



FT. LEONARDWOOD, MO

***Light Capability Rough Terrain Forklift
(LCRTF)***

TX 51-19M



UNITED STATES MARINE CORPS
MARINE CORPS DETACHMENT
U.S. ARMY ENGINEER CENTER
FORT LEONARD WOOD, MISSOURI 65473-5850

E-_____
MAR 2002

LESSON PLAN

FORKLIFT OPERATIONS

INTRODUCTION

LEARNING OBJECTIVES:

1. TERMINAL LEARNING OBJECTIVE (S)
 - a. Provided a Light Capability Rough Terrain Forklift, TX51-19M (LCRTF) and a training area, with the aid of references, operate the tractor in support of engineer operations in accordance with TM-09135B-10/1. (1345.2.14)

2. ENABLING LEARNING OBJECTIVE (S)
 - a. Given descriptions of Light Capability Rough Terrain Forklift, TX51-19M (LCRTF) characteristics, without the aid of references, mark each correct description in accordance with TM-09135B-10/1. (1345.2.14d)

 - b. Provided a Light Capability Rough Terrain Forklift, TX51-19M (LCRTF) equipped with the forks attachment, a simulated haul unit, and pallets, with the aid of references, load the pallets onto the haul unit in accordance with TM-09135B-10/1. (1345.2.14b)

 - c. Provided a Light Capability Rough Terrain Forklift, TX51-19M (LCRTF) and necessary tools, with the aid of references, perform before operation checks in accordance with TM-09135B-10/1. (1345.2.14e)

 - d. Provided a Light Capability Rough Terrain Forklift, TX51-19M (LCRTF) and necessary tools, with the aid of references, perform after operation checks in accordance with TM-09135B-10/1. (1345.2.14f)

1. Safety and Operator Responsibilities

1. Safety:

- a. Always fasten your seat belt prior to any and all operations of the tractor.
- b. Make sure all controls are in their neutral position.
- c. Apply the parking brake and service brake prior to starting the tractor.
- d. No passengers allowed on the tractor other than yourself.
- e. Be aware of all pinch points and ensure they are clear prior to operation.
- f. Keep hands and feet inside the cab while operating.
- g. Check all clearances with any other objects, vehicles, and power lines prior to operation.
- h. Safeguard any and all pedestrians that you may come in contact with.

2. Operator Responsibilities:

- a. Ensure that you are operating in a safe manner.
- b. Practice safe working habits.
- c. Be aware of any hazardous operating conditions.
- d. Ensure that you are familiar with the operation and controls of the tractor you plan to operate.
- e. Ensure that you abide by all safety rules and practices that govern your area of operation.

2. Characteristics & Capabilities

- a. The Light Capability Rough Terrain Forklift, TX51-19M (LCRTF) is a diesel engine powered, self-contained, rough terrain forklift manufactured by TEREX Lift Trucks, a division of Terex American.
- b. It is the smallest forklift in the Marine Corps with a gross vehicle weight of 13,500 pounds.
- c. It is powered by a Perkins, Model 704-30T, turbocharged, 4 cylinder, direct injection diesel engine that produces 80 hp at 2600 RPM.
- d. The Light Capability Rough Terrain Forklift, TX51-19M (LCRTF) has a variable displacements hydraulic pump that drives a hydraulic motor located on the front axle. The pump only begins to drive the motor when the accelerator is depressed. The hydraulic motor adjusts to give maximum torque when under heavy loads, or maximum flow under light loads. Maximum speed forward and reverse is 20 m.p.h..
- e. The Light Capability Rough Terrain Forklift, TX51-19M (LCRTF) is a full time four-wheel drive, and the front axle (limited slip differential) drives the rear axle (locked differential) thru a drive shaft.
- f. It can negotiate a maximum grade of 45% with a full load.

