Introduction

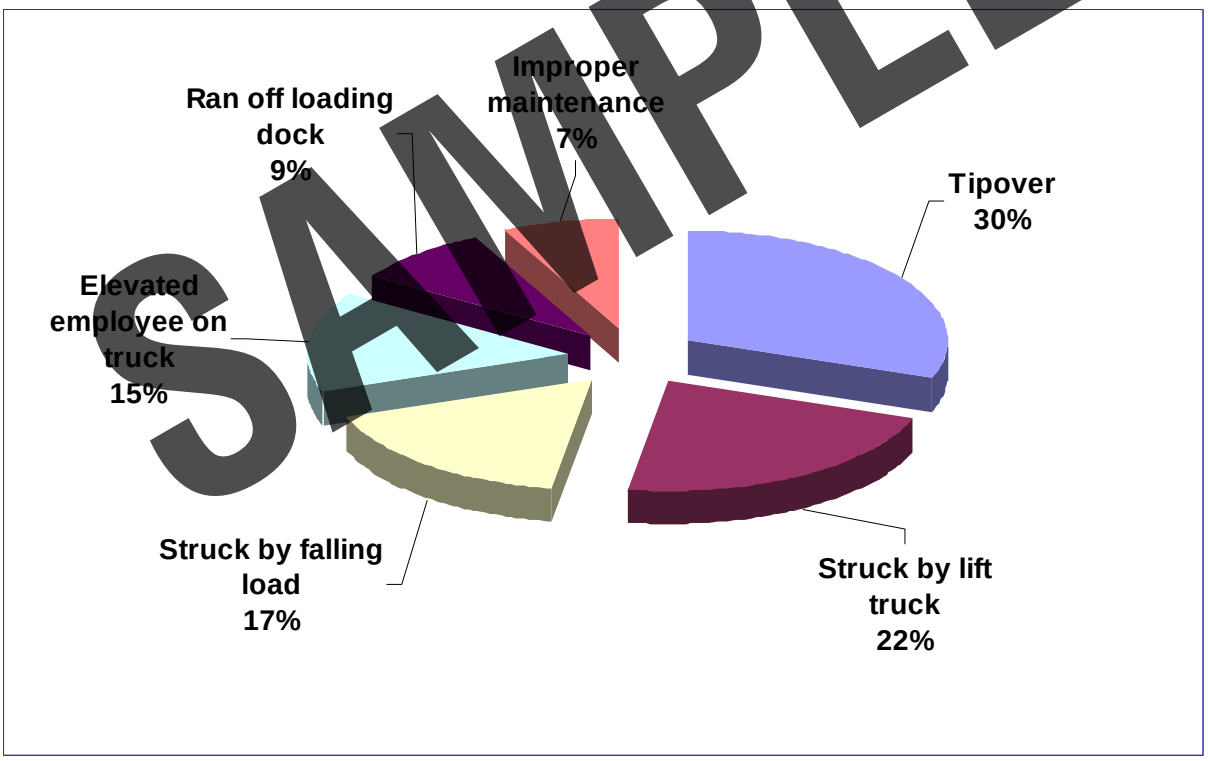
Why Telescopic Handler Operator Safety Training?

1. Training can reduce the risk of accidents and injuries to you and those you work with.

2. Training can also reduce operating cost of your company by avoiding damage to property and product.

3. The Federal Occupational Safety and Health Act, OSHA, requires all lift truck operators to be trained and authorized to operate a lift truck

Lift Truck Accidents



Each year approximately 100 workers are killed and almost 95,000 are injured in lift truck accidents.

Introduction Review

1. **According to OSHA, approximately _____ workers are killed each year in telescopic handler accidents.**

   a. 25
   b. 50
   c. 75
   d. 100

2. **The major reasons why telescopic handler training are so important are:**

   a. It's the law.
   b. It protects the workers.
   c. It reduces operating costs.
   d. All the above.

3. **The number one cause of telescopic handler accidents is:**

   a. Running off the loading dock.
   b. Tip over.
   c. Struck by falling load.
   d. Improper maintenance.

4. **Once you are trained you can operate any type of telescopic handler.**

   a. True
   b. False

Telescopic Handler Fundamentals

What is a professional telescopic handler operator?

- Is responsible.
- Is on time.
- Is rested, alert, and physically prepared.
- Is knowledgeable about safe operating procedures and company policy.
- Never stops learning about his profession.
- Is a skilled operator and never stops trying to improve upon those skills.
- Keeps the machine under control at all times.
- Wears protective clothing where applicable.

This means they are not under the influence of alcohol, drugs, or medication, which could inhibit their ability to operate the telescopic handler safely. Operators also need to be properly dressed for the weather to avoid fatigue and stress on the body. Long hours of operation can dull the operator's senses and therefore breaks are necessary to keep the mind alert.

Being a Professional is a Matter of:

- **Attitude**
- **Team work**

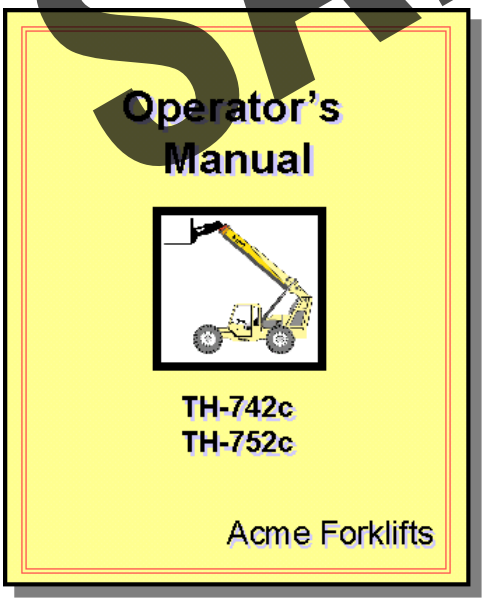
Telescopic Handler Fundamentals

Telescopic Handlers vs. Automobiles

- Telescopic handlers are not to be used to transport people. Only the operator is to be aboard the vehicle when in motion.
- A typical telescopic handler will weigh in excess of 8,000 lbs. where most automobiles weigh much less than this.
- Like automobiles, telescopic handler operators must be properly trained and have passed a proficiency examination prior to operating the vehicle without supervision.
- Telescopic handlers operate on a variety of surfaces. Most automobiles are designed to operate on relatively smooth surfaces.
- Telescopic handlers typically do not have as efficient braking as an automobile.
- Telescopic handlers use many types of steering.

Operators Manual

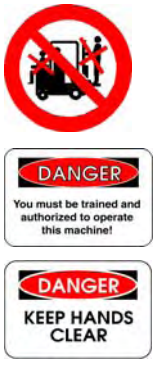
A well-trained telescopic handler operator is familiar with the design of the telescopic handler he is operating.
The vehicle manufacturer's Operation and Maintenance Manual is very important in becoming familiar with the machine. To know how to inspect, operate, and fuel the vehicle correctly, operators must read and understand the manual. **It is required that the Operation and Maintenance Manual be kept on the machine at all times.**



Signal Words

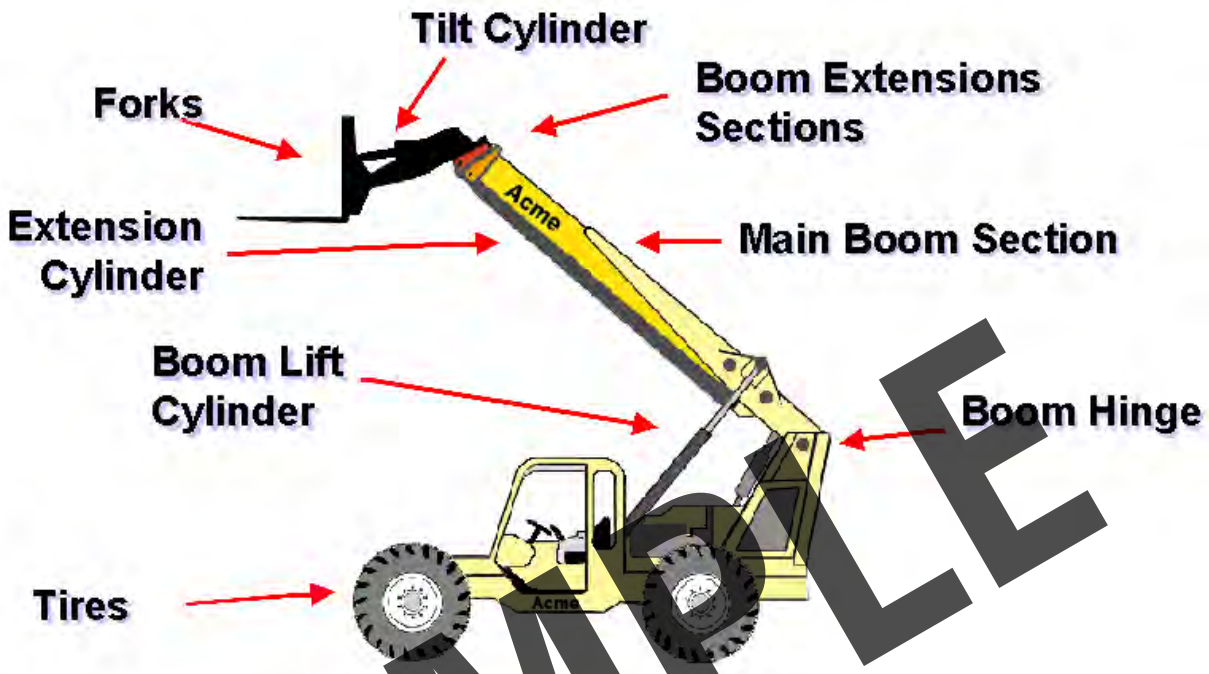
DANGER	Indicates imminently hazardous situation. If not avoided will result in death or serious injury.
WARNING	Indicates potentially hazardous situation. If not avoided could result in death or serious injury.
CAUTION	Indicates potentially hazardous situation. If not avoided may result in minor or moderate injury.

