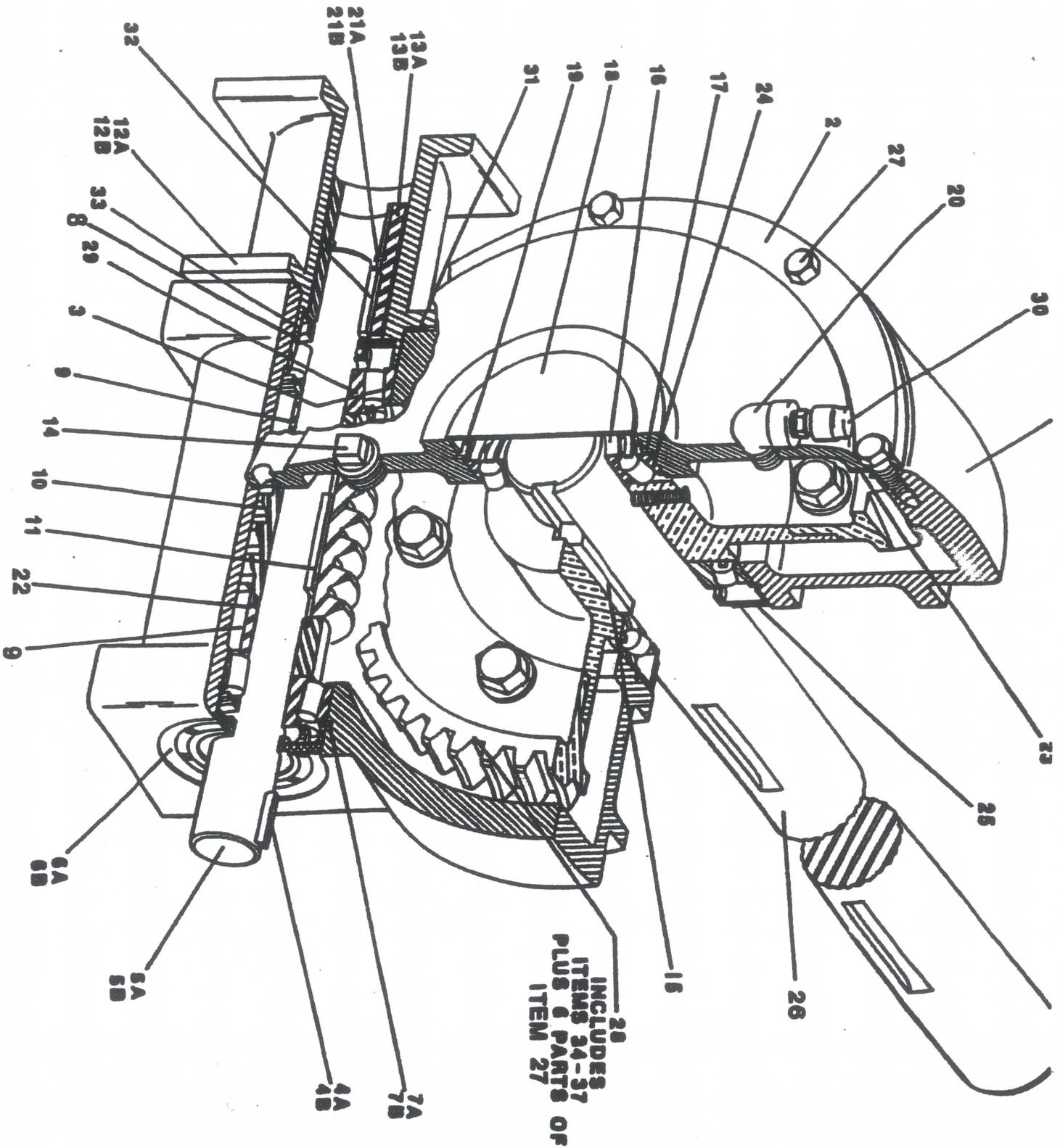
BILL OF MATERIALS			
ITEM	QTY.	PART NO.	DESCRIPTION
A	1	60405	SPINNER ASSEM.
B	1	51832	MOTOR
C	1	60122	PANEL - UPPER
D	1	60123	CHUTE WELD'Y
E	1	60129	4 SEC. BARRIE G.
F	13	10553	HEX SCREW 1/8-16N
G	14	10527	NUT - HEX 3/8
H	14	10539	LOCK WASHER 3/8
J	13	10538	FEET WASHER 3/8
K	2	271	HEX SCREW 1/2-13A
L	2	10560	NUT - HEX 1/2-13NC
M	2	10550	LOCKWASHER 1/2
N	1	10565	HEX SCREW 3/8-16

DATE	REV.	DESCRIPTION	DRAWING
NOV 1954	1	HENDERSON MFG MANUFACTURED BY CDA 1 BA	601
DRYING UNIT	BY	SH	
TITLE: SPINNER GROUP - STD.			
HYD. DR. W/4 SEC. BARRIERS			











**SANDER CALIBRATION WORKSHEET**

**TRUCK #** \_\_\_\_\_

**SANDER #** \_\_\_\_\_

**CALIBRATION DATE** \_\_\_\_\_

**OPERATOR** \_\_\_\_\_

Auger Chain Sander Setting	Shaft RPM	LBS PER REVOL.	LBS. PER MINUTE	NOTES:
1.				
2.				
3.				
4.				
5.				
6.				
7.				
8.				
9.				
10.				

**RPM x AVERAGE LBS. PER REVOLUTION = LBS. PER MINUTE**

SPEED	Time required to travel one (1) mile.	LBS. Required per minute (salt)	LBS. Required per minute (pre-mix)	Chain Setting
15 MPH	4 minutes	125 LBS.		
20 MPH	3 minutes	167 LBS.		
25 MPH	2 min. 24 seconds	208 LBS.		
30 MPH	2 minutes	250 LBS.		
35 MPH	1 min. 43 seconds	291 LBS.		
40 MPH	1 min. 30 seconds	334 LBS.		
45 MPH	1 min. 20 seconds	376 LBS.		
50 MPH	1 min. 12 seconds	417 LBS.		
55 MPH				
60 MPH	1 minute	500 LBS.		

Gate Setting

Gate 2"

Gate 4"

\*1 Cubic yard of salt = 2000 lbs. = 1 ton

\*1 Cubic yard of Pre-mix - 2000 lbs. = 1 ton

**\*TYPE ONE (1) SERVICE = 1/4 YARD SALT OR 1/2 YARD PRE-MIX PER TWO (2) LANE MILE.**



# **Tractors/Mowers**

**UTAH DEPARTMENT OF TRANSPORTATION  
MAINTENANCE DIVISION  
ACTIVITY PERFORMANCE STANDARDS**

**NUMBER AND TITLE**     7S32 - Mowing

**DESCRIPTION**

Mowing of vegetation within the highway right-of-way to improve appearance, control growth height, control seed production, and control plant propagation.

**RESPONSIBILITY**

Station Supervisor

**CALENDAR**

**JUL   AUG   SEP   OCT   NOV   DEC   JAN   FEB   MAR   APR   MAY   JUN**  
████████████████████

**CONDITIONS FOR SCHEDULING**

The annual mowing should be performed during the months of July through October, or after seed set on roadside grasses. Mowing should be avoided during nesting seasons of bird species. Variation of this schedule may be approved by District personnel when safety, noxious weeds are a problem. First priority in mowing should be given to hazard conditions, approaches to cities and towns. Mowing right-of-way to right-to-way should only be done every three to five years.

**LABOR**

**OPERATIONS WITH BAT-WING MOWER**

QTY  
2

TYPE  
People

**EQUIPMENT**

QTY  
2  
1  
2

TYPE  
Tractor, 70 HP and up  
Lease Truck, Pickup, 3/4 Ton  
Rotary Mower, over 7feet

EQUIPMENT #  
0403  
3002  
3802

(Transportation and Signs)

**LABOR**

**OPERATIONS WITH SINGLE UNIT MOWER ONLY**

QTY  
1

TYPE  
Person

**EQUIPMENT**

QTY  
1  
1  
1

TYPE  
Mower, over 7 feet  
Tractor, up to 70 HP  
Truck, Pickup, 3/4 Ton

EQUIPMENT #  
3802  
0403  
1902



**MATERIAL**

QTY    UNIT    TYPE  
No Material

INVENTORY #

**ACCOMPLISHMENT UNIT**

Acres Mowed

**AVERAGE DAILY PRODUCTION**

QTY

WORK MEASUREMENT UNIT

Acres Mowed

Single Unit Mower  
3.0 - 5.0 Acres/Day  
.8 - 1.6 person hours/Acre

Bat-Wing Mower  
10.0 - 14.0 Acres/Day  
1.1 - 1.6 Person hours/Acre

**OTHER**

**MEASURE OF QUALITY**

Rating criteria: (Should be evaluated within 10 days of being mowed).

1. Rural Correct Width = (5'-15' shoulder strip) Mow right-of-way one quarter mile past city limits.

10 points - 1' over/under standard width  
8 points - 1' - 1.9' over/under  
6 points - 2' - 2.9' over/under  
4 points - 3' - 3.9' over/under  
2 points - 4' - 4.9' over/under  
0 points - >5' over/under

2. Rural Safety Mowing = all areas, medians, and transitions mowed to standard

10 points - 90% - 100% of mowable acres  
8 points - 80% - 89%  
6 points - 70% - 79%  
4 points - 60% - 69%  
2 points - 50% - 59%  
0 points - >50%

3. Urban Safety Mowing = Right-of-way to right-of-way including medians.



10 points - 90% - 100% of mowable acres  
8 points - 80% - 89%  
6 points - 70% - 79%  
4 points - 60% - 69%  
2 points - 50% - 59%  
0 points - >50%

4. Mowing Height = Standard Height = 6 inches

10 points - 6"  
8 points - 5" or 7"  
4 points - 4" or 8"  
0 points - <4" or >8"

5. Appearance

10 points - 90% - 100% of identified areas  
8 points - 80% - 89%  
6 points - 70% - 79%  
4 points - 60% - 69%  
2 points - 50% - 59%  
0 points - >50%

This applies to trimming around sign posts, delineators, guardrail, and not leaving unmowed strips.

#### **METHOD / PROCEDURE**

1. Place safety devices and signs (refer to Section 7).
2. The mowing width will vary depending upon if the road is an urban or rural road, and upon the type of road. Gravel roads will not be mowed. Refer to the Vegetation Control Manual for specifications.
3. Before mowing right-of-way to right-of-way, get UDOT Vegetation Manager approval.
4. In fill areas all vegetation should be cut so no vegetation is higher than the roadway.
5. Some hand work may be required around obstructions such as guardrail, sign posts, ditch banks, etc.
6. Mowing is machine paced, therefore, the most efficient operations are those which depend on each mower working independently. Bat-wing mowers are most effectively used to mow wide swaths and make a minimum of turning movements. Seven foot single unit mowers should be used with bat-wing when required for clean up.



7. Remove safety devices and signs.



FARM TYPE TRACTOR  
OPERATOR PREVENTATIVE MAINTENANCE  
BEFORE OPERATION

(Daily before mowing)

FLUID LEVELS

Check and refill Engine oil, Engine coolant, Hydraulic oil, Battery water and brake fluid;

LUBRICATE

Front axle pivots, front axle king pins, steering linkage, hitch and three point.

RADIATOR

Check radiator screens and radiator core. Clean if needed. Clean cooler and radiator areas with compressed air blown from the rear or fan side.

AIR CLEANER

Check pre-cleaner and dust cups. Clean as needed. Squeeze rubber dust valve under cleaner if equipped. Check restriction indicator. replace filter if tripped. DO NOT CLEAN FILTERS REPLACE THEM IF NEEDED!

TIRES AND WHEELS

Check tires for proper inflation, cuts, bruises and damage. Check wheel mounting hardware and lug nuts.

LIGHTS AND WARNING DEVICES

Check lights, roto beams and slow moving vehicle sign.

START ENGINE

Observe gauges for proper pressure and operation. Check outside for visible oil leakage. Check brakes for proper operation. Check position of three point hitch and attachment of implement. Three point hitch must be raised and remain in the up position for Bat wing mower operation.

CAB AND OPERATOR PLATFORM

Check and use Seat belt. Check Fire Extinguisher, First Aid Kit, and Mower Tool Kit.



## DURING OPERATION

(Every 30 Minutes)

### WHEELS, RIMS, LUGS AND TIRES

Check wheels for loose mounts. Inspect tires for damage and nails. Check hitch mounting and pins. Check radiator screens, clean if necessary. Check roto beams.

## AFTER OPERATION

(At the end of day)

Fill fuel tank. Check tires for damage/nails and inflation. Clean cab or operator area. Park tractor in protected area and lock up as needed. Report to supervisor or complete work order for items needing repair.

## WEEKLY CHECKS AND SERVICES

### ENGINE

Check drive belts and coolant hoses. Drain water and sediment from fuel filter bowls.

### CAB AND OPERATORS PLATFORM

Check or clean cab filters. Clean cab interior.

### SERVICE

Check hour meter and service record. Service as per preventative Maintenance Schedule listed in Preventative Maintenance Manual.

Operator preventative maintenance should be accomplished using the Manufactures Operator Manual as a guide.



## MOWERS

### OPERATOR PREVENTATIVE MAINTENANCE

#### BEFORE OPERATION

(Daily before mowing)

#### LUBRICATE

All U-joints, Telescoping shafts, Plastic PTO Shields, Check and fill all gear boxes, Axle Pivots, and Hitch pivots.

#### BLADES

Check mounting hardware, Remove debris from blade carrier and gear box. Oil leakage from gear box onto blades needs attention! Notify Supervisor. Sharpen blades as required.

#### HITCH

Check for cracks, missing pins. Level mower and check mowing height.

DO NOT MOW LESS THAN 6" HIGH

#### DECK

Check chain guards front and rear  
Check all PTO and mower guards

KEEP ALL GUARDS AND SHIELDS IN PLACE

#### POWER TAKE OFF SHAFT

Inspect u-joints shields and shafts.  
Loose drive lines should be replaced or repaired.  
Clean all debris from PTO shafts and shields.  
PTO shields should rotate freely.

#### MOWER CLUTCH

Check friction disc.  
Inspect shear bolts. (tight and correct grade)  
Replace broken springs and adjust as per Manual.

#### HYDRAULICS

Inspect hoses, rams and connections.  
Replace leaking and frayed hoses and connections.  
Check and refill Hydraulic tank.

#### SKID PLATES OR WHEELS

Inspect skid plates for wear and attachment.  
Check wheel mounts, tires and lugs.



## DURING OPERATION

(Every 30 minutes)

### UNDER MOWER

Raise and install safety link.  
Check gear box/blade carrier.  
Remove twine, wire and debris from gear box/blade carrier.  
Inspect gearbox seal for leakage or damage.  
Inspect blades for missing, bent or loose hardware.

### HITCH

Check hitch pins & linkage for proper attachment.

### POWER TAKEOFF SHAFT

Inspect PTO shafts.  
Remove any debris wrapped on shafts or shields.  
Any area of PTO or gear boxes, excessively hot, should be checked. Check and notify Supervisor of excessive heat or unusual vibration.

## AFTER OPERATION MAINTENANCE

Clean mower deck of weeds debris and items which may have collected during day of operation.  
Inspect wheels and tires for loose mounts, damage and debris lodged in tread.

## WEEKLY PREVENTATIVE MAINTENANCE CHECKS

Clean deck of grass and debris. (Wash if necessary)  
Check hitch.  
Inspect frame for cracks.  
Check level rods and deck hinges.  
Lube wheel bearing zerks.  
(Do not over grease and invert seals)  
Check for loose wheel bearings.



YEAR

2003

MAKE **KUBOTA**  
ENGINE **KUBOTA 3.3L**

MODEL **M-8200**  
MODEL **V3300TE**

REV 06/12/03

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**CHECK EACH SHIFT**

**OPERATORS RESPONSIBILITY**

ENGINE COOLANT  
ENGINE CRANKCASE  
ENGINE AIR CLEANER(SEE NOTE # 2)  
TIRES  
TRANSMISSION OIL LEVEL  
FUEL/WATER SEPARATOR  
CLEAN RADIATOR GRILL  
WALK AROUND

PRODUCT #

83  
10  
1  
4  
30  
1  
1  
1

NUMBER OF SERVICE POINTS

1  
1  
1  
4  
1  
1  
1  
1

**APPLICATION**

OIL  
FUEL  
AIR PRIMARY  
AIR SECONDARY  
COOLANT  
HYDRAULIC ( 2 USED )

**FILTERS**

COMMODITY	MFG.	MFG. #
NON-STOCKING	KUBOTA	1C020-82490
06042391711	FLTGRD	FF167
NON-STOCKING	FLTGRD	AF25352
NON-STOCKING	FLTGRD	AF25553
N/A	N/A	N/A
NON-STOCKING	KUBOTA	33980-82630

**SERVICE INTERVALS**

REFILL CAP.

**FIRST 50 HOURS**

(NOTE #1#2#4#8)

CHANGE ENGINE OIL  
CHANGE ENGINE OIL FILTER  
CHANGE HYDRAULIC OIL FILTER  
CHANGE TRANSMISSION FLUID  
CHANGE FRONT AXLE GEAR CASE OIL  
CHANGE FRONT DIFFERENTIAL FLUID

11.8 qt. 10 1  
1  
2  
54.9 QT. 30 1  
3.7 QT 40 2  
3.3 QT 40 1

**LUBRICATION PRODUCTS**

10 15W/40 FLEET CRANKCASE OIL	30 THF TRACTOR HYDRAULIC FLUID
---	--

**EVERY 50 HOURS** (NOTE #1#2#4#8)

CHECK BATTERY  
CLEAN RAD. SCREEN AND CHECK COOLANT LEVEL

1  
1

**EVERY 100 HOURS** (NOTE #1#2#4#8)

GREASE ALL FITTINGS

30

40 GL 80W/90 GEAR LUBE	83 EXT/EG ANTI-FREEZE EXTENDED LIFE	50 MPG MULTIPLE PURPOSE GREASE #2
---------------------------------	---	---

**EVERY 200 HOURS** (NOTE #1#2#4#8)

CHANGE ENGINE OIL FILTER  
CHANGE ENGINE OIL

11.3 qt. 10 1  
1

**EVERY 300 HOURS** (NOTE #1#2#4#8)

CHANGE HYD. FILTER

1

**NOTE # 1**  
SERVICE INTERVALS MAY BE ALTERED BY EQUIPMENT SHOP SUPERINTENDENT DURING UNUSUAL OPERATING CONDITIONS  
**NOTE # 2**  
IF VEHICLE IS EQUIPPED WITH AIR RESTRICTION INDICATOR: CHANGE PRIMARY ELEMENT WHEN RESTRICTION GAUGE READS IN  
IF VEHICLE HAS NO AIR RESTICTION INDICATOR:FOLLOW MANUFACTURER'S RECOMMENDED SERVICE INSTRUCTIONS.  
**NOTE #4**  
SEND REPRESENTATIVE SAMPLE OF FLUID TO CURRENT LAB.TAKE ALL CORRECTIVE ACTIONS AS SUGGESTED BY ANALYSIS RESULYS.  
**NOTE #8**  
REPLACE FILTER OR DCA4 AS PER SECTION 1 (COOLING SYSTEM CHECK AND PROCEDURE)

**EVERY 400 HOURS** (NOTE #1#2#4#8)

CHANGE FUEL FILTER  
CLEAN FUEL/WATER SEPARATOR

1  
1

**EVERY 600 HOURS** (NOTE #1#2#4#8)

CHANGE FRONT DIFFERENTIAL FLUID  
CHANGE FRONT AXEL GEAR CASE FLUID  
CHANGE TRANSMISSION FLUID

5.3 QT 40 1  
3.7 QT 40 2  
54.9 QT 30

**EVERY TWO YEARS** (NOTE #1#2#4#8)

COOLING SYSTEM(CLEAN AND FLUSH)  
CHANGE ENGINE COOLANT

9.5 QT 83 1  
1



TIRES	LOCATION	PRESSURE	
11.2x24	FRONT	23 psi	MAX
18.4x28	REAR	18 psi	MAX

REQUIRE SAFETY	EQUIPMENT
FIRST AID KIT	34532000711
FIRE GUN 5 lb.	34028361504
HAND FLARES	55020441055
GLOW-STICKS	55020550101
TRIANGLE KIT	34532000713

REQUIRE FORMS
VEHICLE USER GUIDE
PROOF OF INSURANCE CARD
ACCIDENT REPORT
WARRANTY CLAIM
EQUIPMENT JACKET
DRIVER'S INSPECTION REPORT

<b>CHECK EACH SHIFT</b>				<b>FILTERS</b>			
<b>OPERATORS RESPONSIBILITY</b>	<b>PRODUCT #</b>	<b>NUMBER OF SERVICE POINTS</b>	<b>APPLICATION</b>	<b>COMMODITY</b>	<b>MFG.</b>	<b>MFG. #</b>	
CHECK HYDRAULIC OIL LEVEL	30	1	HYDRAULIC (SPIN-ON)	NON STOCKING	ALAMO	02578018	
CHECK TIRES			HYDRAULIC (TANK)	NON STOCKING	ALAMO	02984345	
CHECK BLADES							
CHECK BLADE CARRIER							
CHECK FOR OIL LEAKS							
CHECK HITCH							
CHECK SAFETY CHAINS							
WALK AROUND							

<b>SERVICE INTERVALS</b>							
	<b>REFILL CAP.</b>						
<b>EVERY 8 HOURS</b>							
NOTE #1#3							
LUBE LINKAGE ATTACHMENT	50	2					
LUBE HEAD ATTACHMENT PIN	50	1					
LUBE BOOM LINKAGE PIN	50	1					
LUBE TILT CYLINDER PIVOT	50	1					
LUBE BOOM SLEEVE	50	3					
<b>LUBRICATION PRODUCTS</b>							
			<b>50</b>	<b>40</b>	<b>51</b>	<b>30</b>	
			<b>MPG</b>	<b>GL</b>	<b>GREASE</b>	<b>THF</b>	
			MULTIPLE	GEAR	TRIPLE 000	TRACTOR	
			PURPOSE	LUBE	RATED	HYDRAULIC	
			GREASE #2	80W90	GREASE	FLUID	
<b>MONTHLY</b>							
NOTE #1#3							
CHECK OIL LEVEL IN SPEED INCREASER	40	1					
CHECK GREASE LEVEL IN SPINDLE	51	1					

<b>FIRST 200 HOURS</b> NOTE #1#3#4							
CHANGE HYDRAULIC FILTER ( SPIN-ON)	30						
CHANGE HYDRAULIC OIL FILTER (TANK)	30						
TAKE OIL SAMPLE							
<b>EVERY 800 HOURS OR YEARLY</b>							
NOTE #1#3#4							
CHANGE HYDRAULIC FILTER (SPIN-ON)	30	1					
CHANGE HYDRAULIC FILTER ( TANK)	30	1					
TAKE OIL SAMPLE							
<b>EVERY 1600 HOURS OR EVERY OTHER YEAR</b>							
NOTE #1#3#4							
CHANGE HYDRAULIC OIL	60 GAL.	30	1				

**NOTE # 1**  
SERVICE INTERVALS MAY BE ALTERED BY EQUIPMENT SHOP SUPERINTENDENT DURING UNUSUAL OPERATING CONDITIONS

**NOTE # 3**  
EACH SERVICE INTERVAL PROGRESSION INCLUDED ALL PREVIOUS SERVICE INTERVAL OPERATIONS.

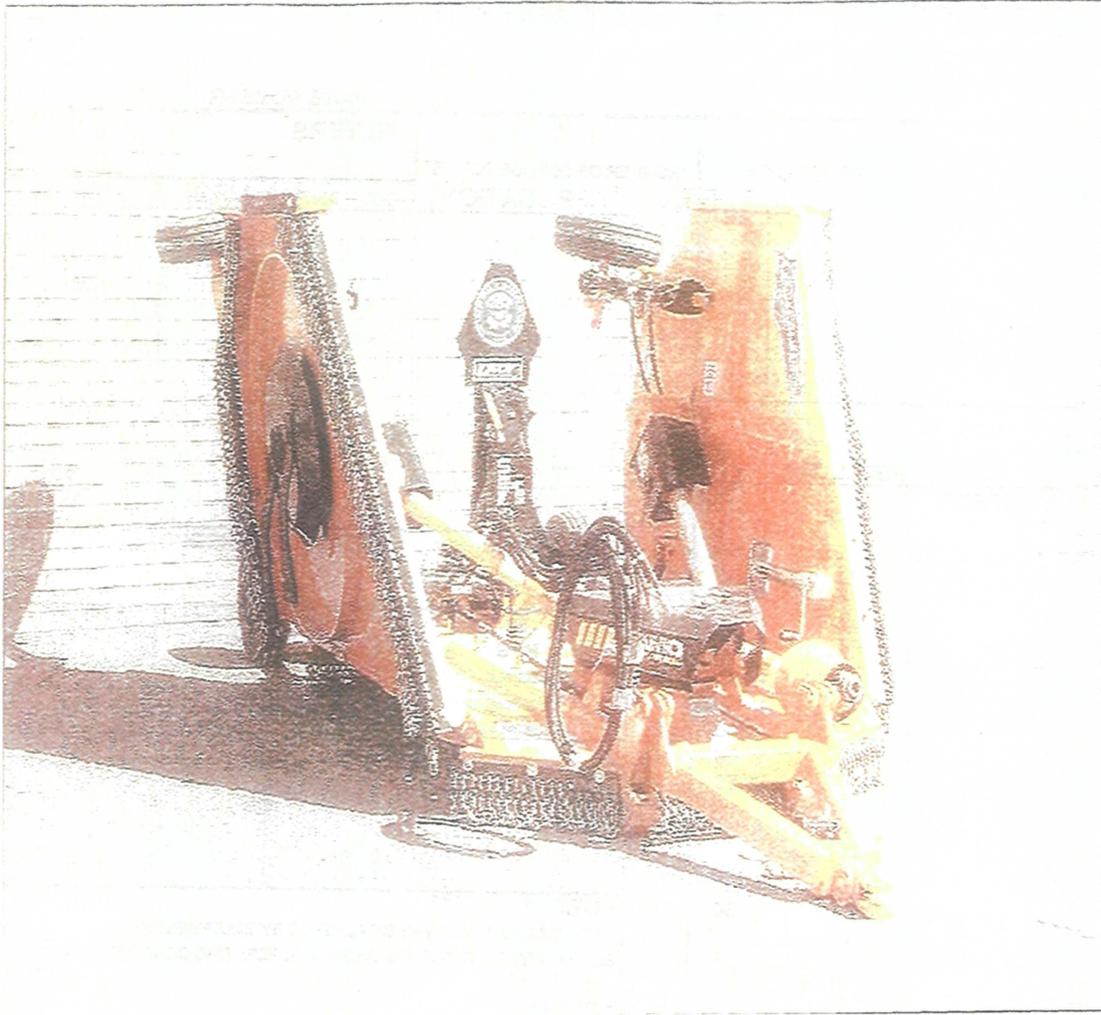
**NOTE # 4**  
SEND REPRESENTATIVE SAMPLE OF FLUID (FROM MAIN STREAM OF SYSTEM AT OPERATING TEMPERATURE) TO CURRENT ANALYSIS CONTRACT LAB TAKE ALL CORRECTIVE ACTIONS AS SUGGESTED BY ANALYSIS RESULTS.

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<b>CHECK EACH SHIFT</b>	PRODUCT #	NUMBER OF SERVICE POINTS	FILTERS			
<u>OPERATORS RESPONSIBILITY</u>			APPLICATION	COMMODITY	MFG.	MFG. #
TIGHTEN BLADE BOLTS INSPECT HYDRAULIC SYSTEM TIRES HITCH AND SAFETY CHAINS GEAR BOX OIL LEVELS CHECK CUTTING BLADES WALK AROUND		4				

<b>SERVICE INTERVALS</b>		REFILL CAP.				
<b>EVERY 4 HOURS (LUBE AND INSPECT)</b>					LUBRICATION PRODUCTS	
<u>NOTE #1 AND #3</u>						
GREASE CONSTANT VELOCITY BODY	50					
GREASE TELESCOPING TUBES	50					
<b>EVERY 8 HOURS</b>   <u>NOTE #1 AND #3</u>						
GREASE DRIVE COMPLETE DRIVE LINES	50			50 MPG MULTIPLE PURPOSE GREASE # 2	40 GL GEAR LUBE 85W50	
GREASE HITCH SWIVEL	50		1			
GREASE HITCH FRAME	50		2			
GREASE MAIN LIFT	50		1			
GREASE WHEEL STANDARDS	50		4			
<b>EVERY 16 HOURS</b>						
<u>NOTE #1 AND #3</u>						
GREASE RAPID PIT YOKE	50		1			<b>NOTE # 1</b> SERVICE INTERVALS MAY BE ALTERED BY EQUIPMENT SHOP SUPERINTENDENT DURING UNUSUAL OPERATING CONDITIONS
<b>FIRST 50 HOURS</b>						
<u>NOTE #1 AND #3</u>						
CHANGE OIL IN ALL GEAR BOXES	40		4			<b>NOTE #3</b> EACH SERVICE INTERVAL PROGRESSION INCLUDED ALL PREVIOUS SERVICE INTERVAL OPERATIONS
<b>EVERY 50 HOURS</b>						
<u>NOTE #1 AND #3</u>						
GREASE WHEEL HUBS	50		6			
<b>YEARLY</b>						
<u>NOTE #1 AND #3</u>						
DISASSEMBLE CLEAN AND RELUBE DRIVE LINES	50		3			
REPACK WHEEL BEARINGS	50		6			
CHANGE OIL IN ALL GEAR BOXES	40		4			



**CUTTING BLADES**

CW WING ALAMO # '02978564  
GCW WING ALAMO # '02978565  
CW CENTER ALAMO # '02978566

YEAR

MAKE SCHULTE

MODEL

XH1500

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**CHECK EACH SHIFT**

**OPERATORS RESPONSIBILITY**

TIGHTEN BLADE BOLTS  
 INSPECT HYDRAULIC SYSTEM  
 TIRES  
 HITCH AND SAFETY CHAINS  
 GRAR BOX OIL LEVELS

PRODUCT #

NUMBER OF SERVICE POINTS

4

**FILTERS**

APPLICATION

COMMODITY

MFG.

MFG. #

**SERVICE INTERVALS**

REFILL CAP.

**EVERY 4 HOURS** NOTE #1#3  
 CONSTANT VELOCITY BODY (30 PUMPS)  
 TELESCOPING TUBES

50

50

**LUBRICATION PRODUCTS**

**EVERY 8 HOURS** NOTE #1#3

LUBE HITCH CLEVIS  
 LUBE HITCH SWIVEL  
 LUBE HITCH FRAME  
 LUBE LIFT ROD  
 LUBE MAIN LIFT  
 LUBE WHEEL STANDARDS  
 LUBE WING LIFT  
 LUBE EQUAL ANGLE HITCH VERTICAL PIVOT  
 LUBE EQUAL ANGLE HORIZONTAL PIVOT  
 LUBE EQUAL ANGLE HITCH SWIVEL YOKE  
 LUBE "U" JOINTS  
 LUBE SHIELD RETAINING BEARING  
 LUBE DRIVELINE SLIP JOINTS  
 RETIGHTEN BLADE BOLTS  
 INSPECT HYDRAULIC SYSTEM  
 CHECK GEAR BOX OIL LEVEL

50

1

50

2

50

2

50

4

50

3

50

4

50

5

50

1

50

1

50

1

50

3

50

6

40

4

ADJUST WALKING BEAM

**FIRST 50 HOURS** NOTE #1#3#4  
 REPLACE OIL IN GEAR BOXS

40

4

**EVERY 50 HOURS** NOTE #1#3  
 LUBE WHEEL HUBS

50

4

**YEARLY** NOTE #1#3#4  
 DISASSEMBLE, CLEAN AND LUBE DRIVE SHAFTS  
 CHANGE OIL IN GEAR BOXS

50

4

40

4

**NOTE # 1**

SERVICE INTERVALS MAY BE ALTERED BY EQUIPMENT SHOP SUPERINTENDENT DURING UNUSUAL OPERATING CONDITIONS

**NOTE # 3**

EACH SERVICE INTERVAL PROGRESSION INCLUDED ALL PREVIOUS SERVICE INTERVAL OPERATIONS.

**NOTE # 4**

SEND REPRESENTATIVE SAMPLE OF FLUID (FROM MAIN STREAM OF SYSTEM AT OPERATING TEMPERATURE) TO CURRENT ANALYSIS CONTRACT LAB TAKE ALL CORRECTIVE ACTIONS AS SUGGESTED BY ANALYSIS RESULTS.