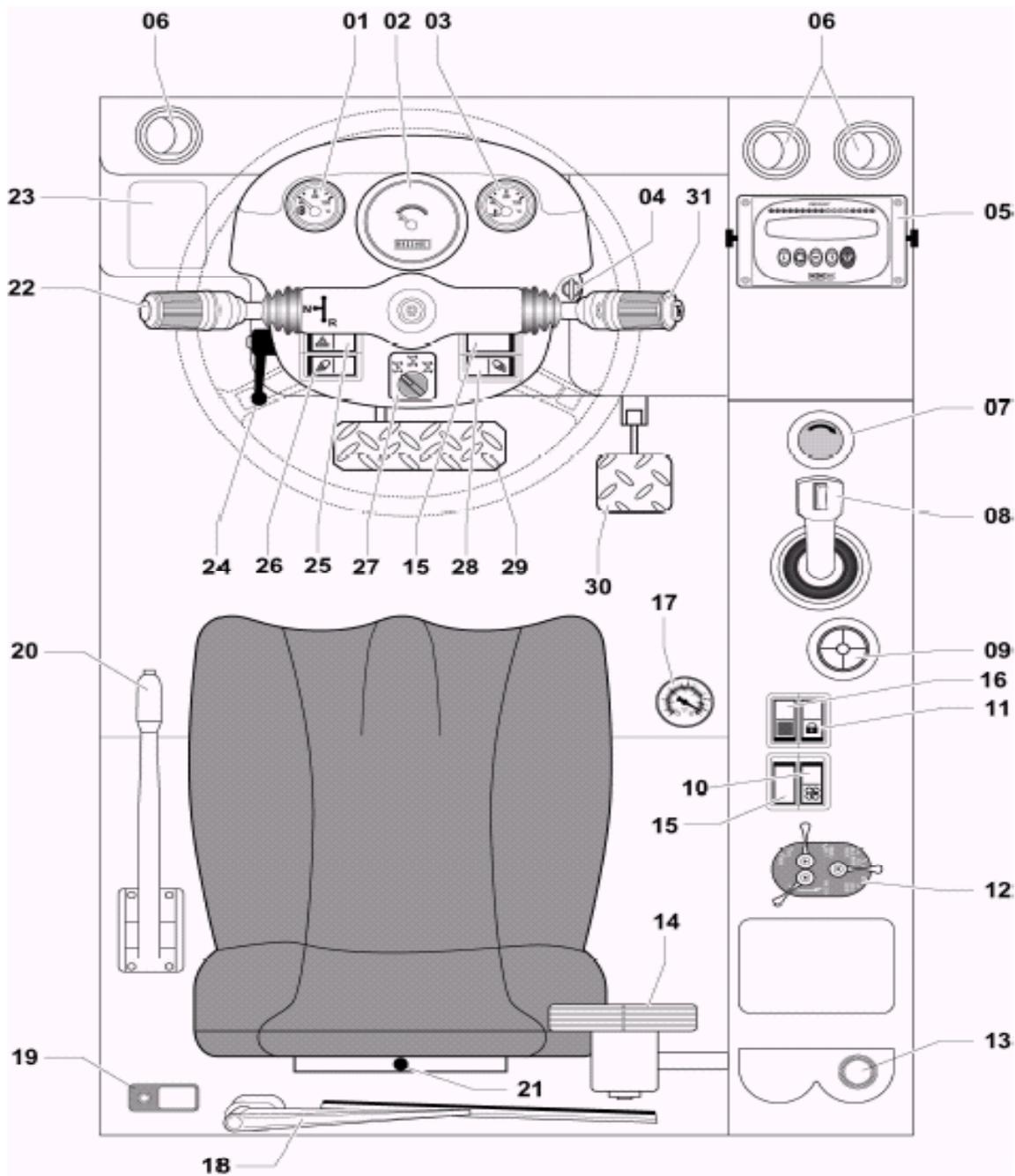
- g. The maximum fording depth is 36 inches.
- h. The fork carriage is hydraulically controlled with manual fork tine adjustment.
- i. The Light Capability Rough Terrain Forklift, TX51-19M (LCRTF) has a fully hydraulic two section-telescoping boom.
- j. The maximum lifting capacity is 5,070 pounds.
- k. The maximum lifting height is 18 feet 9 inches.
- l. The maximum reach forward 10 feet 9 inches. Measured from the front tires.
- m. The Light Capability Rough Terrain Forklift, TX51-19M (LCRTF) is equipped with a 24-volt negative ground electrical system.
- n. It is equipped with either front (two wheel), crab, or 4-wheel steer.
- o. The tractor is equipped with a Roll Over Protective Structure (ROPS) and a Falling Object Protective Structure (FOPS).
- p. The Light Capability Rough Terrain Forklift, TX51-19M (LCRTF) is equipped with two pintle hooks, one permanently attached on the rear, and one removable pintle hook assembly with a maximum capacity of 8,000 lbs.
- q. The removable pintle hook is located on the left side rear fender of the forklift, when in the stowed position.
- r. It mounts on the forks when in the work position, with the pintle above the level of the fork tines.
- s. It is also equipped with a hydraulic motor disconnect which is utilized when the forklift is disabled and is being towed.

Mission: The mission of the TEREX TX51-19M is to load and unload palletized cargo from trucks, trailers, aircraft, ships and ISO containers.

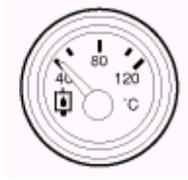
2. Instruments and Controls: The following section provides illustrations and detailed information about the TEREX TX51-19Ms different instruments and controls.

a. The instrument panel, figure 1-1, contains many of the engine, electrical system, transmission, hydraulic, and pneumatic controls and instruments. These controls and instruments are described in the following paragraphs:

Figure 1-1



1. **Hydraulic Oil Temperature Indicator** – Indicates the oil temperature within the reservoir.



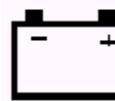
- d. **Water Temperature Indicator** – Indicates when engine coolant is overheated.



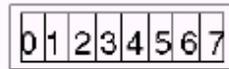
2. **Gauge / Indicator Lights:**



- e. **Low Battery Charge** – Signals a low charge from the alternator.



- a. **Hourmeter** – This indicates the running time of the engine in hours.



- f. **Low Engine Oil Pressure** – This indicator will light up when engine oil pressure is too low. Stop the engine.



- b. **Fuel Gauge** – Indicates the amount of fuel remaining in the fuel tank.



- g. **Parking Brake Engaged** – Indicates the parking brake is engaged.



