P-18 Student Study Guide

1. PRESENTATION: GENERAL DESCRIPTION | **DISTRIBUTE STUDENT STUDY GUIDE**

a. Objective: Given an A/S32P-18 Tanker, T.O. 36A12-23-19-1, and an informal lecture, provide General Information on the vehicle, with at least 80% accuracy and no instructor assists.

(1) Purpose: To equip the Trainee with the knowledge on general information of the P-18 Tanker.

Reference:
T.O. 36A12-23-19-1
A/S32P-18 2,000 Gallon Water Tanker lesson plan.

(a) Purpose of the P-18

To provide a means of storing, transporting, and dispensing water.

(b) Vehicle Arrangement

1. The P-18 consists of eighteen primary systems or assemblies. These systems will be explained in the sections following

(c) Overall Description

The vehicle is designed for over the road operation and accommodates the complement of a two-person crew. All the equipment needed to allow the vehicle to accomplish its purpose is self-contained within the vehicle

1. Manufacturer — Kovatch Mobile Equipment.
2. Type — Truck, Tank, Water, Type A/S32P-18, Diesel Driven, Commercial Type.
3. Engine — Detroit Diesel - 6V-92TA.
4. Drive Train — 6X6 front wheel steer, with a power divider.
5. Transmission — Allison - 5 speed automatic.
6. Fire fighting system — Self-contained water.

((a)) Water — 2,000 gallons.
((b)) Pump — Darley, type HM.

(1) Rated capacities — 500 GPM @ 150 PSI. (100% rated capacity)
350 GPM @ 200 PSI. (70% rated capacity)
250 GPM @ 250 PSI. (50% rated capacity)

(d) Dimensions

1. Length — 363 inches (30 ft. 3 in.).
2. Width — 100 inches (8 ft. 4 in.).
3. Height — 126 inches (10 ft. 6 in.).
4. Wheel base — 212 inches (17 ft. 8 in.).

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(e) Performance Characteristics

1.	Ground clearance under axles	11 inches.
2.	Top speed	Able to maintain a speed of 60 MPH with a 2,000 gallon payload of water at 8.35 pounds/gallon density on a level paved road.
3.	Angle of approach/departure	$17^{o}/17^{o}$.
4.	Gross vehicle weight	38,000 lbs.

(f) Transportability — The P-18 is capable of being transported by a number of methods including truck, rail, self-propelled, ship, barge, C-5 and C-17 military aircraft.

2. PRESENTATION: ENGINE/DRIVE TRAIN ASSEMBLY

a. Objective: Given an A/S32P-18 tanker, T.O. 36A12-23-19-1, and an informal lecture, located components of the Engine/Drive Train Assembly and provide information, with at least 80% accuracy and no instructor assists.

(1) Purpose: To equip the Trainee with the knowledge on location and information of the P-18 engine/drive train assembly.

Reference: T.O. 36A12-23-19-1.

(a) Engine

1.	Make	Detroit Diesel 6V-92TA - 9.05 liter.
((a))	Direct injection, liquid cooled, 6 cylinder diesel	Turbocharged aspiration.
((b))	Power output (rated horsepower)	350 bhp @ 2,100 RPM.
((c))	Full load speed	2,100 RPM.
2.	Operating specifications	
((a))	Oil	
(1)	Type	20W40 - under normal climatic conditions (32^{o} F+).
(2)	Pressure	
(((a)))	Idle	30 to 40 psi with engine running.

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NOTE

Upon actual inspection of the Tanker, the following pressures were observed. These pressures are **not** testable. They are "gee-whiz" information only.

(1) Transmission in (N) and engine at idle - 50 psi.
(2) Transmission in gear and engine at idle - 40 psi.
(3) Transmission in (N) and engine at 2,100 RPM - 75 psi.

(3) Oil pressure indicator light — This light is also a water temperature indicator light.

(((a))) Purpose — Will illuminate when oil pressure approaches 0 psi.
(((b))) Location — Upper left hand corner of the dashboard.

WARNING

IF OIL PRESSURE DROPS TO 10 PSI, STOP ENGINE IMMEDIATELY, OTHERWISE ENGINE DAMAGE COULD OCCUR.

((b)) Engine coolant temperature

(1) Range — Should not exceed 225^0F.

NOTE

If water (engine coolant) temperature exceeds 225^o F, the water temperature indicator light (also the oil pressure indicator light) will illuminate.

((c)) Engine RPMs

(1) Low idle — 500 RPM.
(2) High idle — 2,250 RPM.

(b) Transmission

1. Make — Allison.
2. Speeds — 5 forward/1 reverse.
3. Lubrication type — Dextron II
4. Operating temperature — 160-220 F.