Safety Decals



Safety Decals Must Be Legible And Kept Intact As Provided By The Manufacturer. Illegible Labels Need To Be Replaced.

Telescopic Handler Fundamentals



Other telescopic handler characteristics and options:

- Sway control
- Stabilizers
- Truss (jib) boom
- Bucket
- Rotating forks
- Crab steering
- Four wheel steering
- Enclosed cab
- Joy stick
- Safety overload warning

Telescopic Handler Fundamentals Review

1. Which is not a characteristic of a professional telescopic handler operator?

a. Capable of doing any job without help from others.
b. Responsible.
c. Keeps the machine under control at all times.
d. Never stops learning about his profession.

2. All telescopic handlers are required to have all warning labels visible and legible.

a. True
b. False

3. The Operation and Maintenance Manual is to be on the machine at all times.

a. True
b. False

4. The major differences between automobiles and telescopic handlers are:

a. Telescopic handlers typically weigh more.
b. Telescopic handlers use multiple steering modes.
c. Telescopic handlers do not carry passengers.
d. All the above.

Pre-Operation Inspection

Every telescopic handler part must always be in safe working order. OSHA requires vehicle inspection before each day's use and before each shift for machines used around the clock. Thorough inspections are essential to telescopic handler safety. Never use a telescopic handler that has any damage or operating problem. It must be reported and removed from service**. About 6% of all telescopic handler accidents are a result of improperly maintained telescopic handlers.**

Telescopic handlers that are Inspected Regularly result in:

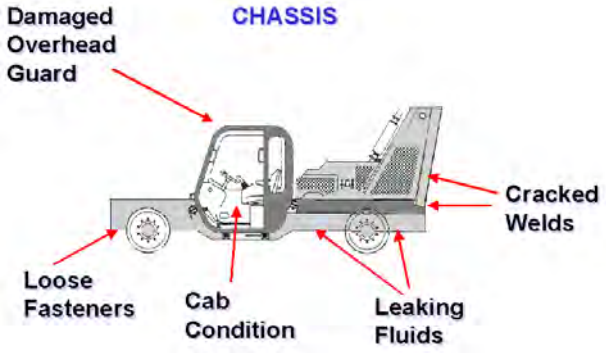
- Reduced downtime
- Increased productivity
- Reduced cost
- Improved safety
- Better care of equipment
- ***Federal OSHA requires it***

Telescopic handler Visual Inspection Checklist:

- ☐ Overall condition
- ☐ Frame
- ☐ Tires
- ☐ Forks
- ☐ Overhead Guard
- ☐ Engine Compartment
- ☐ Electrical Equipment
- ☐ Control labels and markings
- ☐ Operators compartment
- ☐ Fuel level

Some companies provide the operator with an inspection booklet that is filled out daily to ensure that pre-inspections are taking place.

Pre-Operation Inspection



Note: Escaping hydraulic fluid under pressure can penetrate the skin and cause serious injury.

- Use a piece of cardboard or paper.
- **Do not** use your hands.

TIRES AND RIMS

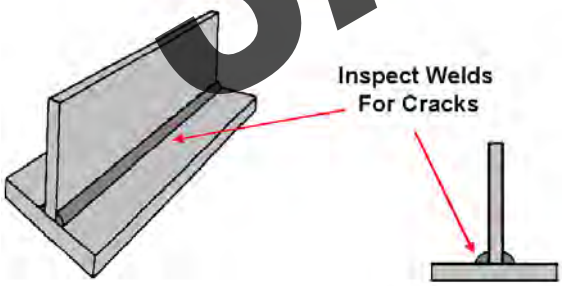
Inspect for:

- Proper Inflation
- Cuts and Gouges
- Worn Tread
- Bent Rims
- Missing Lug Nuts

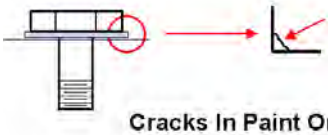
SWAY CONTROL
LATERAL LEVELING

Hydraulic Cylinders Used to Adjust Machine From Side To Side

CRACKED WELDS



CHECKING FOR TIGHTNESS

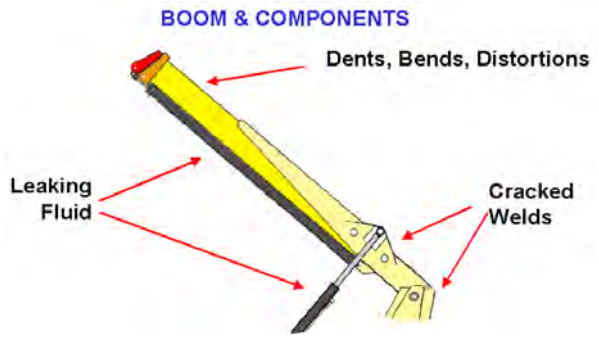


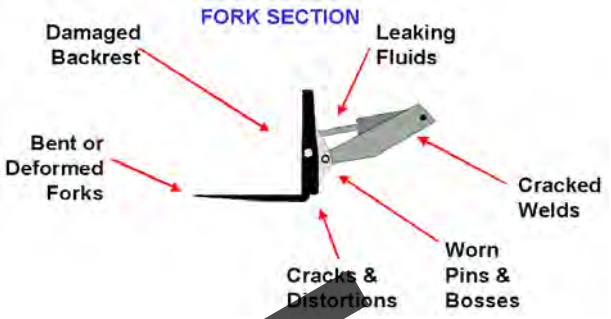
Cracks In Paint Or Dirt Build-up Often Is Caused By Loose Bolts.

- Any unauthorized welding can cause structural failure.
- **Do not** weld or cut on any structural member.

- Loose fasteners should be removed, cleaned and re-torque to specifications.
- Replace it if uncertain of its condition.

Pre-Operation Inspection





- With the boom extended, check for dents, bends, or other distortions. As a rule of thumb, dents over 1/8" deep need to be investigated. Check with the manufacturer.
- Holes that are drilled in the forks or cut out with a torch, weaken them.

Telescopic Handler Operational Inspection Checklist:

- ❑ All warning devices, including horn, must be operational.
- ❑ Gauges should be checked for normal operation.
- ❑ Boom should be fully extended and retracted to ensure it operates smoothly.
- ❑ Verify all steering modes work properly.
- ❑ Test parking brake and service brakes.
- ❑ Test sway controls.
- ❑ Seat belts, if provided, need to be functioning properly

Completion of Inspection

- Report All Defects To Appropriate Individuals
- Never Operate A Telescopic Handler In Need Of Repair
- Only Authorized & Trained Personnel Make Repairs

Pre-Operation Inspection Review

1. Federal OSHA requires the telescopic handler to be inspected:

a. Once a week.
b. At the start of the day or each shift.
c. Once a month.
d. Once a quarter.

2. Pre-operation inspection can:

a. Improve safety.
b. Reduce down time.
c. Reduce cost.
d. All the above.

3. When defects are noted during the pre-operation inspection, it is ok to use the machine until another machine becomes available.

a. True
b. False

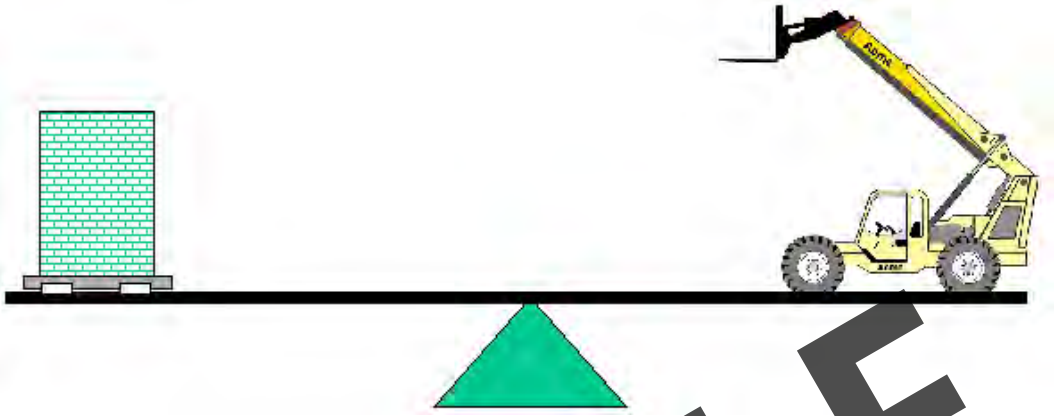
4. It is not necessary for the operator to authorized to make repairs as long as he has access to the proper tools.

a. True
b. False

5. What is the best way to check for hydraulic fluid leaks?

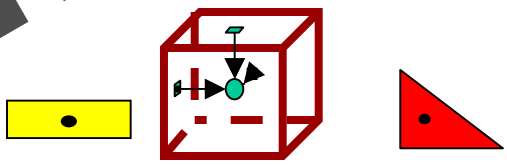
a. Use your hand.
b. Use a piece of cardboard.
c. Use a gloved hand.
d. Look real close.