- c. **Hazard Light** – Green indicator signaling when position lights are ON.



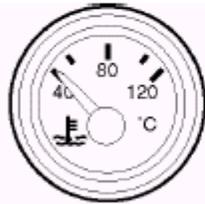
- h. **Blank** – Not used



- i. **Turn signal Indicator** – Green indicator signaling when turn signals are ON.



3. **Engine Coolant Temperature** –Indicates the engine coolant temperature.



Engine cannot be started if the parking brake is not engages, operator completely sitting in seat and Forward/Neutral/Reverse lever in Neutral.

4. **Ignition Switch** - This switch is used to energize the electrical system of the machine and start the machine.



Before using the machine, make sure that the first green LED of the overload warning system is ON.

The overload warning system must not be used to check the load to be lifted: it has only been designed to signal possible unbalances of the machine along its motion axis. Such unbalances may also be caused by an abrupt operation of the levers during the load handling. During work if, several indicators light up, operator the levers more smoothly.



This machine is equipped with overload warning, when machine is on side slope and rear axle reaches maximum angle.

5. **Overload Warning System** – A LED warning display. The LED's switch on in sequence from the right to the left and indicates the gradual variation of the machine stability as follow:



Green LED

- 0-89% of capacity
- normal operation

Yellow LED

- 90-100% capacity

Red LED

- hazardous overload; boom down, extend cut and allows only for the load return within safety limits.

At the machine starting, the overload warning system carries out a diagnostics of all LED's then sets to the first green LED signaling the proper functioning of the instrument.

6. **Air Vents** – Allows air flow in the cab. Rotate the vent to direct the air flow.



7. **Emergency Stop Button** – Any operated function can be stopped by pressing the emergency stop button. This button allows shutting the engine down. To reset, rotate the button clockwise.



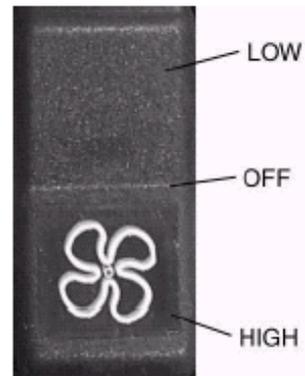
8. **Joystick Lever** – Controls the Boom / Attachment function see section on control levers functions (page)



9. **Machine Level** – Use this device to ensure that the machine is level.



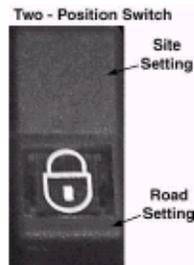
10. **Defroster Fan Switch** – Three – position switch that controls the speed of the fan. Press switch up for low speed, Press down for high speed.





When traveling with or without a load, depress the Work - Travel Switch to lockout tilt, side shift, rotation functions on the attachment and to lockout crab and 4-wheel modes.

11. **Work - Travel Switch** – When traveling with or without a load this switch prevents operations of attachment functions and steering in crab and 4-wheel modes.



- (a). Press the switch down to select the Travel Setting. This disables all attachment functions, steering in crab and 4-wheel modes.
- (b). Press the switch up to select the Work Setting and enable all attachment functions and all steering modes.

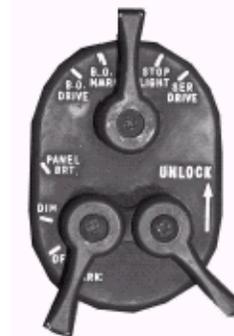
12. **Blackout Lighting Control Switch** –

- (a) Mechanical Lockout Lever
 - Unlock switch by moving the lock CCW when operating the light and auxiliary switch or damage can occur to the switch mechanism.
 - The Mechanical Lock prevents accidental switching in Blackout Modes.
- (b) Lighting Control Lever
 - BO Drive position – Operates the blackout headlight, blackout stoplight-taillights and all four blackout marker lights. All internal, external lights, horn and backup alarm are not operable when blackout lights are in operation. The Auxiliary Switch lever can operate indicator lights on the dash.
 - BO Marker position – Operates the two front and two rear blackout markers. All internal and external lights, horn and the backup alarm are not operable when blackout markers are in operation. The Auxiliary Switch lever can operate indicator lights on the dash.

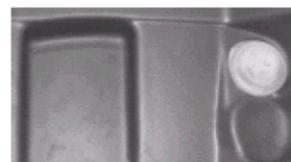
- Off position – All lights, backup alarm, horn, panel lights, blackout headlight, blackout stoplight taillights and all four blackout marker lights are inoperable.
- Stop Light position – Operates taillights, horn and the backup alarm. Blackout headlight, blackout stoplight-taillights and blackout markers are not operable.
- Ser. Drive position – All lights, taillights, and horn and the backup alarm are operable. Blackout stoplight-taillights and blackout markers are not operable.
- Ser. Drive position – All lights, taillights, and horn and the backup alarm are operable. Blackout headlight, blackout stoplight – taillights and blackout markers are not operable.