((a)) Transmission temperature gauge — Located on the mid right hand side of the dashboard.

CAUTION

If the transmission temperature gauge indicates a temperature of 300^o F or higher; SHUT THE ENGINE

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DOWN IMMEDIATELY, shift the transmission into (N), and run engine at 1,500 RPM.

5. Transmission gear selector

1. Type	Manually shifted lever.
2. Location	On the floor, between the two seats.
3. Selection choices	
((a)) Reverse (R)	
((b)) Neutral (N)	
((c)) 2-5	Uses all forward gears.
((d)) 2-4	Uses first four forward gears.
((e)) 2-3	Uses first three forward gears.
((f)) 2	Uses first two forward gears.
((1)) 1	Keeps transmission in first gear.

(c) Transfer Case

1. Purpose	Transmits power to the front driving axle for operation over rough terrain, steep grades, or slippery surfaces (mud, gravel, snow) where improved traction is required.
2. Engagement	A control lever in the cab, on the floor aft of the transmission gear selector lever, is rotated forward to the "ENGAGED" position, rear tot he "DISENGAGED" position. It is stored in the disengaged position.

(d) Drivelines — There are four driveshaft assemblies.

1. Between the transmission and the case	This driveshaft assembly is a fixed length type.
2. Between the transfer case and the front rear axle	This driveshaft assembly is a slip joint type, allowing it to vary in length as the front rear axle moves in the suspension.
3. Between the front rear axle and the most axle	Slip joint type, allowing it to vary in length as the two rear axles move in the suspension (often times at different lengths than each other).
4. Between the transfer case and the front axle	Slip joint type, allowing it to vary in length as the front axle moves in its suspension.

(e) Engine/Drive Train Inspections

1. Daily

((a)) Engine	
(1) Check engine oil level	This should be checked when the engine is cool and not running. The oil level should be kept between the L (low) and F (full) marks. The dipstick is located on the left side

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of the engine. Utilize 20w40 (15w40, if that's all the mechanics have). The fill cap is on top of the left cylinder head.

(2) Visually check for oil, water, or fuel leaks — Looking on the ground where the truck normally sits for extended periods of time can give a good indication if a leak is present. Annotate on AFTO 1812, and notify the A/C.

(3) Check oil pressure gauge for proper operating pressure — Should read between 30 and 40 psi. If the pressure is too low or too high, annotate on AFTO 1812, and notify the A/C immediately.

(4) Listen for unusual engine noises — Try to isolate where the sound is coming from, annotate on AFTO 1812, and notify the A/C.

((b)) Transmission — Dipstick location: Right side of engine (it's real long).

(1) Check transmission oil level — Two types must be performed: cold and hot.

(((a))) Cold check — Performed when the transmission temperature is between 60° F and 120° F. The engine should be run for at least one minute, to allow any air in the system to be dispelled. It is not done when the transmission is stone cold, despite its name. Any level in the COLD run band is acceptable. If it is too low, fill through the dipstick opening.

NOTE

The cold check is done to ensure the transmission has enough oil to be safely operated until a hot check can be made.

(((b))) Hot check

(1) Operate the vehicle in a drive range until normal operating temperature has been reached (160° F to 220° F).
(2) Park the vehicle on a level spot, shift to (N), engage parking brake, and place chock down. Let the engine run at idle speed.
(3) Wipe the dipstick clean and check the oil level. The oil level should be anywhere within the HOT run band. If not within this range, add or remove oil as necessary.

(2) Ensure the vehicle will not start in any gear but (N) — Annotate on AFTO 1812 and **immediately** notify the A/C.

(3) Inspect ground for leaks — Annotate on AFTO 1812, and notify A/C.

2. Periodic

((a)) Check air restriction indicator — There is no set inspection interval, but it should be checked periodically for inadequate air flow. If the indicator is completely red, or is close to being completely red, this condition should annotated on AFTO 1812 and the A/C notified. The air restriction gauge is located above the air conditioner control, on the lower mid section of the dashboard.

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3. PRESENTATION: UNDER CARRIAGE ASSEMBLIES

a. Objective: Given an A/S32P-18 tanker, T.O. 36A12-23-19-1, and an informal lecture, located components of the Under Carriage Assemblies and provide information, with at least 80% accuracy and no instructor assists.

References:
T.O. 36A12-23-19-1
A/S32P-18 2,000 Gallon Water Tanker lesson plan.

(1) Purpose: To equip the Trainee with the knowledge on location and information of the P-18 under carriage assemblies

(a) Front Axle Assembly

A front driving axle.

1. Engagement purpose

To allow the P-18 to obtain better traction on off road or slippery surfaces.

2. Engagement procedures

The front axle is engaged by rotating the transfer case selector valve forward, to the "ENGAGED" position.