TIRES		PRESSURE	
LT235/R16	"E"	80 PSI	MAX

<b>CHECK EACH SHIFT</b>	<b>OPERATORS RESPONSIBILITY</b>	<b>PRODUCT #</b>	<b>NUMBER OF SERVICE POINTS</b>	<b>FILTERS</b>			
TIGHTEN BLADE BOLTS INSPECT HYDRAULIC SYSTEM TIRES HITCH AND SAFETY CHAINS GEAR BOX OIL LEVELS CHECK CUTTING BLADES WALK AROUND			4 4	<b>APPLICATION</b>	<b>COMMODITY</b>	<b>MFG.</b>	<b>MFG. #</b>

<b>SERVICE INTERVALS</b>				<b>REFILL CAP.</b>			
<b>EVERY 4 HOURS</b> (LUBE AND/OR INSPECT) NOTE #1 #3#4 GREASE CONSTANT VELOCITY BODY GREASE TELESCOPING TUBES				<b>LUBRICATION PRODUCTS</b>			
	50 50			<b>50</b>	<b>40</b>		
				<b>MPG</b>	<b>GL</b>		
				<b>MULTIPLE</b>	<b>GEAR</b>		
				<b>PURPOSE</b>	<b>LUBE</b>		
				<b>GREASE #2</b>	<b>ECW/SC</b>		
<b>EVERY 8 HOURS</b> NOTE #1 #3#4 GREASE DRIVE LINES GREASE HITCH SWIVEL GREASE HITCH FRAME GREASE MAIN LIFT GREASE WHEEL STANDARDS	50 50 50 50 50		1 2 1 4				
<b>EVERY 16 HOURS</b> NOTE #1 #3#4 GREASE RAPID FIT YOKE	50		1				
<b>FIRST 50 HOURS</b> NOTE #1 #3#4 CHANGE OIL IN ALL GEAR BOXES	40		4				
<b>EVERY 50 HOURS</b> NOTE #1 #3#4 GREASE WHEEL HUBS	50						
<b>YEARLY</b> NOTE #1 #3#4 DISASSEMBLE CLEAN AND RE-LUBE DRIVE LINES REPACK WHEEL BEARINGS CHANGE OIL IN ALL GEAR BOXES	50 50 40		3 4				
				<b>NOTE #1</b> SERVICE INTERVALS MAY BE ALTERED BY EQUIPMENT SHOP SUPERINTENDENT DURING UNUSUAL OPERATING CONDITIONS  <b>NOTE #3</b> EACH SERVICE INTERVAL PROGRESSION INCLUDED ALL PREVIOUS SERVICE INTERVAL OPERATIONS.  <b>NOTE #4</b> SEND REPRESENTATIVE SAMPLE OF FLUID TO CURRENT LAB. TAKE ALL CORRECTIVE ACTION AS SUGGESTED BY ANALYSIS RESULTS.			

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**CUTTING BLADES**

- CW WING ALAMO # '02978564
- CCW WING ALAMO # '02978565
- CW CENTER ALAMO # '02978566

<b>CHECK EACH SHIFT</b>	PRODUCT #	NUMBER OF SERVICE POINTS	<b>FILTERS</b>			
OPERATORS RESPONSIBILITY			APPLICATION	COMMODITY	MFG.	MFG. #
TIGHTEN BLADE BOLTS						
INSPECT HYDRAULIC SYSTEM						
TIRES						
HITCH AND SAFETY CHAIN						
GEAR BOX OIL LEVELS	40					
CHECK CUTTING BLADES						
WALK AROUND						

<b>SERVICE INTERVALS</b>	REFILL CAP.		<b>LUBRICATION PRODUCTS</b>			
<b>EVERY 4 HOURS</b>						
NOTE						
LUBE CONSTANT VELOCITY BODY		50				
LUBE TELESCOPING TUBES		50				

<b>EVERY 8 HOURS</b>						
NOTE						
LUBE DRIVE LINES		50				
LUBE HITCH SWIVEL		50				
LUBE HITCH FRAME		50				
LUBE MAIN LIFT		50				
LUBE WHEEL STANDARDS		50				

			40	50		
			GL	MPG		
			GEAR	MULTIPLE		
			LUBE	PURPOSE		
			80W90	GREASE # 2		

**EVERY 16 HOURS**  
NOTE  
LUBE RAPID FIT YOKE

50

**NOTE # 1**  
SERVICE INTERVALS MAY BE ALTERED BY EQUIPMENT SHOP SUPERVISOR DURING UNUSUAL OPERATING CONDITIONS

**NOTE # 2**  
EACH SERVICE INTERVAL PROGRESSION INCLUDED ALL PREVIOUS SERVICE INTERVAL OPERATIONS.

**FIRST 50 HOURS**  
NOTE  
CHANGE OIL IN ALL GEAR BOXES

40

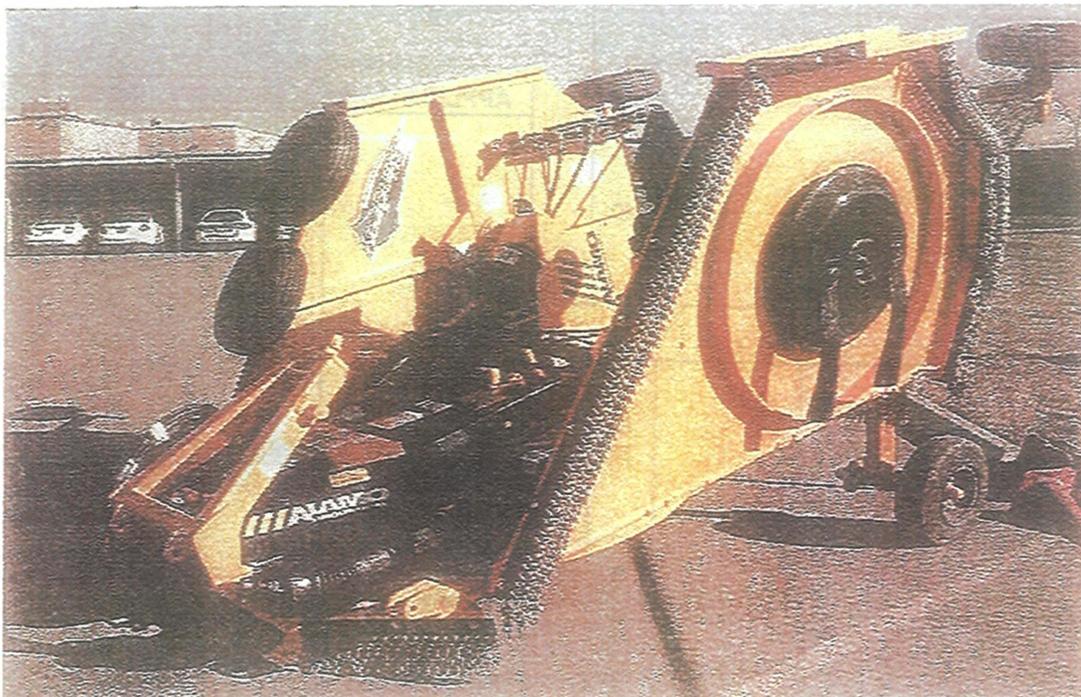
**EVERY 50 HOURS**  
NOTE  
LUBE WHEEL HUBS

50

**YEARLY**  
NOTE  
DISASSEMBLE CLEAN AND RELUBE DRIVE LINES  
REPACK WHEEL BEARINGS  
CHANGE OIL IN ALL GEAR BOXES

50  
50  
40

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**TIRES**

22X6.6X10

20 PLY AIRCRAFT TIRES

# Loaders

CHECK EACH SHIFT	PRODUCT #	NUMBER OF SERVICE POINTS	FILTERS			
OPERATORS RESPONSIBILITY			APPLICATION	COMMODITY	MFG.	MFG. #
ENGINE COOLANT			AIR PRIMARY	NON STOCKING	FLTGRD	AF25364
ENGINE CRANKCASE OIL LEVEL			AIR SECONDARY	NON STOCKING	FLTGRD	AF25491
TRANSMISSION OIL LEVEL			ENGINE FUEL (2 USED)	NON STOCKING	FLTGRD	FF5155
HYDRAULIC OIL LEVEL			FUEL ( INLINE)	06042398022	FRAM	G-3
TIRES			ENGINE OIL	NON STOCKING	FLTGRD	LF18016
			HYDRAULIC	NON STOCKING	FLTGRD	HF5597
			TRANSMISSION	NON STOCKING	FLTGRD	HF55140
			CAB FRESH AIR	NON STOCKING	CASE	257486A1
			HEATER/AIR COND.	NON STOCKING	CASE	330014A1
WALK AROUND						
SERVICE INTERVALS		REFILL CAP.	LUBRICATION PRODUCTS			
<b>EVERY 50 HOURS OR WEEKLY</b>			<b>10</b>			<b>30</b>
NOTE #1 AND #3			<b>15W/40</b>			<b>FHF</b>
LUBE BUCKET AND BELL CRANK PIVOT POINTS	50		<b>FLEET</b>			<b>FLEET</b>
LUBE LOADER LIFT ARMS AND CYLINDER PIVOTS	50		<b>CRANKCASE</b>			<b>HYDRAULIC</b>
LUBE STEERING CYLINDER PIVOT POINTS	50		<b>OIL</b>			<b>FLUID</b>
LUBE FRONT DRIVE SHAFT SUPPORT BEARING	50					
LUBE UPPER AND LOWER CHASSIS PIVOTS	50					
<b>EVERY 250 HOURS OR YEARLY</b>			<b>40</b>	<b>50</b>		<b>55</b>
NOTE #1 THRU #11			<b>GL</b>	<b>MPG</b>		<b>EXT/EG</b>
CHANGE ENGINE OIL	16 QT.	10	<b>GEAR</b>	<b>MULTIPLE</b>		<b>ANTI-FREEZE</b>
CHANGE ENGINE OIL FILTER			<b>LUBE</b>	<b>PURPOSE</b>		<b>EXTENDED</b>
CHECK BATTERY FLUID LEVEL			<b>80W/90</b>	<b>GREASE #2</b>		<b>LIFE</b>
CLEAN/REPLACE CAB AIR FILTER						
REPLACE FUEL FILTERS		3				
DRAIN WATER/SEDIMENT FROM FUEL TANK	50 GAL.	1				
REPLACE HYDRAULIC OIL FILTER	72 QT.	1				
TAKE OIL SAMPLES						
CHECK OIL LEVEL IN ALL GEAR BOXES						
<b>EVERY 1000 HOURS OR YEARLY</b>						
NOTE #1 THRU #11						
REPLACE TRANSMISSION OIL FILTER		1				
REPLACE TRANSMISSION OIL	21 QT.	30				
CLEAN TRANSMISSION BREATHER		1				
TAKE OIL SAMPLES		1				
<b>EVERY 2000 HOUR OR EVERY OTHER YEAR</b>						
NOTE #1 THRU #11						
CLEAN/FLUSH COOLING SYSTEM		1				
REPLACE ENGINE COOLANT	33 QT.	1				

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TIRES			
FRONT	20.5/25	45 psi	MAX
REAR	20.5/25	40 psi	MAX

SAFETY ITEMS	
FIRST AID KIT	34532000711
FIRE GUN 5 LB.	34028361504

WIPERS	
FRONT	27 INCH
REAR	19 INCH

# **Air Compressors**

<b>CHECK EACH SHIFT</b>					<b>FILTERS</b>
OPERATORS RESPONSIBILITY	PRODUCT #	NUMBER OF SERVICE POINTS			
ENGINE COOLANT		<b>APPLICATION</b>	<b>COMMODITY</b>	<b>MFG.</b>	<b>MFG. #</b>
ENGINE CRANKCASE OIL LEVEL		AIR (ENGINE)	NON STOCKING	FLTGRD	AF25555
CHECK AIR FILTER SYSTEM (BOTH)		AIR (COMPRESSOR)	NON STOCKING	FLTGRD	AF25555
CHECK COMPRESSOR OIL LEEL		FUEL PRIMARY	NON STOCKING	SULLAIR	02250118-495
CHECK TRAILER HITCH AND SAFETY CHAINS		FUEL SECONDARY	NON STOCKING	JOHN DEERE	RE308202
CHECK TIRES (PRESSURE/WEAR/DAMAGE)		ENGINE OIL	NON STOCKING	JOHN DEERE	RE518977
WALK AROUND		COMPRESSOR FLUID	NON STOCKING	SULLAIR	250026982
		SEPARATOR	NON STOCKING	SULLAIR	250034-112

<b>SERVICE INTERVALS</b>	<b>REFILL CAP.</b>				
<b>FIRST 50 HOURS</b>					
NOTE #1 THRU #8					
CHANGE COMPRESSOR FLUID FILTER					
CLEAN RETURN LINE ORIFICE AND STRAINER					
DRAIN WATER FROM FUEL FILTERS					
<b>EVERY 50 HOURS</b>					
NOTE #1 THRU #8					
INSPECT AND/OR REPLACE AIR FILTERS					
DRAIN WATER FROM FUEL FILTERS					
<b>EVERY 100 HOURS</b>					
NOTE #1 THRU #8					
CLEAN RADIATOR (EXTERIORS)					
CLEAN OIL COOLER (EXTERIORS)					
<b>EVERY 250 HOURS OR YEARLY</b>					
NOTE #1 THRU #8					
CHANGE COMPRESSOR OIL FILTER					
CHANGE ENGINE OIL					
CHANGE ENGINE OIL FILTER					
CHANGE BOTH FUEL FILTERS					
CHANGE BOTH AIR FILTERS					
TEST COOLANT (DCA4)					
TAKE OIL SAMPLES					
CLEAN RETURN LINE ORIFICE AND STRAINER					
<b>YEARLY</b>					
NOTE #1 THRU #11					
LUBE WHEEL BEARINGS					
CHANGE SEPARATOR FILTER					
<b>EVERY 1200 HOURS (SEE NOTE #11)</b>					
NOTE #1 THRU #8					

<b>LUBRICATION PRODUCTS</b>			
10 15W/40 FLEET CRANKCASE OIL			
	50 MPG MULTIPLE PURPOSE GREASE # 2		83 EXT/EG ANTI-FREEZE EXTENDED LIFE

**NOTE # 1**  
SERVICE INTERVALS MAY BE ALTERED BY EQUIPMENT SHOP SUPERVISOR DURING UNUSUAL OPERATING CONDITIONS

**NOTE # 2**  
IF VEHICLE IS EQUIPPED WITH AIR RESTRICTION INDICATOR: CHANGE PRIMARY ELEMENT WHEN RESTRICTION GAUGE READS IN THE RED ZONE. CHANGE SECONDARY ELEMENT EVERY THIRD PRIMARY CHANGE.

IF VEHICLE HAS NO AIR RESTRICTION INDICATOR: FOLLOW MANUFACTURER'S RECOMMENDED SERVICE INSTRUCTIONS.

**NOTE # 3**  
EACH SERVICE INTERVAL PROGRESSION INCLUDED ALL PREVIOUS SERVICE INTERVAL OPERATIONS.

**NOTE # 4**  
SEND REPRESENTATIVE SAMPLE OF FLUID (FROM MAIN STREAM OF SYSTEM AT OPERATING TEMPERATURE) TO CURRENT ANALYSIS CONTRACT LAB. TAKE ALL CORRECTIVE ACTIONS AS SUGGESTED BY ANALYSIS RESULTS.

**NOTE # 8**  
REPLACE FILTER OR DCA4 AS PER SECTION 1 (COOLING SYSTEM CHECK AND PROCEDURE)

**NOTE #11**  
USE SULLAIR AWF TYPE OIL ONLY.  
DO NOT CHANGE THIS OIL ON A YEARLY SERVICE.  
CHANGE OIL EVERY 1200 HOURS ONLY.

**VENDOR**  
MIRDIES TOOL SALES AND SERVICE  
(801) 798-1149



<b>TIRES</b>				
	B78/13ST	50 PSI	MAX	

**Roller**

## VIBRATORY ROLLERS

Vibratory rollers provide compactive force by a combination of weight and vibration of their steel compaction rolls, commonly referred to as drums. Those used for compaction are self-propelled and vary in weight from 2 to 17 tons.

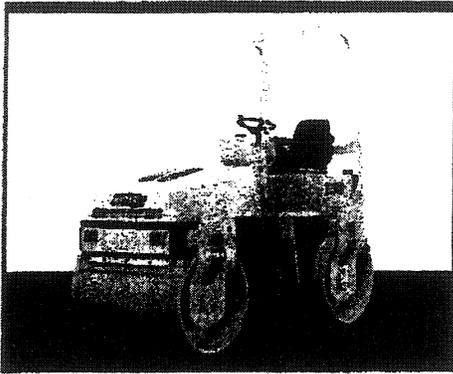


Figure 11-39.-Vibratory roller.

drums on vibratory rollers vary from 3 to 5 feet in diameter and 4 to 8 feet in width.

The engine, providing power for propulsion, also powers the hydraulically driven vibrating unit. Vibrations are generated by a rotating eccentric weight inside the drum, the speed of which determines the frequency, or vibrations per minute, of the drum. The weight and distance from the shaft of the eccentric determine the amplitude (amount) of the impact force. Both the frequency and amplitude of vibrations are controlled independently of roller travel and engine speed.

The vibration frequency of rollers used for compaction is generally between 2,000 to 3,000 vibrations per minute (vpm), depending on the model and manufacturer. Some models provide only one or two specific frequency settings; while others may provide a full range of frequencies within certain limits; for instance, 1,800 to 2,400 vpm.

Vibratory rollers achieve compaction through a combination of three factors: (1) weight, (2) impact forces (roller vibration), and (3) vibration response in the soil.

### Weight

Weight is the natural force in compaction of soils. Vibrating rollers amplify their static weight through vibration to increase the overall dynamic weight.

### Impact Forces

The impact forces are those generated by vibration of the compaction drum. They are regulated by controlling the frequency and amplitude of the vibration. The amount of impact force required to obtain optimum density depends on the type of material being

compacted. The impact forces also vary with the diameter of the drum and the width and the ratio of the roller static weight and dynamic (impact) force.

### Vibration Response

The vibration response in the soil or material is the result of the way the forces are exerted upon it by the vibratory roller. As with other types of rollers, the material will compact easily or with difficulty, depending on its moisture content, cohesion characteristic, particle shape and texture, and confinement; for example, sandy soil requires more vibration and less impact force (amplitude). However, a soil with higher clay content requires more amplitude than vibration because of the kneading action necessary to compact the clay. Vibratory rollers exert repetitive dynamic force on the material, rather than the static force used by other rollers.

The frequency and roller speed should be matched, so there will be at least 10 downward impacts per foot of travel of the roller. The speed of the roller increases for a given frequency of vibration, and the spacing of the impacts grows farther apart.

When using vibratory equipment, keep in mind that the energy imparted by the vibratory wheel must be absorbed in the material being compacted. Controlling the amplitude permits the operator to vary the force developed from the wheel and, therefore, the energy imparted to the material. A change in the lift thickness and material gradation content may require adjustment in the amplitudes being used.

NOTE: It is important that the roller vibrates only when it is moving. If vibration continues while the roller is standing still or changing direction, the vibrating drum will leave an indentation in the material at the stopping point.

Most modern rollers have automatic cutoffs for vibration when the roller stops moving.

### Sheepsfoot Drum

The sheepsfoot drum is used for compacting heavy lifts of 6 to 12 inches thick. As consecutive passes are made, the drum will start to walk out of the ground as the penetration of the sheepsfoots decrease. These rollers should only be used for initial compaction, because the footprints they leave will not allow excess water to drain.

These rollers concentrate the static and dynamic weight on the relatively small contact area of the sheepsfoots. This force is exerted through the one row of feet in contact with the ground. With all the roller weight concentrated on this row of sheepsfoots, they exert more than 22,000 pounds of force.

### Smooth Drum

In most heavy fills, a smooth drum roller is worked behind the sheepsfoot drum and grader. With thinner

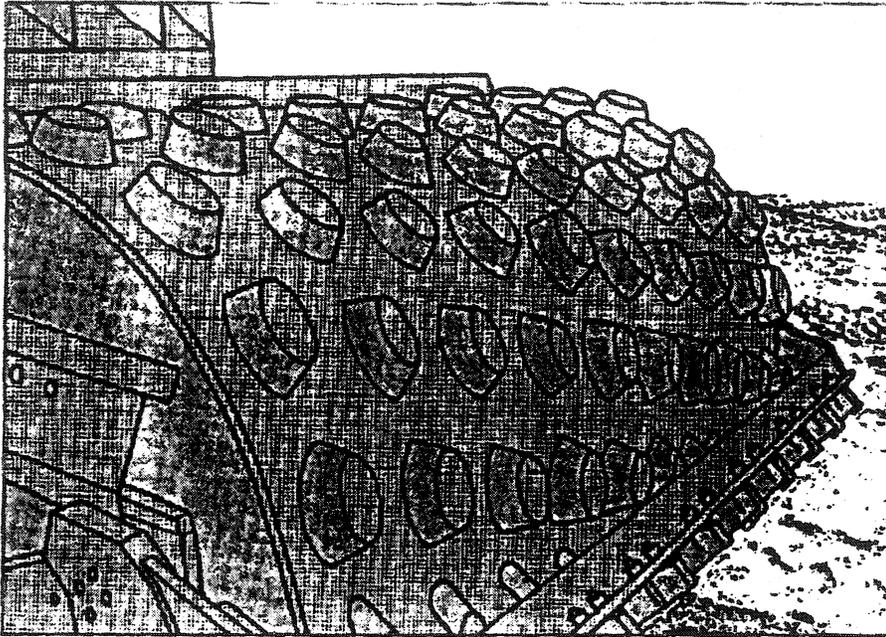


Figure 11-40.-Sheepfoot drum.

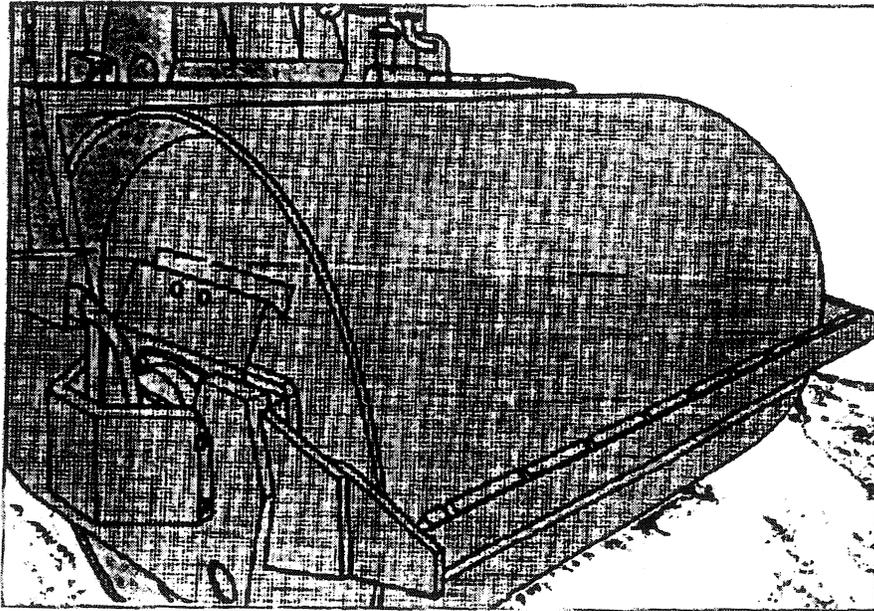


Figure 11-41.-Smooth drum.

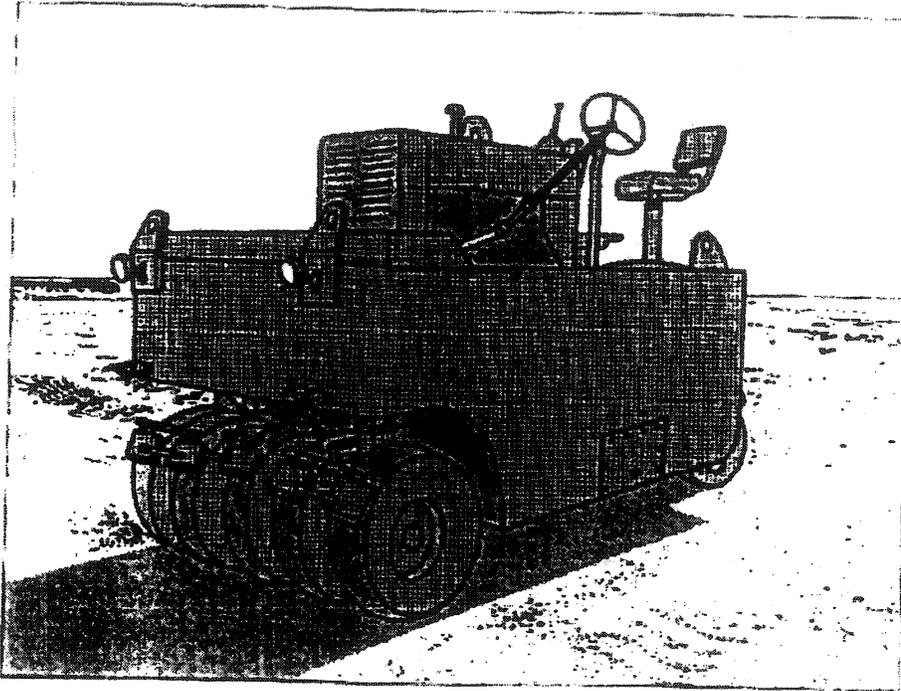


Figure 11-42.-Pneumatic-tired roller.

lifts, a smooth drum is all the compaction equipment required. The smooth drum compacts lifts of 4 to 8 inches and seals the surface to allow the excess water to drain. Unlike the sheepfoot drum, smooth drum rollers concentrate the full width of the drum. The total dynamic force is slightly less, because more of the drum is in contact with the ground

#### PNEUMATIC-TIRED ROLLERS

The pneumatic-tired rollers are widely used for compaction of sub grades, bases, bituminous mixes, and many types of material. They have rubber tires instead of steel tires or drums and generally feature two tandem axles, with three or four tires on the front axle and four or five tires on the rear, as shown in figure 11-42. They are aligned so the rear tires cover the spaces left between the tracks of the front tires. The tires are mounted in pairs that can oscillate, or singly with spring action, so tires can move down into soft spots that would be bridged by a steel drum. The rubber tires add to their downward pressure a kneading effect, as material is pressed toward spaces between the tires. Pneumatic-tired rollers can be ballasted to adjust the weight. Depending on size and type, the weight may vary from 10 to 35 tons. However, more important than gross weight is the weight per wheel for the material being compacted.

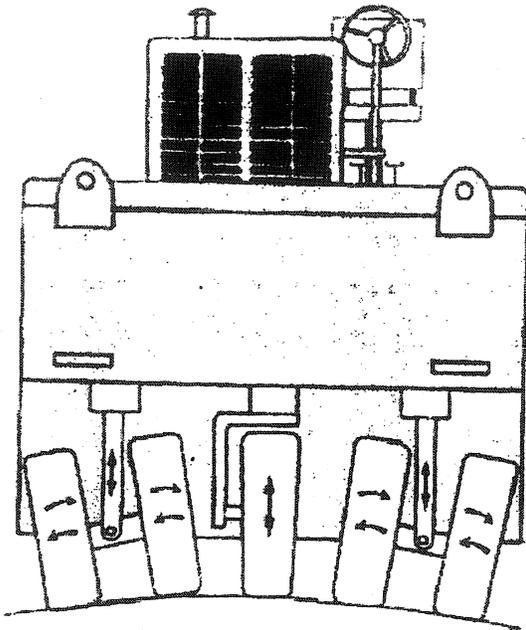


Figure 11-43.-Action of a pneumatic-tired roller.

**CAUTION**

Pneumatic rollers ballast with water are top heavy and are very unstable when operating on uneven terrain.



Figure 11-44.-Steel-wheeled roller.

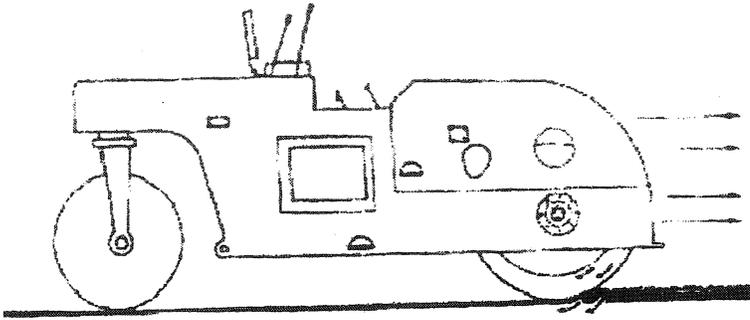


Figure 11-45 - Drive wheel rolling action.

Pneumatic-tired rollers may be equipped with 15-, 17-, 20-, or 24-inch tires. Air pressure in the tires may vary for different types of material, such as 50 to 60 psi to finish asphalt and 100 psi to compact a granular sub base. The tires must be inflated to nearly equal pressure with variation not exceeding 5 psi to apply uniform pressure during rolling.

Figure 11-43 shows the action of a pneumatic-tired roller. Pneumatic-tired rollers are used because the individual wheels can exert a kneading action in small areas that wide, rigid steel drums tend to bridge.

### STEEL-WHEELED ROLLERS

A steel-wheeled roller, as shown in figure 11-44, is used for compaction and finish operations on base coarse materials and asphalt. This roller produces a smooth, solid surface under favorable conditions, but may fail to compact areas narrower than the roll, and do not compact deeply in proportion to their weight. The steel-wheeled roller does not change shape to bring suitable support for itself. Rather it sinks until enough bearing area has come in contact with the roll to support the roller weight.

The drive wheel is ahead of the tiller wheel in the direction of travel. The tiller wheel functions as the steering axle. As shown in figure 11-45, there is a downward vertical force caused by the weight of the wheel. The arrows, concentric with the steel wheel, represent the rotational force on the wheel. This force is transmitted to the base of the wheel, as the roller is propelled. This concentric force tends to move the material under the wheel, rather than to push it away. These forces result in a more direct vertical force than those of the forces under the tiller wheel.

## ROLLING TECHNIQUES

Roller techniques are basically the same with any type of roller. Some things you must consider are steering, changing direction and speed, and rolling sequence.

### Steering

Steering sharply causes scuffing and damage to the surface; therefore, turns should be made slowly and gradually. You may have to back up several times to complete a turn.

### Changing Direction and Speed

Starting and stopping should be done gradually to avoid scuffing the surface. Start stopping well ahead of the point where you want to stop. Engage the direction control slowly to avoid any wheel spin.

Rolling speed is 1 1/2 to 3 miles an hour. You must develop a rolling sequence to ensure the compaction is uniform throughout the fill.

### Rolling Sequence

Overlapping is part of the rolling sequence. When rolling deep, loose fills, you should overlap at least half the drum width. Gradual extension of the rolled material into the unrolled area makes possible greater concentration of weight on local ridges and high spots.

In rolling a graded area with a side slope, as a crowned or banked road, you should work from the bottom to the top. The lower edges of the rolls have a tendency to push downhill, which can be best resisted by compacted material. In working uphill, the creep of soil away from the upper edge helps to preserve the slope.

A crowned road is rolled according to the pattern shown in figure 11-46, starting at one edge and working to the center line. Then move diagonally to the opposite side and work to the center line from that side. Each rerolling is done in the same manner.

It is efficient to roll in sections as long as you can overlap the sections, as shown in figure 11-47.

Banked or sloped elevated curves are rolled in the direction of travel, from the bottom (low side) to the top, as shown in figure 11-48. The rolling transition from the road crown to the bank curve is made by a diagonal from the center of the crown to the low side of the bank. The rolling transition from bank to crown is made straight to the adjoining low side of the road crown.

Rolling should be continued until no compaction advantage is noted on the fill from successive passes. Too much water in the fill material may make compaction impossible.

This may require scarifying and windrowing the fill to aerate the material. A rubbery, or spongy, rolling action of the fill that springs back into nearly its original condition when the rollers have passed may indicate trapped water below the surface. The robbery, or spongy, area may require stabilization by other means, such as excavating the area and

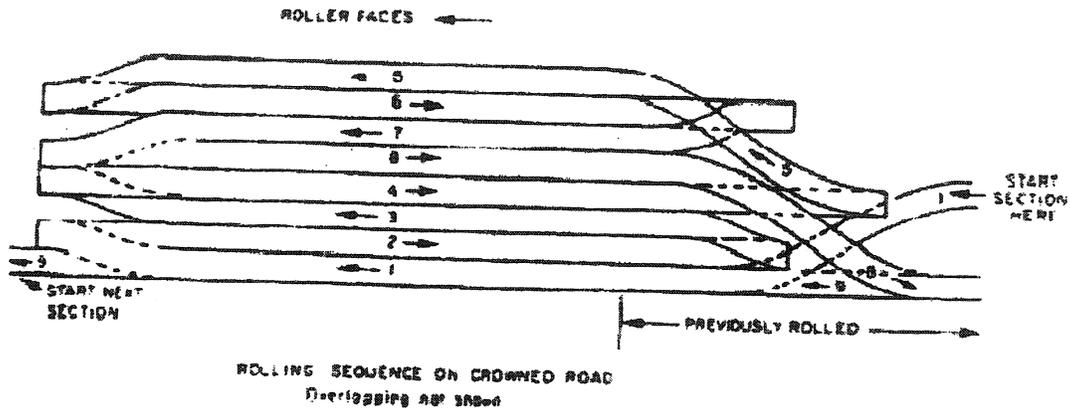


Figure 11-46.-Crowned road rolling sequence.

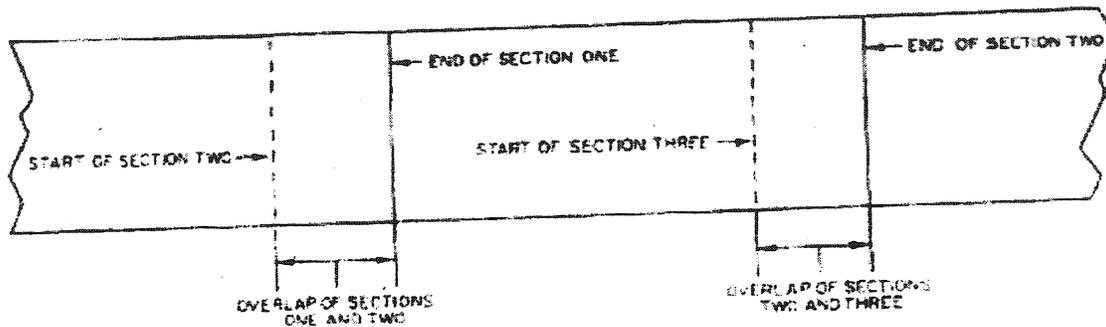


Figure 11-47.-Overlapping sections.