(c) Panel Light Control lever

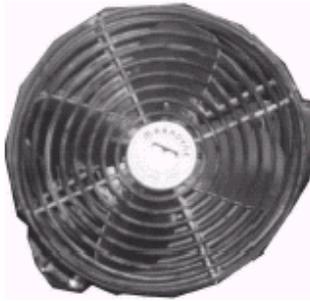
- Panel Brt. position – Operates the bright indicator lights on the dash.
- Dim position – dims the indicator lights on the dash.
- Off position – indicator lights on the dash are inoperable.
- Park position – dims the indicator lights on the dash.



13. **Windshield Water Reservoir** – Holds the washer / water solution.



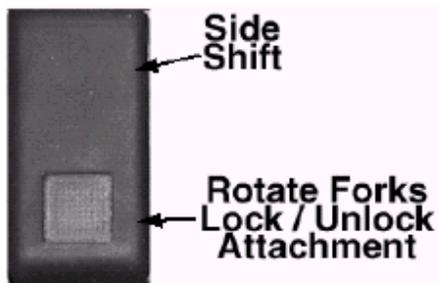
14. **Cab Fan** - To turn the fan on and off use the on / off switch bottom side of fan.



15. **Blank**



16. **Side Shift / Rotate Function Switch** – Works in conjunction with the rocker switch on the joystick control lever.



17. **Filter Indicator** - Indicates the degree of clogging so you will know when to change filter.

ATTENTION

Operating with indicator in red can damage the transmission pump and motor. You must change the filter. Do not wait until the filter change interval is reached.

Green Area - 0-20 (PSI) is normal condition.

Yellow Area - 20-25 (PSI) Prepare to change filter

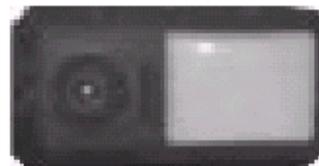
Red Area - 25-30 (PSI) Shut the machine down and change the filter.



18. **Rear Wiper** – To operate the rear wiper depress the rocker switch on the wiper motor box.



19. **Dome Light** - Three position side switch. Turn on / off to light the cab. Center position Off, Forward position Dome Light Rear Position Spot / Map Light.



20. **Parking Brake Lever** – To engage the parking brake, pull the lever upward while holding the locking button pressed. Release the button when reaching the required braking tension. This brake when engaged, by means of a proximity switch allows the machine to start and prevents transmission from going forward or reverse.



Never use the parking brake to slow down the machine, unless in an emergency. This could cause damage to the parking brake.



Engine cannot be started if the parking brake is not engaged, operator completely sitting in seat and Forward/Neutral/Reverse lever in Neutral.

21. **Seat Switch** - Located on bottom of seat. Enables the engine from starting unless operator is sitting in set.



Engine cannot be started if the parking brake is not engages, operator completely sitting in seat and Forward/Neutral/Reverse lever in Neutral.

22. **Forward / Neutral / Reverse Speed Selection Lever** – Three position switch with locking in neutral position:



Engine cannot be started if the parking brake is not engages, operator completely sitting in seat and Forward/Neutral/Reverse lever in Neutral.



- N Neutral position; drive not engaged.
- F Raise and shift lever to pos. F to select forward.
- R Raise and shift lever to pos. R to select reverse.

23. **Fuse / Relay Panel** – The electrical system is protected by fuses placed into the driving cab, on the left of steering column. Before replacing a blown fuse with a new one having the same amperage, find out why the fuse has blown.

ATTENTION

Do not use fuses having higher amperage than that recommended, since they can damage the electric system seriously.



If the fuse blows after a short time, look for the fault source by checking the electric system.

Always keep some spare fuses for an emergency.

Never try to repair or short blown fuses.

Make sure the contacts of fuses and fuse sockets ensure a good electric connection and are not oxidized.

24. **Steering Column Tilt Lever** – Both the steering column and dashboard can be set to different angle. Loosen the control lever and adjust column as required then retighten to lock the column in place.

 **WARNING**

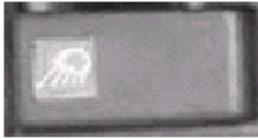
Before driving the machine, ensure the steering wheel is locked in place.



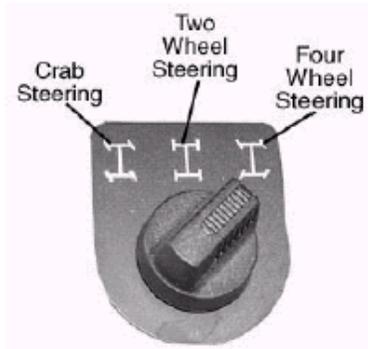
25. **Hazard Light Switch** – Fitted with on-off position, it switches on the hazard lights.



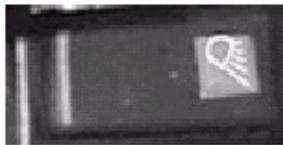
26. **Front Work Light** - A spot light located on the front of the machine, used for night working.



27. **Steering Selection Switch** – Three position switch for selecting the steering mode, See Steering / Tire Alignment.



28. **Rear Work Light** - A spot light located on the rear of the machine, used for night working



29. **Brake Pedal** – Gradually step on the brake pedal to decelerate and stop the machine. The brake operates on the front axle only.



30. **Accelerator Pedal** – Controls the engine rpm. and the machine speed. It is fitted with an adjustable stop located behind the pedal in cab.