(b) Rear Axle Assembly

The rear assembly is a tandem unit.

1. Forward-rear drive unit.

Front mounted, through drive type (it allows the drive shaft assembly to continue on to the rear-rear axle assembly at all times).

2. Rear-rear drive unit

Final drive unit (the drive shaft stops at this axle unit).

(c) Suspension

1. Front suspension
2. Rear suspension

Consists of multi-leaf type springs.
A spring type suspension with a multi-leaf design and walking beam. The walking beam is also known as a "floating" axle. This gives the rear axles the ability to "sway". This is a concern for the Driver/Operator, as it will affect driving characteristics at higher speeds. Keep in mind, this vehicle should not be operated at speeds over 45 mph on the highway, it becomes unstable and unmanageable by even the most experienced operator.

(d) Wheels and Tires

1. Wheels are a solid design and **do not** utilize a split rim
2. Tires

((a)) Type

All six tires are identical. Single 18RX22.5 tubeless steel radial tires with non-directional off road type tread.

((b)) Pressure

(e) Under Carriage Inspections

1. Daily

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((a)) Check under axles for leaks

((b)) Visually check tires for uneven wear, gouges, cuts, and bruises
((c)) Visually inspect rims and check lug nuts for damage

Again, all six are identical at 105 psi.

2. Periodic (weekly)

((a)) Check for proper tire pressure (Done when tires are "cold")

Checking the ground below the axles where the vehicle normally sits for extended periods of time can give an indication of a leak. Annotate on AFTO 1812 and notify A/C.

((b)) Check lug nuts for tightness

All are signs of impending tire failure. Annotate on AFTO 1812 and notify the A/C.
Annotate on AFTO 1812 and notify the A/C.

4. PRESENTATION: FUEL SYSTEM

Done on Tuesday's. Inflate to 105 psi, if necessary. Annotate adjusted tire pressure on the back of the AFTO 1812 and place signature in appropriate area.

a. Objective: Given an A/S32P-18 tanker, T.O. 36A12-23-19-1, and an informal lecture, located components of the Fuel System and provide information, with at least 80% accuracy and no instructor assists.

Done in conjunction with tire pressure check, on Fridays. Annotate any discrepancy on AFTO 1812 and **immediately** notify A/C and/or maintenance. Have this discrepancy fixed ASAP.

(1) Purpose: To equip the Trainee with the knowledge on location and information of the P-18 fuel system.

References:
T.O. 36A12-23-19-1
A/S32P-18 2,000 Gallon Water Tanker lesson plan.

(a) Fuel Tank

1. Location

Right side of vehicle, underneath Crew Chief's door. Fill opening is located on top of fuel tank

2. Fuel type
Grade 2 diesel.
3. Capacity
100 gallons.
4. Engine fuel consumption
96 gallons per hour.

(b) Fuel Gauge

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1. Location

Top, right side of dashboard. Reads E, ¼, ½, ¾, F.

(c) Operation Under Extreme Climatic Conditions

1. Keep fuel tank full in order to minimize moisture accumulation in the fuel

(d) Fuel System Inspections

1. Daily

((a)) Check fuel level

Keep in mind that fuel gauges can be inaccurate, so checking the fuel level involves opening the fuel tank cap and visually checking the level of fuel. It should be to the bottom of the fill opening neck. If there is a discrepancy between gauge reading and actual tank level, annotate on AFTO 1812 and notify the A/C.

2. Periodic

There are no periodic Driver/Operator inspections because the fuel/water separator is accomplished by the Vehicle Maintenance section. It is marked "MAINT. ONLY".

5. PRESENTATION: COOLING SYSTEM

a. Objective: Given an A/S32P-18 tanker, T.O. 36A12-23-19-1, and an informal lecture, located components of the Cooling System and provide information, with at least 80% accuracy and no instructor assists.

References:
T.O. 36A12-23-19-1
A/S32P-18 2,000 Gallon Water Tanker lesson plan.

(1) Purpose: To equip the Trainee with the knowledge on location and information of the P-18 cooling system.

(a) Ambient Operating Temperature

-40° F to 125°

1. Not to exceed 225° F

The thermostat will be fully open at 197° F.

2. Temperature gauge

Indicates engine water (coolant) temperature. It is located on the upper part of the left hand side of the dashboard.

3. Water indicator light

Will illuminate when water temperature reaches 225° F

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(b) Cooling System

Glycol/water.

1. Utilize $^{50}/_{50}$ anti-freeze mixture

(c) Cooling System Inspections

2. Daily

((a)) Check level of coolant

Accomplish this by opening the fill cap located on top of the radiator. Level should be to the bottom of the fill neck. If level is low, reservice with antifreeze. Accomplish when engine is cold.