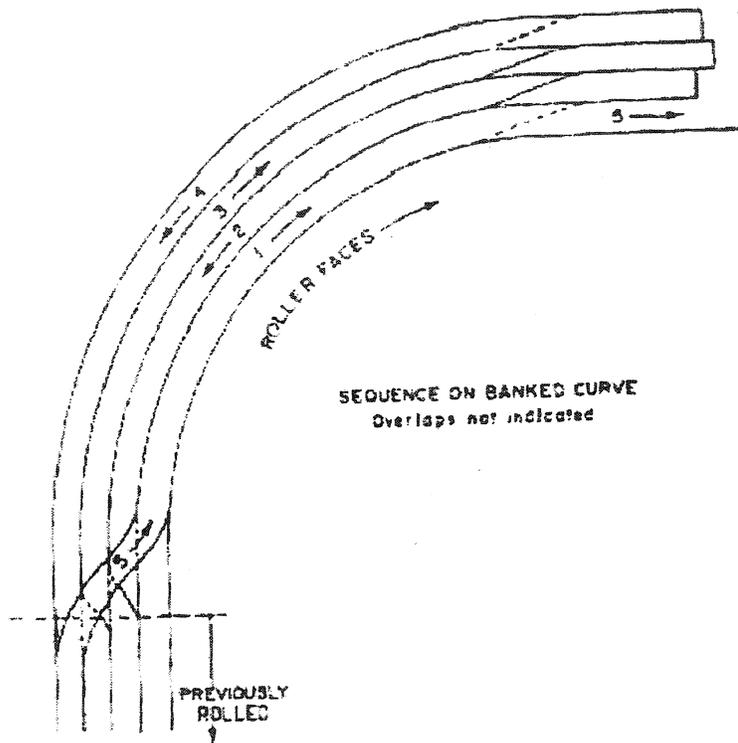


Figure 11-48 -Banked curve rolling sequence.

placement of riprap, soil cement, asphalt stabilization, and so forth.

### BITUMINOUS ROLLING

Most of the compaction required in bituminous construction is achieved by the tamper on the asphalt paver. Additional compaction and final surface texture are achieved by applying the rollers in the proper sequence. The hot mix should be at its optimum temperature for rolling when the rollers start to operate on the mat being laid. This optimum temperature should range between 225°F to 285°F.

Rollers designed for bituminous operations are equipped with sprinklers that spray water on the smooth tires and drums. When you are rolling bituminous materials, the roller tires and drums must be moist with water to keep the bituminous materials from sticking. When water is not enough to keep the bituminous material from sticking, a non-foaming detergent is added to the water until the water has a soapy feeling.

NOTE: Do NOT use a detergent that is designed to break down grease or oil, as this will break down the petroleum products used in the bituminous mix.

NOTE: Ensure roller tires and drums are free of debris, such as sand, mud, dirt, and so forth, before rolling a hot bituminous mix.

## CAUTION

Avoid prolonged skin contact with and inhalation of vapors from bituminous operations.

When you are rolling bituminous materials, the rollers should move at a slow, uniform speed with the drive wheels positioned toward the paver. The speed should not exceed 3 mph for steel-wheeled rollers or 5 mph for pneumatic-tired rollers. Asphalt rollers must be kept in good condition and should be capable of being reversed without backlash. The line of rolling should not be suddenly changed or the direction of rolling suddenly reversed, thereby displacing the mix. Any pronounced change in direction should be made on stable material.

Rolling hot bituminous mix is done in the following order:

1. Transverse joints
2. Longitudinal joints (when adjoining a previously placed lane)
3. Breakdown or initial rolling
4. Intermediate or second rolling
5. Finish rolling

As a guide, longitudinal joint and edge rolling should be performed directly behind the paver; breakdown rolling less than 200 feet behind the paver; intermediate rolling 200 feet or more behind the breakdown rolling; and finish rolling as soon as possible behind the breakdown rolling.

### Transverse Joints

When a transverse joint is placed next to an adjoining lane, the first pass is made with a steel wheeled roller moving along the longitudinal joint for a short distance. The surface is then straightedge and corrections made if necessary. The joint is then rolled transversely with all except 6 inches of the wheel width on the previously laid material (fig. 11-49). This operation should be repeated with successive passes

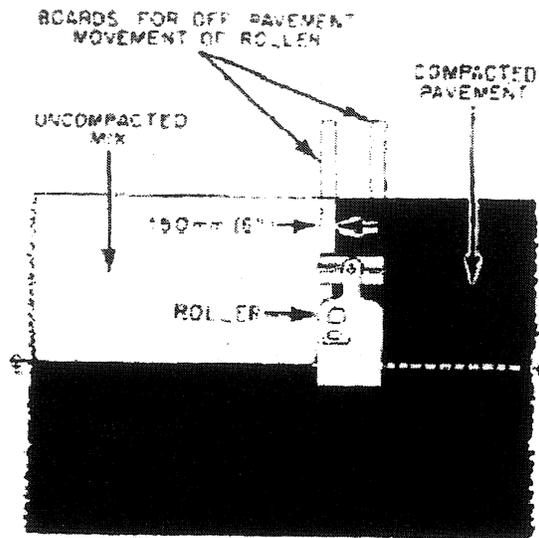


Figure 11-49.-Rolling a transverse joint.

covering 6 to 8 inches of fresh material until the entire width of a roll is on the new mix.

During transverse rolling, boards of proper thickness should be placed at the edge of the pavement to provide the roller a surface to drive on once it passes the edge of the hot bituminous mat. If boards are not used, the transverse rolling must stop 6 to 8 inches short of the outside edge in order to prevent damage to the edge. The outside edge then must be rolled out during longitudinal rolling.

#### Longitudinal Joints

Longitudinal joints should be rolled directly behind the paving operation. Only 4 to 6 inches of the roller width should ride on the newly placed mix (fig. 11-50). The rest of the roller should ride on the previously compacted side of the joint. With each subsequent pass, more and more of the roller width is placed on the mix until the entire width of the roller is on the newly placed mat.

When rolling a longitudinal joint with a vibratory roller, the roller drum extends only 4 to 6 inches on the previously compacted lane with the rest of the drum width riding on the newly placed mat. The roller continues to roll along this line until a thoroughly compacted, neat joint is obtained.

Longitudinal joints can be categorized as a hot or cold joint.

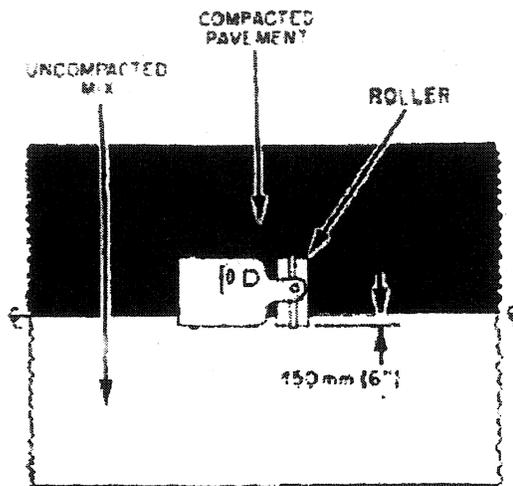


Figure 11-50.-Rolling a longitudinal joint.

**HOT JOINTS.**- A hot joint is a joint between two lanes of bituminous mix placed at approximately the same time by pavers working in echelon. This type of lay down produces the best longitudinal joint, because both lanes are at, or near, the same temperature when rolled. The material compacts into a single mass under the roller, resulting with little or no difference in density between the two lanes. When you are paving in echelon, the breakdown roller following the lead paver leaves a 3- to 6-inch unrolled edge that the second paver and roller should stay as close as possible to the first paver to ensure a uniform density is obtained across the joint. The roller following the second paver compacts the hot joint on its first pass (fig. 11-51).

**COLD JOINTS.**- A cold joint is a joint between two lanes, one of which has cooled overnight or longer before the adjoining lane is placed. Because of the difference in temperature between the two lanes, there is a difference in density between the two sides of the joint. The longitudinal joint should be rolled directly behind the paver.

### Breakdown Rolling

Breakdown rolling may be accomplished with static or vibratory steel-wheel rollers. Breakdown rolling should start on the low side of the hot bituminous mat, which is usually the outside of the lane being paved, and progress toward the high side. The reason for this is that hot bituminous mixtures tend to migrate towards the low side of the mat under the action of the roller. If rolling is started on the high side, this migration is much more pronounced than if the rolling progresses from the low side. When adjoining lanes are placed, the same rolling procedure should be followed, but only after compaction of the longitudinal joint.

A rolling pattern that provides the most uniform coverage of the lane being paved should be used. Rollers vary in width, and a single recommended pattern that applies to all rollers is impractical. For this reason, the best rolling pattern for each roller being used should be worked out and followed to obtain the most uniform compaction across the lane.

The rolling pattern not only includes the number of passes but also the location of the first pass, the sequence of succeeding passes, and the overlapping between passes. Rolling speed should not exceed 3 mph. In addition, sharp turns and quick starts or stops are to be avoided.

For thin lifts (a lift of less than 2 inches compacted thickness), a recommended rolling pattern for static

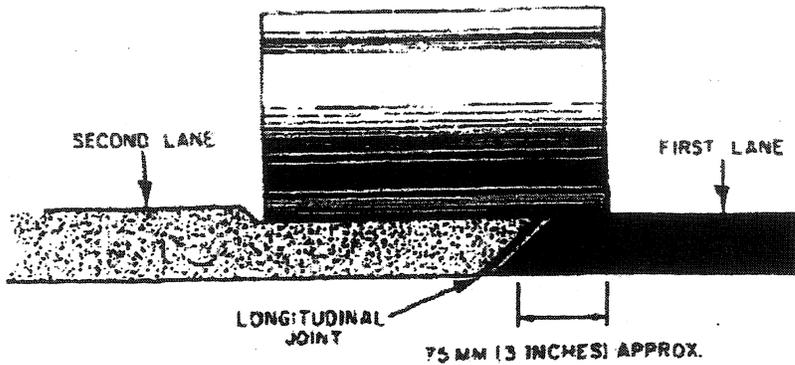


Figure 11-51.-Rolling a hot longitudinal joint.

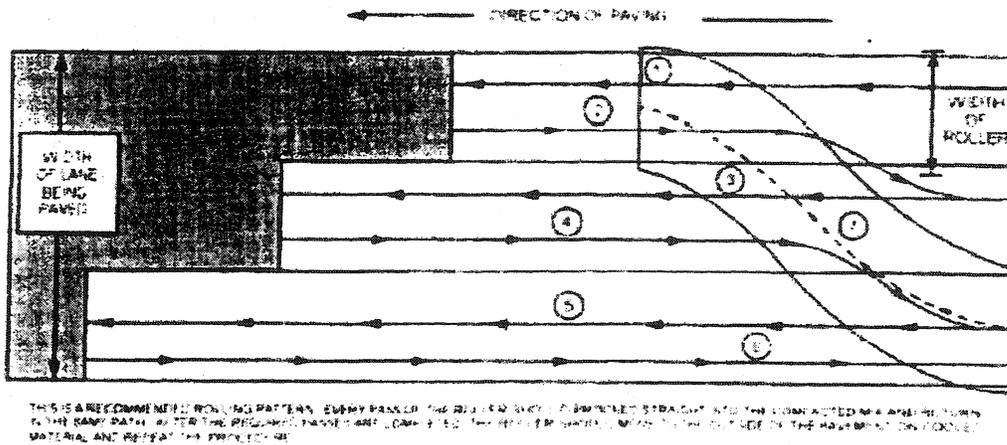


Figure 11-52.-Correct rolling pattern.

steel-tired rollers is shown in figure 11-52. The rolling operation should start from the edge of the hot mat on the low side with the roller moving forward as close behind the paver as possible. The second movement of the roller should be reversed in the same path until the roller has reached previously compacted material. At this point align the roller for pass number three, again staying as close as possible behind the paver. The fourth movement is a reversal of the third path and a repetition of the third operation. After the entire width of the hot mix has been rolled in this fashion, you should swing the roller back to the low side and repeat the process. With this pattern, on each forward pass the roller only needs to overlap the previous rolled area by 3 to 4 inches.

For thick lifts (a lift of 4 inches or more compacted thickness), the rolling process should start 12 to 15 inches from the lower unsupported edge and progress towards the center portion of the hot mix. The uncompacted edge provides initial confinement during the first pass, thus minimizing lateral movement of the hot mix. After the central portion of the hot mix has been rolled and compacted, the compacted portion of the hot mix will support the roller and allow the edge to be compacted without lateral movement.

When using steel-wheeled rollers, the operation should always progress with the drive wheel forward in the direction of travel. This is especially important in breakdown rolling. A primary reason that breakdown rolling should be done with the drive wheel in the direction of travel is that there is a more direct vertical load applied by this wheel than by the tiller wheel (fig. 11-53).

If the breakdown pass of the roller is made with the tiller wheel forward, the pushing force and the weight are slightly ahead of the downward vertical force, causing material to push up in front of the wheel. The greater weight of the drive wheel produces the compaction, while the turning force tends to tuck the hot mix under the front of the wheel.

There are exceptions to rolling with the drive wheel forward. They usually occur when superelevations are being constructed or if the grade on which the asphalt mix is being placed is excessive. The exception occurs when, due to these high grades, the drive wheel of the roller begins to chatter on the hot mat, causing displacement of the hot mix resulting with a very rough

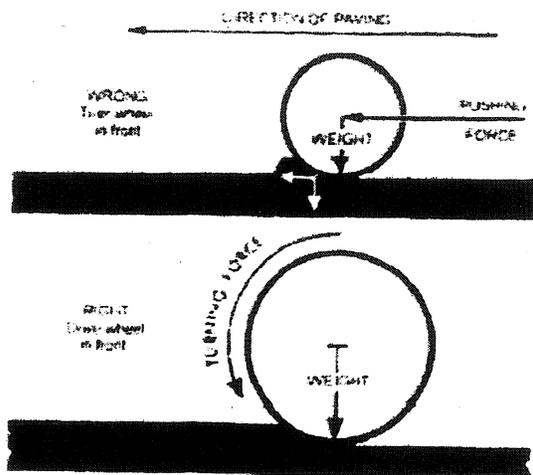


Figure 11-53.-Forces acting when tiller wheel or drive wheel is forward.

surface. In these cases, the roller must be turned around to allow the tiller wheel to compact the material partially so the drive wheel can then proceed over it.

### Intermediate Rolling

Intermediate rolling should closely follow breakdown rolling, while the asphalt mix is still well above the minimum temperature of 185 degrees at which densification can be achieved. Pneumatic-tired or vibratory rollers may be used for intermediate rolling. Pneumatic-tired rollers have several advantages:

1. They provide a more uniform degree of compaction than steel-wheeled rollers.

2. They improve the seal near the surface by kneading the material closer together.
3. They orient the aggregate particles for greatest stability, as high ground pressure truck tires do after using the asphalt surface for some time.

Tire contact pressures should be as high as possible without causing displacement of the mix that cannot be remedied in the final rolling.

Pneumatic-tired rolling should be continuous after breakdown rolling until all of the hot mix has been thoroughly compacted. At least three coverages should be made.

NOTE: Turning of pneumatic-tired rollers on the hot mix should not be permitted unless it does not cause undue displacement.

Vibratory rollers (of proper static weight, vibration frequency, and amplitude) are used to provide required densities with fewer coverages than static-weight tandem or pneumatic-tired rollers (or combinations of the two).

Regardless of the type of roller used, the rolling pattern should be developed in the same manner as for breakdown rolling. This pattern should be continued until the desired compaction is obtained.

#### Finish Rolling

Finish rolling is done solely for the improvement of the surface. It should be accomplished with steel-wheel tandems, static-weight or vibratory, while the hot mat is still warm enough for removal of roller marks.

## ROLLER SAFETY

Many of the safety precautions previously listed for graders, scrapers, and dozers also apply to roller operations. Additional safety precautions are as follows: . Never perform roller operations alone. Always have a safety person in the area of the rolling operation. ) Only operate the roller at speeds at which the machine can be kept under control at all times.

1 Always wear a seat belt when rolling, as well as other required personal protective equipment, such as steel toe safety shoes and hard hats.

2 Operate the roller from the sitting position, never from a standing position.

3 Use the safety handrails when mounting or dismounting a roller. Do not grab the transmission control levers, as this might cause the roller to make a sudden movement.

4. If the roller ignition starts in any transmission position besides neutral, this machine should be placed out of service and repaired before further usage.

5 Use caution and make sure the area is clear of personnel, tools, and vehicles when performing forward and reverse rolling operations.

6 A roller is easier to overturn than most equipment. Rolling on a side slope should always be done at right angles or diagonally, rather than parallel to the slope.

7 Steer carefully when rolling a shoulder to avoid capsizing into the ditch, and never bring a roller near the edge of a cut.

8 Use extreme care when loading steel-wheeled rollers on tractor-trailers during periods of inclement weather. The wet deck of the trailer can cause a steel-wheel roller to slip during loading and unloading operations.

# Tar Pot

**UTAH DEPARTMENT OF TRANSPORTATION  
MAINTENANCE DIVISION  
ACTIVITY PERFORMANCE STANDARDS**

**NUMBER AND TITLE**     7S02 - Bituminous Crack Sealing

**DESCRIPTION**

Sealing bituminous surface cracks.

**RESPONSIBILITY**

Station Supervisor

**CALENDAR**

JUL   AUG   SEP   OCT   NOV   DEC   JAN   FEB   MAR   APR   MAY   JUN

**CONDITIONS FOR SCHEDULING**

Cracks should be filled during periods of maximum contraction of the surface (September through April).

**LABOR**

<u>QTY</u>	<u>TYPE</u>
6	People

This staffing provides for two flaggers. Conditions may warrant the addition or deletion of flaggers.

**EQUIPMENT**

<u>QTY</u>	<u>TYPE</u>	<u>EQUIPMENT #</u>
1	Asphalt Dist Crack Sealer	1004
1	Compressor 100-250 CFM	1501
1	Lease Truck, Pickup, 3/4 Ton	3002
1	Lease Truck, 1 Ton, Dual Wheel	3011
1	Traffic Controller, Trailer	3308

If routing is used, or if other conditions warrant, additional men and equipment may be added.

**MATERIAL**

<u>QTY</u>	<u>UNIT</u>	<u>TYPE</u>	<u>INVENTORY #</u>
2250	Pound	Crack Sealing Comp. LB	74556791502



**ACCOMPLISHMENT UNIT**

Square Yards

**AVERAGE DAILY PRODUCTION**

<u>QTY</u>	<u>WORK MEASUREMENT UNIT</u>
15,000	Square Yards/Day

**OTHER**

**MEASURE OF QUALITY**

**METHOD / PROCEDURE**

1. Notify local agencies and/or businesses.
2. Place safety devices and signs (See Standard Drawings).
3. Clean foreign matter from cracks either by air, or by routing, if applicable.
4. Fill cracks 3/8" to 1", flush with surface of the roadway using DOT approved crack sealing material.
5. Spread dry sand, if applicable, to allow traffic to cross.
6. Remove safety devices and/or signs.



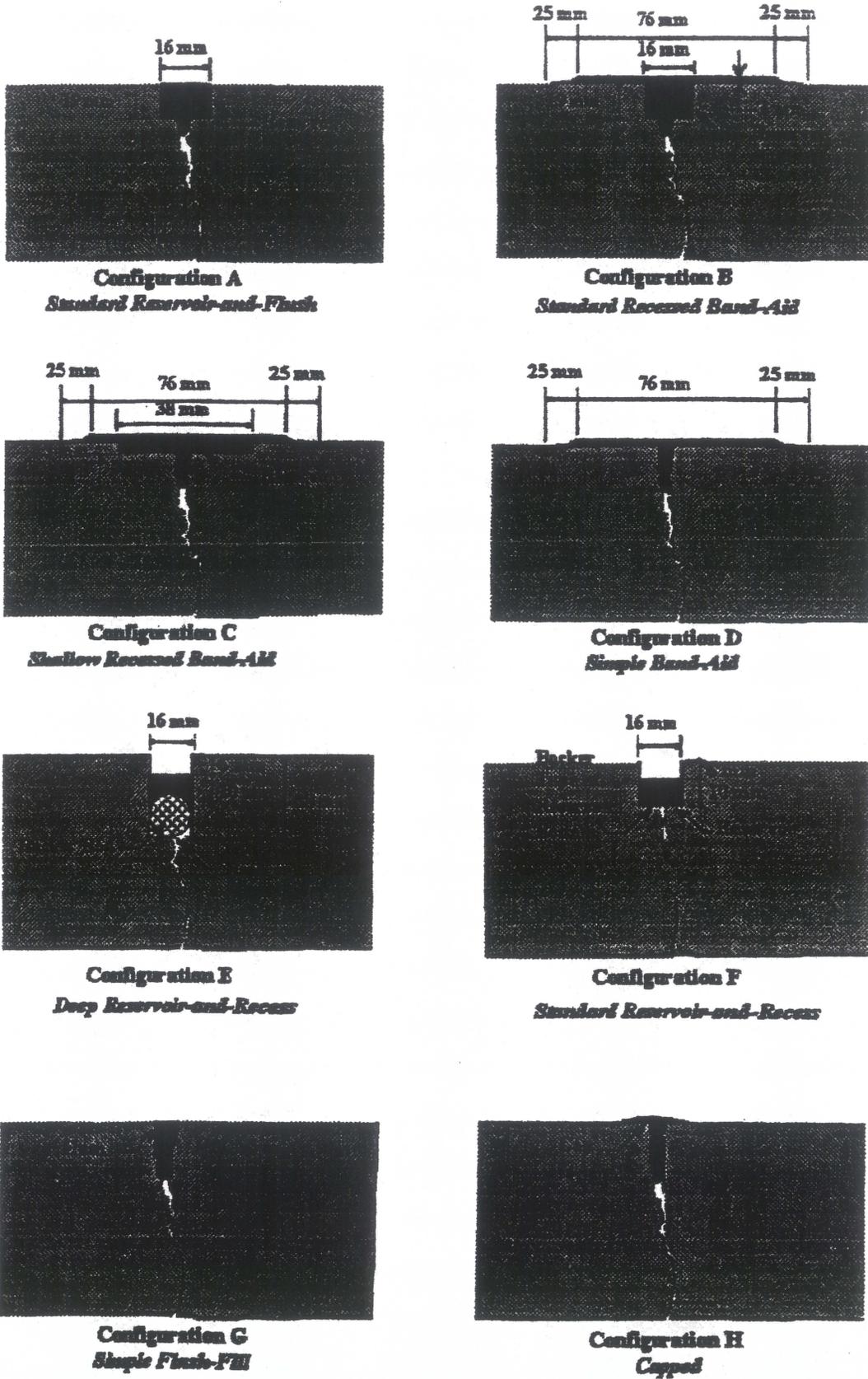


Figure 2. Material placement configurations for AC crack treatments.



CHECK EACH SHIFT	PRODUCT #	NUMBER OF SERVICE POINTS	FILTERS			
OPERATORS RESPONSIBILITY			APPLICATION	COMMODITY	MFG.	MFG. #
CHECK HYDRAULIC OIL LEVEL	30		ENGINE OIL	NON STOCKING	FLTGRD	LF3823
ENGINE CRANKCASE OIL LEVEL	10		ENGINE FUEL	06042341708	FRAM	G-2
CHECK AIR FILTER SYSTEM			HYDRAULIC	NON STOCKING	FLTGRD	HF5720
CHECK TRAIL HITCH AND SAFETY CHAIN			AIR (OIL BATH)			
TIRES			BURNER FUEL	NON STOCKING	HATZ	50478800
WALK AROUND						
SERVICE INTERVALS	REFILL CAP.	LUBRICATION PRODUCTS				
<b>WEEKLY (LUBE AND/OR INSPECTION)</b>			10	17		30
NOTE #1 THRU #4			15W/40	30W		FHF
LUBE MAN HOLE COVER (SPARINGLY)	10		FLEET	FLEET		FLEET
LUBE SPRAY BAR CONTROLS (SPARINGLY)	10		CRANKCASE	ENGINE		HYDRAULIC
LUBE BAR SWIVELS	50		OIL	OIL		FLUID
<b>EVERY 250 HOURS</b>				50		
NOTE #1 THRU #4				MPG		
CLEAN AIR FILTER HOUSING (ADD NEW OIL)	17	1		MULTIPLE		
CHANGE ENGINE OIL	10	1		PURPOSE		
CHANGE ENGINE OIL FILTER				GREASE # 2		
CLEAN ENGINE COOLING FINS						
CLEAN ENGINE COOLING INTAKE SCREEN						
TAKE OIL SAMPLES						
<b>EVERY 500 HOURS or YEARLY</b>						
NOTE #1 THRU #4						
CHANGE ENGINE FUEL FILTER		1				
CHANGE HYDRAULIC OIL FILTER	20 GAL.	1				
CHANGE BURNER FUEL FILTER		1				
<b>YEARLY</b>						
NOTE #1 THRU #4						
CHECK BRAKES						
REPACK WHEEL BEARINGS						
			<b>NOTE # 1</b> SERVICE INTERVALS MAY BE ALTERED BY EQUIPMENT SHOP SUPERVISOR DURING UNUSUAL OPERATING CONDITIONS <b>NOTE # 3</b> EACH SERVICE INTERVAL PROGRESSION INCLUDED ALL PREVIOUS SERVICE INTERVAL OPERATIONS. <b>NOTE # 4</b> SEND REPRESENTATIVE SAMPLE OF FLUID (FROM MAIN STREAM OF SYSTEM AT OPERATING TEMPERATURE) TO CURRENT ANALYSIS CONTRACT LAB. TAKE ALL CORRECTIVE ACTIONS AS SUGGESTED BY ANALYSIS RESULTS.			

VENDOR  
 G TRUCK EQUIPMENT  
 (401) 975-0400



TIRES			
FRONT	LT235/85R/16	80 PSI	MAX
REAR	LT235/85R/16	80 PSI	MAX

CHECK EACH SHIFT		PRODUCT #	NUMBER OF SERVICE POINTS	FILTERS		
OPERATORS RESPONSIBILITY				APPLICATION	COMMODITY	MFG.
ELECTRICAL CONNECTOR			AIR		HONDA	ZE1B
TRAILER HITCH (AND SAFETY CHAINS)						
TIRES						
LAMPS						
CHECK LP FUEL TANK						
ENGINE OIL LEVEL						
WALK AROUND						

SERVICE INTERVALS	REFILL CAP.		LUBRICATION PRODUCTS			
WEEKLY (LUBE AND/OR INSPECTION)						
NOTE #1 #8						
FIRST 20 HOURS ONLY			17	30W		
NOTE #1 #8		17	FLEET			
CHANGE ENGINE OIL			ENGINE			
			OIL			
EVERY 100 HOURS						
NOTE #1 #8		17				
CHANGE ENGINE OIL						

EVERY YEAR  
 NOTE #1 #8  
 REPAK WHEEL BEARINGS  
 REPLACE AIR FILTER

**NOTE #1**  
 SERVICE INTERVALS MAY BE ALTERED BY EQUIPMENT SHOP SUPERVISOR DURING UNUSUAL OPERATING CONDITIONS  
**NOTE #3**  
 EACH SERVICE INTERVAL PROGRESSION INCLUDED ALL PREVIOUS SERVICE INTERVAL OPERATIONS

VENDOR:  
 DATE EQUIPMENT:  
 (801) 973-2800



TIRES			
205/70D/14	60 PSI	MAX	

SAFETY ITEMS		COMMODITY #	
FIRST AID KIT		34532000711	
FIRE GUN 6 LB.		34028861604	

CHECK EACH SHIFT OPERATORS RESPONSIBILITY	PRODUCT #	NUMBER OF SERVICE POINTS	FILTERS			
			APPLICATION	COMMODITY	MFG.	MFG. #
ENGINE COOLANT LEVEL	88	1	OIL	08042858508	FLTRGD	LF0482
ENGINE CRANKCASE	10	1	FUEL PRIMARY	non-stocking	ISZU	2908848100
ENGINE AIR CLEANER(SEE NOTE #2)		1	AIR	78288418847	FLTRGD	AP1885K
TRAILER HITCH (AND SAFETY CHAINS)			HYDRAULIC (SPIN-ON)	08042858581	FLTRGD	HF8710
TIRES	80	1	HYDRAULIC (IN TANK)	NON-STOCKING	SOHROEDER	8240
HYDRAULIC OIL LEVEL	80	1				
HEAT TRANSFER OIL LEVEL	90	1				
WALK AROUND						

SERVICE INTERVALS	REFILL CAP.
WEEKLY (LUBE AND/OR INSPECTION) NOTE #1, #2, #3	

	80	10	88	80
	MPG	18W40	EXT/EG	THF
	MULTIPLE	FLEET	ANTIFREEZE	TRACTOR
	PURPOSE	CRANKCASE	EXTENDED	HYDRAULIC
	SPELSE #2	OIL	LIFE	FLUID
PUMP PACKING (ADJUST AS NEEDED)				
LUBE PUMP OUTBOARD BEARING	80			
CHECK BATTERY				
CHECK BRAKE FLUID LEVEL				

	80	90	60
	MPG	HTO	DOT 3
	PURPOSE	HEAT	BRAKE
	SPELSE #2	TRANSFER	FLUID
	OIL	OIL	FLUID
FIRST 80 HOURS NOTE #1, #2, #3, #4, #8			
CHANGE ENGINE OIL			
CHANGE ENGINE OIL FILTER			
CHANGE AIR FILTER	10		
CHANGE HYDRAULIC FILTER (SPIN-ON)			
CHANGE HYDRAULIC FILTER (IN-TANK)			
CHANGE FUEL FILTER			

**NOTE # 1**  
SERVICE INTERVALS MAY BE ALTERED BY EQUIPMENT SHOP SUPERINTENDENT DURING UNUSUAL OPERATING CONDITIONS

**NOTE # 2**  
IF VEHICLE IS EQUIPPED WITH AIR RESTRICTION INDICATOR: CHANGE PRIMARY ELEMENT WHEN RESTRICTION GAUGE READS IN THE RED ZONE. CHANGE SECONDARY ELEMENT EVERY THIRD PRIMARY CHANGE.

IF VEHICLE HAS NO AIR RESTRICTION INDICATOR: FOLLOW MANUFACTURER'S RECOMMENDED SERVICE INSTRUCTIONS.

**NOTE # 3**  
EACH SERVICE INTERVAL PROGRESSION INCLUDED ALL PREVIOUS SERVICE INTERVAL OPERATIONS.

**NOTE # 4**  
SEND REPRESENTATIVE SAMPLE OF FLUID (FROM MAIN STREAM OF SYSTEM AT OPERATING TEMPERATURE) TO CURRENT ANALYSIS CONTRACT LAB TAKE ALL CORRECTIVE ACTIONS AS SUGGESTED BY ANALYSIS RESULTS.