31. **Turn Signals / Horn / Wiper / Windshield Washer Switch** –



- a. **Turn Signals** – Set lever to pos. 1 to indicate a turn left or to pos. 2 to indicate a turn to the right.
- b. **Windshield Wiper** – To operate the windshield wiper, rotate the lever tip to one of the four positions:

0	Wiper OFF
J	Timed wiper (if available)
1	Low Speed
2	High Speed

- c. **Windshield Washer** – Push the second stage of the lever to spray windshield washer solution on the windshield.
- d. **Horn Function** – By pressing the lever built-in button, horn will sound.

CONTROL AND INSTRUMENT SYMBOLS

This paragraph illustrates those symbols, which are normally applied on the main control devices and instruments of a standard machine, and those, which can be applied on accessories or special attachments.

Symbol	Description	Symbol	Description	Symbol	Description
	Hazard indicator lights		Steering selection		Lift/Tie Down
	Windshield wiper		Brake pressure		Work - road setting
	Windshield washer		Engine oil pressure		
	Cab ventilation fan		Boom raising		
	Diesel engine water temperature		Boom lowering		
	Fuel level		Boom extension		
	Hydraulic oil temperature		Boom retraction		
	Fork Rotating		Attachment locking device		
	Turn signals		Attachment releasing device		
	Parking brake		Fork pitching forward		
	Battery charge		Fork pitching back		
			Oil filter clogged		
			Air filter clogged		

3. Basic Operations:

a. Pre Operation Checks

(1) Perform the daily before-operation checks and services before the daily initial start of the engine as follows:

- ✓ Fluid Leaks
- ✓ All Windows and Light Clean
- ✓ All lights clean
- ✓ Tire and Wheels
- ✓ Guards in Place
- ✓ Operators Manual and
- ✓ Rating Chart in Cab
- ✓ Boom Slide Pads
- ✓ Engine Air Cleaner
- ✓ Engine Oil Level
- ✓ Hydraulic Oil Level
- ✓ Brake Oil
- ✓ Engine Coolant Level

(2) Before operating the machine verify the controls and functions listed below:

- ✓ Horn
- ✓ Gauges
- ✓ Brake Lights
- ✓ Reverse Lights
- ✓ Head Lights
- ✓ Turn Signal Lights
- ✓ Black Out Lights
- ✓ Wipers (front & rear)
- ✓ Park Brake
- ✓ Transmission
- ✓ Service Brake
- ✓ Accelerator
- ✓ Back up Alarm
- ✓ Steering Selector
- ✓ Wheel Alignment
- ✓ All hydraulic functions
- ✓ All switches
- ✓ Secondary Steering

4. STARTING PROCEDURES:

Do not operate the starter motor for more than 20 seconds at a time. If the engine fails to start within that time, release the switch lever and wait 2 minutes before trying again. If this precaution is not followed serious damage to the starter motor may result.

(1) To start the engine proceed as follows:

- a. Apply the parking brake.

- b. Place the gear lever in the NEUTRAL (N) position.
- c. To start the engine, turn the ignition switch on and release when the engine starts. If the engine does not start within 20 seconds, release the switch lever and wait at least 2 minutes before attempting again.
- d. As soon as the engine starts reduce engine speed to idle. Wait some seconds before engaging a gear; this allows for a gradual warm up of the engine oil and a better lubrication.
- e. Release the parking brake.
- f. Slowly press the accelerator pedal to start moving.

5. STOPPING PROCEDURES:

(1) To stop and park the machine proceed as follows:

- a. When possible, stop the machine on a dry, level and firm ground.
- b. Bring the machine to a smooth stop by easing up the accelerator pedal and stepping down on the brake pedal.
- c. When stopped engage the parking brake and ensure its indicator lights up.



Always engage the parking brake when stopping the machine to prevent any accidental motion of the vehicle.

- d. Release the service brake pedal.
- d. Rest the attachment coupled to the boom flat on the ground.
- f. Get out the operators cab and close the cab door.



Always face the machine when getting off the driving cab; make sure that your hands and shoe soles are clean and dry, and hold to the handholds to prevent falls and slips.

- g. Set the battery cutout switch to OFF position.