CAUTION

DO NOT attempt to check if the engine has recently been operated. Serious personal injury can occur if the contents spill out. If it MUST be done, see ((c)).

((b)) Check for any evidence of rust inside the radiator

This condition is characterized by the coolant being a reddish/brown color. This is an indication that the rust inhibitor in the coolant has become ineffective. This condition must be annotated on the AFTO 1812, reported to the A/C, and brought to Vehicle Maintenance's attention **immediately**.

((c)) If the radiator cap **must** be removed, and there isn't time to allow the engine coolant to cool, follow these procedures

(1) Place a **thick** cloth over the radiator cap.
(2) Rotate radiator cap counter-clockwise to the pressure release position.
(3) Remove hand immediately, and wait for all pressure to be released. **Caution:** The coolant that is being released can be heated to temperatures in excess of 200° F. This is hot enough to cause 3rd degree burns.
(4) When all the pressure has been released, remove radiator cap completely by pushing down and rotating counter-clockwise until cap is removed.
(5) Check level and reservice as necessary.

Try to isolate leak. Annotate on AFTO 1812 and notify the A/C.

((d)) Check for evidence of leaks on the ground around the radiator

2. Periodic

There are no periodic cooling system checks required by the Driver/Operator.

The combination oil and water indicator light. Will illuminate if the water (coolant) temperature exceeds 225° F.

6. PRESENTATION: ELECTRICAL SYSTEM

a. Objective: Given an A/S32P-18 tanker, T.O. 36A12-23-19-1, and an informal lecture, located components of the

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Electrical System and provide information, with at least 80% accuracy and no instructor assists.

(1) Purpose: To equip the Trainee with the knowledge on location and information of the P-18 electrical system.

References:
T.O. 36A12-23-19-1
A/S32P-18 2,000 Gallon Water Tanker lesson plan.

(a) System Type — 12 volt - DC, negative ground.

(b) Batteries

1. Amount/configuration — 4-12v, connected in parallel.
2. Location — All four batteries are located in a compartment that is located below and behind the Driver/Operator's door.
3. Purpose — The batteries are used for starting the vehicle; also, according to the T.O., all accessories utilize the batteries for their power source.
4. C.C.A. (above 32^{o} F) — 2,500 amps.
5. C.C.A. (below 32^{o} F) — 1,900 amps.
6. Engagement

(c) Alternator

1. Amount — 1
2. Output (cold)

((a)) Amperes — 105.
((b)) Volts — 14.
((c)) At RPM — 8,000.

3. Purpose — To keep the batteries charged.
4. Regulator (non-winterized trucks) — Limits (regulates) the output of the alternator to 14 volts.

(d) Battery/Charging System Voltmeter — Combination gauge.

1. Purpose — The two purposes are to indicate the condition of the battery and the charging system. The voltmeter monitors a range of 10 to 16 volts. Color segments are also used to indicate system condition as follows:

(1) Green - well charged battery/proper charging system operation.

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2. Location — The left most large gauge on the top part of the left hand side of the dashboard.

(e) Electrical System Inspections

1. Check operation of all lighting, siren, and emergency warning (red) lights — Replace inoperative bulbs. Annotate any other discrepancies on AFTO 1812 and notify the A/C. Also check internal lighted switches.
2. Check battery connections for tightness and/or corrosion — Tighten and clean as necessary.
3. Clean light lenses and inspect for damage — Obtain light lenses from Vehicle Maintenance and replace, if necessary.
4. Visually inspect voltmeter (with engine running) for 12 - 15.5 volts, or the needle in the green area — If there is a deficiency, annotate on AFTO 1812 and notify A/C.
5. Check all cab instrumentation for proper operation — If there is a discrepancy, annotate on AFTO 1812 and notify the A/C.

7. PRESENTATION: POWER STEERING SYSTEM

a. Objective: Given an A/S32P-18 tanker, T.O. 36A12-23-19-1, and an informal lecture, located components of the Power Steering System and provide information, with at least 80% accuracy and no instructor assists.

(1) Purpose: To equip the Trainee with the knowledge on location and information of the P-18 steering system.

References:
T.O. 36A12-23-19-1
A/S32P-18 2,000 Gallon Water Tanker lesson plan.

(a) System Type — Power assisted by a hydraulic system.

(b) Components Concerning the Driver/ Operator and Operating Principles

1. Hydraulic reservoir — Utilizes 10w oil.
2. Operating principles — The hydraulic pump provides fluid under pressure to the control valve where it is regulated and governs pressure within the system according to the varying conditions of operation. The control valve is directly coupled with the steering shaft and drag links.

(2) Red - discharged battery or overcharging charging system.

(3) Yellow - under-charged battery/charging system inoperative.