Telescopic Handler Stability & Capacity



Center of Gravity

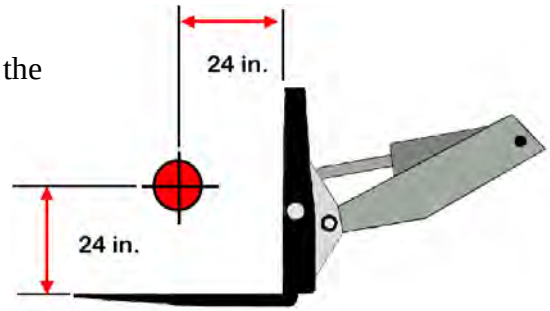
A point in the load around which all weight is evenly distributed



Telescopic Handler Capacity

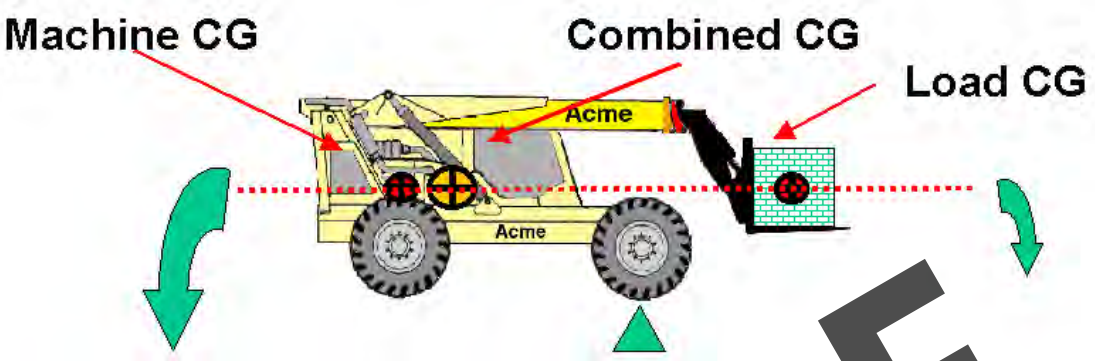
Most telescopic handlers rate the capacity of the vehicle based on a load center measured 24” from the the backrest and 24” up from the forks.

When the loads center of gravity is outside this range, the capacity of the machine decreases.



Telescopic Handler Stability & Capacity

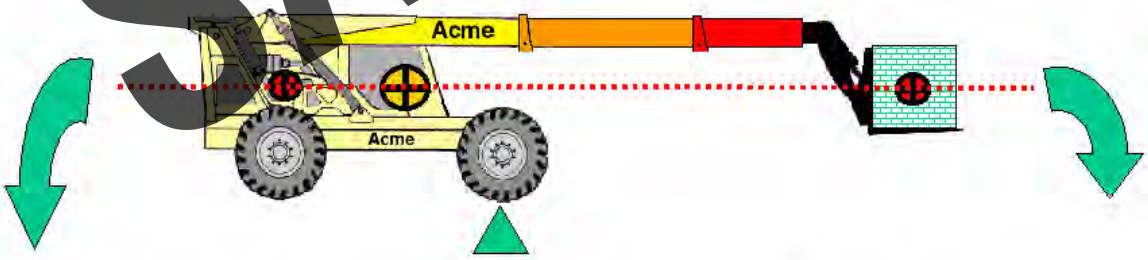
Telescopic Handler Stability



Weight Behind The Front Axle Offsets
The Weight In Front Of The Axle

Changing Stability

Combined CG is always on the
line between load & machine CGs

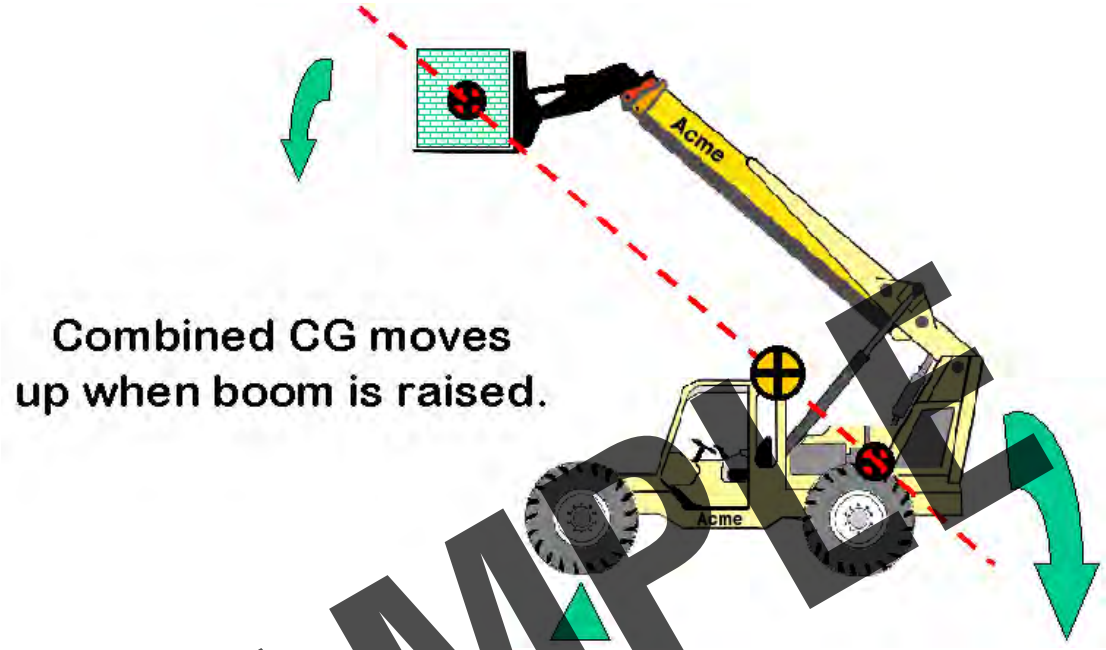


As the load moves farther from the pivot point
the combined CG moves forward.

- **Anytime the center of gravity moves over or beyond the front axle there could be a tip over.**

Telescopic Handler Stability & Capacity

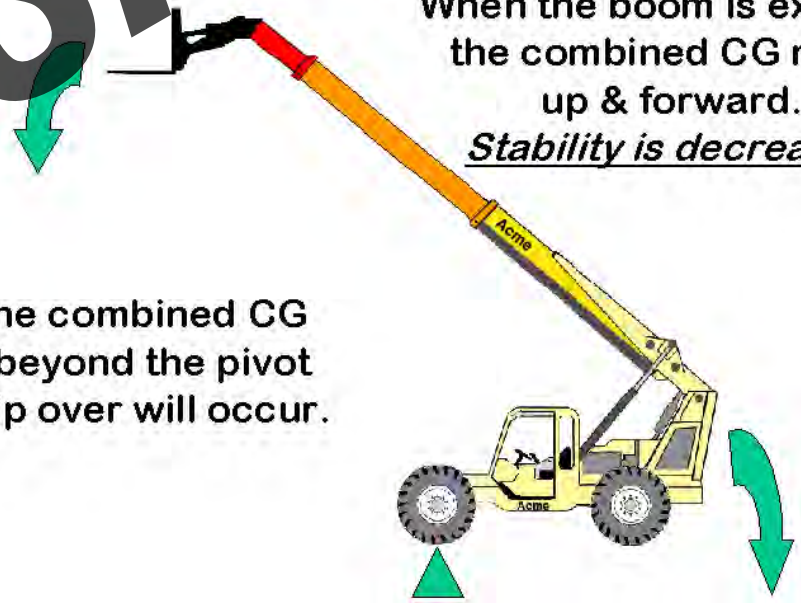
Changing Stability



Combined CG moves up when boom is raised.