**NOTE # 5**  
REPLACE FILTER OR DOAM AS PER SECTION 1 (COOLING SYSTEM CHECK AND PROCEDURE)

EVERY 250 HOURS OR YEARLY NOTE #1, #2, #3, #4, #8	10	1		
CHANGE ENGINE OIL				
CHANGE ENGINE OIL FILTER				
CHANGE HYDRAULIC OIL FILTER (SPIN-ON)	80	1		
REPLACE AIR FILTER		1		
REPLACE FUEL FILTER		1		
EVERY 500 HOURS OR YEARLY NOTE #1 THRU #8	88	1		
CHANGE ENGINE COOLANT	80	1		
CHANGE HYDRAULIC OIL	90	1		
CHANGE HEAT TRANSFER OIL		4		
CHECK BRAKE LINING		1		
CHANGE HYDRAULIC FILTER (IN-TANK)				
EVERY TWO YEARS NOTE #1 THRU #8 REPACK WHEEL BEARINGS	80	8		



TIRE	PRESSURE
185R14	88 PSI MAX

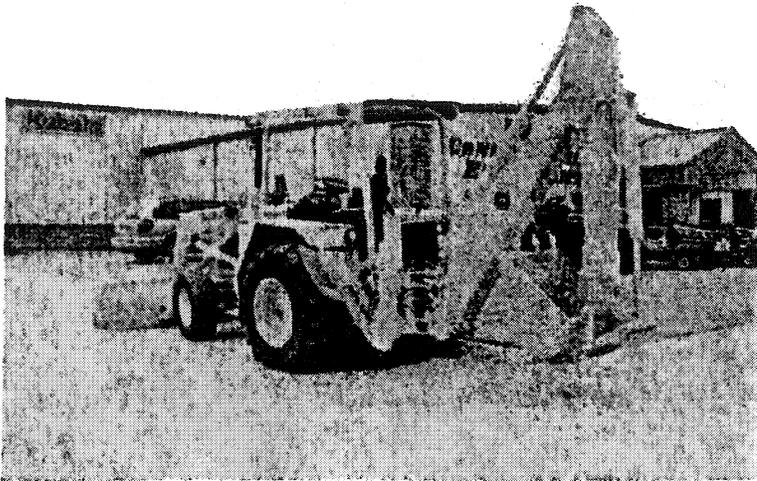
VENDOR	
QATE EQUIPMENT	801 678-2900

# **G Backhoe**

# Backhoe

## Familiarization

**This Section on Backhoe's is intended to familiarize you with the uses and characteristics of the backhoe, daily inspection information and some operating techniques and tips. It is not an all inclusive manual or instruction guide. Consult your machines operating manual for specific information on operating and maintenance.**



# **BACKHOE LEVEL 1**

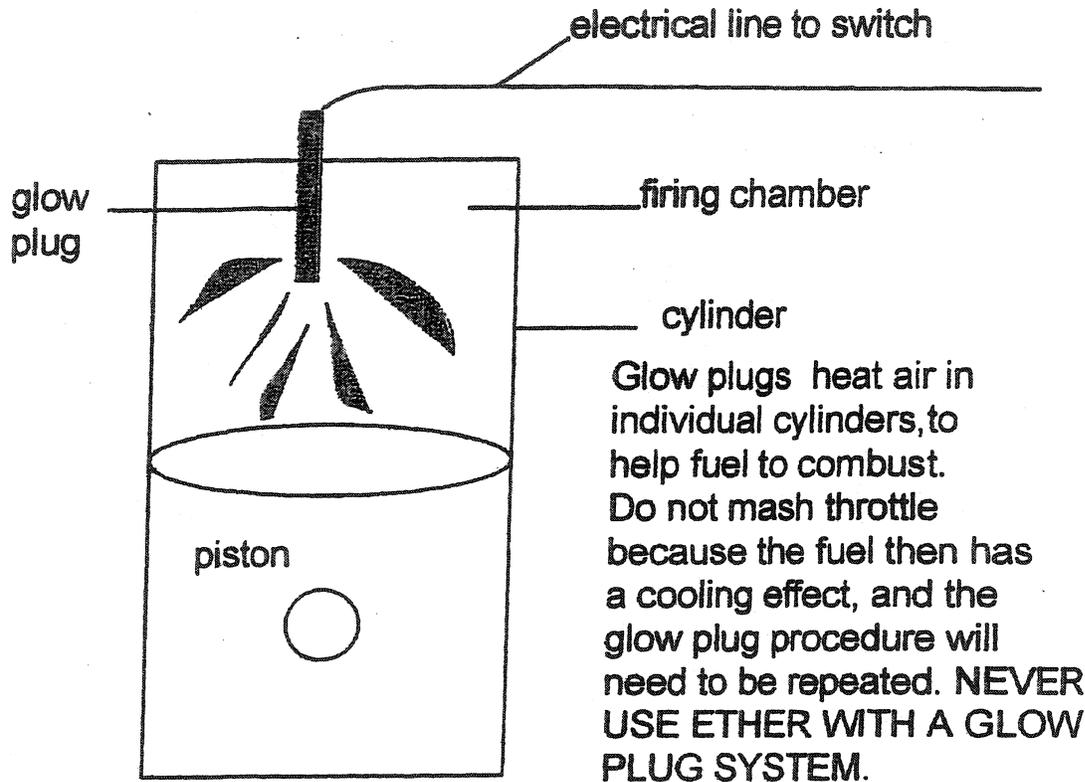
## **Indications of a bad injector:**

- 1. Black Smoke:** Black smoke from the exhaust stack in the form of smoke rings.
- 2. Making Oil:** A condition in which fuel droplets from a bad injector wash the cylinder walls or oil, causing excessive heat and friction in that cylinder, and score the cylinder wall. This adds fuel to the lubrication system.
- 3. Injector Knock:** Sounds like knocking noise in cylinder head of engine. If these conditions occur, shutdown engine immediately and notify your supervisor immediately.
- 4. System not receiving fuel:**
  - A. No smoke from exhaust stack.**
  - B. Engine not firing.**

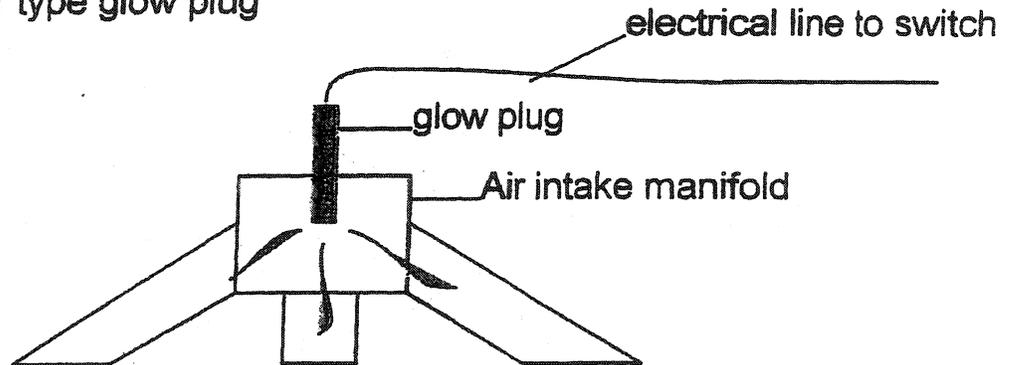
If these conditions occur, check engine cutoff switch. Check fuel filters, they may be clogged or frozen, or lift pump may not be working.

**Fuel Return Line:** This is the line that runs from the injectors to the fuel tank. The fuel system supplies much more fuel than what the engine uses and you need to have a return line. Due to the heat and the friction the fuel is heated as it travels through the system. Therefore, warm fuel is deposited back into the fuel tank. Keep in mind that when this occurs in the winter, condensation forms in the fuel tanks. Water must be drained on a daily basis.

# GLOW PLUG SYSTEM



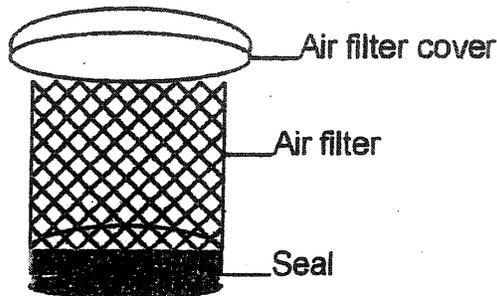
cylinder type glow plug



Intake manifold type glow plug

A single glow plug is used to heat the air in the air intake manifold. When the engine is turned over warm air is drawn into the cylinder firing chamber which helps fuel to combust in cold weather. **NEVER USE ETHER WITH A GLOW PLUG SYSTEM.**

## AIR INTAKE SYSTEM



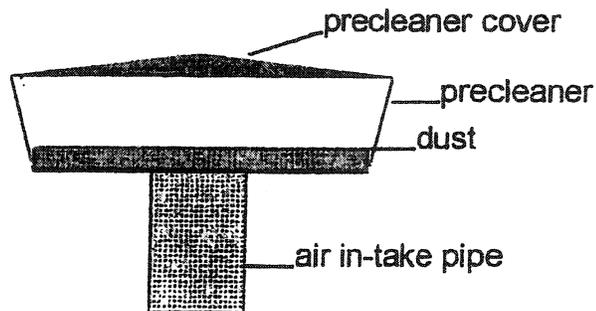
A diesel engine requires 3 things to run

1. fuel
2. air
3. compression

Lack of any one of these will prevent the engine from firing

There are a few items on this system that require attention daily.

1. Pre-cleaner - Clean daily



Remove cover and empty contents of precleaner away from in-take pipe.

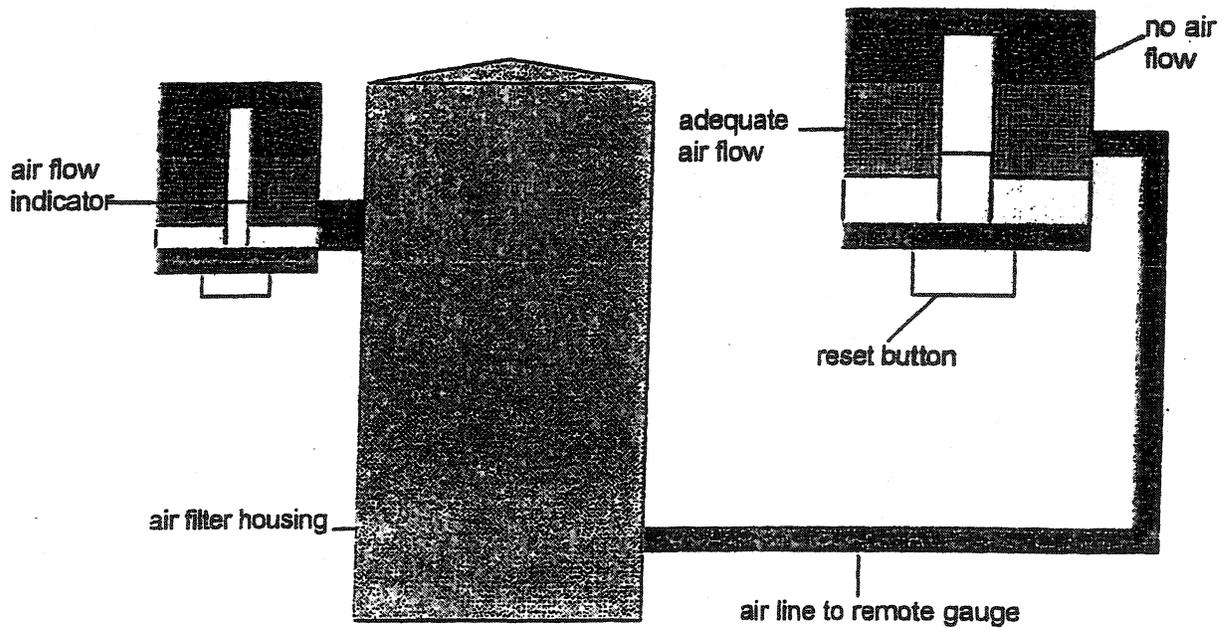
If not equipped with a precleaner you may be required to pull the air filter and inspect it.

**NEVER**

- A) USE AN AIR-GUN TO BLOW DIRT FROM FILTER. THIS MAY DAMAGE THE PAPER ELEMENT AND ALLOW LARGE PARTICULATES INTO THE ENGINE CAUSING ENGINE DAMAGE**
- B) TAP FILTER ON THE GROUND TO REMOVE DIRT THIS MAY DAMAGE THE SEAL AND/OR THE PAPER ELEMENT.**

## Air intake System

2. Air restriction gauge - Indicates air flow or lack of air flow through the air filter.
  - a) Direct mount to air cleaner housing
  - b) remote mount-Tube runs from air cleaner housing to gauge in cab.

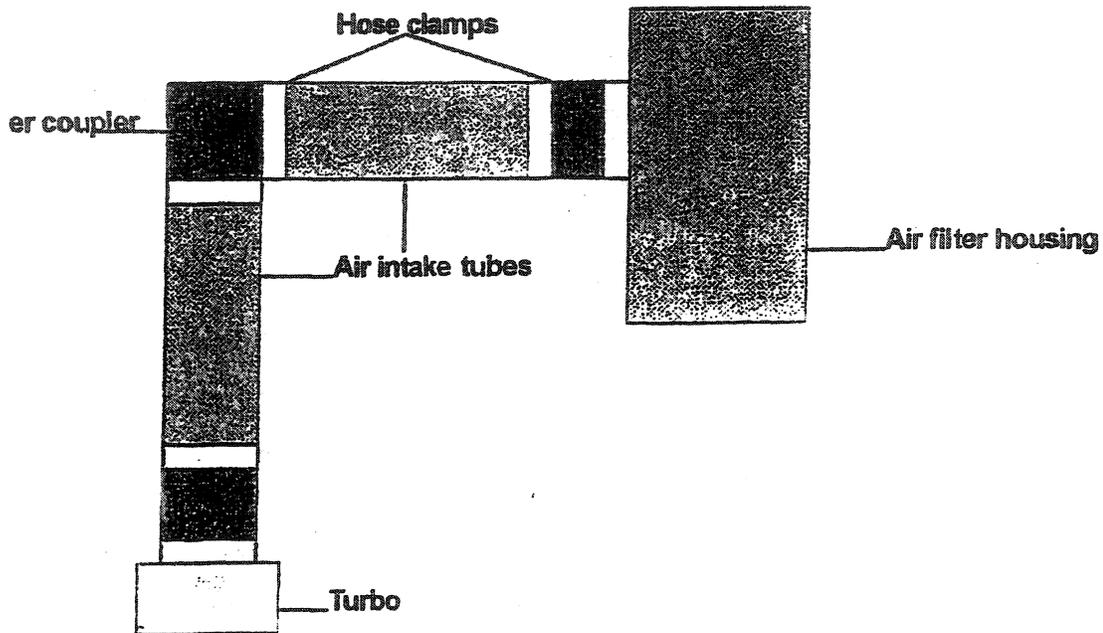


Inspect air line for holes - since this line is usually plastic holes may occur. If there is a hole in this line the gauge will not function properly and dirt may be drawn into the system

A new air filter is not at its maximum filtering ability until it has had the chance to pick up some particulates which helps the filtering process.

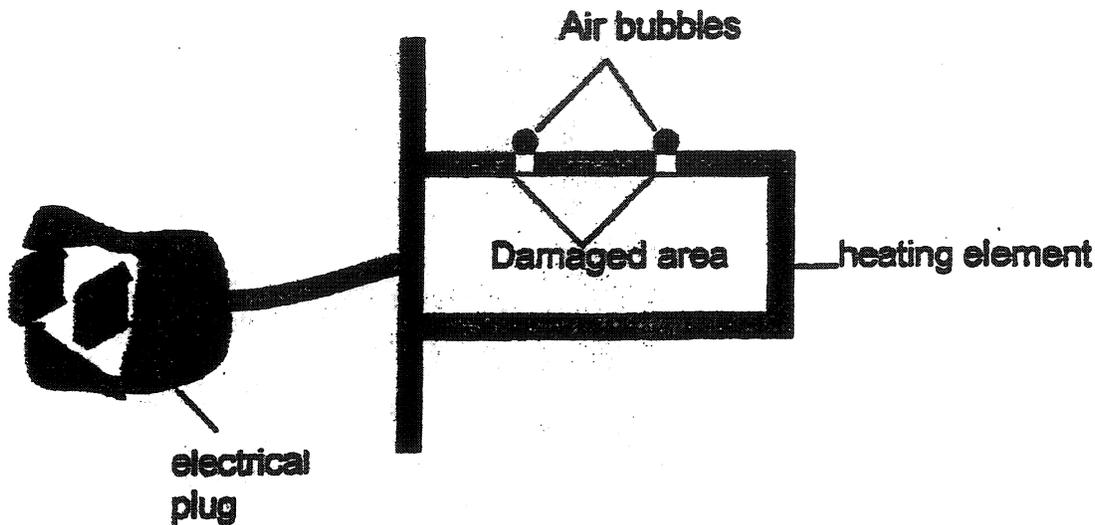
# AIR INTAKE SYSTEM

## 3. INSPECT ALL AIR LINES AND COUPLERS



- a) Inspect hose clamps for tightness
- b) Inspect rubber couplers for cracks and holes
- c) Inspect intake tubes for cracks
- d) Inspect turbo mounting

# ENGINE BLOCK HEATER



For those of us that work in cooler climates a block heater helps in starting your engine. However, there are a few precautions that will need to be taken to avoid damage to the engine block heater.

- 1) **Preseason check-** Make sure the outlet that will be used this winter is functional. Take the block heater plug and plug it into your outlet. If it makes a faint crackling sound there's a good chance the block heater is functional. Leave it plugged in over night and touch the block in the morning to make sure it is working, and engine block is warm.
- 2) **NEVER** start the engine with the block heater plugged in. Having sat over night the pressure on the cooling system has bled off. On initial start up the water pump picks up air with the antifreeze and circulates both air and antifreeze through the system. If still plugged in, the air bubbles seek out and stick to the heating element. This causes hot spots on the block heater element which damage the element beyond repair. (fig 6) By unplugging the block heater first you can also save yourself the embarrassment of driving down the road with 50 ft. of extension cord flapping behind you.

# DAILY BACKHOE INSPECTION

DATE  NAME

JNIT NO. LOCATION MILES/HRS.

WEATHER COND. TEMPERATURE

CODES: / = OK R = REPLACE/REPAIR  
 NA = NOT APPLICABLE

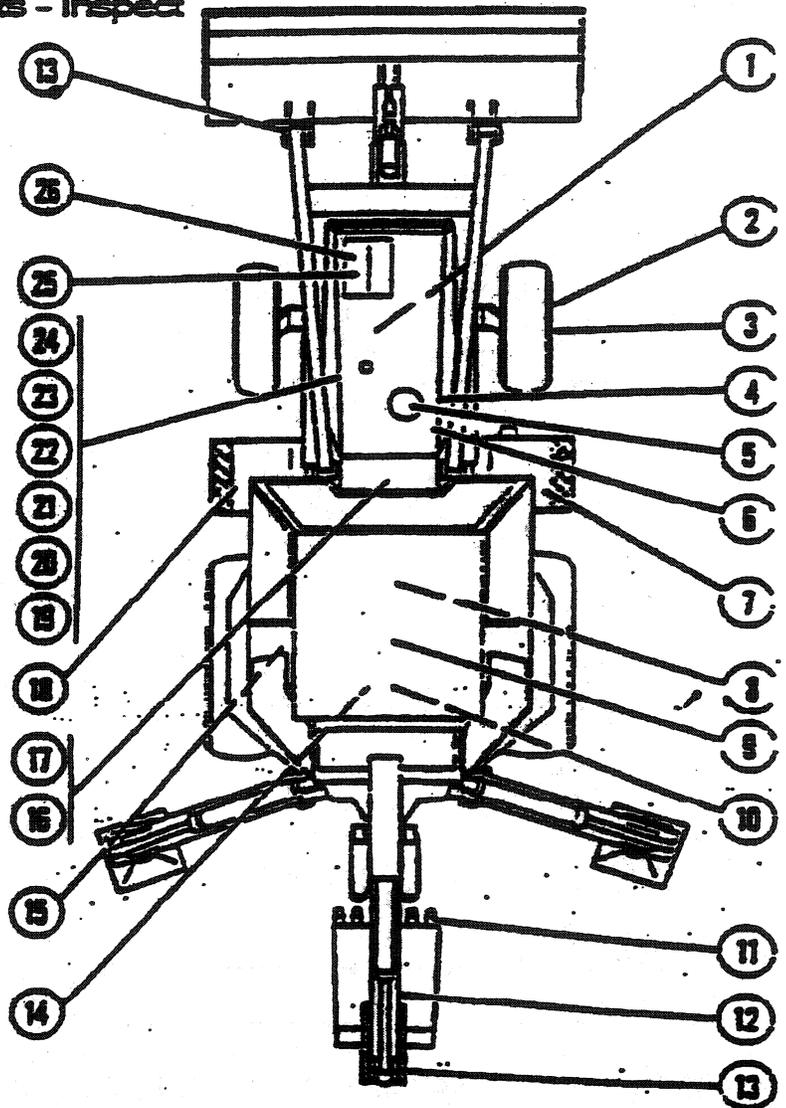
	CHECK FOR LEAKS ON GROUND	
	ENGINE OIL	
	TRANSMISSION/TORQUE CONVERTER	
	HYDRAULIC	
S	ANTIFREEZE	
T	FAN BELTS	
A	AIR CLEANER	
R	CHECK AND UNPLUG BLOCK HEATER	
T	LUBE PUMP DRIVE JOINTS	
	STARTING AID	
	STARTER OPERATION	
U	ENGINE OPERATION	
P	INSTRUMENTS AND GAUGES	
	SWITCHES	
I	WASHERS AND WIPERS	
N	LIGHTS AND SIGNALS	
S	MIRRORS AND GLASS	
P	SAFETY EQUIPMENT	
E	HEATER AND BLOWER	
C	HORN	
T	PARKING BRAKE	
I	BACKUP ALARM	
O	CLUTCH OPERATION	
N	THROTTLE OPERATION	
	DOOR AND WINDOW OPERATION	
	STEERING	
	APPLY BRAKES	
	CONTROLS AND CYLINDER OPERATION	
	AUXILIARY CONTROLS	

	STARTER MOUNT	
	ALTERNATOR MOUNT	
	FAN AND SHROUD	
	BATTERY HOLD DOWN	
	BATTERY CABLES	
	BATTERY BOX AND LID	
E	KINGPIN BEARINGS	
X	WHEEL LUG NUTS	
T	INSPECT FRAME FOR CRACKS	
E	CHECK CYLINDER PINS AND BOSSES	
R	STEPS AND GRAB HANDLES	
I	HYDRAULIC LINES/FITTINGS	
O	BUCKET AND BUCKET TEETH	
R	CUTTING EDGE AND SIDE BITS	
	MOUNTING BOLTS	
I	INSPECT BOOM AND DIPPER	
N	GENERAL APPEARANCE	
S	INSPECT STABILIZERS AND PADS	
P	INSPECT SWING CYLINDERS	
E	TRUNION BEARING	
C	EXHAUST PIPES AND MOUNTS	
T	AIR INTAKE HOSES/CLAMPS	
I	FUEL LINES	
O	SMM STICKER/PLATE	
N	CHECK WHEELS FOR CRACKS	
	RADIATOR	
	VALVE STEMS AND CAPS	
	MATE AND MATCH	
	INSPECT AUXILIARY ATTACHMENTS	
	TIRE PRESSURE	
	<input type="checkbox"/> RIGHT <input type="checkbox"/>	
	<input type="checkbox"/> LEFT <input type="checkbox"/>	

REMARKS: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

# BACKHOE LUBRICATION CHART

1. Front Power Axle - Lubricate
- Wheel Seal - inspect
- Wheel Lug Nuts - inspect
- Fuel Filter and Separator - inspect and/or drain
5. Air Cleaner - inspect
6. Transmission Fluid level - inspect
7. Fuel Tank - fill
8. Drive Shaft U-joints - Lubricate
9. All Cab Safety Equipment - inspect
10. Rear Axle - inspect
11. Bucket Teeth - inspect
12. Extendable Dipper Stick - inspect
13. Lubricate all Backhoe pivot points - lube
14. Parking and Service Brakes - check & adjust
15. Drive Line Brake - check & adjust
16. Cab Heater/Air conditioning - inspect
17. Cab Air Filter - inspect
18. Batteries - inspect
19. Alternator/Fan and Compressor Belts - inspect
20. Check Engine for Leaks - inspect
21. Engine Oil Level - inspect
22. Starting Aid - inspect
23. Hoses and Injector Lines - inspect
24. Power Steering - check fluid level
- Radiator - check fluid
- Hydraulic Tank - check fluid





## OSHA Regulations (Standards - 29 CFR) 1926 Subpart P App B - Sloping and Benching

 [OSHA Regulations \(Standards - 29 CFR\) - Table of Contents](#)

- **Standard Number:** 1926 Subpart P App B
- **Standard Title:** Sloping and Benching
- **SubPart Number:** P
- **SubPart Title:** Excavations

(a) **Scope and application.** This appendix contains specifications for sloping and benching when used as methods of protecting employees working in excavations from cave-ins. The requirements of this appendix apply when the design of sloping and benching protective systems is to be performed in accordance with the requirements set forth in 1926.652(b)(2).

(b) **Definitions.**

"Actual slope" means the slope to which an excavation face is excavated.

"Distress" means that the soil is in a condition where a cave-in is imminent or is likely to occur. Distress is evidenced by such phenomena as the development of fissures in the face of or adjacent to an open excavation; the subsidence of the edge of an excavation; the slumping of material from the face or the bulging or heaving of material from the bottom of an excavation; the spalling of material from the face of an excavation; and raveling, i.e., small amounts of material such as pebbles or little clumps of material suddenly separating from the face of an excavation and trickling or rolling down into the excavation.

"Maximum allowable slope" means the steepest incline of an excavation face that is acceptable for the most favorable site conditions as protection against cave-ins, and is expressed as the ratio of horizontal distance to vertical rise (H:V).

"Short term exposure" means a period of time less than or equal to 24 hours that an excavation is open.

(c) **Requirements - (1) Soil classification.** Soil and rock deposits shall be classified in accordance with appendix A to subpart P of part 1926.

(2) **Maximum allowable slope.** The maximum allowable slope for a soil or rock deposit shall be determined from Table B-1 of this appendix.

(3) **Actual slope.** (i) The actual slope shall not be steeper than the maximum allowable slope.

(ii) The actual slope shall be less steep than the maximum allowable slope, when there

are signs of distress. If that situation occurs, the slope shall be cut back to an actual slope which is at least 1/2 horizontal to one vertical (1/2H:1V) less steep than the maximum allowable slope.

(iii) When surcharge loads from stored material or equipment, operating equipment, or traffic are present, a competent person shall determine the degree to which the actual slope must be reduced below the maximum allowable slope, and shall assure that such reduction is achieved. Surcharge loads from adjacent structures shall be evaluated in accordance with 1926.651(i).

(4) Configurations. Configurations of sloping and benching systems shall be in accordance with Figure B-1.

TABLE B-1  
MAXIMUM ALLOWABLE SLOPES

SOIL OR ROCK TYPE	MAXIMUM ALLOWABLE SLOPES (H:V) (1) FOR EXCAVATIONS LESS THAN 20 FEET DEEP (3)
STABLE ROCK	VERTICAL (90 Deg.)
TYPE A (2)	3/4:1 (53 Deg.)
TYPE B	1:1 (45 Deg.)
TYPE C	1 1/2:1 (34 Deg.)

Footnote(1) Numbers shown in parentheses next to maximum allowable slopes are angles expressed in degrees from the horizontal. Angles have been rounded off.

Footnote(2) A short-term maximum allowable slope of 1/2H:1V (63 degrees) is allowed in excavations in Type A soil that are 12 feet (3.67 m) or less in depth. Short-term maximum allowable slopes for excavations greater than 12 feet (3.67 m) in depth shall be 3/4H:1V (53 degrees).

Footnote(3) Sloping or benching for excavations greater than 20 feet deep shall be designed by a registered professional engineer.

Figure B-1 - Slope Configurations

(All slopes stated below are in the horizontal to vertical ratio)

B - 1.1 Excavations made in Type A soil.

1. All simple slope excavation 20 feet or less in depth shall have a maximum allowable slope of 3/4:1.

SIMPLE SLOPE - GENERAL

Exception: Simple slope excavations which are open 24 hours or less (short term) and which are 12 feet or less in depth shall have a maximum allowable slope of 1/2:1.

SIMPLE SLOPE - SHORT TERM

2. All benched excavations 20 feet or less in depth shall have a maximum allowable slope of 3/4 to 1 and maximum bench dimensions as follows:

**SIMPLE BENCH; MULTIPLE BENCH**

3. All excavations 8 feet or less in depth which have unsupported vertically sided lower portions shall have a maximum vertical side of 3 1/2 feet.

**UNSUPPORTED VERTICALLY SIDED LOWER PORTION - MAXIMUM 8 FEET IN DEPTH)**

All excavations more than 8 feet but not more than 12 feet in depth with unsupported vertically sided lower portions shall have a maximum allowable slope of 1:1 and a maximum vertical side of 3 1/2 feet.

**UNSUPPORTED VERTICALLY SIDED LOWER PORTION - MAXIMUM 12 FEET IN DEPTH)**

All excavations 20 feet or less in depth which have vertically sided lower portions that are supported or shielded shall have a maximum allowable slope of 3/4:1. The support or shield system must extend at least 18 inches above the top of the vertical side.

**SUPPORTED OR SHIELDED VERTICALLY SIDED LOWER PORTION)**

4. All other simple slope, compound slope, and vertically sided lower portion excavations shall be in accordance with the other options permitted under 1926.652(b).

**B - 1.2 Excavations Made in Type B Soil**

1. All simple slope excavations 20 feet or less in depth shall have a maximum allowable slope of 1:1.

**SIMPLE SLOPE**

2. All benched excavations 20 feet or less in depth shall have a maximum allowable slope of 1:1 and maximum bench dimensions as follows:

**SINGLE BENCH AND MULTIPLE BENCH (These benches allowed in cohesive soil only).**

3. All excavations 20 feet or less in depth which have vertically sided lower portions

shall be shielded or supported to a height at least 18 inches above the top of the vertical side. All such excavations shall have a maximum allowable slope of 1:1.

**VERTICALLY SIDED LOWER PORTION**

4. All other sloped excavations shall be in accordance with the other options permitted in 1926.652(b).

**B - 1.3 Excavations Made in Type C Soil**

1. All simple slope excavations 20 feet or less in depth shall have a maximum allowable slope of 1 1/2:1.

**SIMPLE SLOPE**

2. All excavations 20 feet or less in depth which have vertically sided lower portions shall be shielded or supported to a height at least 18 inches above the top of the vertical side. All such excavations shall have a maximum allowable slope of 1 1/2:1.

**VERTICAL SIDED LOWER PORTION**

3. All other sloped excavations shall be in accordance with the other options permitted in 1926.652(b).

**B - 1.4 Excavations Made in Layered Soils**

1. All excavations 20 feet or less in depth made in layered soils shall have a maximum allowable slope for each layer as set forth below.

**B OVER A**

**C OVER A**

**C OVER B**

**A OVER B**

## Subpart Subpart P—Excavations

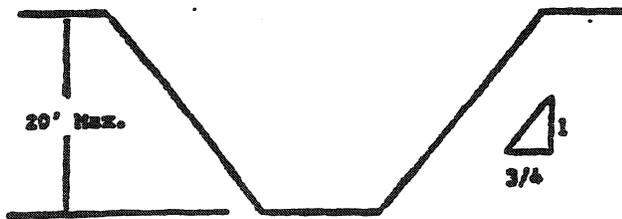
Figure B-1

### Slope Configurations

(All slopes stated below are in the horizontal to vertical ratio)

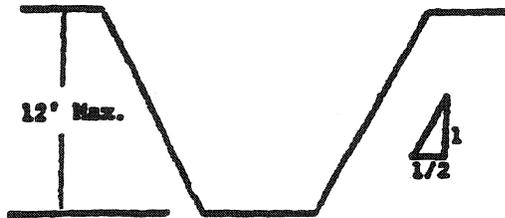
#### B-1. Excavations made in Type A soil.

1. All simple slope excavation 20 feet or less in depth shall have a maximum allowable slope of 1:1.



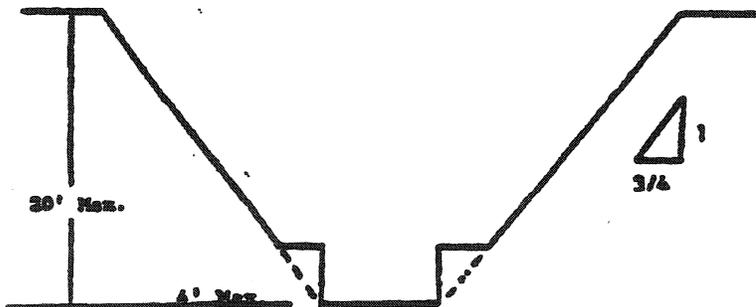
#### SIMPLE SLOPE—GENERAL

Exception: Simple slope excavations which are open 24 hours or less (short term) and which are 12 feet or less in depth shall have a maximum allowable slope of 1:1.



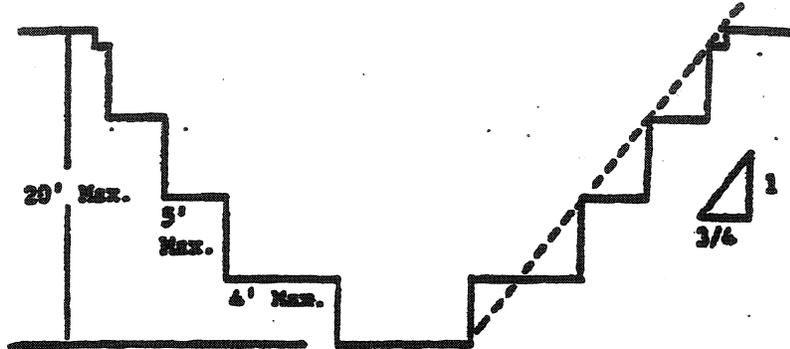
#### SIMPLE SLOPE—SHORT TERM

2. All benched excavations 20 feet or less in depth shall have a maximum allowable slope of 1/2 to 1 and maximum bench dimensions as follows:



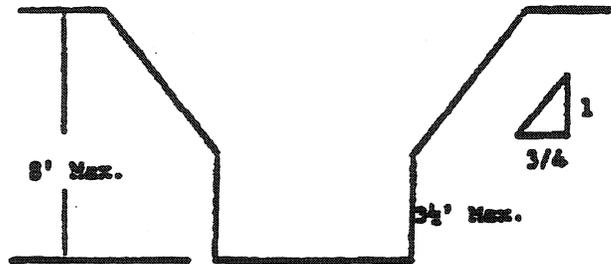
**Construction Standards**

**SINGLE BENCH**



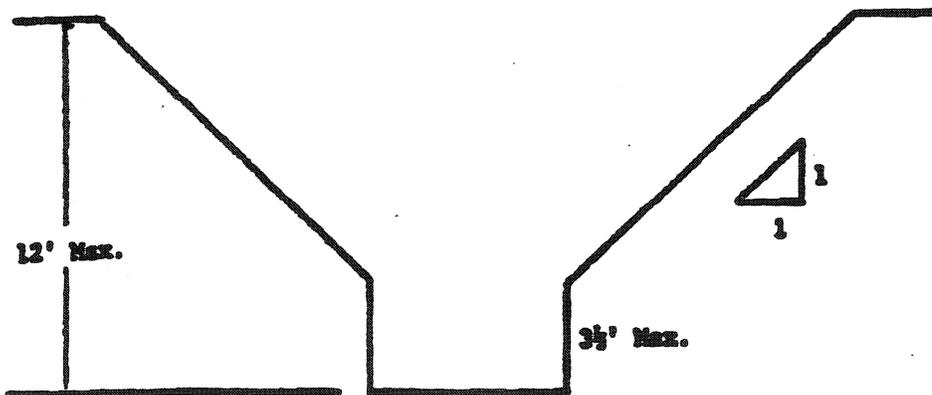
**MULTIPLE BENCH**

2. All excavations 8 feet or less in depth which have unsupported vertically sided lower portions shall have a maximum vertical side of 3/4 feet.