(c) Power Steering System Inspections

1. Inspect fluid reservoir level

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2. Inspect steering system for evidence of leaks — Annotate any discrepancies on AFTO 1812 and notify the A/C. (Try to isolate the leak)
3. Inspect all visible lines and hoses for damage — Annotate on AFTO 1812 and notify the A/C.
4. Check for proper operation — Do this by way of a road test. Annotate any discrepancies on AFTO 1812 and notify the A/C.

8. PRESENTATION: POWER TAKE-OFF

a. Objective: Given an A/S32P-18 tanker, T.O. 36A12-23-19-1, and an informal lecture, located components of the Power Take-Off and provide information, with at least 80% accuracy and no instructor assists.

(1) Purpose: To equip the Trainee with the knowledge on location and information of the P-18 power takeoff.

References:
T.O. 36A12-23-19-1
A/S32P-18 2,000 Gallon Water Tanker lesson plan.

(a) Location — Mounted on the transmission and powered by the engine.
(b) Purpose — The PTO is required in order to engage the pump, in either stationary mode or pump and roll mode.
(c) Operating Principle — The PTO is engaged by an electric control in the cab and on the pump panel. For stationary pumping, safety interlock devices are used to prevent engaging the PTO unless the transmission is in neutral (N) and the parking brake set. For pump and roll operation, safety interlock devices are installed which prevent engaging the PTO unless the transmission is set in first gear (1) and the parking brakes are disengaged.
(d) Pump and Roll Procedures — The procedures for engaging the Pump and Roll feature of the A/S32P-18 are explained in detail in Section 11 (e).
(e) Power Take-Off Inspections

1. Check operation of power take-off interlock system — This should be performed a minimum of once a week, on Mondays. The check is accomplished by ensuring that the pump will not engage (stationary mode) if the transmission is not in neutral (N) and the parking brake set, and by ensuring that the pump will not engage (pump and roll mode) if the transmission is not in first (1) gear and the parking brake disengaged. Annotate any discrepancies on

The dipstick is located on the right side of the engine compartment. Proper level should be between the "FULL" and "ADD" marks. Fill if necessary.

9. PRESENTATION: AIR SYSTEM

a. Objective: Given an A/S32P-18 tanker, T.O. 36A12-23-19-1, and an informal lecture, located components of the

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Air System of the A/S32P-18 and provide information, with at least 80% accuracy no instructor assists.

(1) Purpose: To equip the Trainee with the knowledge on location and information of the P-18 air system.

References:
T.O. 36A12-23-19-1
A/S32P-18 2,000 Gallon Water Tanker lesson plan.

(a) Components of the Air System

1. Air compressor — Runs continuously and operates on the re-valve theory.

((a)) Purpose — To provide air for the dual air brake system.
((b)) Capacity — 12.0 CFM (Ft_3 / min.).
((c)) Location — Mounted on the engine and is gear driven.

2. Air compressor governor — Cuts compressor in at 95 PSI, and out at 120 PSI.

((a)) Purpose — To govern (limit) the amount of air pressure that the air compressor will continue to send through the air lines.

((b)) Location — Mounted to the air compressor.

3. Air dryer

((a)) Purpose — To remove moisture and contaminants from the pressurized air being received from the air compressor before these harmful items reach the wet tank and on to the storage tank.

((b)) Location — Underneath the vehicle, mid-chassis, attached to the frame.

4. Wet tank — The wet tank is the first air storage reservoir in line following the air dryer. So air is actually "dry" before it reaches the wet tank. The purpose of the wet tank is to maintain a minimum pressure to supply the large dual compartment storage tank. It is sometimes referred to as a "quick build-up tank". The wet tank is also responsible for sending the air pressure reading to the air compressor governor (to allow the compressor to stop sending air through the air lines) after it has reached its maximum

AFTO 1812, notify the A/C and ensure Vehicle Maintenance is made aware of this situation immediately. This is a safety consideration.

5. Dual compartment storage tank

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(b) Air Pressure Gauge

A combination gauge with dual needles.

1. Purpose

To indicate the pressure present in the primary and secondary air reservoirs separately (both the primary and secondary air reservoirs, although separate entities, are co-located in the dual compartment storage tank). The red needle indicates the primary, or rear brake, air system and the green needle indicates the secondary, or front brake, air system. Since the pressures are the same in a properly operating system, the second needle (red) will usually remain hidden behind the first needle (green).

2. Location

It is located on the gauge cluster row at the top of the dash board. It is the fourth gauge from the left and is marked "AIR PRESSURE".

(c) Low Air Warning Light

1. Purpose

To indicate to the Driver/Operator that air pressure has dropped to below 60 PSI and will illuminate red. 60 PSI is the minimum recommended operating pressure the vehicle should be operated at, as brake failure could occur at any pressure below this minimum. Keep in mind that there is **no** audible warning device associated with this light. When illuminated, this light is marked "AIR".