6. LOAD CHART



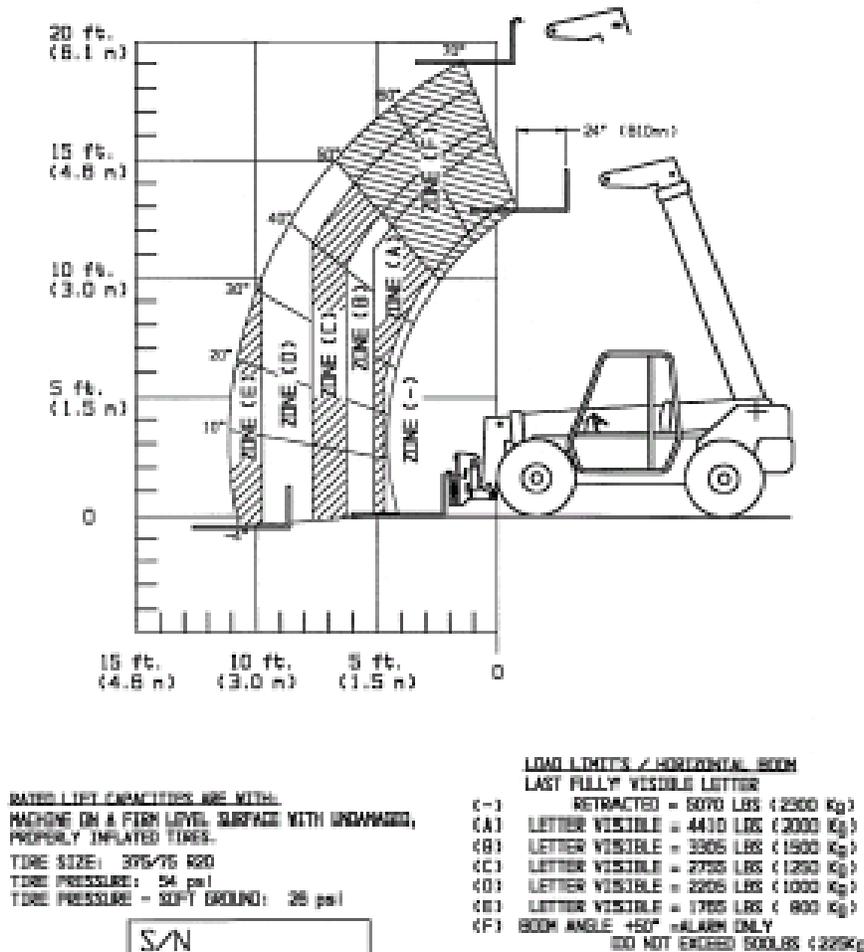
The load charts illustrated in this manual are given only as an example. To define the payload limits, refer to the load charts applied within the cab of your machine.



The load charts applied within the cab refer to a stationary machine stopped on a solid and level ground. Raise the load a few inches and check its stability before raising it completely.

When moving from one zone to another, the smallest rated capacity must be used.

TEREXLIFT TX51-19M



a. This tractor is equipped with a load chart. If the load chart is damaged, missing, or unreadable the forklift will be safety deadline.

b. The load chart must be used to determine a safe boom angle and boom length, with respect to the weight of the load.

c. The angle and extension indicators must be used along with the load chart instructions to determine correct boom lifting capacities.

(1) Boom Angle - Is the angle determined when the boom is raised from a horizontal position.

(2) Boom Length - Is the distance from the center of the boom hinge pin at the base of the boom to the end of the last boom section. The alpha characters, "A", "B", or "C" on the left side of the boom, indicate this distance.

d. For any lifts made, all corresponding load charts are read the same way.

- (1) Boom lengths are shown along the bottom, and listed as ZONE (-) through (E).
- (2) Above each boom length gives a complete range of boom angles.
- (3) Each ZONE, shown on the bottom right hand corner, will give a specific weight that can be safely lifted for that ZONE.

7. CHANGING ATTACHMENTS

1. Disconnect the quick connectors from the fork rotate cylinder and connect them to the attachment lock / unlock cylinder. Then disconnect the quick connectors from the side shift cylinder.
2. Disconnecting the quick connectors of the attachment, and connect the hydraulic locking pipes of the attachment to couplings.
3. Operator the Joystick function to unlock attachment pins.
4. Rest the attachment flat on the ground.
5. Tilt the holding frame forward and retract the boom to release the attachment upper lock.
6. Move back with the machine (or with the boom) and drive to the new attachment going to be coupled.
7. Hold the frame tilted forward and hook the upper pins of the new attachment.
8. Retract and raise the attachment a few inches. Attachment will center automatically on the quick coupling frame.
9. Operate the joystick function to lock the attachment.
10. Couple the connectors of the attachment, to the quick couplings of the frame.

8. TOWING THE MACHINE

Each towing situation presents special problems, which cannot be anticipated in advance. Therefore, the following procedures are general in nature. Additional steps may also be necessary to safely tow the machine under a given set of circumstances. If it becomes necessary to tow the machine, proceed as follows:

1. Attach a tow bar from the towing vehicle to the lowing lugs on rear of machine.
2. Tow the machine for short distances and at a low speed only (max. speed 20 mph).
3. Select the two-wheel steer.
4. Disconnect the hydraulic motor from the axle.
5. Move the speed selection lever to neutral and release the park brake.

9. EMPLOYMENT

- (1) **General Forklift Operation:** In a garrison or field environment, the Light Capability Rough Terrain Forklift, TX51-19M (LCRTF) can be used for loading and unloading trailers, trucks, aircraft, ISO containers and ships.
 - (a) When positioning the forklift to pick up or deposit a load, it should be brought in square to the load.
 - (b) Use side shift to align the carriage if needed.
 - (c) When working in uneven terrain or the load is at an angle, use the rotation or oscillation control.
 - (d) Always carry a load against the fork carriage.
 - (e) Carry the load as low to the ground as possible or 12 to 18 inches.
 - (f) The fork carriage should be tilted back when carrying a stable load. Not all loads are to be considered stable, some loads need to be carried with the carriage level.
 - (g) Wide loads should be carried centered on the forks.
 - (h) When hauling bulky loads travel in reverse.
 - (i) When hauling a load up a steep grade travel forward with forks tilted to the rear.
 - (j) When hauling a load down a steep grade travel in reverse with the forks tilted to the rear.