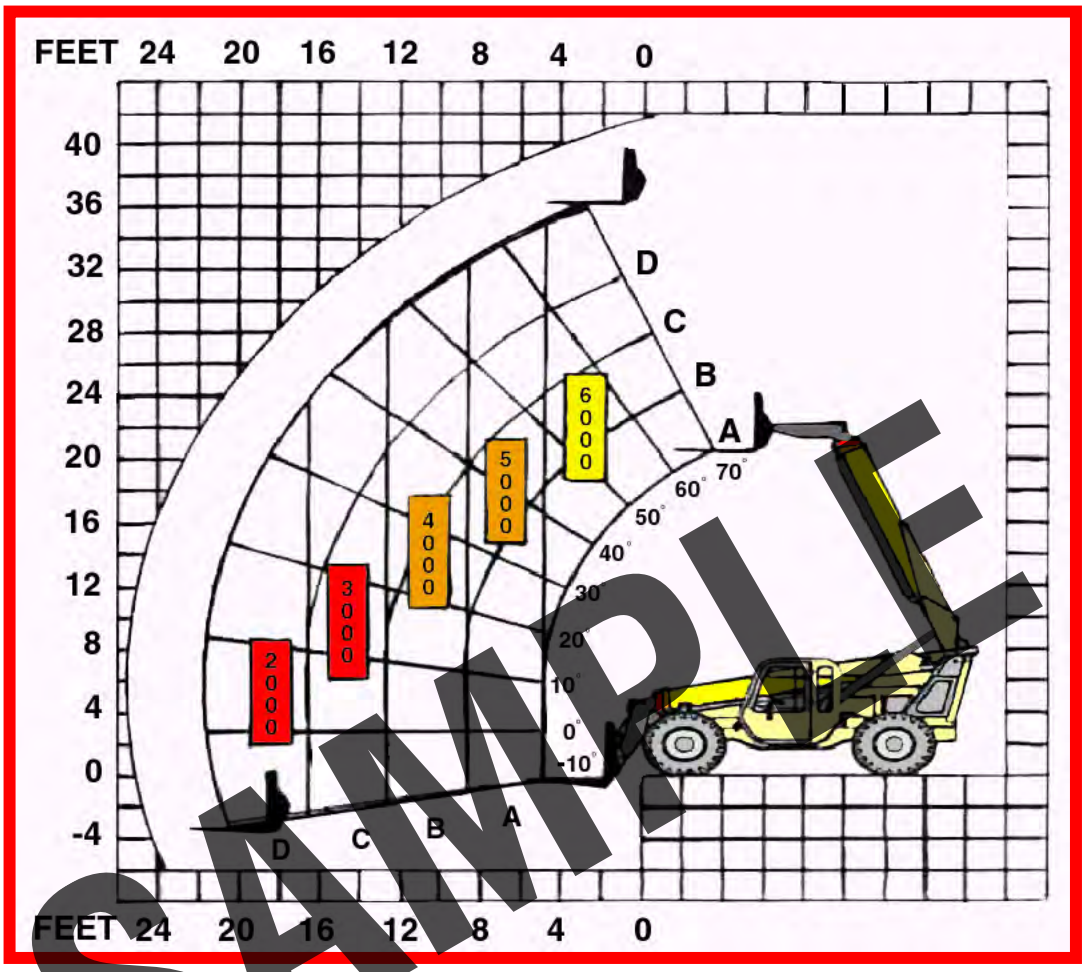
Changing Stability

When the boom is extended the combined CG moves up & forward.
Stability is decreasing.



When the combined CG moves beyond the pivot point, tip over will occur.

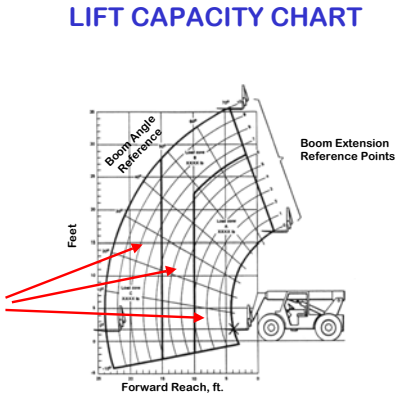
Load Capacity Chart



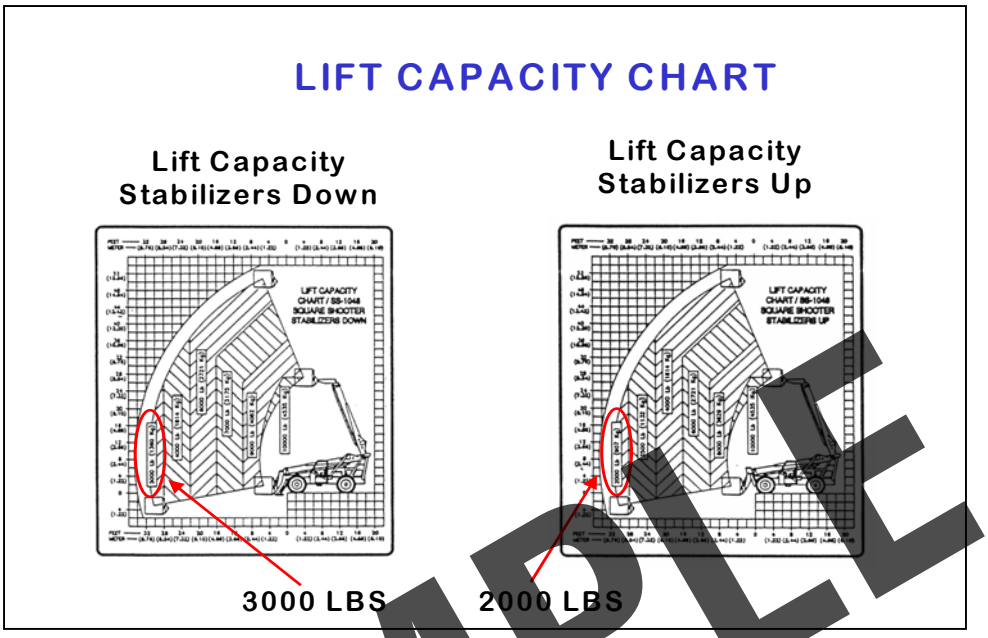
The load chart shows the operating limits of a **properly maintained and operated** machine. To use the load chart, the operator **must** know the weight of the load and how far 'out' and 'up' it is to be placed.

If the load is heavier than stated on the load chart, 3 options can be used:

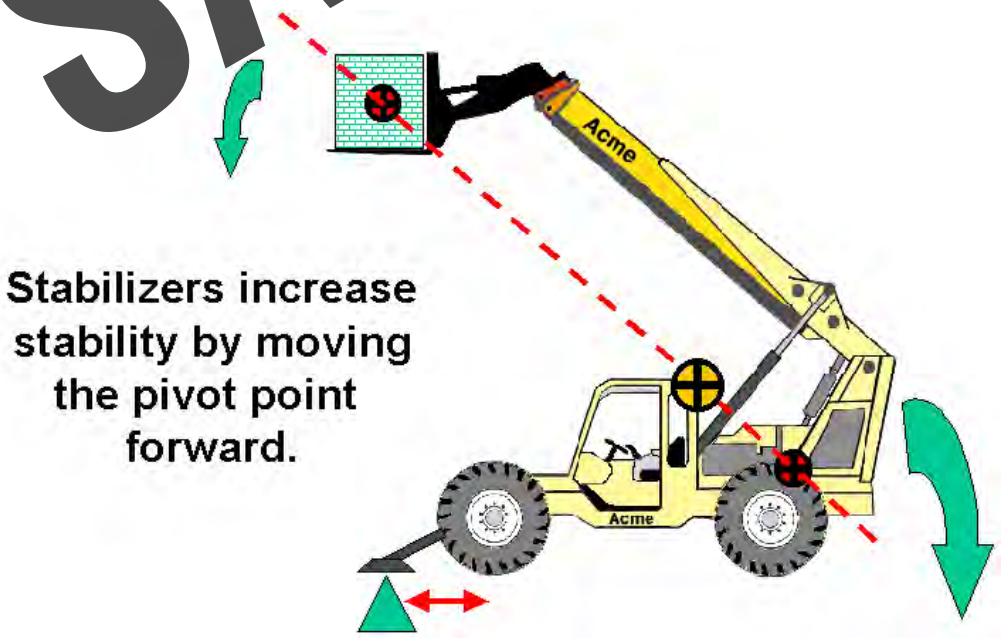
1. Move the machine closer to the load.
2. Break the load down into smaller loads.
3. Use a larger machine that can handle the load.



Load Capacity Chart



- Some telescopic handlers have stabilizers. This will increase the lift capacity by widening and extending out the balancing point.
- The operator needs to make sure he is referencing the correct load chart when making a lift.



Attachments to the Telescopic Handler

The capacity of the telescopic handler is affected any time an attachment is added to the machine. The attachment will:

- Add weight to the front of the machine causing it to be partially loaded.
- The additional weight may extend the load center.

If you want to add an attachment to the telescopic handler after you receive it from the manufacturer, you must:

- Have written approval from the manufacturer.
- Have a new capacity plate installed on the telescopic handler indicating the new capacity when using that attachment. The plate is only available through the manufacturer.

Dynamic and Static Conditions

The telescopic handler's balance is affected by both **static** and **dynamic** conditions. Static conditions are those which affect the telescopic handler when it is not moving. Dynamic conditions are created when the telescopic handler is moving.

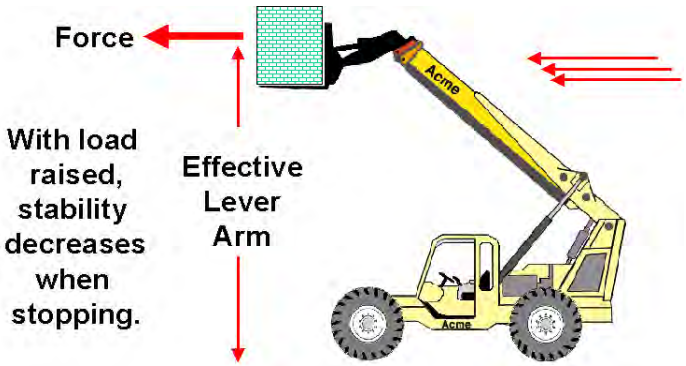
Static conditions include:

- Load size
- Load shape
- Position of load on forks
- Lift height
- Amount of tilt
- Tire pressure

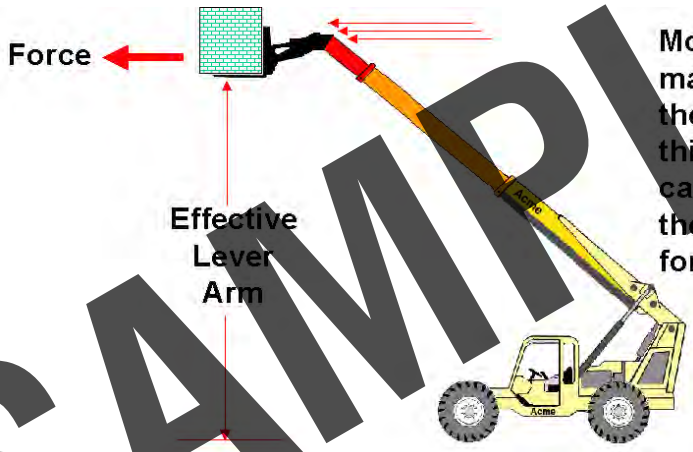
Dynamic conditions include:

- Acceleration
- Speed
- Braking
- Ramps and slopes
- Raising load
- Lowering load

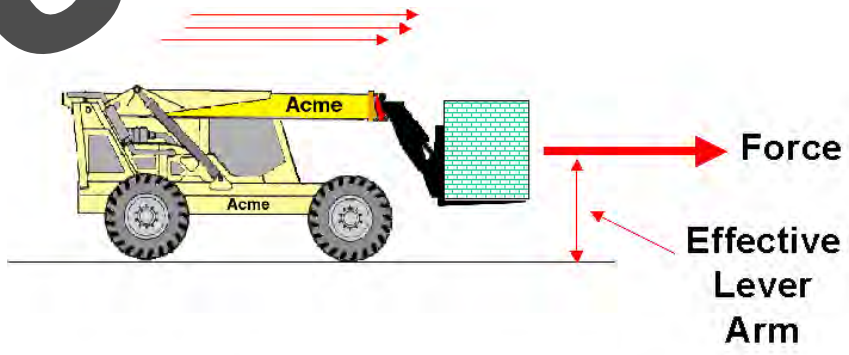
Dynamic and Static Conditions



- The length of the boom makes it an effective lever arm.



- The further out the boom is extended, the easier it is to tip over.

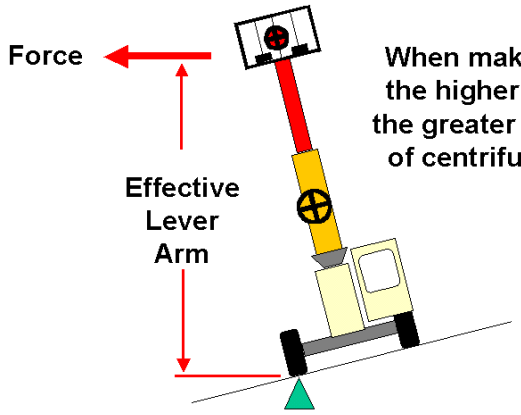


Moving the machine with the load low has minimal effect on stability.

- Therefore, never move the machine with the boom above travel height.

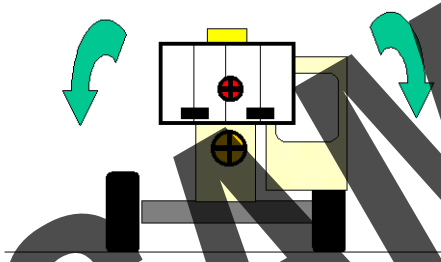
Dynamic and Static Conditions

Lateral Stability



When making a turn the higher the load, the greater the effects of centrifugal force.

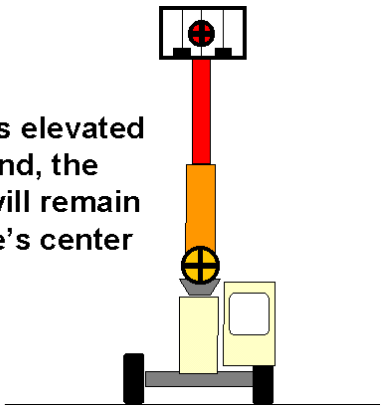
- Never turn a telescopic handler with the forks n the air.
- Avoid turning on a slope.



On level ground, the combined CG will be on the machine's center line.

- Lateral stability is the stability of the machine from side to side.
- When the load is carried low to the ground, the combined CG will be on the center line.
- This is the most stable position for traveling.

When the load is elevated on level ground, the combined CG will remain on the machine's center line.

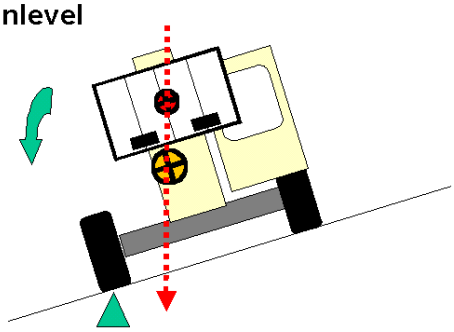


- When the load is raised on level ground and no wind is present, the combined CG will remain on the machine's center line.
- This is only true when the machine is level.

Dynamic and Static Conditions

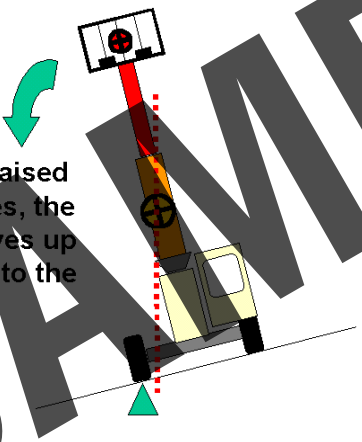
Lateral Stability

When the load is kept low lateral stability remains good even on unlevel surfaces.



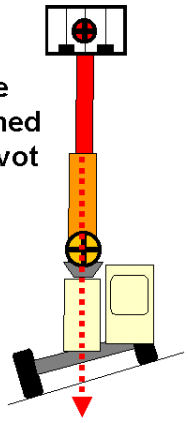
- Note how the combined CG moves toward the down slope wheels which now become the pivot point
- If the slope were steep enough, the combined CG would move past the wheels resulting in a tip over.

When the load is raised on unlevel surfaces, the combined CG moves up and comes closer to the pivot point.



- When the load is raised, the combined CG moves upward. Because the machine is on a slope, the CG moves toward the direction of the pivot point wheels more rapidly and can result in a tip over.
- Thus, an elevated load on a slope is more likely to cause a tip over than a load in the lowered position.

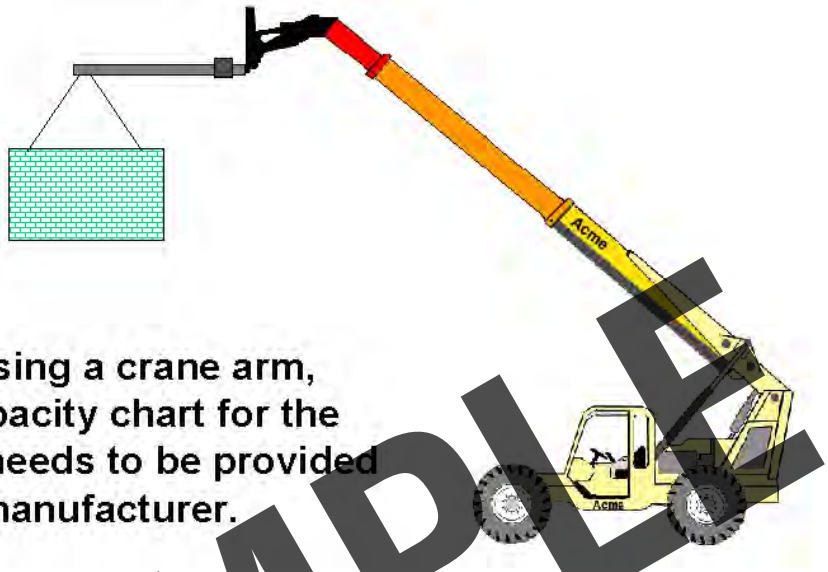
Leveling the machine will move the combined CG away from the pivot point.



- Leveling the machine with the sway control will move the combined CG back toward the center line.
- The machines lateral stability is restored.
- Never attempt to level the machine with the boom raised.

Dynamic and Static Conditions

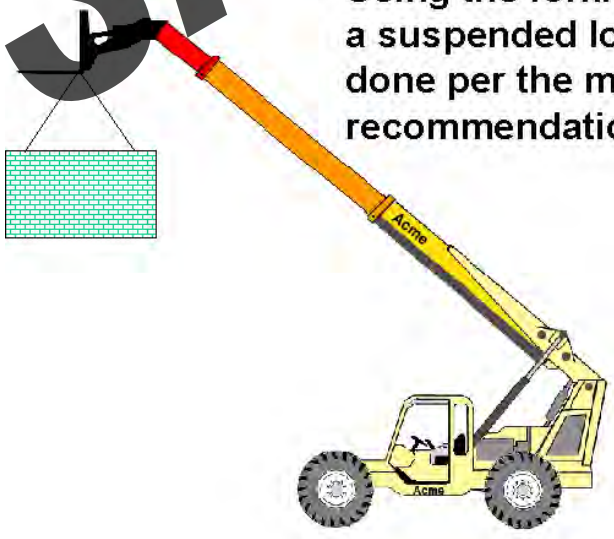
Lifting Suspended Loads



When using a crane arm, a lift capacity chart for the forklift needs to be provided by the manufacturer.

At no time should any load be suspended from the forks by use of chains, ropes, straps etc. If a load must be suspended the use of a Truss (Jib) boom is mandatory. Proper rigging procedures should always be followed.