2. Location

Located on the lower part of the left hand side corner of the dash board.

3. What to do

In the event that the Low Air Warning Light illuminates, the Driver/Operator should **immediately** begin slowing the vehicle down and prepare to stop quickly, before the parking brakes are automatically applied due to a loss in air pressure. This action will occur slowly and will begin with partial braking at first. Place the transmission into neutral (N), set the parking brake and increase the engine speed to around 1,200 RPM. Wait for pressure to build back up. If

pressure and has serviced the large storage tank to its maximum pressure.

The wet tank is the smaller tank located on the left side of the vehicle. It is equipped with a quick-connect coupling that allows for reservicing of the air system should it fall below minimum required pressure needed for brake operation. The wet tank also has a safety valve that allows for the release of pressure before it becomes dangerous.

This is the large tank directly below the Driver/Operator's door, to the left of the battery compartment, and is forward of the wet tank. It is a dual compartment tank. One side supplies the primary air system (rear brakes) and one side supplies the secondary system (front brakes).

(d) Quick Disconnect

1. Purpose

2. Location

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(e) Air System Inspections

1. Bleed moisture from the large storage tank (dual-compartment) until all evidence of moisture is removed

This must be accomplished regardless of the air dryer the vehicle is equipped with. The tank has two drain cock valves, one for each system. Turn counter-clockwise.

2. Inspect for proper operation of low air warning light

This is accomplished by chocking the vehicle and setting the parking brake, running the engine at idle speed until full operating pressure is attained and then shutting the engine down. Leave the ignition switch in the ON position. Pump the service brake pedal continuously until the air pressure is reduced to 60 PSI. At, or near, this point, the red low warning light should illuminate. If it does not, within at least 10 PSI, annotate on AFTO 1812 and notify the A/C. Be sure to allow pressure to build back up so the vehicle is ready for response.

3. Check for air leaks

Accomplish this after the engine has been shut down. Try to isolate where the leak is coming from. Annotate on AFTO 1812 and notify the A/C. Vehicle Maintenance should be contacted ASAP, as this condition could lead to brake failure.

10. PRESENTATION: AIR OPERATED COMPONENTS

a. Objective: Given an A/S32P-18 tanker, T.O. 36A12-23-19-1, and an informal lecture, located components of the Air Operated Components of the A/S32P-18 and provide information, with at least 80% accuracy and no instructor assists.

(1) Purpose: To equip the Trainee with the knowledge on location and information of the P-18 air operated components.

References:

(a) Service Brakes

1. Type

To allow an external source of pressurized air to be connected to the vehicle to allow the air system to remain at a pressure that is safe for brake operation. Can also be used to charge up a low air system quickly.

2. Operation

Located on the wet air tank, on the left side of the vehicle.

3. Support

pressure does not build up, **discontinue use of the vehicle**. Radio the A/C and have Vehicle Maintenance contacted immediately. Even if pressure builds back up, terminate the response of the vehicle, with the A/C's concurrence, as the air system is not operating properly. This is **major** safety consideration.

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4. Minimum air pressure required for safe operation
5. Amount/location
6. What to do if one of the air systems loses air pressure

Support for the service brake system is provided by the large dual-compartment storage tank, which houses the primary and secondary air tanks simultaneously.
60 PSI.

There are six total, one on each of the six wheel assemblies. Even though the dual air system (often referred to as a split system) will allow for partial braking by the remaining air system, this constitutes a safety concern. If this should happen, bring the vehicle to a complete stop and engage the parking brake. Keep the vehicle running. Contact the A/C, or Senior Fire Officer, and advise of situation. The response of the vehicle at this point should be terminated, and the use of the vehicle should be discontinued as the remaining air system may not be capable of handling the required load. Vehicle Maintenance should be contacted immediately.

(b) Parking/Emergency Brakes

1. Type
2. Operation

Spring brake chambers.
The parking/emergency brakes are spring applied and air released (opposite of the service brakes). This brake system is operated by a pull/push type parking brake control valve (knob), which is located in the middle of the dashboard, above the ignition key. It is yellow and is marked "PARKING BRAKE". There is no parking brake ON indication light on the P-18. When the knob is pulled out, air pressure from the braking system chambers is exhausted and the brakes are applied.

3. Setup

The four spring brake chambers are mounted piggyback onto the four rear service brake chambers.

T.O. 36A12-23-19-1
A/S32P-18 2,000 Gallon Water Tanker lesson plan.

Rapid "pumping" of the service brakes should be avoided.