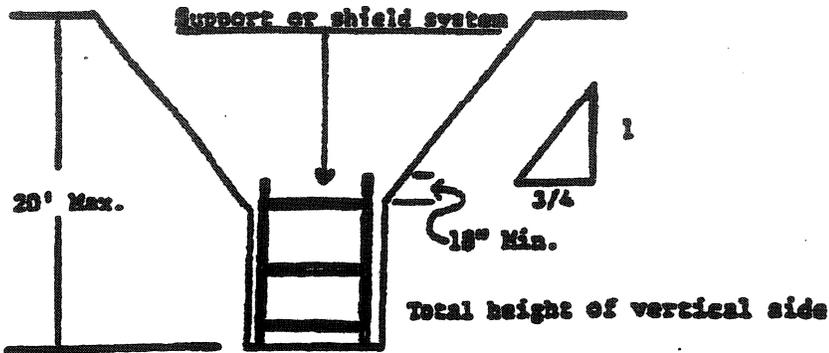


**UNSUPPORTED VERTICALLY SIDED LOWER PORTION—MAXIMUM 8 FEET IN DEPTH**

All excavations more than 8 feet but not more than 12 feet in depth which unsupported vertically sided lower portions shall have a maximum allowable slope of 1:1 and a maximum vertical side of 3/4 feet.



**Subpart Subpart P—Excavations**

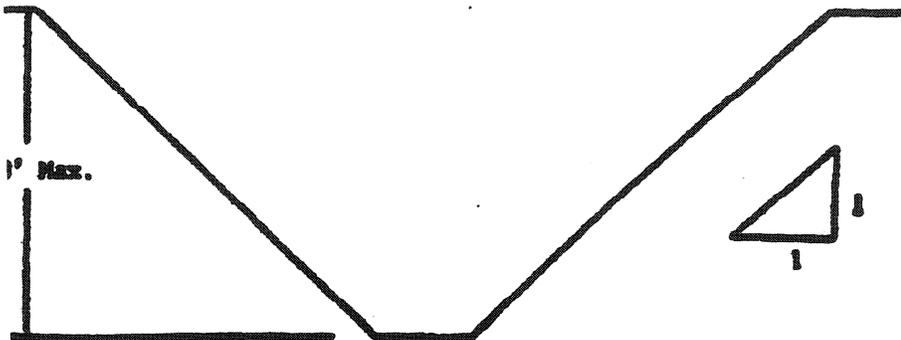


**SUPPORTED OR SHIELDED VERTICALLY SIDED LOWER PORTION**

All other simple slope, compound slope, and vertically sided lower portion excavations shall be in accordance with the other options permitted under §1926.652(b).

**B-1.2 Excavations Made in Type B Soil**

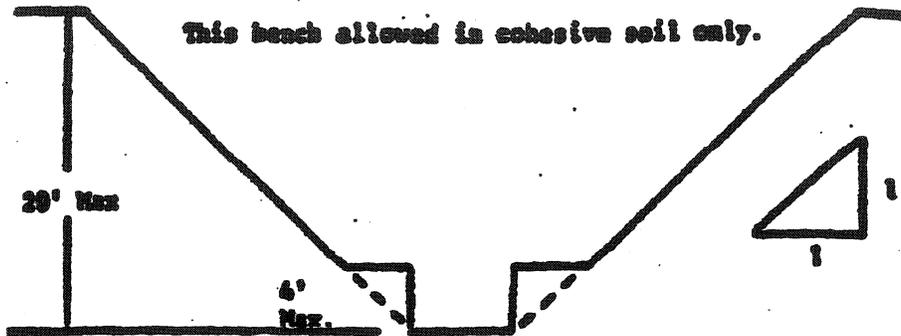
All simple slope excavations 20 feet or less in depth shall have a maximum allowable slope of 1:1.



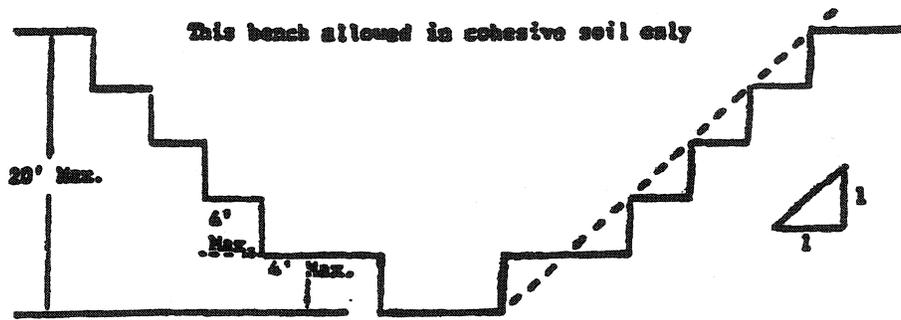
**Simple Slope**

All benched excavations 20 feet or less in depth shall have a maximum allowable slope and maximum bench dimensions as follows:

**Construction Standards**

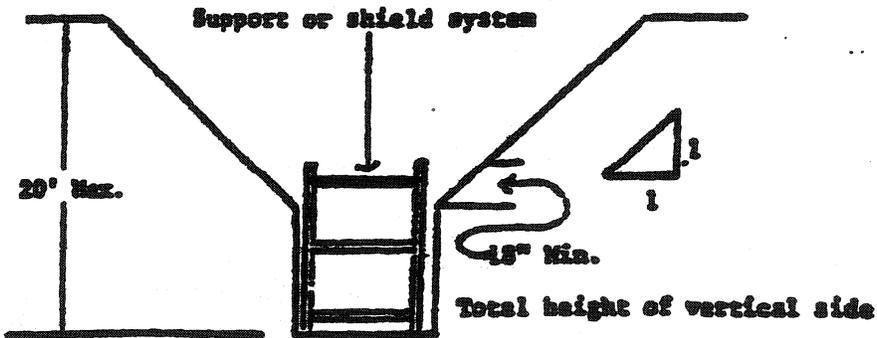


**SINGLE BENCH**



**MULTIPLE BENCH**

All excavations 20 feet or less in depth which have vertically sided lower portions shall be shielded or supported to a height at least 18 inches above the top of the vertical side. All excavations shall have a maximum allowable slope of 1:1.



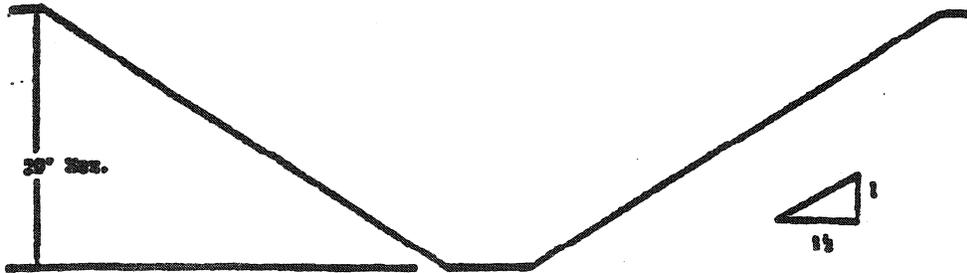
**Subpart Subpart P—Excavations**

**VERTICALLY SIDED LOWER PORTION**

4. All other sloped excavations shall be in accordance with the other options permitted in §1926.652(b).

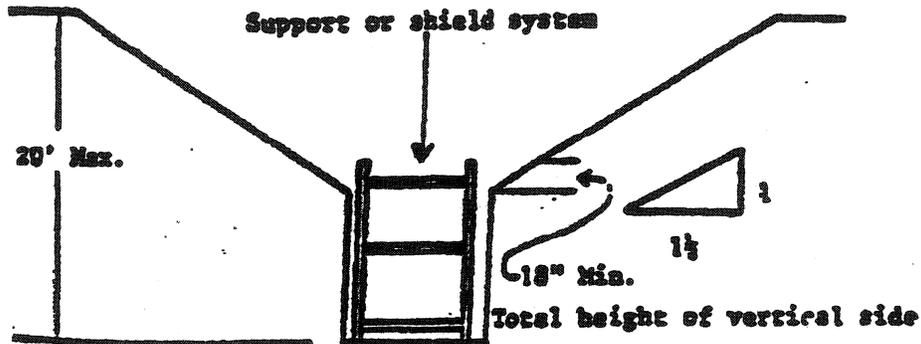
**B-1.3 Excavations Made in Type C Soil**

1. All simple slope excavations 20 feet or less in depth shall have a maximum allowable slope of 1½:1.



**SIMPLE SLOPE**

2. All excavations 20 feet or less in depth which have vertically sided lower portions shall be shielded or supported to a height at least 18 inches above the top of the vertical side. All such excavations shall have a maximum allowable slope of 1½:1.



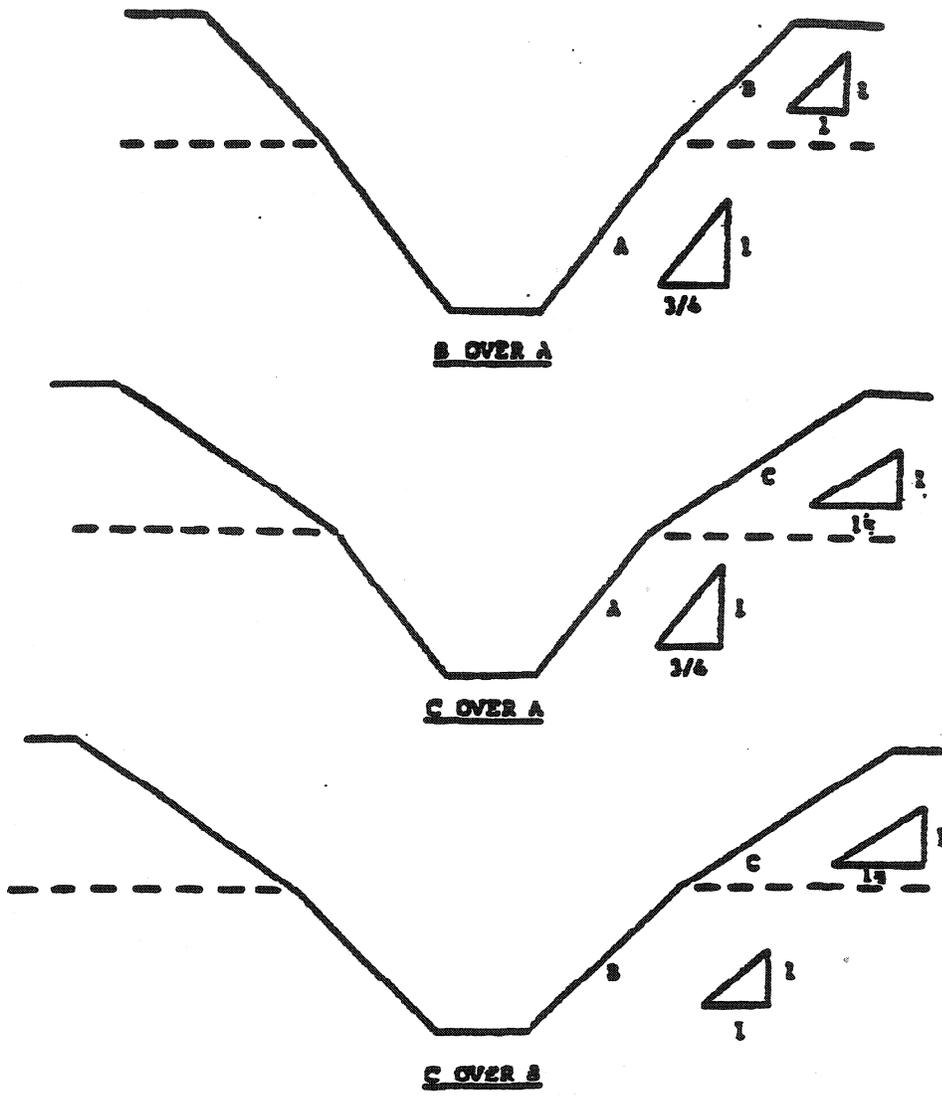
**VERTICAL SIDED LOWER PORTION**

3. All other sloped excavations shall be in accordance with the other options permitted in §1926.652(b).

**B-1.4 Excavations Made in Layered Soils**

1. All excavations 20 feet or less in depth made in layered soils shall have a maximum allowable slope for each layer as set forth below.

**Construction Standards**



## Subpart Subpart P—Excavations

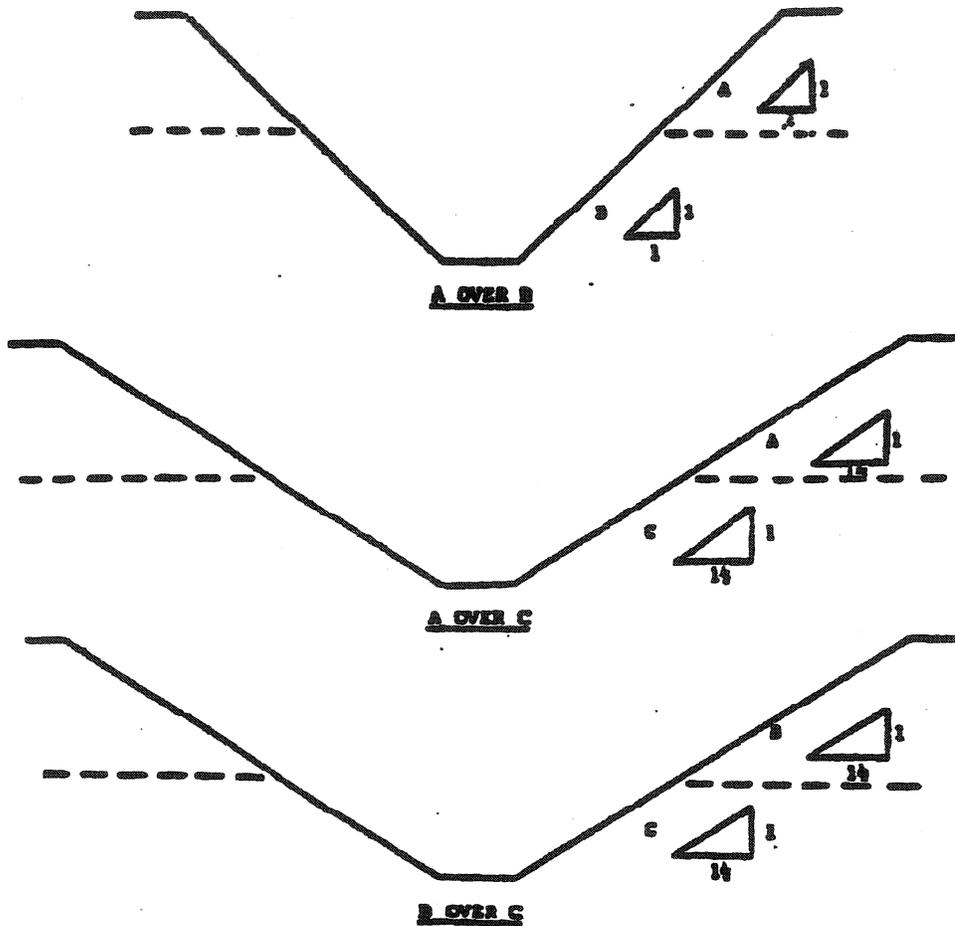


FIG. 2. All other sloped excavations shall be in accordance with the other options permitted in § 1926.652(b).

### Appendix C to § 1926 Subpart P— Timber Shoring for Trenches

1926.652. This appendix contains information that can be used when timber shoring is provided as a method of protection for workers in trenches that do not exceed 10 feet (3.1 m) in depth. This appendix shall be used when design of timber shoring systems is to be performed in accordance with § 1926.652(c)(1). Other shoring configurations, other systems of support such as hydraulic and pneumatic systems and other protective systems such as sloping, benching, shoring, and bracing systems must be designed in accordance with the requirements set forth in § 1926.652(b) and § 1926.652(c).

1926.652. In order to use the data presented in this appendix, the soil type in which the excavation is

made must first be determined using the soil classification method set forth in appendix A of subpart P of this part.

(c) Presentation of Information. Information is presented in several forms as follows:

(1) Information is presented in tabular form in Tables C-1.1, C-1.2 and C-1.3, and Tables C-2.1, C-2.2 and C-2.3 following paragraph (c) of the appendix. Each table presents the minimum size of timber members to use in a shoring system, and each table contains data only for the particular soil type in which the excavation or portion of the excavation is made. The data are arranged to allow the user the flexibility to select data among several acceptable configurations of members based on varying the horizontal spacing of the crossmembers. Stable rock is exempt from shoring require-

ments and therefore, no data are presented for this condition.

(2) Information concerning the basis of the tabular data and the limitations of the data is presented in paragraph (d) of this appendix, and on the tables themselves.

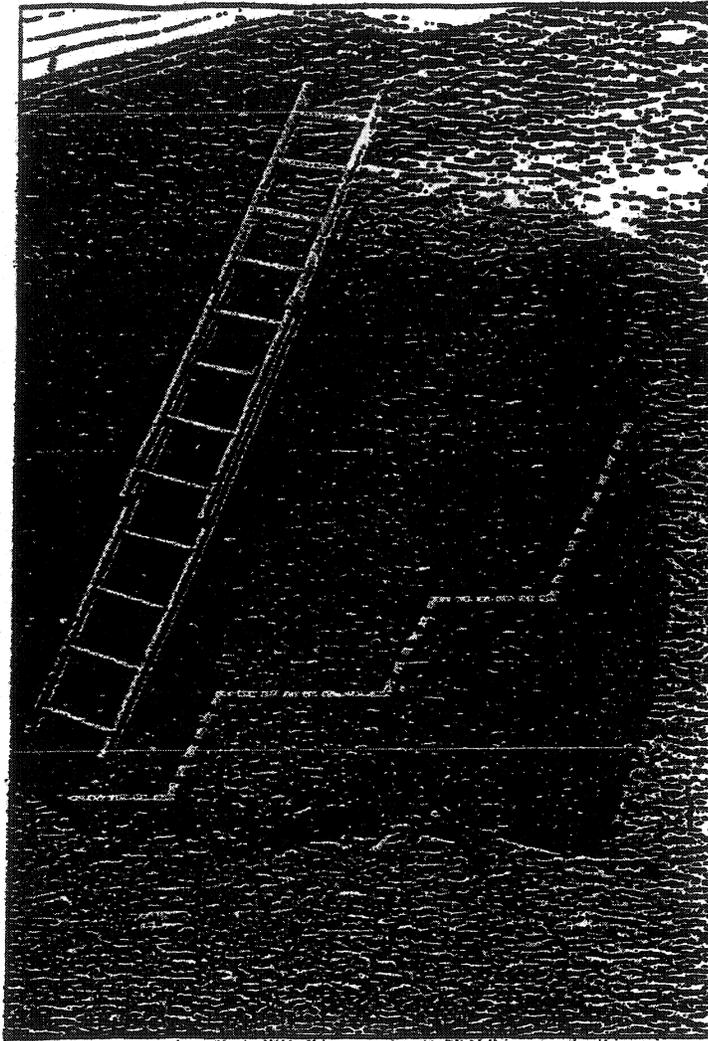
(3) Information explaining the use of the tabular data is presented in paragraph (e) of this appendix.

(4) Information illustrating the use of the tabular data is presented in paragraph (f) of this appendix.

(5) Miscellaneous questions regarding Tables C-1.1 through C-1.3 and Tables C-2.1 through C-2.3 are presented in paragraph (g) of this Appendix.

(6) Basis and limitations of the data.—  
 (1) Dimensions of timber members. (2) The size of the timber members listed in Tables

## § 1926 Subpart P App. C

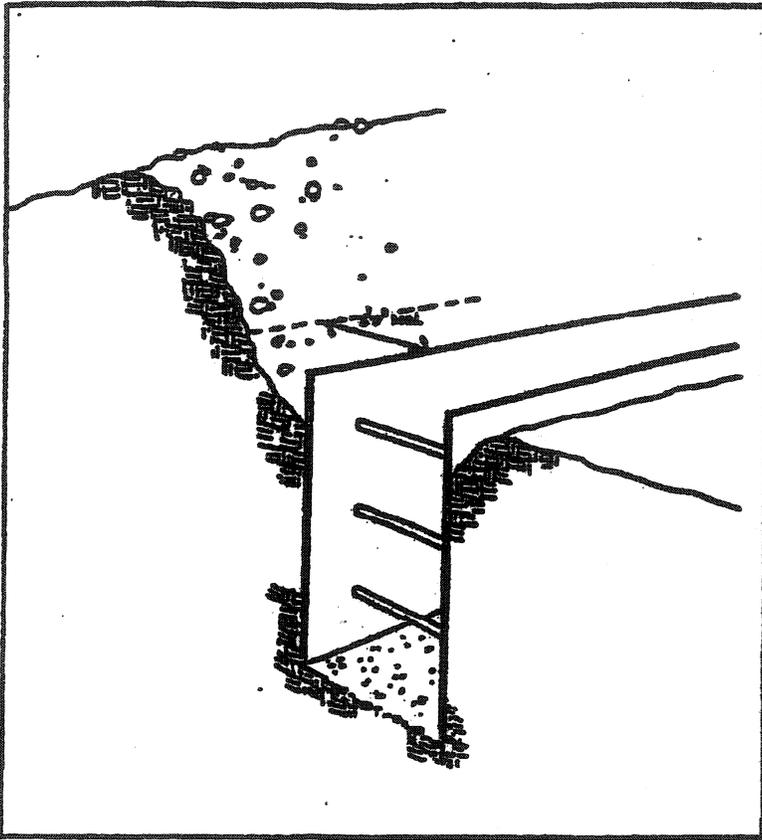


*As shown by the dotted line, this excavation was benched at a 1:1 slope after the competent person determined the soil type was stable for that type of protection. Usually, most residential excavations will be type C soil and will need a slope of 1½:1. A ladder is placed in the excavation to let workers climb in and out easily. The spoils pile is at least 2 feet back from the edge.*

## **Excavations & Trenching**

### **General**

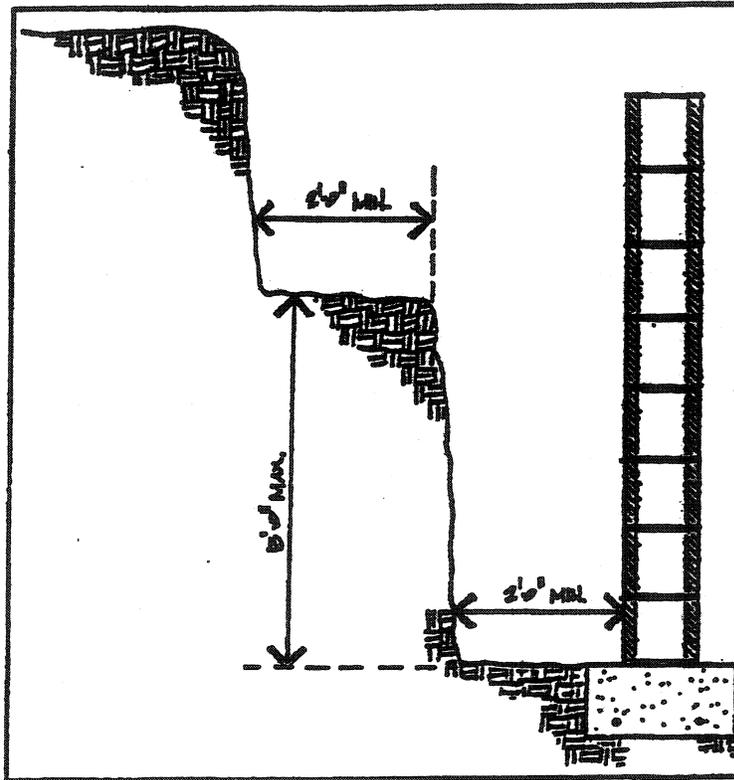
- Find the location of all underground utilities by contacting the local utility locating service before digging.
- Keep workers away from digging equipment and never allow workers in an excavation when equipment is in use.
- Keep workers from getting between equipment in use and other obstacles and machinery that can cause crushing hazards.



*Drawing of a trench box used the right way.*

- Keep equipment and the excavated dirt (spoils pile) back 2 feet from the edge of the excavation.
- Have a competent person conduct daily inspections and correct any hazards before workers enter a trench or excavation.
- Provide workers a way to get into and out of a trench or excavation. Ladders and ramps can be used and must be within 25 feet of the worker.
- For excavations and utility trenches over 5 feet deep, use shoring, shields (trench boxes), benching, or slope back the sides. Unless soil analysis has been completed, the earth's slope must be at least 1½ horizontal to 1 vertical.
- Keep water out of trenches with a pump or drainage system, and inspect the area for soil movement and potential cave-ins.

- Keep drivers in the cab and workers away when dirt and other debris are being loaded into dump trucks. Workers must never be allowed under any load and must stay clear of the back of vehicles.



*Drawing of a properly benched trench along a house foundation.*

## **Foundations**

After the foundation walls are constructed, special precautions must be taken to prevent injury from cave-ins in the area between the excavation wall and the foundation wall:

- The depth of the foundation/basement trench cannot exceed 7½ feet deep unless other cave-in protection is provided.
- Keep the horizontal width of the foundation trench at least 2 feet wide. Make sure there is no earth vibration while workers are in the trench.

## **Vehicles & Mobile Equipment**

- **Inform workers verbally and provide training to stay clear of backing and turning vehicles and equipment with rotating cabs.**
- **Maintain back-up alarms for equipment with limited rear view or use someone to help guide them back.**
- **Verify experience or provide training to crane and heavy equipment operators.**
- **Maintain at least a 10 foot clearance from overhead power lines when operating equipment.**
- **Block up the raised bed when inspecting or repairing dump trucks.**
- **Use a tag line to control materials moved by a crane.**

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## Loader Operation

SMCS Code: 7000

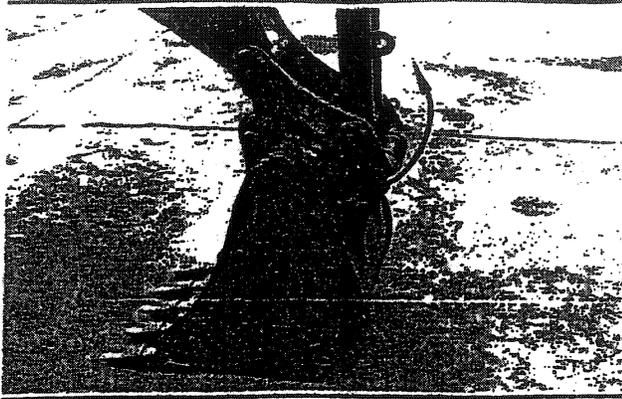


Illustration 161

g00738377

3. Retract the bucket cylinder in order to remove the quick coupler from the linkage pin.

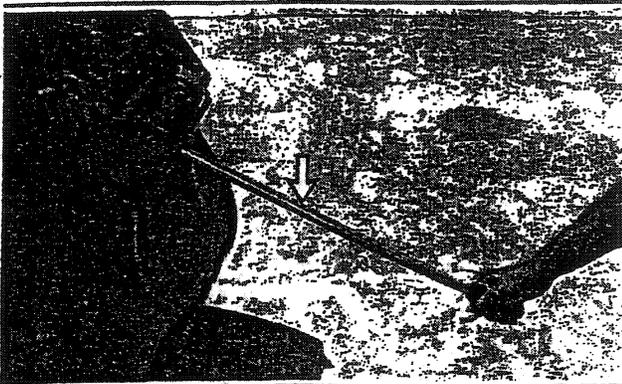


Illustration 162

g00739384

Note: If the quick coupler does not release the linkage pin, use the 132-3821 Actuating Lever to release the linkage pin. Push down on the lever in order to release the linkage pin.

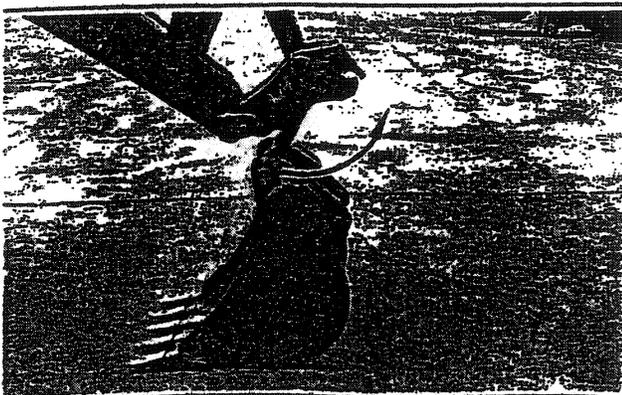


Illustration 163

g00739367

4. Raise the stick and move the stick away from the machine in order to release the quick coupler from the pivot pin of the work tool.

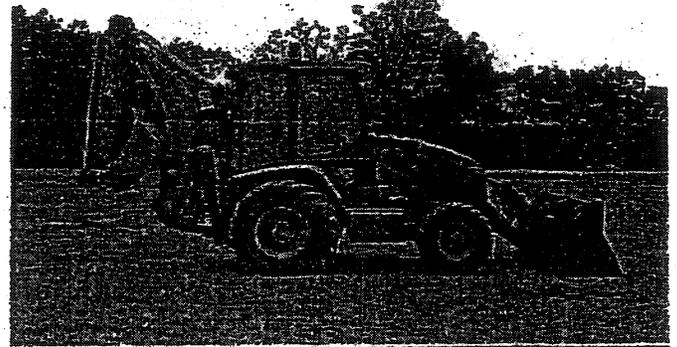


Illustration 164

g00730170

Do not operate the loader unless you are in the operator's seat. Face forward toward the loader. If you are moving the machine forward during backhoe operation, refer to Operation and Maintenance Manual, "Backhoe Operation".

Carry an empty bucket or a loaded bucket low to the ground. This will give better operator visibility and machine stability.

All Wheel Drive (If Equipped) provides additional traction and braking capabilities.

Always activate the all wheel drive (if equipped) when you are operating the machine on a slope.

Avoid turning on a slope.

When you carry a load downhill, travel in reverse. When you carry a load uphill, travel forward.

Use extra care when you cross side hills, ridges, logs, and ditches.

Utilize waiting periods to clean the work area. Utilize waiting periods to level the work area.

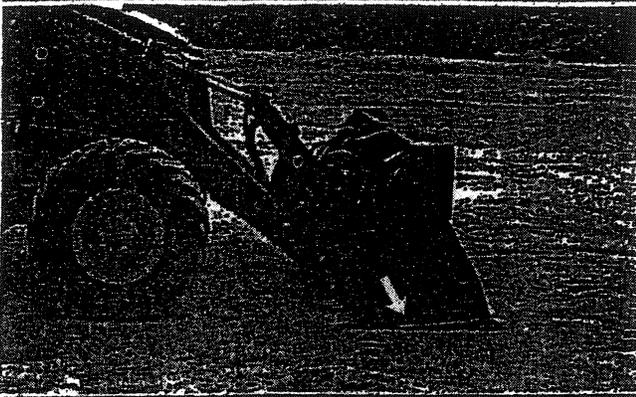


Illustration 165

g00730160

Use the rear edge of the bucket in order to backgrade ruts while you move in reverse.

Dozing and grading can be accomplished by fully dumping the bucket and lowering the bucket to the ground.

Grading can be improved by moving the loader control all the way forward to the FLOAT position.

Avoid excessive down pressure on the bucket in order to prevent loss of traction.

Use the teeth of the bucket when you work in hard material.

## Loading the Bucket

Skim the ground when you move the machine forward.

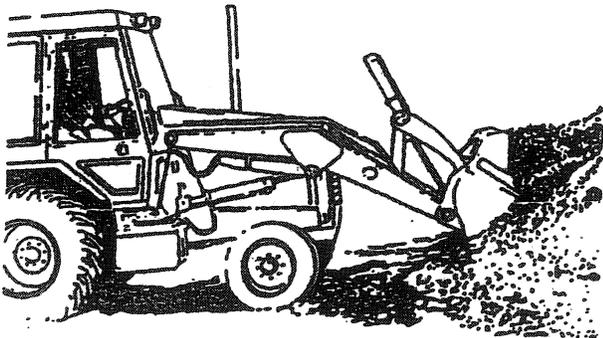


Illustration 166

g00106913

Move the control lever in order to lift the bucket and tilt back the bucket. The efficiency of the bucket and the breakaway effort will increase.

Productivity will be reduced by making more than one pass in order to completely fill the bucket.

Fully tilt back the bucket in order to avoid spillage.

## NOTICE

NEVER use the FLOAT position to lower a loaded bucket.

Machine damage can result from bucket falling too fast.

When you load the machine on a hard surface move the lever all the way to the FLOAT position. If the bucket is level, the bucket will float on the ground contour. If bucket down pressure is applied, the bucket will wear faster.

The FLOAT position will assist in preventing gouging of the surface material and mixing of surface material.

## Loading a Truck

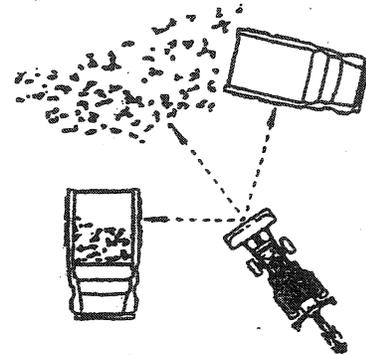


Illustration 167

g00106914

1. Position the truck at a 45 degree angle to the material that is being loaded. This will reduce the loader turning and the travel of the loader. The lift height should be reached within the travel distance without slowing down the loader.