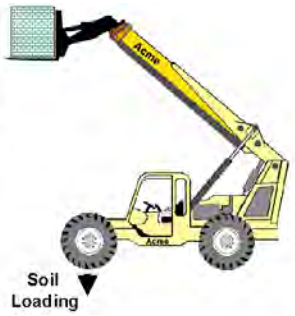
Using the forklift to move a suspended load needs to be done per the manufacturer's recommendations.



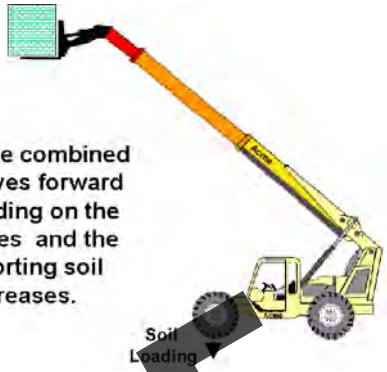
Dynamic and Static Conditions

Soil Bearing Strength & Stability

Stability also depends the strength of the soil to support the front tires or stabilizers.



When the combined CG moves forward the loading on the front tires and the supporting soil increases.



Many telescopic handler accidents occur as the load is being lifted and boomed out, the ground gives way to the weight of the load and the telescopic handler tips over.

SOIL BEARING STRENGTH & STABILITY

Soil Type	lbs/sq. in.	Conditions
Sound Rock	833	
Medium Rock	555	
Interm. Rock	277	
Porous Rock	28 - 111	
Hard Pan	166	Well Cemented
Hard Pan	111	Poorly Cemented
Gravel Soils	139	Compact, Well Graded
Gravel Soils	111	Compact w/ more than 10% gravel
Gravel Soils	83	Loose, Poorly Graded
Gravel Soils	55	Loose, Mostly Sand
Sand Soils	42 - 83	Dense
Fine Sand	28 - 55	Dense
Clay Soil	69	Hard
Clay Soil	28	Medium Stiff
Silt Soil	42	Dense
Silt Soil	21	Medium Dense
Compacted Fill	28 - 55	By Test Only

Telescopic Handler Stability and Capacity Review

1. The stability of a telescopic handler is based on what principal?

a. Gravity
b. Stability
c. Balance
d. Momentum

2. The balancing point of a telescopic handler is:

a. The counterbalance
b. The rear wheels
c. The front wheels
d. The boom or mast

3. What may happen when the combined center of gravity moves over the front wheels of the telescopic handler?

a. Potential for a tip over
b. Loss of steering
c. Loss of traction
d. All the above

4. A legible lift capacity chart is always to be mounted on the machine.

a. True
b. False

5. An attachment to the telescopic handler can be installed at any time without written approval from the manufacturer

a. True
b. False

6. The later stability of the telescopic handler is better on a level surface.

a. True
b. False

7. The center of gravity is always at the physical center of the load.

a. True
b. False

8. The point in an object around which all the weight is evenly distributed is:

a. The weight of the load
b. The center of gravity
c. The balancing point
d. The fulcrum point

9. When a load is lifted, the center of gravity of the telescopic handler does not change position.

a. True
b. False

10. When the stabilizers are down, they become the balancing point of the telescopic handler.

a. True
b. False

Safe Operating Guidelines

Operator Qualifications

- Only trained and authorized operators shall be permitted to operate a telescopic handler.
- Operators of telescopic handlers shall be qualified as to visual, auditory, physical, and mental ability.

Operator Training

- The user shall ensure that operators understand that safe operation is the operators responsibility.
- An effective operator training program should center around user's company policy, operating conditions, telescopic handlers.
- The training should be presented completely to all new operators and not be condensed for those claiming previous experience.

Safe Operating Guidelines

- Safe operation is the responsibility of the operator.
- The operator shall develop safe working habits.
- He shall be familiar with all controls and instruments.
- He shall be familiar with the Operators Manual.

Climbing On and Off a Telescopic Handler

- Many telescopic handler operators suffer minor injuries climbing on and off a telescopic handler.
- Make sure hands and feet are free of grease and oil.
- Squarely face the vehicle and use the three-point method:
  - two hands and a foot for mounting.
  - one hand and two feet for dismounting.
- Avoid grabbing the steering wheel.
- Never jump on or off a moving machine.

Safe Operating Guidelines

General Safety Guidelines

- **Before beginning to operate telescopic handler:**
  a) fasten seat belt, if so equipped;
  b) place directional controls in neutral;
  c) disengage clutch on manual transmission, or apply brake on power shift or automatic;
  d) start engine.

- Do not start or operate telescopic handler, any of its functions,or attachments from any place other than the designated operators position.

- Keep hands and feet inside the compartment.

- Never put any part of the body into the mast structure or within the reach mechanism or other attachments.

- Check clearance under electrical wires, bridges, etc.

- Understand limitations of telescopic handler so as not to cause injury to personnel.

- Do not drive telescopic handler up to anyone standing in front of an object.

- Exercise care at cross-aisles, doorways, and other locations where pedestrians may step into the path of travel.

- Do not allow anyone to stand or pass under the elevated portion of the telescopic handler, whether empty or not.

- Do not permit passengers to ride on the telescopic handler unless a safe place has been provided by the manufacturer.

- Maintain a safe distance from the edge of ramps, plat-forms, and other similar working surfaces.

- Do not block access to fire aisles, stairways, and fire equipment.

Safe Operating Guidelines

Attended vs Unattended Parking

• A telescopic handler is *attended* when the operator is less than 25 ft from the truck which remains in his view.
• A telescopic handler is *unattended* when the operator is 25 ft or more from the truck, or is out of view of the truck.

Before leaving the operators position:
• put telescopic handler in neutral;
• apply parking brake;
• fully lower the forks.
In addition, when leaving the telescopic handler unattended:
• stop engine;
• if on an incline, block wheels.

When traveling on public roads or changing job sites:

• If telescopic handler is equipped with individual wheel brake pedals, lock pedals together for simultaneous operation.
• If telescopic handler has a differential lock, the lock should not be engaged when driving on the road or at high speeds or when turning. There could be loss of steering control.
• Observe all traffic regulations
• Keep to the right
• Maintain safe distance from other vehicles
• Keep truck under control at all times
• Yield right of way to pedestrians
• Yield right of way to emergency vehicles
• Cross railroad tracks at an angle if possible
• Keep a clear view of path of travel
• If the load obstructs your view, travel in reverse or use a spotter
• Travel at a speed that will permit it to be stopped in a safe manner.
• Travel with the forks or load tilted back if possible
• Do not elevate the load except when stacking
• Make starts, stops, turns, or directional reverses in a smooth manner so as not to shift load or overturn the truck.
• Slow down on wet or slippery surfaces
• Do not indulge in stunt driving or horseplay
• Avoid running over loose objects on the ground
• Lateral turnover is greater when forks are empty

Safe Operating Guidelines

When negotiating turns:

- Know which steering mode you are in
- Before changing modes, align back wheels
- Reduce speed to a safe level
- Turn steering wheel in a smooth, sweeping motion
- Never turn while the load is elevated
- Except at very slow speeds, turn steering wheel at a moderate, even rate

Ascending or descending grades:

- On grades of 5% or more, load should be *upgrade*
- Empty forks should be *downgrade*
- On all grades, the load should be tilted back and raised only enough to clear the road surface
- Avoid turning, if possible, normally travel straight up and down

Stabilizers

- Use stabilizer controls only in compliance with the manufacturer's instructions.
- For telescopic handlers that are equipped with lateral leveling:
  - **Always level the frame before raising boom.**
  - **Lateral leveling should never be used to position an elevated load.**
  - **Never attempt to level the machine with the boom up.**

Handling Loads

- Handle only stable or safely arranged loads.
- When using attachments, make sure they are properly used and secured.
- Complete engage load with forks at least 2/3 under the load.
- Use extreme care when tilting the load forward

Safe Operating Guidelines

Elevating Personnel

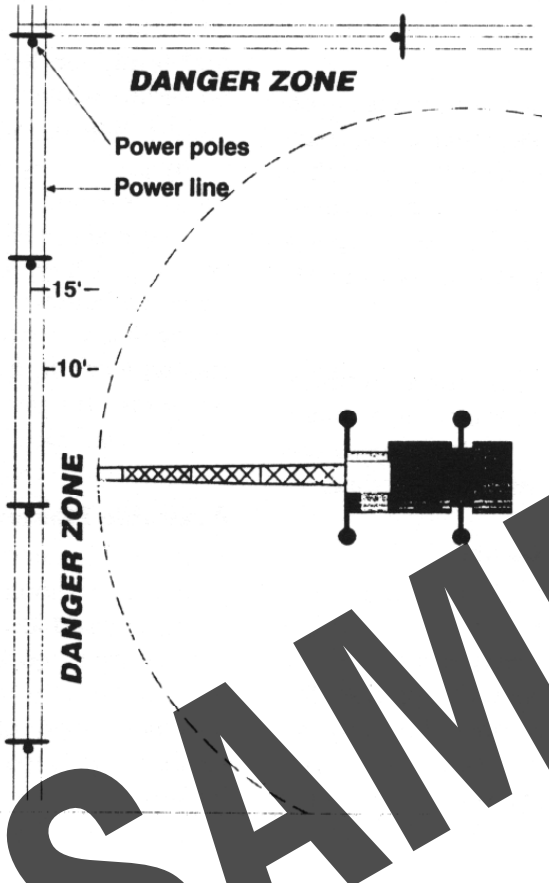
A telescopic handler should not be used to lift people unless there is no other practical option and the manufacturer approves it.