***IMPORTANT: NEVER exceed the rated capacities of the forklift.
NEVER add extra counter weight.
NEVER add fork extensions.***

- (2) **Operating the Forklift:** The engine should be permitted to operate through a short warm-up period at all times prior to putting the forklift in action. This enables the operator to observe the various indicating instruments and check operation of the engine.

10. OPERATING THE CONTROL LEVER:

Handlers are equipped with a piloted supplied service control lever. Only one function can be operated at a time.

The lever is equipped with a two-position button that returns to central position for the selection of the Fork Attachment functions: Side Shift, Rotate, Tilt and Disconnect Attachment.

Additionally, when operated in the four directions (right / left, forward / back) it allows for the control of the boom functions (up / down, retract / extend) and the Fork Attachment functions (forward / rearward tilting), (left/right side shift), Rotate clockwise / counter clockwise, connect / disconnect attachment.



Smoothly move the control lever. The motion speed of the actuators depends on the lever position: a small motion results in a slow control movement of the actuators; vice versa, a full range motion of the lever corresponds to the max. speed of the actuator.



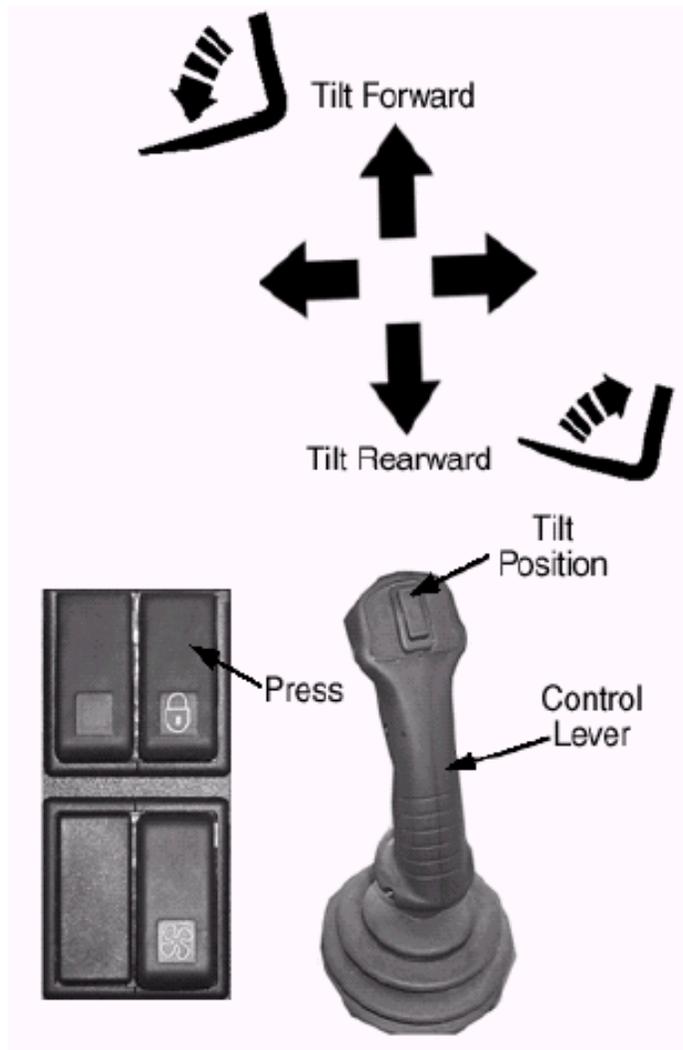
Before operating the control lever, make sure that nobody is within the working range of the machine.

11. TILTING THE FORKS FORWARD AND REARWARD:



Before operating the boom, make sure that nobody is within the working range of the machine.

- Depress the rocker switch forward to tilt position.
- Shift the lever forward to tilt the forks forward.
- Shift the lever rearward to tilt the forks rearward.