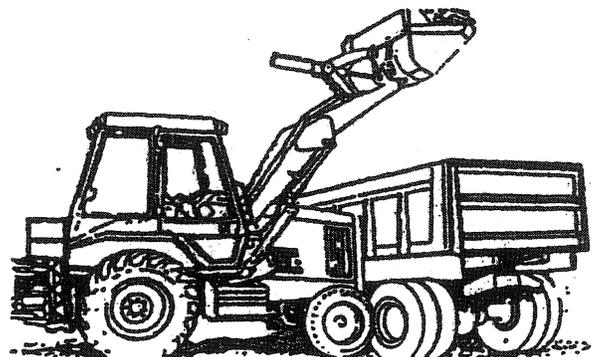


Illustration 168

g00106915

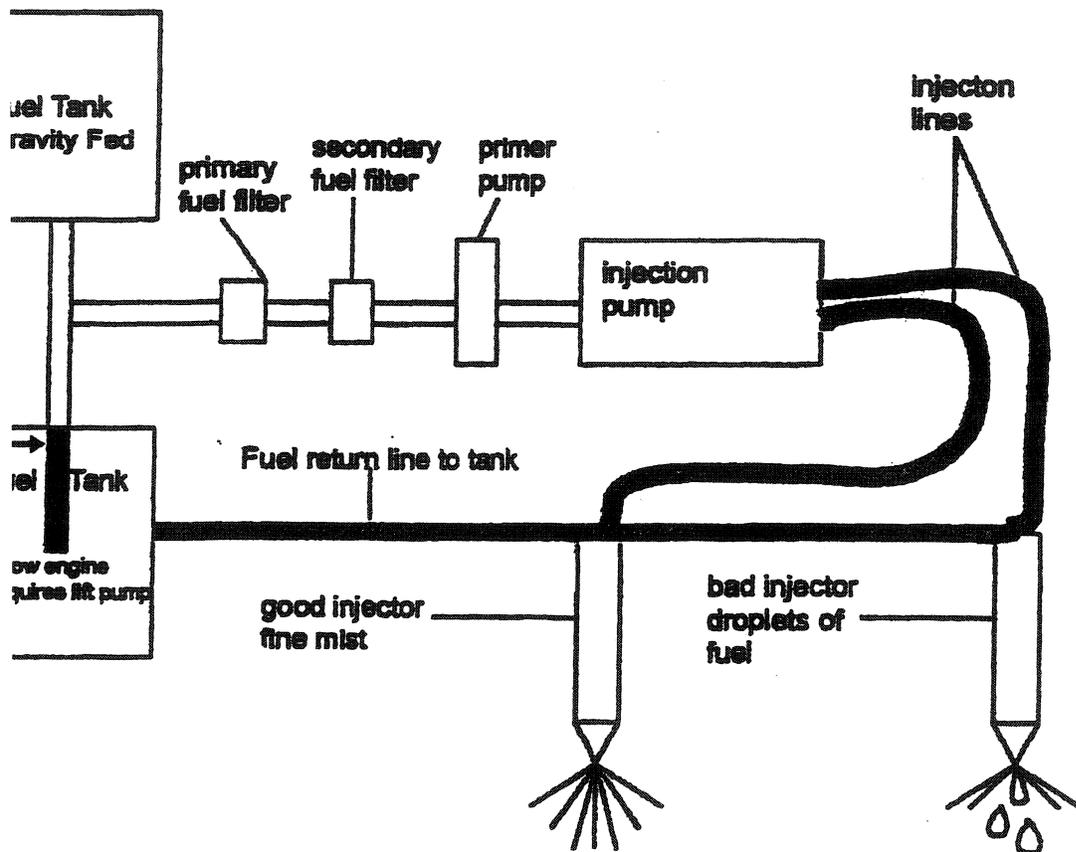
# BACKHOE

## LEVEL 1

### **Basic Fuel System:**

- 1. Fuel Tank:** If the fuel tank sits above or higher than the injection pump, or fuel pump, chances are that it is a gravity fed system. If the fuel tank sits below or under the injection pump, a fuel lift pump is required to feed the fuel up to the injection pump.
- 2. Primary fuel Filter:** The main purpose of a primary fuel filter is to trap moisture and debris before it gets into other components of the fuel system. Never remove a bad fuel filter and dump the contents into a new fuel filter. You have defeated the purpose and ruined the new filter.
- 3. Secondary Fuel Filter:** The purpose of secondary filter is to catch any moisture or debris that has managed to bypass the primary fuel filter. Again, never remove a bad fuel filter and dump the contents into a new fuel filter. Always use clean fuel.
- 4. Primer Pump:** This is a manual pump in close proximity to an actual pump or part of the injection pump used to manually fill new fuel filters and remove air from the fuel systems.
- 5. Injection Pump:** The injection pump is set to the timing of the engine, dispensing fuel to the required cylinder through the injection lines and injector. The injection pump pressurizes the proper injector so that the injector opens and sprays fuel into the cylinder.
- 6. Injection Lines:** Lines carrying fuel from injector pump to the injectors. These lines need to be inspected for cracks or leaks on a daily basis.
- 7. Injectors:** Deliver fuel to the firing cylinder in the form of a mist or atomized spray assuring proper firing in that cylinder.

## Basic fuel systems



2. Position the loader in order to dump the load in the center of the hauler body. If the truck body is longer than two bucket, load the front of the truck first.

Move the machine as close as possible before you dump the load.

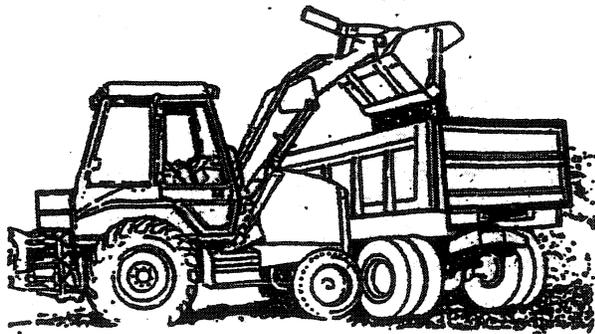


Illustration 169

g00287706

3. For controlled dumping, engage the tilt control lever for a short period. Return the lever to the HOLD position. Repeat this action until the bucket is empty.
4. Quickly, move the tilt control lever back and forth in order to shake the bucket. This will loosen the sticky material.

When possible, keep the wind to your back when you dump a load. This will help to keep the dust out of your eyes, out of the engine air cleaner, out of the radiator, etc.

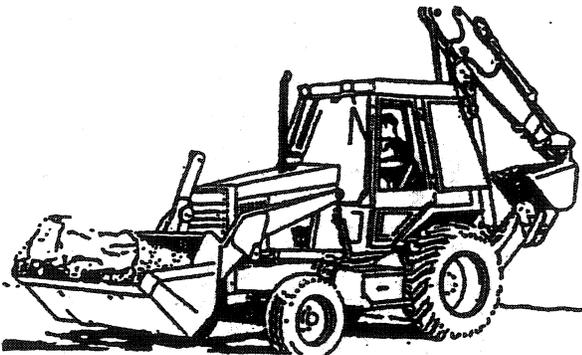


Illustration 170

g00106928

5. If you load a large rock, place a bucket load of smaller rock in the truck first. This will cushion the truck bottom against impact of larger material.

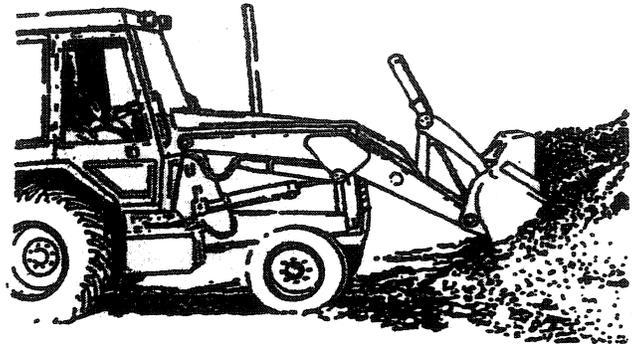


Illustration 171

g00106913

6. Tilt back the bucket. Lower the bucket to the loading position while you move the loader for another load.

## Loading From a Bank or Stockpile

### **WARNING**

To prevent possible injury or death, remove any overhang and watch for sliding material.

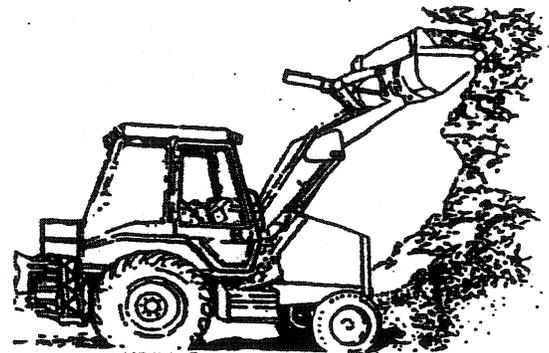


Illustration 172

g00287707

1. Remove any overhang before you start at the base. Watch for sliding material.

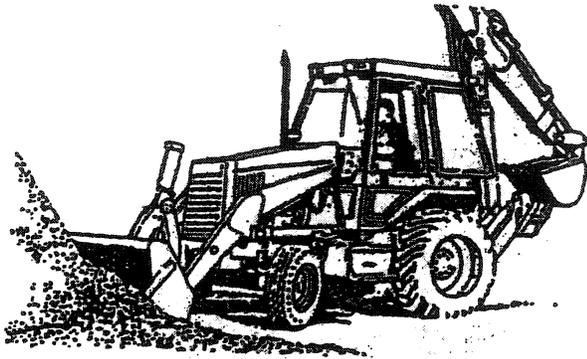


Illustration 173

g00106917

2. For loading the material, start digging at the base of the bank and follow up the face.



Illustration 174

g00287708

3. In extremely dense material, start at the top of the bank and work downward.

In a stockpile, start about a bucket height off the ground. Lower the bucket to the ground after the stockpile height has been reduced. This will aid in the breakout force.

## Loader Backfilling

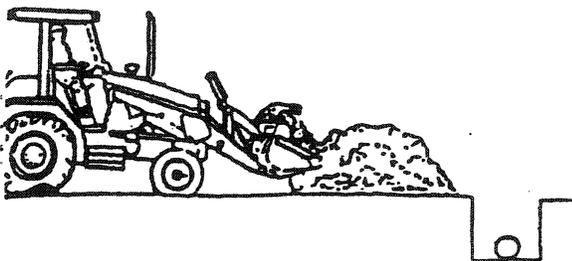


Illustration 175

g00287709

While the bucket is level, move the machine forward.

Adjust the depth of the cut so that the load can be moved without stalling the machine.

Downshift the machine or reduce the depth of the cut in order to prevent stalling.

Push the maximum amounts of the load into the ditch without stalling the machine. This is the most productive procedure.

Dumping the load after each pass is a time consuming task. Leave the soil in the bucket for better productivity.

While you back away from the excavation, lift the bucket and level the bucket. This will prepare you for the next pass. Move the load at right angles to the excavation.

Leave spillage from the bucket for the final lengthwise pass cleanup. In most cases, this will leave the grade of the backfill acceptable.

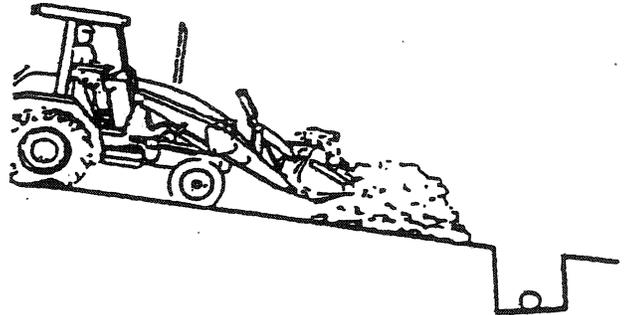


Illustration 176

g00287710

Pile the load on the high side of the slope for easier backfilling.

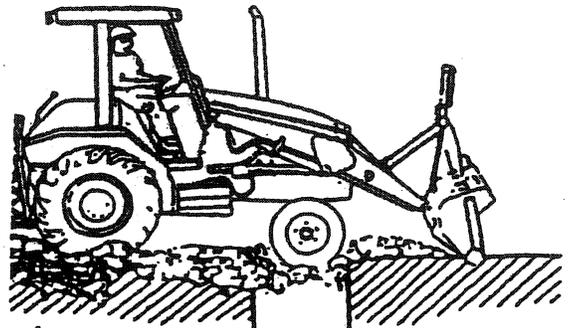


Illustration 177

g00287711

Use the bucket to aid the machine when the machine is stuck in the excavation. Dump the bucket. Apply down pressure in order to raise the front wheels from the ditch. Tilt back the bucket. Move the direction control to the REVERSE position. Accelerate the engine in order to move backward.

101367058

## Lift Fork Operation

SMCS Code: 7000

### Preparing to Use Lift Forks

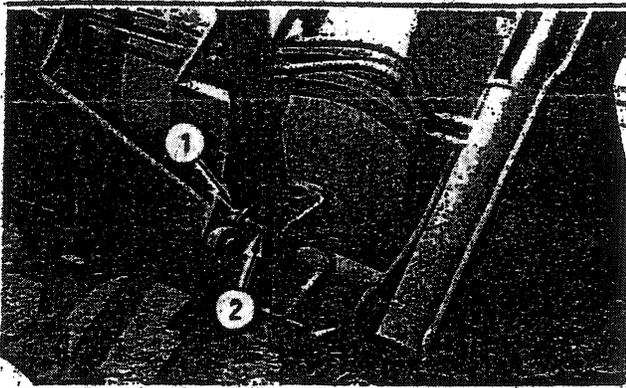


Illustration 178

g00287655

1. Remove pin assembly (1) from pin assembly (2) behind the bucket.
2. Remove the pin assembly (2) that is holding the fork in the storage position.

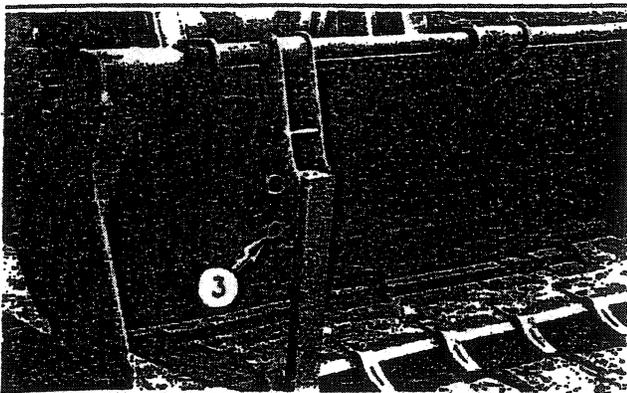


Illustration 179

g00287656

3. Remove the pin (3).
4. Flip the fork over the bucket.
5. Reinstall the pin (3) in order to secure the fork in place.

## Using Forks to Move a Load

When you are using forks, make sure that the load is centered.

Lift the load carefully off the ground.

Tilt the load backward in order to cradle the load.

Travel with the load as low as possible, while you are still maintaining ground clearance.

Do not open the bowl of the multipurpose clam bucket when you are using the forks to carry loads.

Tilt the load forward ONLY when you are directly over the unloading area.

Deposit the load and back away carefully in order to disengage the forks.

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## Multipurpose Bucket Operation

SMCS Code: 7000

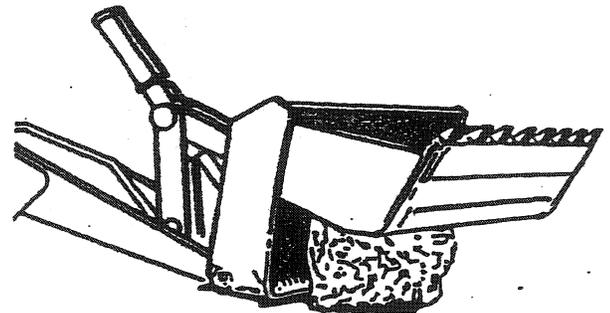


Illustration 180

g00104874

The multipurpose bucket as a clamp:

Open the bowl and position the bucket over the material that will be loaded. Lower the bucket and close the bowl.

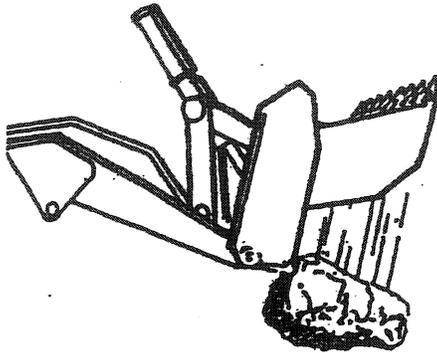


Illustration 181

g00104873

The multipurpose bucket can be used when increased dump height is desired or when you are unloading sticky material. Position the bucket over the dump area and open the bowl.

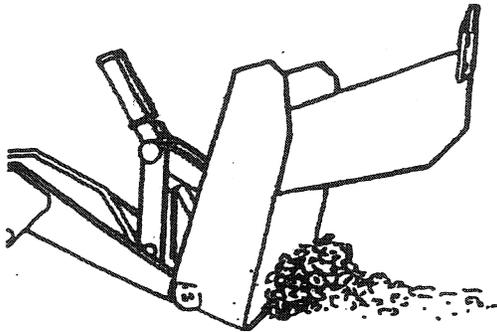


Illustration 182

g00104872

Multipurpose bucket as a dozer:

To use the blade for dozing, open the bowl. Maintain a level cut.

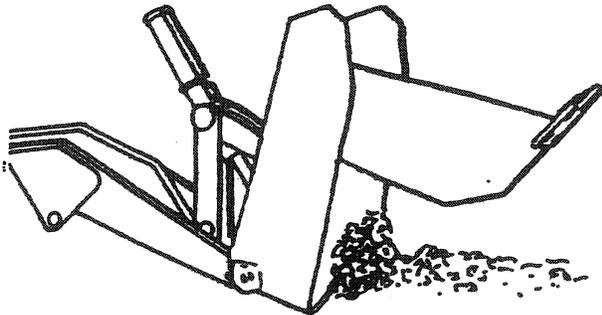


Illustration 183

g00104871

Multipurpose bucket as a scraper:

Raise the bowl slightly and position the bucket as if the bucket is used for dozing. When the bucket is loaded, tilt back the bucket and close the bowl. The bucket is dumped in the normal tilt forward position.

i01378996

## Backhoe Operation

SMCS Code: 7000

### Preparing to Operate the Backhoe Boom

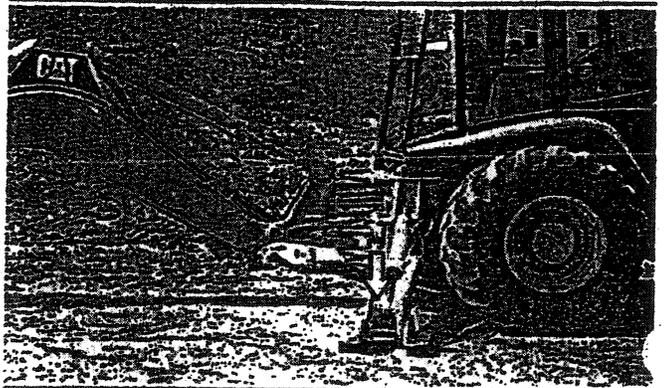


Illustration 184

g00287728

#### **WARNING**

Reposition flip-over stabilizer pads by standing outside the machine, on the ground. **DO NOT** reposition the pads while in the cab. Personal injury can result.

1. Lower the loader bucket until the front wheels are slightly off the ground. When conditions permit you, tilt the loader bucket forward to the dump position in order to reduce sliding of the vehicle.
2. Move the transmission direction and speed control to **NEUTRAL** and engage the transmission neutral lock control.
3. Engage the parking brake.
4. Turn the seat in order to face the backhoe.
5. Lower the stabilizers until the rear tires are slightly off the ground.

Level the backhoe with the stabilizers in order to allow the machine to be in a level position before you dig.

6. Disengage the boom lock and disengage the swing lock.

When possible, dig with the backhoe uphill on slopes.

When possible, dump the load uphill in order to avoid tipping the machine.

## Digging with the Backhoe

1. Close the bucket slowly and move the stick inward at the same time for maximum performance.

Keep the bucket teeth at the proper digging angle for best penetration. This will help prevent the bucket from just scraping the ground.

Apply down pressure with the boom in order to increase bucket penetration in hard packed ground conditions. Move the boom downward while you close the bucket.

2. Close the bucket completely. Move the stick and the bucket outward from the machine slightly while you lift the bucket from the excavation.

This provides a cleaner trench, and this allows the excess material to fall back into the excavation. Also, this will prevent the buildup of material between the stabilizers and the excavation.

3. Swing the bucket to the side. Dump the load as you approach the pile.
4. Return to the excavation. After the bucket is dumped, the stick and the bucket should be close to the dig position.

### NOTICE

Avoid stopping the bucket against the excavation or dump pile to prevent early pin and bushing wear.

Do not backfill by using swing cylinders and bucket side. Backhoe damage could result.

5. Lift the bucket over the dump pile to backfill. Pull the bucket inward and lift the boom evenly.

## Extendable Backhoe (If Equipped)

### NOTICE

When the bucket/stick are FULLY EXTENDED, follow rules below and specifications to avoid backhoe damage.

Do not strike the bucket on the ground in order to remove sticky soil or mud.

Do not allow the swing cylinder to fully extend.

Do not use the side of the bucket to push dirt into the excavation.

Forcing the stick outward against objects will damage the cylinder rod.

Avoid using a bucket which is too large in heavy soil conditions that could possibly overload the backhoe.

Avoid swinging the load on the downhill side of the excavation in order to dump the load.

Do not reposition the machine while the stick is extended in order to avoid damage to the stick or damage to the cylinder.

## Digging Between Objects

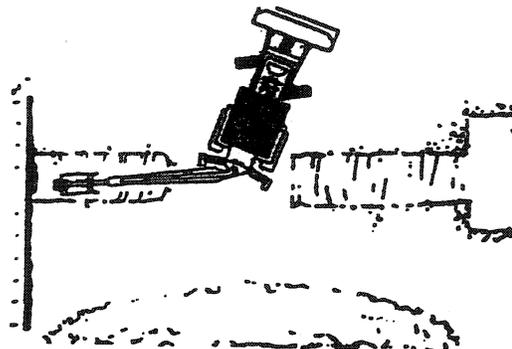


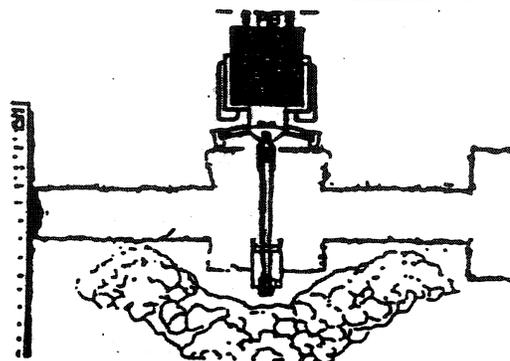
Illustration 185

g00104561

Center the machine over the trench, as shown. Lower the stabilizers. Dig in the maximum swing position.

Dump the load behind the backhoe.

If necessary, move the machine in order to dig in the opposite excavation.



Move the machine in order to connect both excavations, as shown.

Dig a larger excavation in order to enable the connection of both side excavations.

## Digging Trenches

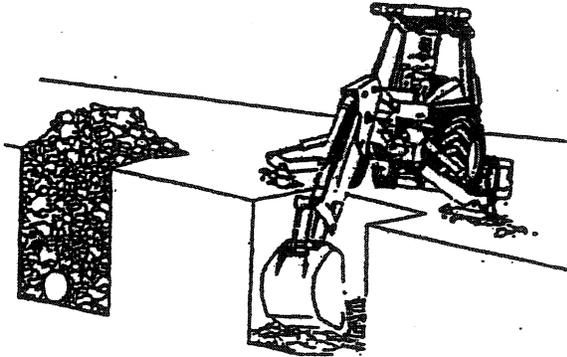


Illustration 187

g00104563

When you dig trenches for field tile, etc., pile the trench dirt in the next trench, as shown. Fill the trench after you lay the tile, etc.

## Trenching Next to Walls

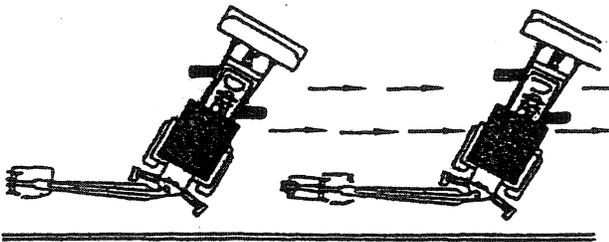


Illustration 188

g00104564

Move the machine close to the wall, as shown.

Position the front wheels parallel to the wall in the direction of the excavation. Raise the rear of the machine in order to reposition the machine along the wall.

Raise the stabilizer closest to the wall while you are trenching. Lower the other stabilizer for digging stability.

## Trenching on Slopes

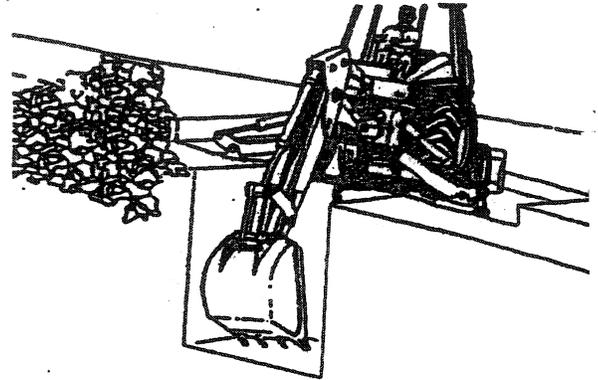


Illustration 189

g001045

Use the stabilizers to level the machine on slopes;

Note: On steep slopes, consult your Caterpillar dealer in order to adjust the proper fluid levels.

On steep slopes, use the loader or the backhoe to cut a level uphill slot for the wheels and for the stabilizer. If necessary, pile the cut downhill under the wheels and under the stabilizer in order to level the machine. Pile the trench dirt uphill from the trench.

## Finishing Straight Walls

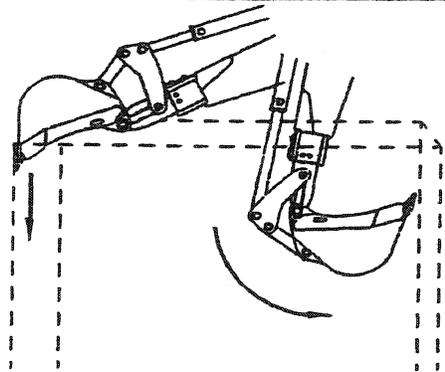


Illustration 190

g00640015

Move the stick outward while you move the bucket downward in order to finish the farthest wall. Hold the bucket open and vertical.

To finish the closest wall, lift the bucket upward and keep the cutting edge vertical.

In sandy soil, use a platform under the rear tires and under the stabilizers. This will distribute the load more evenly and this will lessen cave-in possibilities.

# **BACKHOE**

## **LEVEL 1**

**NOTE: DO NOT OPEN RADIATOR CAP IF ENGINE IS HOT. ALWAYS LET ENGINE AND RADIATOR COOL BEFORE YOU OPEN. ALWAYS OPEN RADIATOR CAP SLOWLY.**

4. Radiator (Look inside for contamination).
5. Fuel level, fuel filters, and if supplied by the manufacture, the sediment bowl.

**NOTE: KEEP OPEN FLAME OR ANY COMBUSTIBLE SOURCE AWAY FROM BATTERIES.**

6. Battery cables, cable ends and all connection.
7. Exhaust system for cracks or leaks, restrictions or general damage.
8. Transmission fluid level.
9. Transmission pressure lines, transmission filter and transmission breather.
10. Brake master cylinder fluid level.
11. Brake adjustment.
12. Condition of clutch for possible adjustment.
13. Hydraulic fluid levels, hoses, lines, fittings, and filter housings for leaks.
14. Front and rear axle oil level.
15. Accessory belts for wear, match, condition, and pressure.
16. Grease fittings.
17. Windshield and windshield wipers.
18. All safety devices.
19. All components and accessories.
20. All gauges for proper operation and controls for proper operation.

# **BACKHOE**

## **LEVEL 1**

**WORK SHEET FOR START, WARM UP, CHECK GAUGES, and CHECK CONTROLS FOR PERFORMANCE AND SHUT DOWN PROCEDURES.**

**Equipment: Rubber tired, tractor type backhoe.**

**Procedure:**

1. Check the site and note if there are any obstacles above ground or underground before you start the machine.
2. Check parking brake and make sure that it is set.
3. Set throttle to the  $\frac{1}{4}$  open position.
4. Engage the starter.

**NOTE: DO NOT OPERATE STARTER FOR MORE THAN THIRTY SECONDS. IF ENGINE FAILS TO START, WAIT TWO MINUTES BEFORE REPEATING STARTING PROCEDURE.**

5. Visually check to see that all gauges are functioning properly.
6. Let the machine warm up for two to three minutes then operate the hydraulic controls to warm up the hydraulic oil.
7. Make sure that all personnel are clear of the machine and there are no obstructions on the ground or in the air. Then put foot on the brake pedal, hold, and remove the parking brake. With foot still on the pedal, move control to the forward, neutral, then the reverse position and at the same time check the steering for free travel in both directions. Re-set the parking brake.
8. Move the controls to raise, lower, and curl the loader bucket. Set loader bucket flat on the ground.
9. Always set the stabilizers before unlocking boom.
10. Move the controls to unlock the boom and raise and lower the boom.
11. Move the controls to swing the boom left and right.
12. Move the controls to extend and retract the dipper arm.
13. Move the controls to crowd and curl the bucket.
14. Move the controls to put boom in the locked position.
15. Raise the stabilizers.
16. Let the engine cool for three to five minutes.
17. Move the throttle to the idle position.
18. Shut off the engine.
19. Do a walk around of the machine to check for worn, loose, or broken parts and check for leaks.

# **BACKHOE**

## **LEVEL 1**

### **PERFORM A DAILY INSPECTION ON A BACKHOE:**

#### **Equipment Needed:**

1. Backhoe.
2. Tool kit.
3. Shop rags.

#### **Procedure:**

**NOTE: ANY AND ALL DEFICIENCIES SHOULD BE WRITTEN DOWN ON DAILY INSPECTION REPORT AND ANY AND ALL CORRECTIVE ACTION TAKEN CARE OF.**

1. Check and make sure equipment is clean.
2. Do a walk around inspection to look for damaged or missing parts and look for leaks.
3. Check radiator coolant level.
4. Check engine oil level.
5. Check wires wire insulation and all connections.
6. Check fuel sediment bowl.
7. Check exhaust system.
8. Check condition of engines accessory belts and tension of belts.
9. Check battery electrolyte levels all battery cables and connections.
10. Check air filter.
11. Check fuel level.
12. Check hydraulic oil level.
13. Check transmission fluid level.
14. Check conditions of tires and make sure they match.
15. Check major components and all accessories.
16. Check windshield and windshield wipers.
17. Check all safety devices.
18. Check all gauges to make sure that they are working properly
19. Check all controls to be sure that they are all working properly.

# **BACKHOE**

## **LEVEL 1**

### **PROCEDURES ON SERVICING A BACKHOE.**

#### **Equipment and materials needed:**

1. Backhoe.
2. Tool kit.
3. Clean solvent or suitable cleaning agent.
4. Engine coolant or water.
5. Battery Electrolyte or water.
6. Transmission fluid.
7. Brake fluid.
8. Fuel.
9. Hydraulic fluid.
10. Grease and grease gun.
11. Air supply.
12. Shop rags.
13. Manufactures service manual or operators manual.

**NOTE: ALWAYS USE MANUFACTURES SERVICE RECOMMENDATIONS AND MANUALS WHEN SERVICING EQUIPMENT.**

#### **Procedure:**

1. Visually check all components of machine and all attachments for any worn, damaged, broken, or missing parts and leaks.
2. Check engine oil level, oil filter and all hoses/lines for any leaks or cracks. Add oil if necessary with recommended oil.

**NOTE: ALWAYS LET ENGINE AND RADIATOR COOL BEFORE OPENING RADIATOR CAP. ALWAYS OPEN CAP SLOWLY TO RELEASE PRESSURE.**

3. Check engine coolant level, radiator, radiator hoses, and radiator cap. Add coolant or water as needed.
4. Check fuel level and fill if necessary. Check fuel lines, hoses, filters, and sediment and/or water separator if supplied.

**NOTE: ALWAYS KEEP ANY AND ALL SOURCES OF SPARK OR FLAME AWAY FROM BATTERY. IF DOING ANY WORK ON BATTERIES ALWAYS DO IN A WELL-VENTILATED AREA.**

5. Check battery electrolyte level and all cable and all connections for cracks, cleanliness, and be sure that all connections are tight.
6. Check exhaust system for damage, leaks, or cracks.
7. Check levels of hydraulic oil and fill if necessary with manufacturer's approved oil. Check all lines, hoses, and fittings for leaks or cracks.
8. Check the transmission fluid level and fill if necessary with manufacturer's approved oil and check all hoses, lines, and fittings for cracks or leaks.
9. Check transmission pressure line filter and transmission breather for leaks and cleanliness.
10. Check all drive, and accessory belts for condition and tension. Replace or adjust as necessary.
11. Check brake master cylinder fluid level and fill with manufacturer's approved fluid if necessary.
12. Check wiring condition, connections, and be sure that none of the wiring is kinked, broken, or bound up.
13. Check brake condition and adjustment. Adjust the brakes if necessary.
14. Check clutch condition. Adjust if necessary.
15. Check the tire pressure, the tread, and the wear. Adjust if necessary.
16. Check the windshield, windshield wipers, and clean the windshield inside and out.
17. Check all safety and security devices.
18. Check all components and accessories.
19. Clean all grease fittings and grease using manufacturer's approved lubricant.
20. Check all controls and gauges to insure of their proper function.