Full air S-cam drum brakes in the rear and wedge-cam drum brakes in the front. It is a dual air type. This means that there are separate sets of air lines for the primary (rear) air system and the secondary (front) air system. If air is lost in one set of air lines, the other set will retain pressure for partial braking.
Air applied and spring released.

CAUTION

If air pressure in both primary and secondary air systems is reduced to 25-30 PSI, the parking brakes will automatically apply. It should be noted, however, that upon loss of air pressure, partial spring brake action will occur prior to automatic application of the control valve (approximately 40 PSI).

(c) Air Purge

1. Purpose

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2. Locations/operation

One air purge switch is located on the pump panel; the other is located in the booster line compartment, on the right rear of the vehicle. It is the top most switch, and must be held continuously to maintain air flow. Perform this for as long as necessary to completely evacuate all water.

(d) Air Operated Components Inspections

1. Service brakes

((a)) With the system at normal operating pressure, and the vehicle at a safe speed, apply the service brakes

((b)) While at normal operating pressure and the engine off with the ignition switch in the ON position, press and hold the service brake pedal down hard

Check for pulling, grabbing, pulsing, squealing, or any other abnormal operation. Annotate on AFTO 1812 and notify the A/C. Vehicle Maintenance should be contacted immediately, as the brake system is a safety consideration.
Ensure the vehicle parking brake is applied and the wheel is chocked. While holding the service brake pedal down, monitor the air pressure gauge. There should be no more than a 4 PSI per minute loss in air pressure. If there is a discrepancy, annotate on the AFTO 1812 and notify the A/C. Vehicle Maintenance should contacted immediately, as this is a safety consideration.

2. Parking/emergency brakes

((a)) Ensure parking brake will hold vehicle in place

Accomplish this by applying the parking brake and placing the transmission into (2-5). Vehicle should not move.

((b)) Test operation of low air pressure engagement

Ensure the vehicle wheels are chocked before attempting to perform this inspection! Accomplish this inspection by allowing the system to build up to at least over 50 PSI. Turn the engine off and leave the ignition switch in the "ON" position. Disengage the parking brake. Depress and release the service brakes repeatedly while monitoring the air pressure gauge. At around 40 PSI, the parking brake knob will begin to engage and between 25 and 30 PSI, the

To use system air to force water through the water lines in order to completely evacuate any water, at the end of a fire fighting operation.

11. PRESENTATION: FIRE FIGHTING SYSTEM

P-18 Student Study Guide

a. Objective: Given an A/S32P-18 tanker, T.O. 36A12-23-19-1, and an informal lecture, located components of the Fire Fighting System of the A/S32P-18 and provide information, with at least 80% accuracy and no instructor assists.

(1) Purpose: To equip the Candidate with the knowledge on location and information of the P-18 fire fighting system.

References:
T.O. 36A12-23-19-1
A/S32P-18 2,000 Gallon Water Tanker lesson plan.

(a) Water Tank

1. Capacity — 2,000 gallons.
2. Methods of servicing

((a)) Overhead
((b)) Pressure — There is a tank hatch for gravity feeding of the tank.

(1) 2½-inch suction — Suction is located on the lower center part of the left side (streetside) pump panel. Water inlet is controlled by a ball valve control handle, and is marked "SUCTION". The ball valve control handle is above the suction inlet, with the left position marked "CLOSED" and the right position marked "OPEN". There is only one installed 2½-inch suction on the P-18. The water goes through the pump first, and is allowed into the tank only by opening the TANK FILL valve (located on the left side pump panel)

(2) 6-inch suction — There are two, one on each side of the vehicle. Water inlet to these suctions is not controlled by any valves, therefore once a pumping operation begins these suction caps **should not be removed**. Water from these suctions go directly into the pump, and is only allowed into the tank by opening the TANK FILL valve. The 6-inch suction on the right side of

parking brakes will be completely engaged. If this does not occur, annotate on AFTO 1812 and notify the A/C. Vehicle Maintenance should be contacted immediately, as this is a safety consideration. Be sure to build air pressure back up to operating pressure to allow the vehicle to be ready for an immediate emergency response. Also, be sure to back the vehicle up slightly as it will have rolled forward and wedged the wheel chock under the tire and will be unable to be removed.

(3) $2^{1}/_{2}$" direct rear fill inlet

(b) Water Tank Level Gauges

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1. Purpose — To indicate to the Driver/Operator the amount of water remaining in the tank.
2. Locations/setup — One gauge is located in the cab, above the center of the windshield on the emergency warning switch cluster. It consists of four horizontal red L.E.D.s. Each of these L.E.D.s represents 500 gallons of water, and will extinguish each time 500 gallons is used. They are marked (starting from the left L.E.D.) "FULL, ¾, ½, ¼."
The second water level gauge is located on the top center of the pump panel. It consists of four orange vertical lights. Each of these lights represents 500 gallons of water, and will extinguish each time 500 gallons is used. They are marked (starting from the top light) "FULL, ¾, ½, ¼."