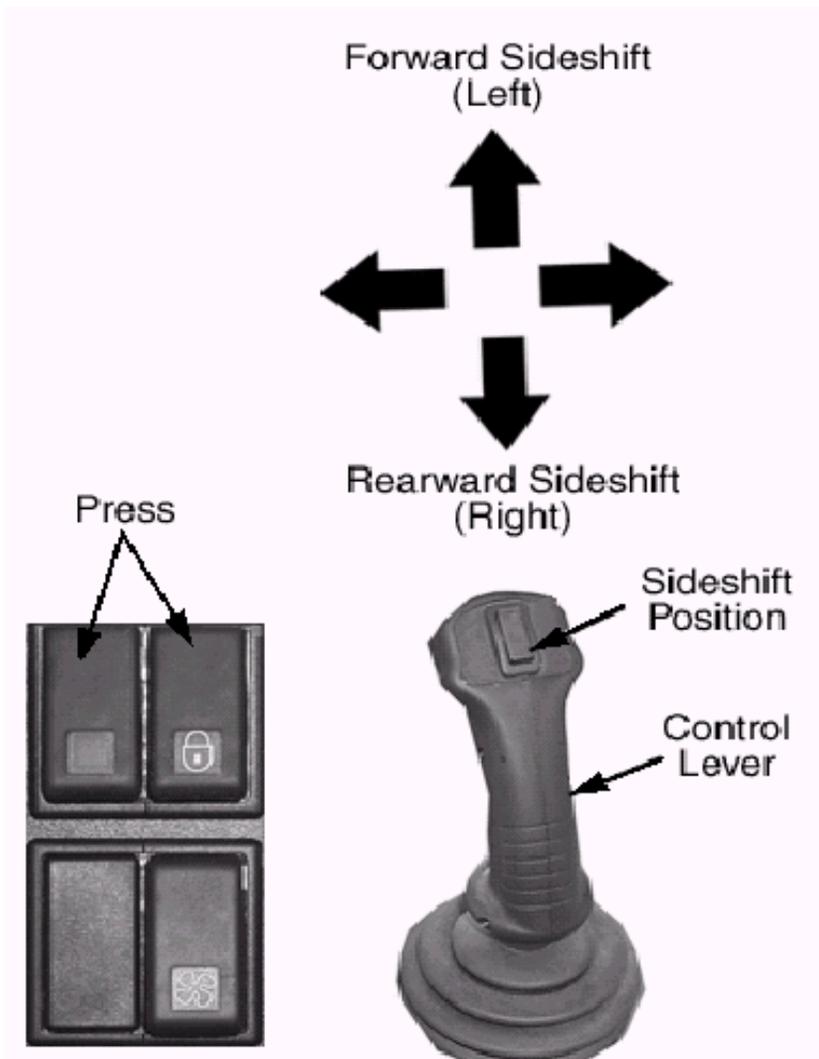


12. SIDE SHIFTING THE FORKS:

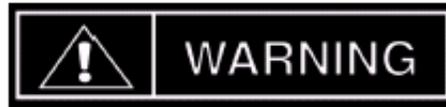


Before operating the Forks make sure that nobody is within the working range of the machine.

- Ensure the side shift / Rotate rocker switch is depressed in the Side Shift Position.
- Depress the rocker switch on the lever to the Side Shift Position.
- To Side Shift the Forks left move the control lever forward.
- To Side Shift the Forks right, move the control lever rearward.

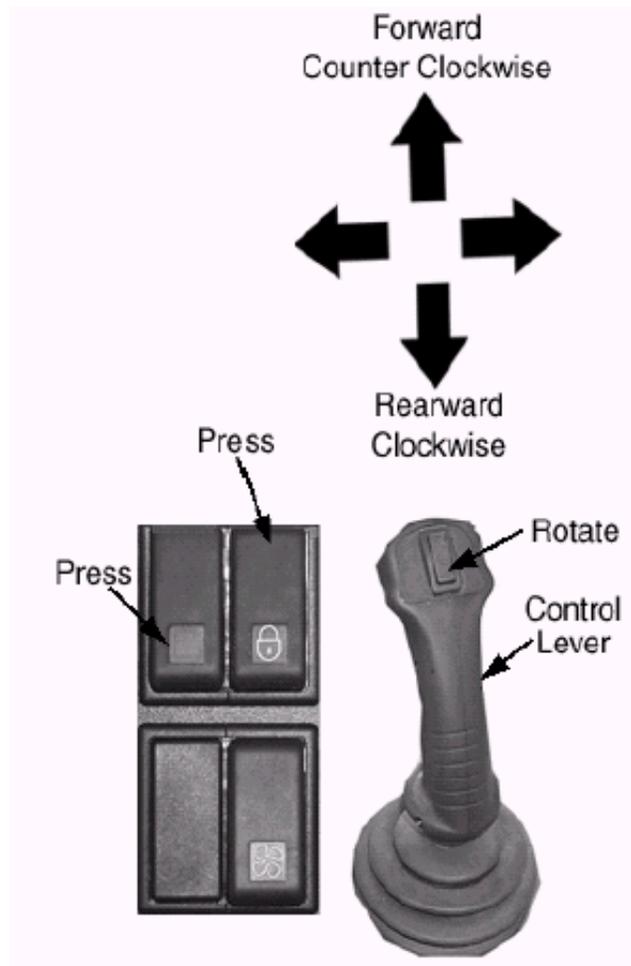


13. ROTATING THE FORKS:



Before operating the boom, make sure that nobody is within the working range of the machine

- Ensure the side shift / rotate rocker switch is in the rotate position.
- Depress the rocker switch on the control lever to the rotate position.
- To rotate the fork clockwise move the control lever rearward.
- To rotate the forks counter clockwise move the control lever forward.



14. QUICK COUPLING THE FORK ATTACHMENT:



Before operating the boom, make sure that nobody is within the working range of the machine.

To lock / unlock the attachment couplings, it is necessary to change the connection of the hydraulic lines to the control valve placed on the fork carriage carrier element.

- Disconnect both quick couplings controlling the fork rotation.
- Connect hoses that feed the locking cylinder whose quick couplings are coupled to the hose holding attachment.
- Depress the rocker switch on the control lever to the lock/unlock position.
- To unlock the fork attachment move the lever forward.
- To lock the fork attachment move the lever rearward.