# **BACKHOE LEVEL 1**

## **BASIC HYDRAULIC SYSTEM:**

**Two types of fluid are used in this system:**

1. **Dextron:** Dextron, which is red, colored oil, is expansive oil.
2. **10w Hydraulic:** 10w Hydraulic is a honey colored oil, and is an expansive oil.

**Hydraulic filters:**

**NOTE: ALWAYS USE MANUFACTURES SUGGESTED FILTERS ON THESE SYSTEMS. THESE FILTER OUT SOLIDS AND MOISTURE..**

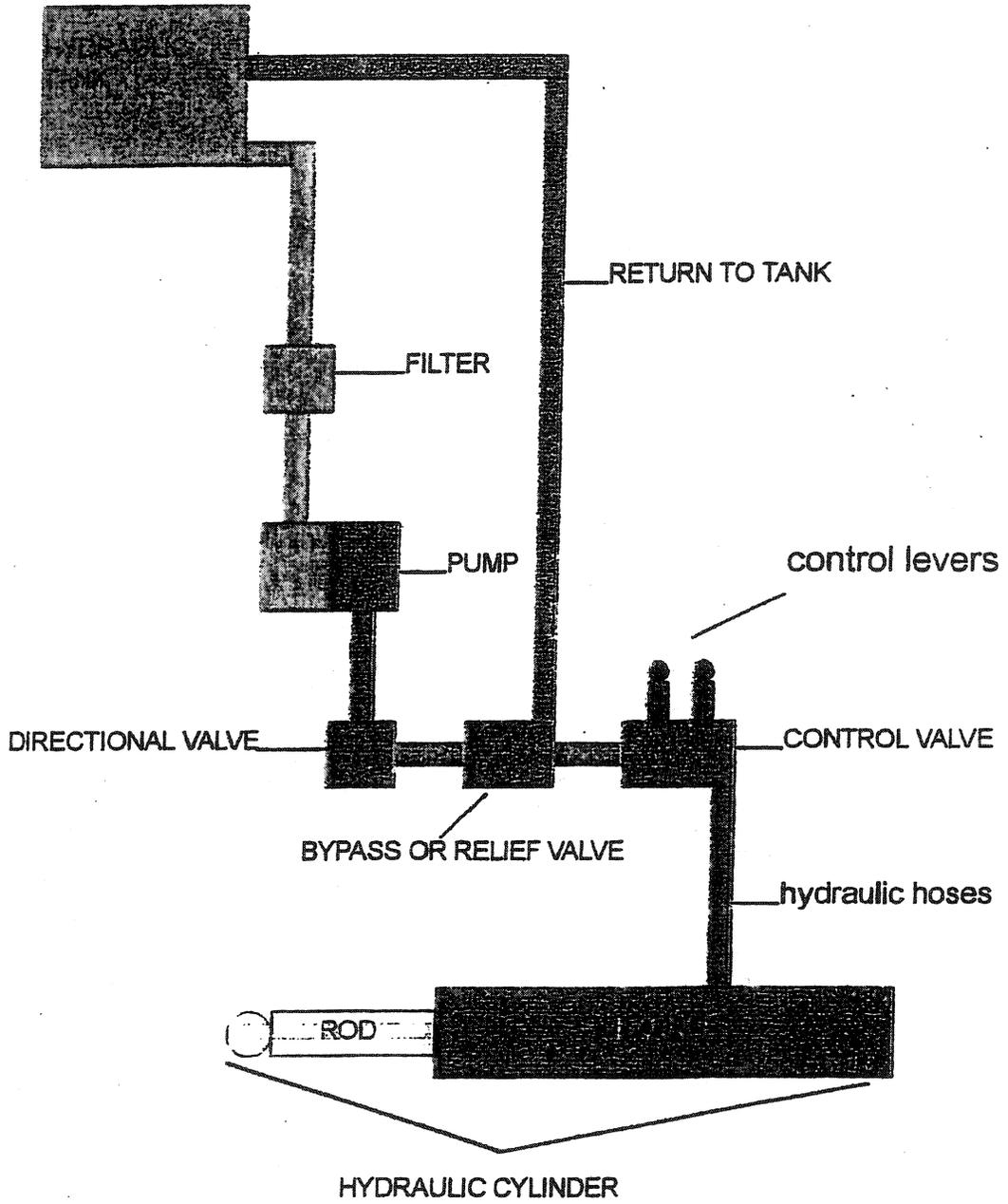
1. **Magnetic Filters:** Magnetic filters pick up magnetic particles out of the fluid.
2. **Cannister or Cartridge:** Cannister or cartridge comes in paper or cloth and they filter out solids and moisture.

**Hydraulic pump:**

**NOTE: ALWAYS USE CAUTION WITH THE HYDRAULIC SYSTEM AS THESE ARE UNDER A VERY HIGH PRESSURE. THESE SYSTEMS HAVE A SUCTION SIDE AND A PRESSURE SIDE.**

1. **Suction Side:** As indicated in figure 4 by blue. If there is a hole in this side, atmosphere will be drawn into the system, aerating the oil. It can turn the Dextron (red) to a pink color in the sight glass or turn the 10w oil to a creamy coffee color. This indicates either water and/or air contamination. Shut the vehicle off and let sit for period of time. In air contamination, the bubbles will dissipate and the Dextron and/or 10w will return to its natural color within a couple of hours. If water contamination, it will take a much longer period of time for the water to separate from the oil. In either case, notify your supervisor. Serious damage could occur in either instance.
2. **Pressure side:** Indicated in figure 4 by red. If a hole occurs on this side, it will be noticeable, discharging fluid from hose, cylinder, or fitting. Pressure can exceed 400psi depending on manufacturer and model. Never check hydraulic hose or fitting with the machine running. A pinhole can inject fluid into your hand if machine is running. Doing this could cause serious injury or even death.
3. **Directional Valve:** A safety device used to save the pump from a spike in the hydraulic system, assuring flow into one direction only.

# BASIC HYDRAULIC SYSTEM



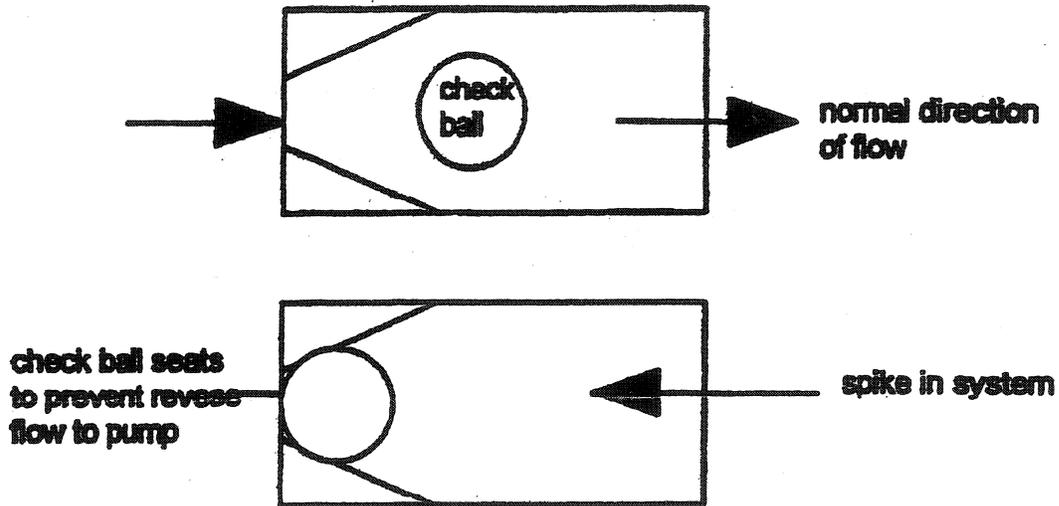
 SUCTION SIDE

 PRESSURE SIDE

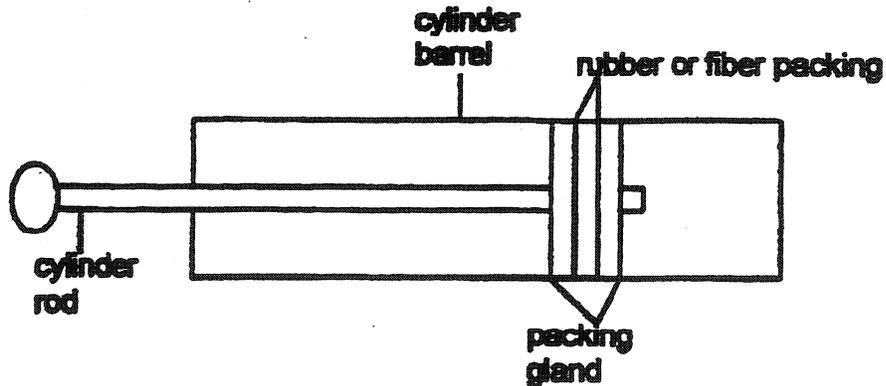


# Basic Hydraulic System

## Directional Valve



- E. Bypass or Relief Valve- A safety device which opens when system exceeds its normal pressure by opening and returning the fluid to tank.
- F. Control Valve- Control valve is operated by pushing or pulling on the levers to direct the cylinder in or out depending on the desired movement.
- G. Hydraulic Cylinder- Extends or retracts by use of the control valve.



# CHECKING HYDRAULIC HOSES

Figure 11



Although the outer coating of this hydraulic hose has weather cracked and fallen off, this hydraulic hose is still acceptable. However, if it is your company policy to replace the hose at this point, please do so.

Figure 12



This hydraulic hose is not acceptable. The steel braiding has begun to separate. To check hoses properly for steel braiding damage place a glove on your hand and slide it gently over the hose. If any of the steel fibers catch the glove, it is an indication that the steel braiding is starting to separate and the hose needs to be replaced immediately.

# DAILY BACKHOE INSPECTION

DATE  NAME

UNIT NO.  LOCATION  MILES/HRS.

WEATHER COND.  TEMPERATURE

CODES: / = OK R = REPLACE/REPAIR  
NA = NOT APPLICABLE

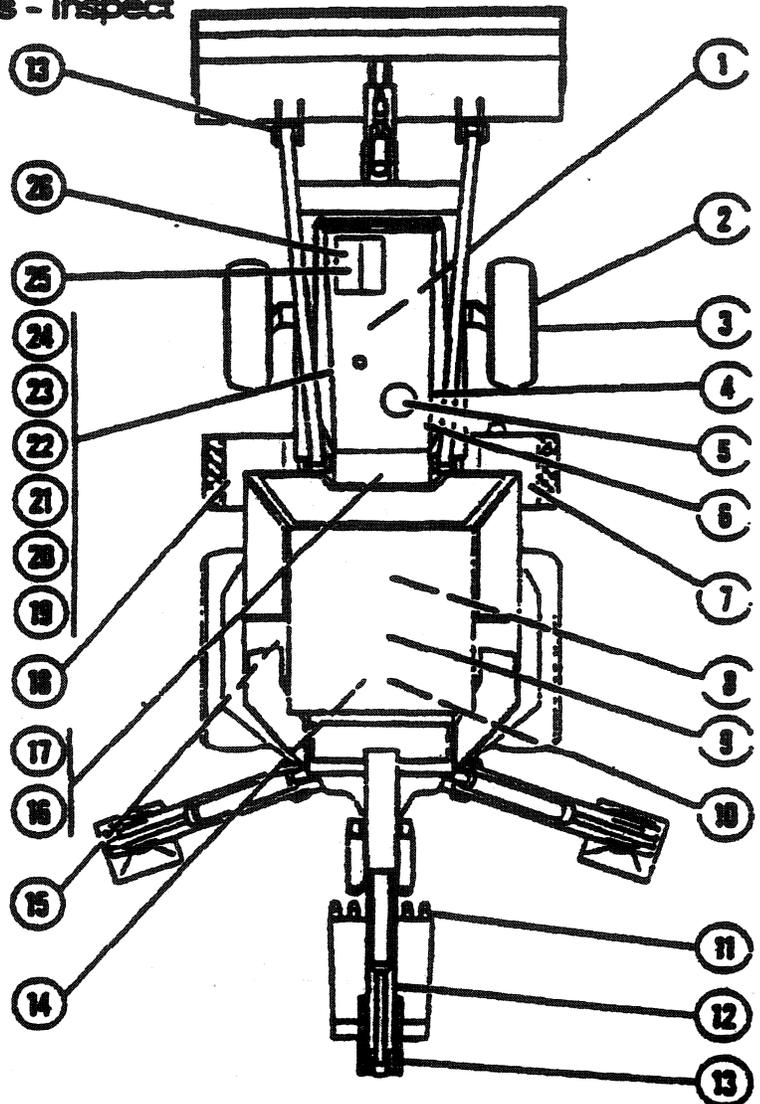
	CHECK FOR LEAKS ON GROUND	
	ENGINE OIL	
	TRANSMISSION/TORQUE CONVERTER	
	HYDRAULIC	
S	ANTIFREEZE	
T	FAN BELTS	
A	AIR CLEANER	
R	CHECK AND UNPLUG BLOCK HEATER	
T	LUBE PUMP DRIVE JOINTS	
	STARTING AID	
	STARTER OPERATION	
U	ENGINE OPERATION	
P	INSTRUMENTS AND GAUGES	
	SWITCHES	
I	WASHERS AND WIPERS	
N	LIGHTS AND SIGNALS	
S	MIRRORS AND GLASS	
P	SAFETY EQUIPMENT	
E	HEATER AND BLOWER	
C	HORN	
T	PARKING BRAKE	
I	BACKUP ALARM	
O	CLUTCH OPERATION	
N	THROTTLE OPERATION	
	DOOR AND WINDOW OPERATION	
	STEERING	
	APPLY BRAKES	
	CONTROLS AND CYLINDER OPERATION	
	AUXILIARY CONTROLS	

	STARTER MOUNT	
	ALTERNATOR MOUNT	
	FAN AND SHROUD	
	BATTERY HOLD DOWN	
	BATTERY CABLES	
	BATTERY BOX AND LID	
E	KINGPIN BEARINGS	
X	WHEEL LUG NUTS	
T	INSPECT FRAME FOR CRACKS	
E	CHECK CYLINDER PINS AND BOSSES	
R	STEPS AND GRAB HANDLES	
I	HYDRAULIC LINES/FITTINGS	
O	BUCKET AND BUCKET TEETH	
R	CUTTING EDGE AND SIDE BITS	
	MOUNTING BOLTS	
I	INSPECT BOOM AND DIPPER	
N	GENERAL APPEARANCE	
S	INSPECT STABILIZERS AND PADS	
P	INSPECT SWING CYLINDERS	
E	TRUNION BEARING	
C	EXHAUST PIPES AND MOUNTS	
T	AIR INTAKE HOSES/CLAMPS	
I	FUEL LINES	
O	SMM STICKER/PLATE	
N	CHECK WHEELS FOR CRACKS	
	RADIATOR	
	VALVE STEMS AND CAPS	
	MATE AND MATCH	
	INSPECT AUXILIARY ATTACHMENTS	
	TIRE PRESSURE	
	<input type="checkbox"/>	RIGHT <input type="checkbox"/>
	<input type="checkbox"/>	LEFT <input type="checkbox"/>

REMARKS: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

## BACKHOE LUBRICATION CHART

1. Front Power Axle - Lubricate
2. Wheel Seal - Inspect
3. Wheel Lug Nuts - inspect
4. Fuel Filter and Separator - inspect and/or drain
5. Air Cleaner - inspect
6. Transmission Fluid level - inspect
7. Fuel Tank - fill
8. Drive Shaft U-joints - Lubricate
9. All Cab Safety Equipment - Inspect
10. Rear Axle - Inspect
11. Bucket Teeth - Inspect
12. Extendable Dipper Stick - inspect
13. Lubricate all Backhoe pivot points -lube
14. Parking and Service Brakes - check & adjust
15. Drive Line Brake - check & adjust
16. Cab Heater/Air conditioning - inspect
17. Cab Air Filter - inspect
18. Batteries - inspect
19. Alternator/Fan and Compressor Belts - inspect
20. Check Engine for Leaks - inspect
21. Engine Oil Level - inspect
22. Starting Aid - inspect
23. Hoses and Injector Lines - inspect
24. Power Steering - check fluid level
25. Radiator - check fluid
26. Hydraulic Tank - check fluid



# Construction

# Skills Challenge 1

## Objective:

To demonstrate the skills obtained from the Specials & Standards, and Estimate & Quantity's presentations.

## Challenge:

Using the Method & Payment (M&P) and 2012 Standard Specifications book to answer the following questions in the following challenges.

Challenge A: Find the unit of measurements for the following bid items.

Curb & Gutter -Item# 62 \_\_\_\_\_

Plowable End Section -Item# 72 \_\_\_\_\_

Pedestrian Ramp -Item# 65 \_\_\_\_\_

Sidewalk -Item# 75 \_\_\_\_\_

Driveway -Item# 76  
(Concrete Flatwork 4 inch thick) \_\_\_\_\_

Challenge B: What type of concrete is to be placed for the above bid items?

\_\_\_\_\_

Bonus Challenge: What is the PSI (strength)? \_\_\_\_\_

At how many days? \_\_\_\_\_

# Utah Department of Transportation

Construction Division  
4501 South 2700 West  
Salt Lake City UT 84114-8220  
(801) 965-4346

**Bid Opening Date:** 9/16/2008  
**Project Number:** SP-0171(18)6  
**Project Name:** 3500 South; Bangerter Hwy to 2700 West, Phase II  
**Contractor:** GRANITE CONSTRUCTION COMPAN'

**Region:** REGION 2  
**County:**

Item No	Item Description	Units	Quantity	Unit Price	Extended Amount
<b>10 - ROADWAY</b>					
Description: 1-Roadway					
70	02771008P Concrete Curb Type B5 Modified	foot	1833	\$11.00	\$20,163.00
71	02771009P Concrete Curb Type B6	foot	1963	\$11.00	\$21,593.00
72	027710100 Plowable End Section	each	3	\$210.00	\$630.00
73	02771011* Plowable End Section Type 3	each	9	\$270.00	\$2,430.00
74	02771012* Concrete Waterway	square foot	857	\$8.50	\$7,284.50
75	027760015 Concrete Sidewalk	square yard	7870	\$22.00	\$173,140.00
76	027760030 Concrete Flatwork 4 Inch thick	square foot	2426	\$2.45	\$5,943.70
77	02776003P Patterned Concrete Flatwork 4 Inch thick	square foot	29117	\$5.00	\$145,585.00
78	027760050 Concrete Flatwork 7 Inch thick	square foot	4053	\$3.60	\$14,590.80
79	027760060 Concrete Flatwork 8 Inch thick	square foot	74	\$10.50	\$777.00
80	027860010 Open Graded Surface Course	ton	88	\$210.00	\$18,480.00
81	027860050 Asphalt Binder PG 64-28	ton	5	\$0.01	\$0.05
82	02891026P Relocate Street Name Sign	each	6	\$87.00	\$522.00
83	028910270 Remove Sign Less Than 20 Square Feet	each	56	\$145.00	\$8,120.00
<b>Subtotal for 10 - ROADWAY</b>					<b>\$11,395,738.20</b>
<b>10 - ROADWAY</b>					
Description: 2 - Drainage					
84	026101004 18 Inch Culvert, Class A, Smooth	foot	996	\$39.00	\$38,844.00
85	026101006 24 Inch Culvert, Class A, Smooth	foot	2397	\$46.00	\$110,262.00
86	026101008 30 Inch Culvert, Class A, Smooth	foot	747	\$59.00	\$44,073.00
87	026101010 36 Inch Culvert, Class A, Smooth	foot	471	\$78.00	\$36,738.00
88	026101230 18 Inch Culvert, Reinforced Concrete, Class B	foot	1335	\$32.00	\$42,720.00
89	026101232 24 Inch Culvert, Reinforced Concrete, Class B	foot	3084	\$38.00	\$117,192.00
90	026101234 30 Inch Culvert Reinforced Concrete, Class B	foot	544	\$54.00	\$29,376.00

62	02771002P	Concrete Gutter Type B12	Feet
----	-----------	--------------------------	------

Measured along the roadway face, and through driveways. Includes excavation.

63	02771003P	Concrete Gutter Type B11	Feet
----	-----------	--------------------------	------

Measured along the roadway face. Includes excavation.

64	02771004P	Concrete Driveway Flared, 7 inch Thick	Square Feet
----	-----------	--	-------------

Include Radius and Flares. Includes excavation. Includes 4" PVC Pipe, Schedule 40 to be placed at each driveway location, parallel to and at the back of sidewalk, and to extend a minimum of two feet on each side of the driveway approach, with each end capped. Place pipe so that top of pipe is level with top of UTBC.

**Measurement:**

Does not include curb and gutter and curb cut.

65	027710059	Pedestrian Access Ramp	Each
----	-----------	------------------------	------

Includes all labor, equipment, and materials necessary for a complete pedestrian access ramp. The curb cut will remain part of the curb and gutter installation. Includes up to 8 feet width of truncated domes.

66	02771005P	Concrete Curb and Gutter Type B8	Feet
----	-----------	----------------------------------	------

Measured along the roadway face. Includes excavation.

67	02771006P	Concrete Curb and Gutter Type B10	Feet
----	-----------	-----------------------------------	------

Measured along the roadway face. Includes excavation.

68	02771007P	Concrete Curb and Gutter Type B13	Feet
----	-----------	-----------------------------------	------

Measured along the roadway face. Includes excavation.

69	02771008*	Concrete Stairs	Square Feet
----	-----------	-----------------	-------------

In place. Includes excavation, reinforcing steel, and handrail. Use the area of horizontal projection to compute the area of steps

70	02771008P	Concrete Curb Type B5 Modified	Feet
----	-----------	--------------------------------	------

Measured along the roadway face. Includes pavement drilling and dowels.

71	02771009P	Concrete Curb Type B6	Feet
----	-----------	-----------------------	------

Measured along the roadway face. Includes excavation.

72	027710100	Plowable End Section	Each
In place. Includes excavation and yellow paint.			
73	02771011*	Plowable End Section Type 3	Each
In place. Includes excavation and yellow paint.			
74	02771012*	Concrete Waterway	Square Feet
In place. Includes excavation and reinforcing steel.			
75	027760015	Concrete Sidewalk	Square Yard
In place. Includes excavation.			
76	027760030	Concrete Flatwork 4 inch thick	Square Feet
In place. Includes excavation.			
77	02776003P	Patterned Concrete Flatwork 4 inch thick	Square Feet
In place. Includes excavation. Includes concrete color, sealant, and manufactures recommended application rates.			
78	027760050	Concrete Flatwork 7 inch thick	Square Feet
In place. Includes excavation.			
79	027760060	Concrete Flatwork 8 inch thick	Square Feet
In place. Includes excavation.			
80	027860010	Open Graded Surface Course	Ton
<b>Measurement:</b> Includes aggregates, hydrated lime, tack coat, and all other additives except for asphalt binder. Asphalt binder is measured and paid for separately. No deduction is made for the weight of asphalt binder in the measurement of Open Graded Surface Course.			
81	027860050	Asphalt Binder PG 64-28	Ton
82	02891026P	Relocate Street Name Sign	Each
83	028910270	Remove Sign Less Than 20 Square Feet	Each

## SECTION 02771

# CURBS, GUTTERS, DRIVEWAYS, PEDESTRIAN ACCESS RAMPS, AND PLOWABLE END SECTIONS

### PART 1 GENERAL

#### 1.1 SECTION INCLUDES

- A. Materials and procedures for constructing curbs, gutter transitions, driveways, pedestrian access ramps, and plowable end sections.

#### 1.2 RELATED SECTIONS

- A. Section 02056: Embankment, Borrow, and Backfill
- B. Section 02721: Untreated Base Course (UTBC)
- C. Section 02776: Concrete Sidewalk, Median Filler, and Flatwork
- D. Section 03055: Portland Cement Concrete
- E. Section 03152: Concrete Joint Control
- F. Section 03211: Reinforcing Steel and Welded Wire
- G. Section 03310: Structural Concrete
- H. Section 03390: Concrete Curing
- I. Section 05120: Structural Steel

#### 1.3 REFERENCES

- A. AASHTO M 306: Drainage, Sewer, Utility, and Related Castings
- B. ASTM A 48: Grey Iron Castings

#### 1.4 DEFINITIONS **Not Used**

#### 1.5 SUBMITTALS

- A. Concrete mix design for Engineer's approval.
- B. Hot and cold weather plan.

- C. Manufacturer's product data, specifications, and recommended application instructions for concrete curing compound, expansion joint filler, and detectable warning surface.

## **1.6 ACCEPTANCE**

- A. Curbs, gutters, driveways, disabled pedestrian ramps and plowable end sections may be accepted at a reduced price when the concrete strength is below that specified.
  - 1. Price adjustment pay factor following Section 03055.

## **PART 2 PRODUCTS**

### **2.1 PORTLAND CEMENT CONCRETE**

- A. Class AA(AE) – Refer to Section 03055.

### **2.2 EXPANSION JOINT FILLER**

- A. Premolded material. Refer to Section 03152.

### **2.3 UNTREATED BASE COURSE**

- A. Refer to Section 02721.

### **2.4 STEEL**

- A. Reinforcing – Refer to Section 03211. Deformed billet-steel reinforcing bars as specified.
- B. Structural – Refer to Section 05120 and as specified in the plans.

### **2.5 DETECTABLE WARNING SURFACE**

- A. Use In-line truncated dome pattern that meets the requirements of GW Series Standard Drawings.
- B. Provide a color that contrasts visually with the adjoining surfaces, either light-on-dark or dark-on-light.
- C. Minimize number of panels used.
- D. Do not cut panels.

- E. Acceptable products for installation:
1. Polymer Composite Panel – Epoxy polymer composition, homogenous integral color, UV stable, skid resistant, non-glare finished panel. Use modular panel size 2 ft by 4 ft or 2 ft by 2 ft. Use for new construction or retrofit construction.
  2. Polymer Concrete Panel – Constructed principally of polymer of cementitious concrete material, homogeneous integral color, UV stable, skid resistant panel. Use modular panel size 2 ft by 4 ft or 2 ft by 2 ft. Use for new construction only.
  3. Precast Concrete Panel – High strength concrete with structural monofilament fibers, homogeneous integral color, UV stable, skid resistant panel. Use modular panel size 2 ft by 2 ft. Use for new construction only.
  4. Gray Iron Casting – Manufactured from iron conforming to ASTM A 48 Class 35B, as specified in AASHTO M 306, uniform quality, free from sand holes, gas holes, cracks, and other surface defects. Provide reasonably smooth, cleaned by shot blasting, free of burned-on sand skid resistant, skid resistant, weathered iron finished panel with embedment anchors. Use modular panel size 2 ft x 2 ft square or curved panels as specified. Use for new construction only.

## **PART 3 EXECUTION**

### **3.1 PREPARATION**

- A. Construct subgrade to plan elevations. Refer to Section 02056.
- B. Place and compact fill material and untreated base course. Refer to Section 02056 and Section 02721.
- C. May use a slip form curb and gutter machine.
- D. Dampen the untreated base course before placing concrete.
- E. Curbs and Gutters – Refer to GW Series Standard Drawings.
- F. Pedestrian Access Ramp – Refer to GW Series Standard Drawings.
- G. Plowable End Section – Refer to GW Series Standard Drawings.
- H. Forms – Refer to Section 02776.

### **3.2 PLACE CONCRETE**

- A. Furnish materials and construct structural concrete. Refer to Section 03310.
  - 1. Do not use mechanical vibrators.
  - 2. Hand tamp forms to eliminate honeycomb.
  - 3. Deposit concrete continuously when using a slip form machine.
  - 4. Use dowels as shown on the plans when placing curb on existing pavement.

### **3.3 FINISH CONCRETE**

- A. Round edges to a ½ inch radius.
- B. Use a float to finish the top and front face of the curb and the top of the gutter.
- C. Finish the traveled portion of the driveway with a broom finish.
- D. Remove form marks or irregularities from finish surfaces.

### **3.4 JOINTS**

- A. Place joints perpendicular to the subgrade and as shown.
- B. Contraction Joints
  - 1. ⅛ inch to ³/₁₆ thick steel plates.
  - 2. Space the joints every 10 ft.
  - 3. Remove the templates as soon as the concrete takes an initial set.
  - 4. Cut joint 1½ inches deep when using slip form method to place the concrete.
- C. Expansion Joints
  - 1. Place expansion joint every 30 ft.
  - 2. Expansion joint not required when using slip form method to place concrete, except at adjacent pavement, curb radius, sidewalk, or structures.
  - 3. ½ inch thick premolded expansion joint filler.
  - 4. Place joint filler between the curb and gutter and sidewalk or structures.

### **3.5 CURE AND PROTECT CONCRETE**

- A. Cure the surface. Refer to Section 03390.

- B. Seal the surface after curing. Refer to Section 03390.

### **3.6 DETECTABLE WARNING SURFACE**

- A. Polymer Composite Panel Installation
  - 1. Install cast-in-place detectable warning panel directly into the finished plastic concrete surface according to manufacturer recommendations. Provide a smooth transition between the panel and the surrounding concrete surface.
  - 2. Install surface applied detectable warning panel directly on existing concrete surface according to manufacturer recommendations and installation procedures. Use mechanical fasteners to secure the panel to the existing surface. Caulk a smooth transition bead along beveled panel edge and surrounding concrete surface.
- B. Polymer Concrete Panel, Precast Concrete Panel, Cast Iron Plate Installation
  - 1. Place as shown on drawings. Install according to manufacturer recommendations for cast-in-place method. Provide a smooth transition between the panel and the surrounding concrete surface.

END OF SECTION

# Skills Challenge 2

## Objective:

To demonstrate the skills obtained from the Standard Drawings and Plan Reading presentations.

## Challenge:

Using the attachments from ~~2012~~ Standard Drawings, and plan set answer the following questions in the following challenges.

Challenge A: Answer the following questions from the Standard Drawings:

Curb & Gutter - What is the minimum depth of untreated base course under B1 Curb?

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Plowable End Sections- What is the transition length for type B5 curb? \_\_\_\_\_

Pedestrian Ramp - What colors are acceptable for the detectable warning surface?  
Describe the surface detail pattern of the detectable warning surface.

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Driveways- What are the two types of driveways UDOT uses? Is the sidewalk that passes through the driveway considered sidewalk or driveway?

---

---

Challenge Question: What is the difference between commercial and residential driveways?

---

Challenge B: Answer the following questions using the attached plan sheets.

Pedestrian ramps- At what Stations and offsets are the pedestrian ramps located?

---

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How many tons of UTBC is needed underneath the pedestrian ramp at Station 713+95; 67.93 LT? \_\_\_\_\_

Roadway- How wide is the road at Station 713+00? \_\_\_\_\_

What type of pavement is to be used at Station 724+00 and how thick?

---

This pavement is placed upon a pavement section consisting of?

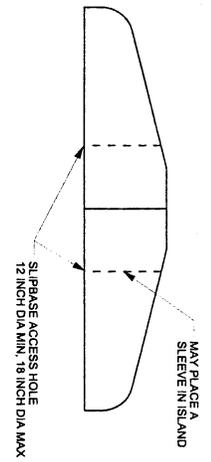
\_\_\_\_\_ inches of  $\frac{3}{4}$  HMA

\_\_\_\_\_ inches of untreated base course (UTBC)

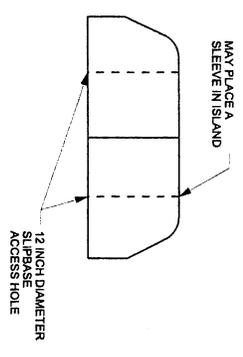
\_\_\_\_\_ inches of granular barrow

Challenge question: How many through lanes are there in each direction of this road?