If it must be used to elevate people, the following pre-cautions for the protection of personnel shall be taken:

- Provide an ASME approved personnel platform that is securely attached to the lifting carriage or forks.
- Be certain that the platform is horizontal and never tilt forward or rearward when elevated.
- Area should be marked to warn of elevated personnel.
- Provide protection for personnel, including: restraining means, overhead guard, and shielding from moving parts.
- Be certain that the lifting mechanism is operating smoothly though its entire range.
- Be certain that the mast or boom travel is vertical.
- Be certain that the truck has a firm footing.
- Place truck control(s) in neutral and set brake.
- Make sure path of platform is clear of wires, racks, etc.
- Keep hands and feet clear of controls other than those in use.
- Lift and lower personnel smoothly, with caution, and only at their request.
- Always lower the platform if you must move the telescopic handler for repositioning. Alert personnel before moving.
- The combined weight of the platform, load, and personnel shall not exceed **one-third** of the capacity.
- Platform shall be lowered to floor level for entering and exiting.

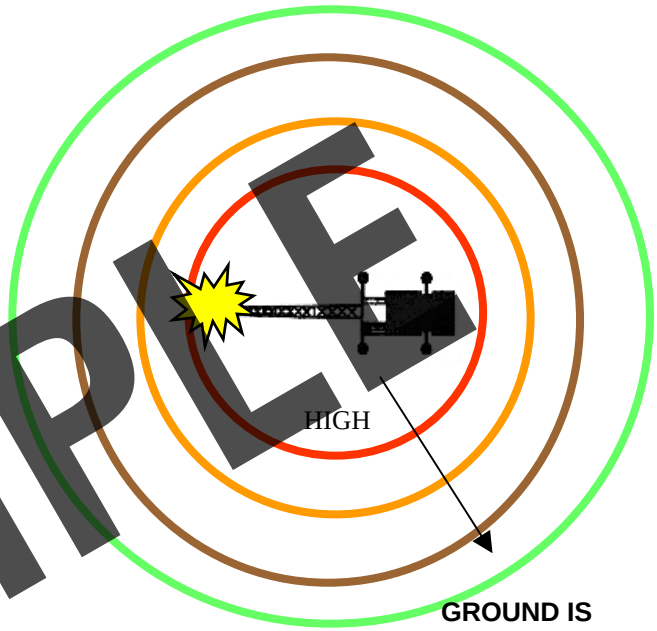
Safe Operating Guidelines

POWERLINE CONTACT



Required Clearances

50kV	10 ft
50 to 200kV	15 ft
200 to 350kV	20 ft



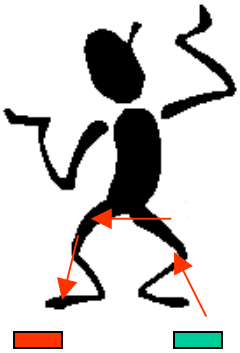
GROUND IS ENERGIZED OUT FROM THE CRANE

ELECTROCUTION IS THE #1 CAUSE OF DEATH INVOLVING CRANES. If contact is made….

1. The operator should remain with the crane if possible until the utility company indicates it is safe.

2. No one should be allowed to approach the machine or touch it. If the operator is unconscious, no attempt should be made to rescue him until it is safe.

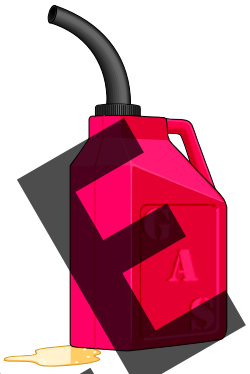
3. If the operator must leave the machine due to fire, he should stand up carefully without touching anything and carefully jump to the ground landing on both feet. Once on the ground, he should shuffle away from the machine.



VOLTAGE PATH

Refueling the Telescopic Handler

- Refuel when the engine is cool.
- In a designated area.
- Fire extinguisher available.
- Park in *unattended* mode.
- Do not 'top off' the tank.
- No smoking, flames, sparks.
- Clean up spills



NOTES

Safe Operating Guidelines Review

1. **When you are more than 25 feet from your machine you should turn the ignition off.**

   a. True
   b. False

2. **When operating the telescopic handler, it is:**

   a. The pedestrian's responsibility to watch out for you.
   b. Your responsibility to watch the pedestrian.
   c. The horns responsibility to warn them.
   d. Managements responsibility to keep the pedestrians out of the work area.

3. **If a load obstructs your vision, you should travel in reverse or use a spotter to direct you.**

   a. True
   b. False

4. **Railroad tracks, curbs or other such surfaces should be crossed diagonally if possible.**

   a. True
   b. False

5. **When lifting personnel, only OSHA/ANSI approved platforms should be used.**

   a. True
   b. False

6. **When elevating personnel, the combined weight of the platform, personnel, and material shall not exceed:**

   a. 1/2 the rated lift capacity
   b. 1/4 the rated lift capacity
   c. 1/3 the rated lift capacity
   d. 2/3 the rated lift capacity

7. As the boom is extended, the pressure on the soil under the front wheels:

a. Increases
b. Decreases

8. When lift a suspended load with a crane arm attachment:

a. The crane arm needs to meet OSHA requirements.
b. A load chart for using the attachment needs to be provided by the manufacturer.
c. Loads must not swing into or strike the boom.
d. All the above.

9. Stopping suddenly with the load elevated has no effect on stability.

a. True
b. False

10 Before traveling with a load you should:

a. Lower the load as far as possible.
b. Retract the boom.
c. Check wheels for alignment.
d. All the above.

11. When the boom is extended with a load on the forks, the telescopic handler becomes:

a. Increasingly stable
b. Increasingly unstable

12. When the stabilizers are used during a lift, the operator needs to do what before raising them?

a. Check his rear view mirror.
b. Retract the boom.
c. Disengage the parking brake
d. All the above.

13. If your boom comes in contact with a power line, you should:

a. Immediately move the boom away from the lines.
b. Get out of the machine as fast as possible.
c. Stay in your seat and avoid contact with metal objects and yell for others to stay back until power company can turn off electricity.
d. Wet your pants.

Calculating Load Weight

Importance of Load Weights

The weight of the load to be lifted must be known to prevent overloading of the boom truck. Without the weight the load chart cannot be referred to and guessing the weight can be dangerous.

You must know the weight of the load to prevent tipovers!

If you must estimate, never boom out to a point where the estimated weight would exceed 50% of the capacity of that load zone. In other words, make the best estimate you can and then multiply it by 2 to determine the safest load zone you can operate in.

Acceptable methods of determining weight

You may find the weight from:

- Data on manufacturing label plates.
- Manufacturer documentation.
- Blueprints or drawings.
- Shipping receipts.
- Weigh the item.
- Bill of lading (be careful)
- Stamped or written on the load
- Approved calculations

Never use word of mouth to establish the weight of and item!

Calculating Load Weight

To find the weight of any item you need to know its volume and unit weight.

- Volume x Unit weight = Load weight
- Unit weight is the density of the material

Here are some examples of common materials and their unit weight:

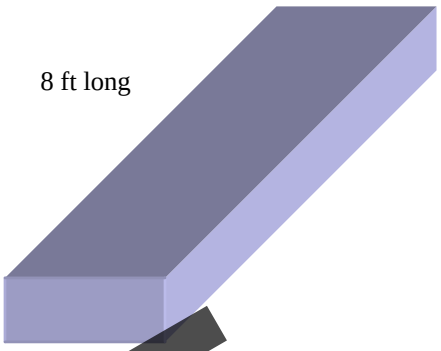
WEIGHTS OF MATERIALS BASED ON VOLUME (lbs. per cubic ft.)

MATERIAL	UNIT WEIGHT	MATERIAL	UNIT WEIGHT
METALS		**TIMBER**	
Aluminum	165	Cedar	34
Brass	535	Cherry	36
Bronze	500	Fir, seasoned	34
Copper	560	Fir, wet	50
Iron	480	Hemlock	30
Lead	710	Maple	53
Steel	490	Oak	62
Tin	460	Pine	30
MASONARY		Poplar	30
Ashlar masonry	160	Spruce	28
Brick, soft	110	White pine	25
Brick, pressed	140	Railroad ties	50
Clay tile	60	**LIQUIDS**	
Rubble masonry	155	Diesel	52
Concrete, cinder, haydite	110	Gasoline	45
Concrete, slag	130	Water	64
Concrete, stone	144	**EARTH**	
Concrete, reinforced	150	Earth, wet	100
MISC.		Earth, dry	75
Asphalt	80	Sand and gravel, wet	120
Glass	160	Sand and gravel, dry	105

Calculating Load Weight

Calculating Volume

Volume of a Cube



Length x Width x Height = Volume

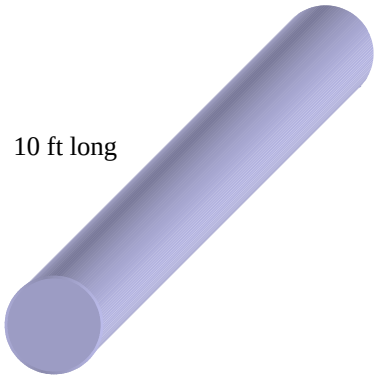
8 ft x 4 ft x 2 ft = 64 cubic feet

If the material was **cedar**, then all we need to do to determine it's weight would be to multiply the unit weight of cedar x 64.

Unit weight x Volume = Weight

34 lbs per cubic foot X 64 cubic ft. = 2,176 lbs.