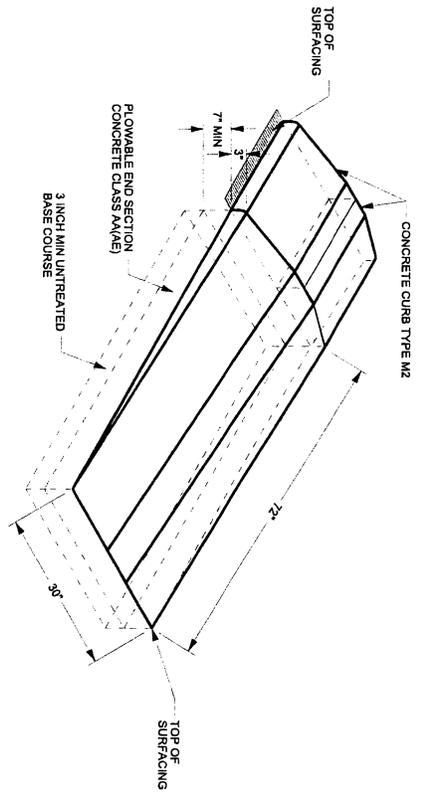
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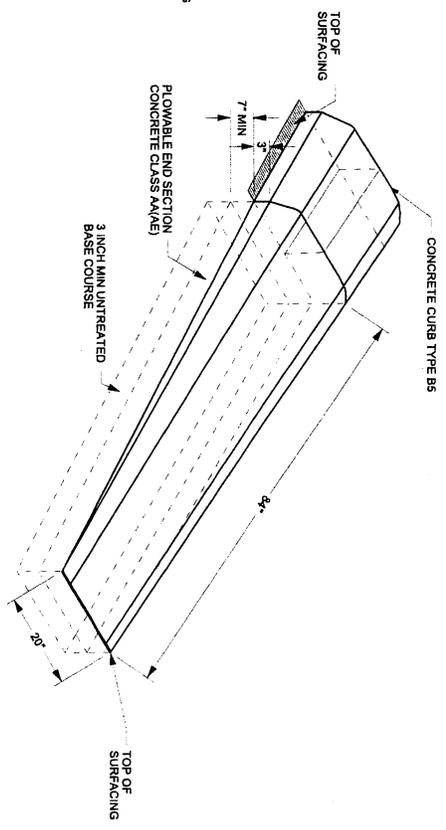
**RAISED ISLAND DETAIL**  
TYPE "M2" CURB



**RAISED ISLAND DETAIL**  
TYPE "B5" CURB



**PLOWABLE END SECTION DETAIL**  
TYPE "M2" CURB

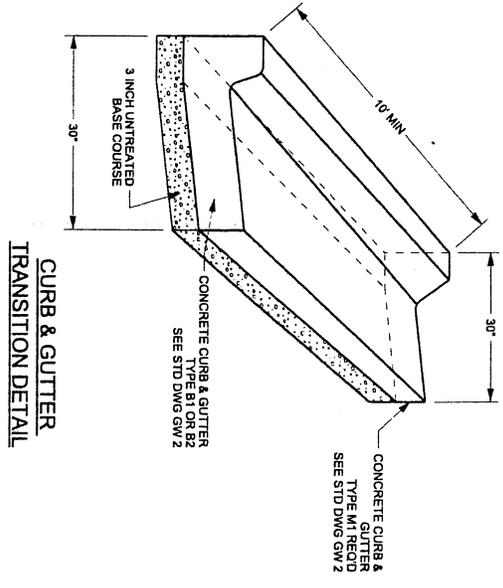
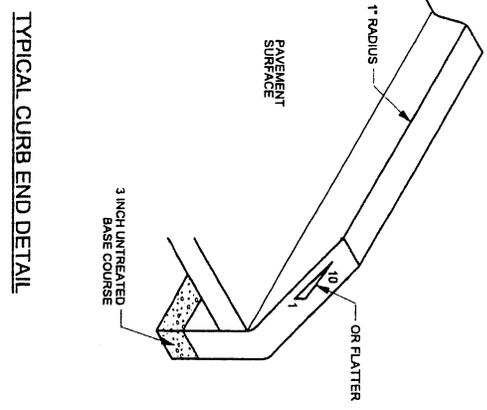
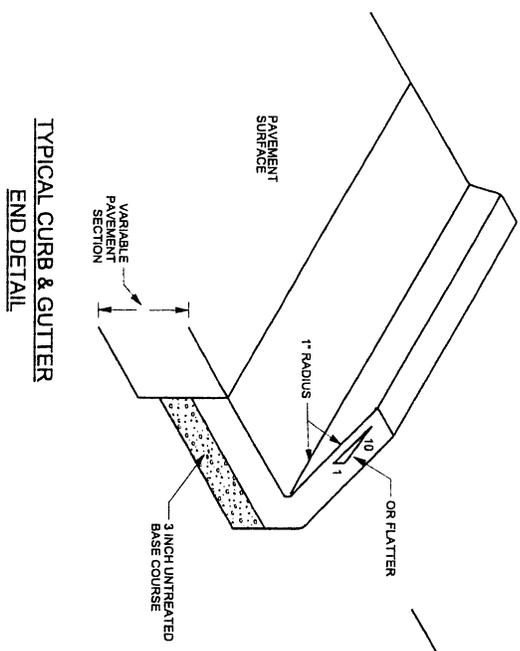
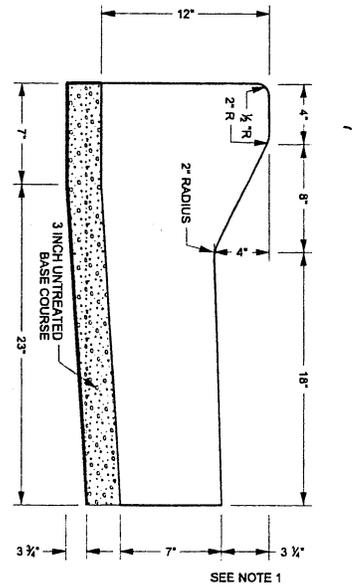
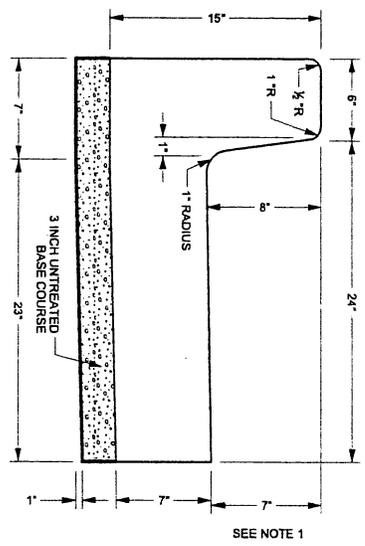
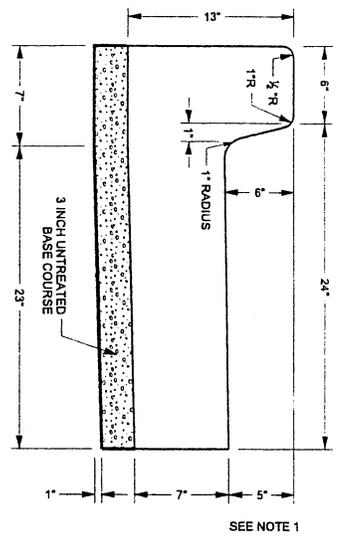


**PLOWABLE END SECTION DETAIL**  
TYPE "B5" CURB

- NOTES:**
1. RAISED ISLAND IS TWO TYPE M2 OR TYPE B5 CURBS TYPICALLY PLACED BACK TO BACK.
  2. SEE STD DWG GW 2 FOR M2 AND B5 CURB DETAILS.
  3. PAINT PLOWABLE END SECTION TO MATCH ADJACENT EDGE LINE.
  4. USE 18 INCH DIAMETER SLIPRASE ACCESS HOLE ON ISLANDS 24 INCHES AND WIDER. USE 12 INCH DIAMETER SLIPRASE ACCESS HOLE ON ISLANDS LESS THAN 24 INCHES WIDE.
  5. SEE STD DWG GW 1C FOR HOLE DETAILS.

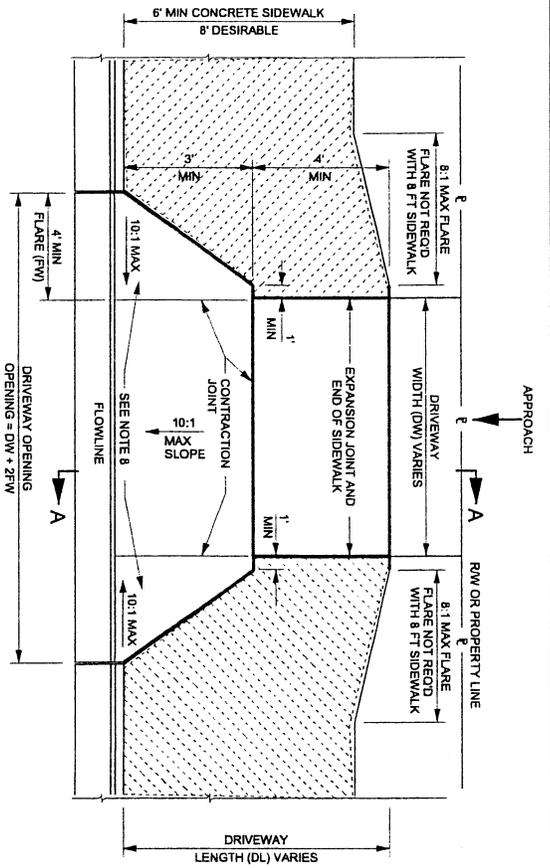
STD. DWG. NO. <b>GW 1B</b>	<b>RAISED ISLAND AND PLOWABLE END SECTION</b>	<b>UTAH DEPARTMENT OF TRANSPORTATION</b> STANDARD DRAWINGS FOR ROAD AND BRIDGE CONSTRUCTION SALT LAKE CITY, UTAH		REVISIONS			
		RECOMMENDED FOR APPROVAL <i>[Signature]</i>	DATE JAN. 01. 2012				
		CHAIRMAN STANDARDS COMMITTEE APPROVED <i>[Signature]</i>	DATE JAN. 01. 2012				
STANDARD DRAWING TITLE		DEPUTY DIRECTOR		NO.	DATE	APPR.	REMARKS



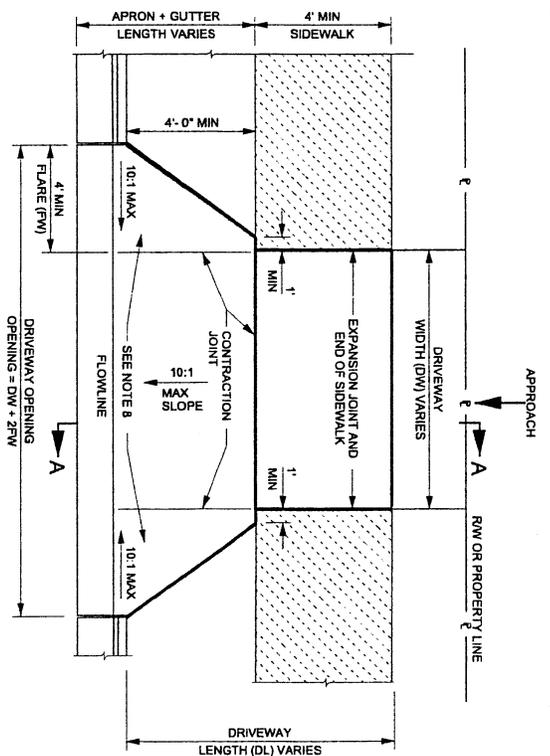


**NOTE:**  
 1. FLATTEN GUTTERS AS SHOWN AT ADA RAMP LOCATIONS. FLATTEN GUTTER BETWEEN RAMPS AS WELL AS AT CURB RAMPS WHERE MORE THAN ONE RAMP WILL BE CONSTRUCTED AT A CORNER.

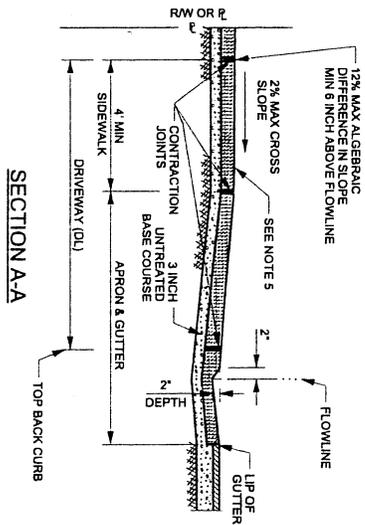
STANDARD DRAWING TITLE		UTAH DEPARTMENT OF TRANSPORTATION		REVISIONS	
CONCRETE CURB AND GUTTER DETAILS		STANDARD DRAWINGS FOR ROAD AND BRIDGE CONSTRUCTION		SALT LAKE CITY, UTAH	
		RECOMMENDED FOR APPROVAL		DATE	
GW 3		CHAIRMAN STANDARDS COMMITTEE APPROVED		DATE	
		DEPUTY DIRECTOR		DATE	
NO.	DATE	APPL.	REMARKS		



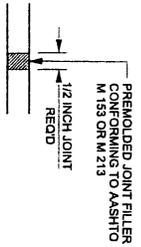
FLARED DRIVEWAY WITH ADJACENT SIDEWALK



FLARED DRIVEWAY WITH PARKSTRIP



DRIVEWAY FLARE AREA CHART	
FLARED DRIVEWAY DISTANCE FROM BACK OF CURB TO SIDEWALK	FLARE AREA
3 FT	18 ft <sup>2</sup>
4 FT	24 ft <sup>2</sup>
6 FT	36 ft <sup>2</sup>
8 FT	48 ft <sup>2</sup>
10 FT	60 ft <sup>2</sup>
ADD (DL)(DW) FOR TOTAL QUANTITY	
QUANTITY CALCULATED USING A 6 INCH CURB	



EXPANSION-CONTRACTION JOINT DETAIL

- NOTES:**
1. DRIVEWAY DIMENSIONS (MAX. & MIN.) ARE LOCATED IN UDOT ADMINISTRATIVE RULE R308 ACCOMMODATION OF UTILITIES AND THE CONTROL AND PROTECTION OF STATE HIGHWAY RIGHTS OF WAY - CURRENT EDITION.
  2. MAXIMUM DISTANCE BETWEEN CONTRACTION JOINTS 10 FT. LATERALLY.
  3. PROVIDE EXPANSION JOINTS IN CONCRETE SIDEWALK AT 30 FT. INTERVALS AND WHERE CONCRETE SIDEWALK BUTTS AGAINST DRIVEWAY.
  4. SIDEWALK INSIDE THE DRIVEWAY LIMITS IS PAID AS PART OF DRIVEWAY, NOT AS PART OF SIDEWALK.
  5. FLARED CONCRETE DRIVEWAY AT RESIDENTIAL = 6 INCH THICK COMMERCIAL = 7 INCH THICK. USE THESE THICKNESSES FOR APRON, SIDEWALK WITHIN DRIVEWAY AREA, APPROACH AND FLARE.
  6. DEPRESS THE LONGITUDINAL SLOPE OF THE SIDEWALK AT A MAXIMUM RATE OF 5 PERCENT TO USE THE APRON-APPROACH ELEVATION IF THE GRADES OF SIDEWALK AND DRIVEWAY ARE DIFFERENT. THE MINIMUM CURB AND GUTTER AT ALL TIMES TO BE A MINIMUM 6 INCHES ABOVE THE FLOWLINE OF CURB AND GUTTER AT ALL TIMES.
  7. USE CLASS (AA)(E) CONCRETE FOR SIDEWALK AND DRIVEWAYS.
  8. QUANTITIES FOR DRIVEWAYS INCLUDE FLARES TO TOP BACK OF CURB, CURB AND GUTTER PAID SEPARATELY THROUGH DRIVEWAY LOCATIONS.
  9. REMOVE EXISTING SIDEWALK AND REPLACE BACK TO NEAREST EXPANSION JOINT.
  10. APPROACH IS FROM OUTSIDE OF RIGHT-OF-WAY LINE TO ROADWAY.
  11. APPROACH IS PART OF DRIVEWAY QUANTITIES.

STD. DWG. NO.  
GW 4A

CONCRETE DRIVEWAYS AND SIDEWALKS

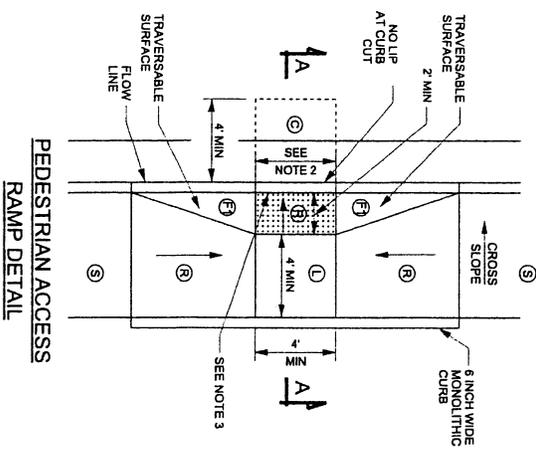
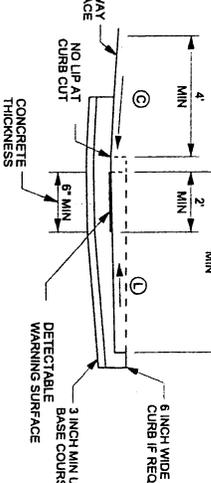
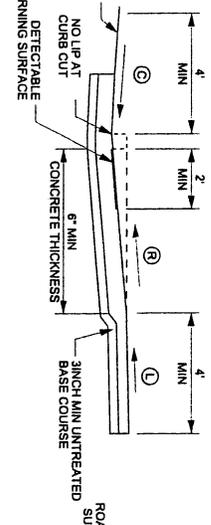
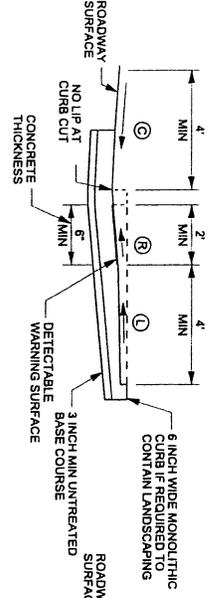
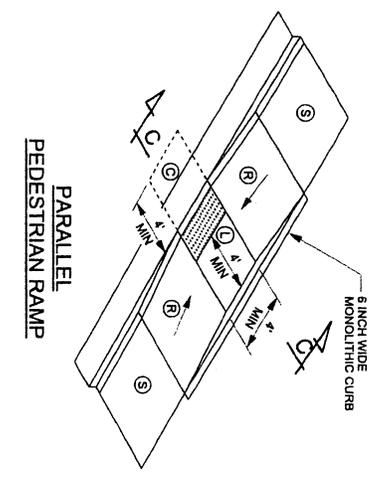
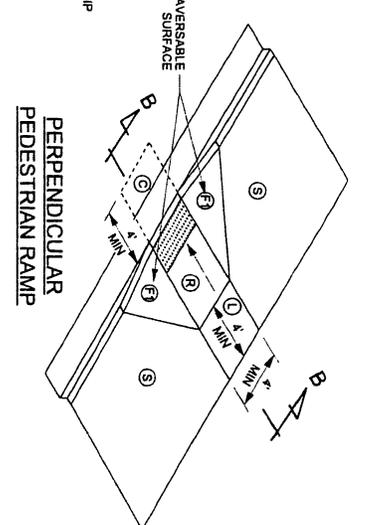
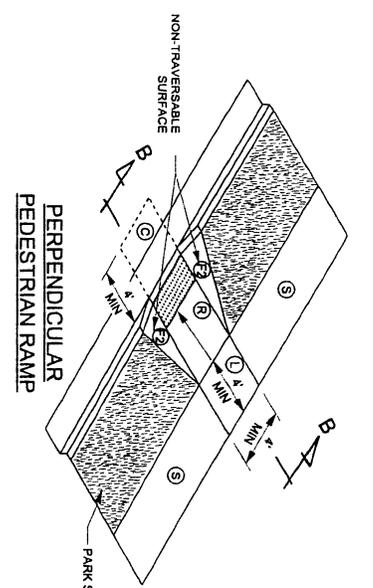
STANDARD DRAWING TITLE

UTAH DEPARTMENT OF TRANSPORTATION  
STANDARD DRAWINGS FOR ROAD AND BRIDGE CONSTRUCTION  
SALT LAKE CITY, UTAH

RECOMMENDED FOR APPROVAL: *Ryan G. Park*  
CHAIRMAN STANDARDS COMMITTEE APPROVED: *Carl D. Brown*  
DEPUTY DIRECTOR

JAN. 01. 2012 DATE  
JAN. 01. 2012 DATE

REVISIONS			
NO.	DATE	APPR.	REMARKS



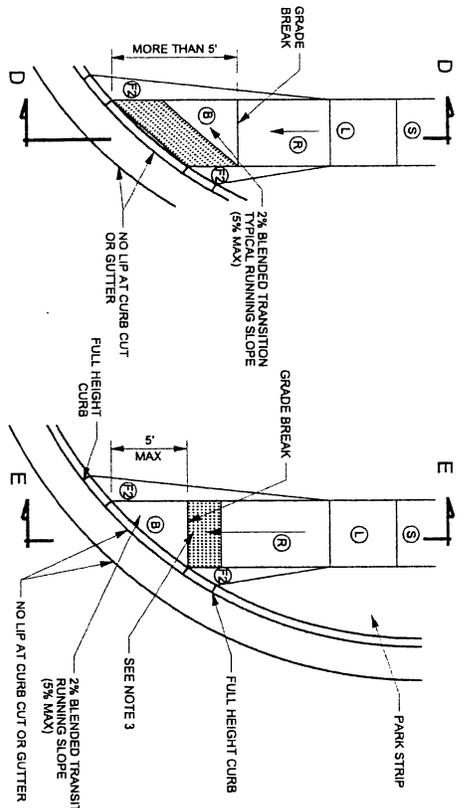
SLOPE TABLE			
ITEM	MAX RUNNING SLOPE *	MAX CROSS SLOPE *	
(L) LANDING	2% (1V/48H)	2% (1V/48H) (c)	
(R) RAMP	8.33% (1V/12H) (c)	2% (1V/48H) (c)	
(C) CLEAR SPACE	5% (1V/20H) (a)	2% (1V/48H) (c)	
(S) SIDEWALK	-	2% (1V/48H)	
(F) TRAVERSABLE SURFACE	10% (1V/10H) (b)	-	
(E) NON-TRAVERSABLE SURFACE	25% (1V/24H) (b)	5% (1V/20H) (b)	
(B) BLENDED TRANSITION	2% MIN.	2% (1V/48H)	

- \* RUNNING SLOPE IS IN THE DIRECTION OF PEDESTRIAN TRAVEL.
- CROSS SLOPE IS PERPENDICULAR TO PEDESTRIAN TRAVEL.
- (a) CLEAR SPACE RUNNING SLOPE NEEDS TO BE CONSISTENT ACROSS ENTIRE CURB CUT. WARP GUTTER PAN TO MEET REAR SPACE SLOPE AT CURB CUT.
- (b) FLARE SLOPE IS MEASURED PARALLEL TO CURB LINE.
- EXCEPTIONS:
- (c) CROSS SLOPE REQUIREMENTS DO NOT APPLY AT MID-BLOCK CROSSINGS.
- (d) PARALLEL RAMPS ARE NOT REQUIRED TO EXCEED 15 FEET IN LENGTH.
- (e) SIDEWALKS ARE NOT REQUIRED TO EXCEED 15 FEET IN LENGTH.
- (f) MID-BLOCK CROSSINGS DO NOT EXCEED ROADWAY PROFILE GRADE.

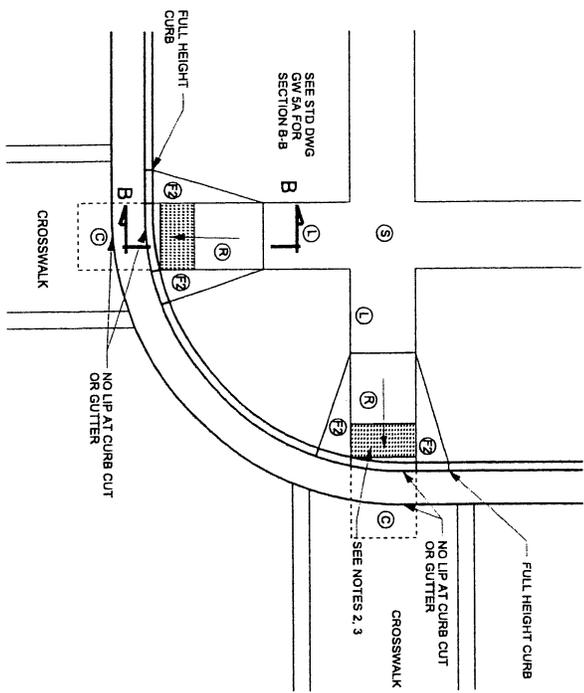
GENERAL NOTES:

- SITE CONDITIONS WILL VARY. CONFIGURATION OF RAMP, LANDING, AND CLEAR SPACE MAY BE CHANGED BUT THEY MUST MEET DIMENSIONS AND ARE AT THE DISCRETION OF THE ENGINEER.
- PROVIDE DETECTABLE WARNING SURFACE FOR FULL WIDTH OF CURB CUT. SEE DETAIL A ON STD DWG GW 5C FOR DETECTABLE WARNING SURFACE DIMENSIONS.
- LOCATE DETECTABLE WARNING SURFACE SO THE CORNERS NEAREST THE STREET ARE WITHIN 1 INCH OF THE BACK OF CURB.
- PERPENDICULAR AND PARALLEL PEDESTRIAN RAMPS SHOWN ON THIS DRAWING ARE ACCEPTABLE FOR USE AT MID-BLOCK OR CORNER CROSSINGS. SEE DETAIL A ON STD DWG GW 5B AND GW 5C FOR EXAMPLES OF CORNER INSTALLATIONS.
- PROVIDE DETECTABLE WARNING SURFACE COLOR THAT CONTRASTS WITH ADJACENT WALKING SURFACE, EITHER LIGHT-ON-DARK OR DARK-ON-LIGHT.
- USE CLASS (AA&B) CONCRETE.
- USE UNTREATED BASE COURSE UNDER ALL CONCRETE FLATWORK.
- GRIND OFF REMAINING PORTION OF ANY CUT DOMES WHEN DETECTABLE WARNING SURFACE IS CUT. SEAL ALL CUT PANEL EDGES TO PREVENT WATER DAMAGE.
- LOCATE CURB CUT WITHIN CROSSWALK.
- RAMP GRADE BREAK MUST BE PERPENDICULAR TO THE RUNNING SLOPE.
- REFER TO STD DWG SL 9 FOR DISTANCE TO PEDESTRIAN SIGNAL BUTTON.
- CLEAR SPACE AND LANDINGS SIZE: 4 FT MIN X 4 FT MIN.

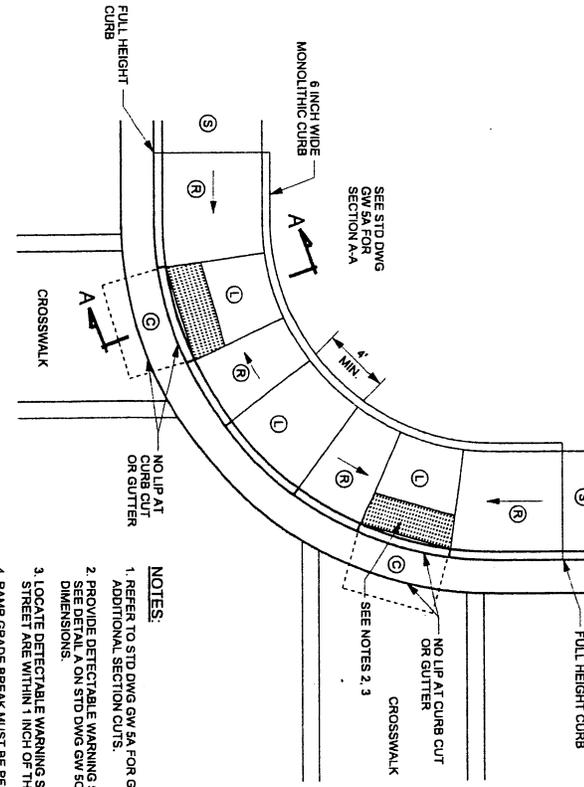
STD. DWG. NO. <b>GW 5A</b>	PEDESTRIAN ACCESS	UTAH DEPARTMENT OF TRANSPORTATION STANDARD DRAWINGS FOR ROAD AND BRIDGE CONSTRUCTION SALT LAKE CITY, UTAH		REVISIONS	
		RECOMMENDED FOR APPROVAL <i>[Signature]</i>	CHAIRMAN STANDARDS COMMITTEE APPROVED	JAN 01 2012 DATE	NO. DATE APPR. REMARKS
		DEPUTY DIRECTOR	JAN 01 2012 DATE		



**CORNER PEDESTRIAN RAMP**  
EXAMPLES  
SEE NOTE 3

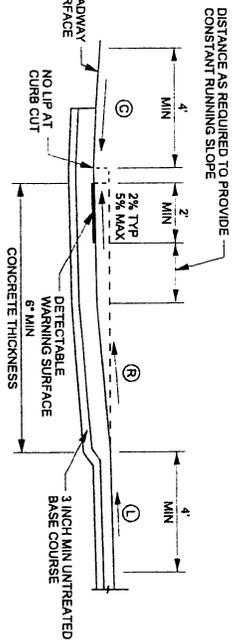


**CORNER PEDESTRIAN RAMP**  
EXAMPLE  
(TWO CURB CUTS)

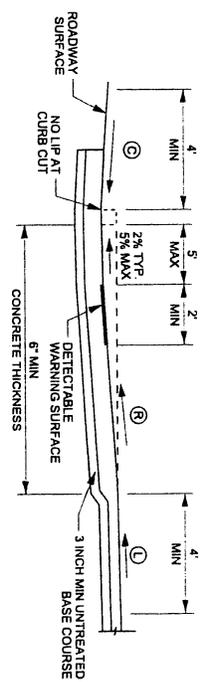


**CORNER PEDESTRIAN RAMP**  
EXAMPLE  
(TWO CURB CUTS)

- NOTES:**
1. REFER TO STD DWG GW 5A FOR GENERAL NOTES, SLOPE TABLES, AND ADDITIONAL SECTION CUTS.
  2. PROVIDE DETECTABLE WARNING SURFACE FOR FULL WIDTH OF CURB CUT. SEE DETAIL A ON STD DWG GW 5C FOR DETECTABLE WARNING SURFACE DIMENSIONS.
  3. LOCATE DETECTABLE WARNING SURFACE SO THE CORNERS NEAREST THE STREET ARE WITHIN 1 INCH OF THE BACK OF CURB.
  4. RAMP GRADE BREAK MUST BE PERPENDICULAR TO THE RUNNING SLOPE.
  5. BLENDED TRANSITIONS MAY NOT REQUIRE RAMP AND LANDING.



**SECTION D-D**



**SECTION E-E**

DISTANCE AS REQUIRED TO PROVIDE CONSTANT RUNNING SLOPE

**UTAH DEPARTMENT OF TRANSPORTATION**

STANDARD DRAWINGS FOR ROAD AND BRIDGE CONSTRUCTION  
SALT LAKE CITY, UTAH

RECOMMENDED FOR APPROVAL: *Russell G. Park* JAN 01, 2012 DATE  
CHAIRMAN STANDARDS COMMITTEE APPROVED: *Carl B. ...* JAN 01, 2012 DATE  
DEPUTY DIRECTOR

REVISIONS			
NO	DATE	APPR	REMARKS

STANDARD DRAWING TITLE: **PEDESTRIAN ACCESS**

STD. DWG. NO.: **GW 5B**



**Insert 11X17**

# *Final Skill Challenge*

## *Objective:*

To demonstrate the skills obtained from the Documentation, Equipment, Design features, presentations.

## *Challenge:*

Using the daily report, document all the daily activities and details using the following scenario and the given picture.

### Scenario:

Harper excavating has been working 10 hrs shifts starting at 7am. The crew has been backfilling an MSE wall using a Select Backfill material. The weather report said it would be a high of 95 and low of 65 degrees, and partly cloudy. Assume all equipment is in use and is being used for the MSE wall operation. The pick up trucks belong to the superintendants.

# INSPECTORS DAILY REPORT

PROJECT NO:  
LOCATION:  
CONTRACTOR:

INSPECTORS DAILY REPORT OF \_\_\_\_\_ (Phase of Construction)

INSPECTORS TIME: FROM \_\_\_\_\_ AM/PM to \_\_\_\_\_ AM/PM DATE \_\_\_\_/\_\_\_\_/\_\_\_\_  
CONTRACTORS TIME: FROM \_\_\_\_\_ AM/PM to \_\_\_\_\_ AM/PM DAY OF WEEK \_\_\_\_\_  
SUBCONTRACTORS TIME: FROM \_\_\_\_\_ AM/PM to \_\_\_\_\_ AM/PM WEATHER: CLEAR SUNNY RAIN  
TIME CHARGE \_\_\_\_ DAY TEMPERATURES LOW \_\_\_\_ HIGH \_\_\_\_ CLOUDY P. CLOUDY SNOW FOG

## LABOR:

SUPERVISION \_\_\_\_ SKILLED \_\_\_\_ UNSKILLED \_\_\_\_ TOTAL LABOR \_\_\_\_

## EQUIPMENT USED THIS DAY:

PICKUP.....	____ EACH	FRONT END LOADER.....	____ EACH	TRENCHER.....	____ EACH
END DUMP TRUCK.....	____ EACH	DOZER.....	____ EACH	AIR COMPRESSOR.....	____ EACH
BELLY DUMP TRUCK.....	____ EACH	GRADER.....	____ EACH	AIR TOOLS.....	____ EACH
WATER TRUCK.....	____ EACH	SCRAPER.....	____ EACH	BOBCAT LOADER.....	____ EACH
FLATBED TRUCK.....	____ EACH	LAYDOWN MACHINE.....	____ EACH	CONC. SAW (SELF PROP).....	____ EACH
UTILITY TRUCK.....	____ EACH	ROLLER (LARGE).....	____ EACH	SANDBLASTER.....	____ EACH
TACK TRUCK (DISTRIBUTOR).....	____ EACH	ROLLER (HAND OPER).....	____ EACH	ROTOMILL MACHINE.....	____ EACH
BACKHOE (LARGE).....	____ EACH	COMPACTOR (SHEEP).....	____ EACH	MESSAGE BOARD.....	____ EACH
BACKHOE LOADER.....	____ EACH	COMPACTOR (HAND).....	____ EACH	PORTABLE NIGHTLIGHT.....	____ EACH
_____	____ EACH	TACK POT.....	____ EACH	MANLIFT.....	____ EACH
_____	____ EACH	_____	____ EACH	AUGER.....	____ EACH

Information to be included in remarks - Description of work done by contractor, location, station to station, source of materials, where placed. Description and location of any construction signs, agreements entered into, instructions given, etc.

CONTRACTOR: \_\_\_\_\_ SUBCONTRACTOR: \_\_\_\_\_

REMARKS:

IF ADDITIONAL SPACE IS NEEDED USE BACK OF THIS SHEET. OVER

INSPECTORS SIGNATURE