Volume of a Cylinder



Pi (π) x Radius Squared x Length = Volume

π = 3.14

3.14 x 1^2 ft x 10 ft = 31.4 cubic ft

If the material was **reinforced concrete,** then all we need to do to determine it's weight would be to multiply the unit weight of reinforced concrete x 31.4.

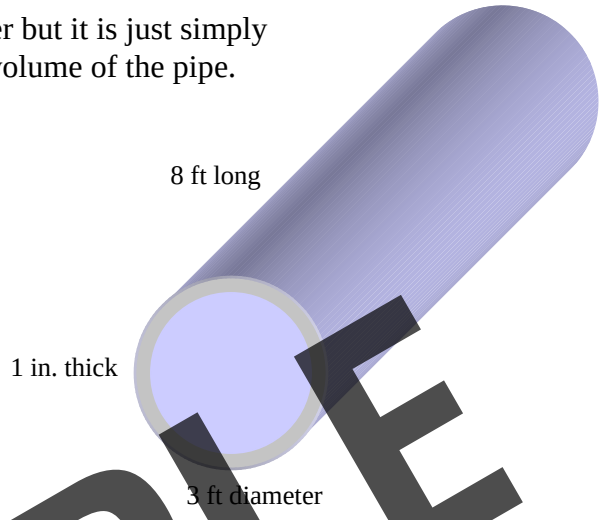
150 lbs per cubic foot x 31.4 cubic ft. = 4,710 lbs.

Calculating Load Weight

Volume of Pipe

Calculating the volume of pipe is a bit trickier but it is just simply subtracting the volume of the hole from the volume of the pipe.

If the pipe were one inch thick, three feet in diameter and 8 feet long, then we would figure the volume of the entire pipe and subtract the volume of the hole to get the the volume of the material.



3.14 x (1 ½ ft.)² x 8 feet = total volume of pipe (56.52 ft³)

3.14 x (1ft 5 in.)² x 8 feet = volume of hole (50.41 ft³)

56.52 ft³ – 50.41 ft³ = 6.11 ft³

Volume of material x unit weight = total weight

If this pipe were **steel** then the unit weight would be 490 lbs.

6.11 x 490 lbs = 2,994 lbs.

For thin pipe a quick way to *ESTIMATE the volume is to split the pipe open and calculate the volume like a cube. The formula would be:

π x diameter = width, so:

π x diameter x length x thickness x unit weight = weight of object

3.14 x 3 ft x 8 ft x 1/12 ft (or .008 ft) x 490 lbs = *3,077.2 lbs

Calculating Load Weight

WEIGHT TABLES

Weight tables are an excellent way to calculate load weight. If you are handling certain materials often, then having a chart that gives you the weight per cubic foot, cubic yard, square foot, linear foot or per gallon is handy. Here are a few examples:

METAL PLATES

1 INCH STEEL PLATE weighs approximately 40 lbs per sq. ft. 1/2 inch steel plate would then be about 20 lbs. per sq. ft.

A steel plate measuring 8 ft. x 10 ft. x 1inch would then weigh about 3,200 lbs. (8 x 10 x 40 lbs = 3,200 lbs.)

BEAMS

Beams come in all kinds of materials and shapes and lengths. STEEL I-BEAMS weigh approximately 40 lbs a linear ft. at 1/2 inch thick and 8 inches x 8 inches. If it were 1 inch thick then it would be 80 lbs a linear ft. If it were 20 feet long at 1 inch thick then it would weigh about 1,600 lbs. (20 ft. x 80 lbs. = 1,600lbs.)

There are weight tables for everything from creosoted pine poles to steel coils. Take advantage of these. But, if you don't know for sure the weight of a load and there are no other resources available to help you, don't hesitate to do the calculations yourself.

Calculating Load Weight Review

USING THE FORMULAS AND WEIGHT TABLES FROM THE PREVIOUS PAGES, CALCULATE THE WEIGHT OF THE FOLLOWING OBJECTS:

1. A load of cedar 4” x 4” x 8’ posts. The stack is 3’ high and 4’ wide.

a. 6,528 lbs.
b. 3,264 lbs.
c. 1,632 lbs.
d. not enough information was given.

2. A concrete pipe 1’ thick, 4’ in diameter and 12’ long.

a. 33,930 lbs.
b. 8,482 lbs.
c. 16,965lbs.
d. 1,696.5 lbs.

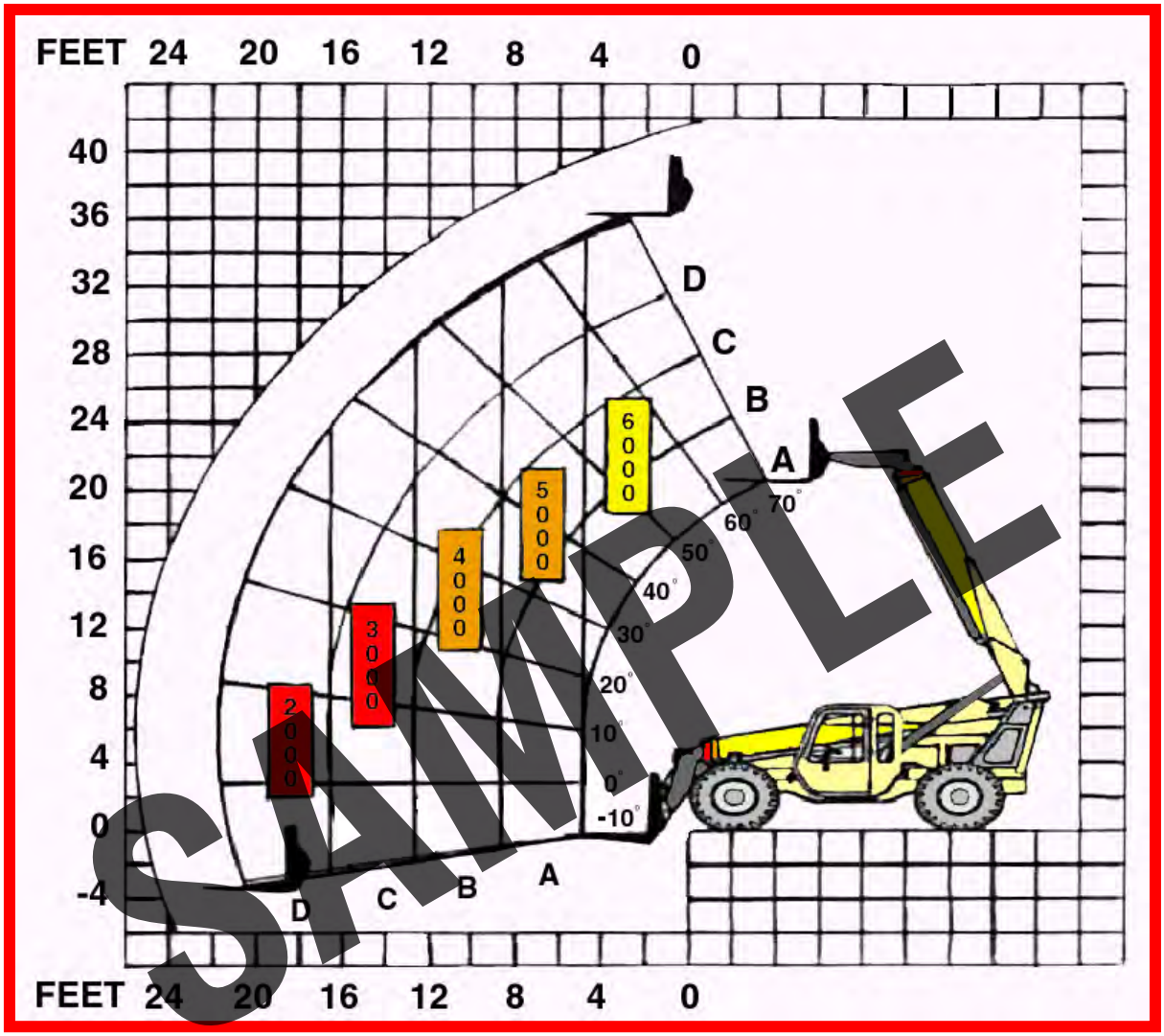
3. A steel plate that is 1” thick x 8’ x 12’.

a. 3,840 lbs.
b. 6,550 lbs.
c. 1,920 lbs.
d. none of the above.

4. An 1” thick I-beam that is 8” x 8” x 12 ft long.

a. 9,600 lbs.
b. 6,300 lbs.
c. 1,820 lbs.
d. 960 lbs.

Load Chart Exercise



Using the above load chart for the following questions:

5. If a 3,000 lb. load needed to be placed on the roof of a building, what is the maximum height it could be placed?

a. 24 ft.
b. 30 ft.
c. 32 ft.
d. 36 ft.

42. A 4,000 lb. load needs to be placed on a platform 8 feet high and 16 ft. from the machines front wheels. Can the load be placed within the capacity of the telescopic handler?

a. Yes
b. No

43. Using the above problem, how far away can the telescopic handler be from the placement area?

a. 8 ft
b. 10 ft
c. 12 ft
d. 14 ft

44. A telescopic handler has a 5,000 lb. Load with the boom fully extended and elevated all the way up. How far down can the boom be lowered safely?

a. 60 degrees
b. 55 degrees
c. 50 degrees
d. 45 degrees

Student Manual

Telescopic Handler Operator Safety Training

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