(c) Fire Pump

1. Type — W.S. Darley - single stage centrifugal pump.
2. Location — Mid-ship mounted.
3. Rated capacities
   - ((a)) 100% — 500 GPM @ 150 PSI.
   - ((b)) 70% — 350 GPM @ 200 PSI.
   - ((c)) 50% — 250 GPM @ 250 PSI.
4. Operating the fire pump
   - ((a)) Stationary mode
     - (1) Ensure the transmission is in neutral (N)
     - (2) Ensure parking brake is set — The fire pump on the P-18 will not engage if the parking brake is not engaged. Also, if the pump and roll switch is not activated, the fire pump will not engage if the transmission is in any gear other than neutral (N).

the vehicle has been reduced down to 2½-inches.

- (3) Ensure wheels are chocked
- (4) Establish water source

There is one. It is located in the center of the rear of the vehicle. It is marked "TANK FILL". It allows water to go directly into the tank. Water inlet is controlled by a pull type handle.

NOTE

There are no pressure or flow limits associated with the direct tank refill listed in the T.O. **Use caution**.

There are two.

- (4) Proceed to pump panel

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At this point, engage the MASTER PANEL switch, which is the top left most red covered toggle switch (raise red cover and flip toggle up). The green signal light, located directly above the switch, should illuminate. Raise the red cover on the PUMP ENGAGE switch and flip the toggle switch up. The pump should now be engaged. If pump does not engage, repeat the above steps ensuring all are performed completely and correctly. If pump, again, fails to engage, notify the A/C, or the Senior Fire Officer, and ensure Vehicle Maintenance is contacted **immediately**.

(5) Keep water circulating

The fire pump will heat up rapidly if it is not discharging water. Either crack open a discharge to allow cooler tank water to flow through the pump or pull the CIRCULATION VALVE pull type handle to keep water circulating between pump and tank.

(6) Open discharge(s)

Open all discharges **slowly** so as to prevent any injuries to fire fighters.

(5) "Throttle" up the engine speed until desired pump pressure is achieved

Do this **slowly and evenly!**

(6) **Set the relief valve!**

Place the relief control lever to the ON position (left). When the relief valve is closed (not relieving any discharge pressure) the orange light marked "CLOSED" (located on the top right section of the relief valve unit) will be illuminated. When the relief begins to relieve excess pressure, the green light marked "OPEN" (located on the top left section of the relief valve unit) will be illuminated.

The use of the relief valve is required for all pumping operations. This is to prevent damage to other apparatus and equipment and to prevent injury to fire fighters.

(7) Monitor the intake gauge, ensure it does not fall below 10 PSI

The 10 PSI is to allow for gauge inaccuracy. The gauge is a compound type and is marked "COMPOUND". It registers 30" of vacuum to 600 PSI pressure. This applies only to drafting operations and operations involving a pressurized source of water. The use of the internal water tank is not included in this warning.

(8) Continually monitor all gauges, including discharge gauges, for major fluctuations

If using internal water, pull TANK TO PUMP pull type handle. If using a hydrant, connect water supply to vehicle. If operating from a draft, setup hard suction and proceed with drafting operation, as outlined in *Driver/Operator Certification Module* lesson plan #7, *Operating Fire Pumps.* Remember, when drafting to ensure all connections are tight and that the primer pump is operated for no more than 30 seconds (pumps rated less than 1,500 GPM). Allow a two minute cool down if priming is unsuccessful. The primer is an electrically operated rotary vane type positive displacement pump.

5. Disengaging the fire pump

((a)) "Throttle" down slowly
((b)) Close all discharges
((c)) Disengage PUMP ENGAGE switch
((d)) Raise relief valve pressure
((e)) Close TANK TO PUMP and

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CIRCULATION VALVE

((f)) Disengage MASTER PANEL switch

((g)) Reservice tank at earliest possible time — If necessary.

(d) Discharges — There are a total of four.

1. 2½-inch discharges — There are two.

((a)) Left side discharge — Discharge is located on the left side of the vehicle, at the lower left corner of the pump panel. It is marked "LEFT SIDE" and is controlled by a ball type valve which is located directly above the discharge. The valve is marked "CLOSED" (left side) and "OPEN" (right side). The discharge is equipped with a pressure gauge that registers 0-300 PSI. It is the left most gauge above the discharge handles.

((b)) Right side discharge — The discharge is located on the right side of the vehicle, at the lower right of the control panel. It is marked "RIGHT SIDE" and is controlled by a ball type valve which is located on the left side directly above the left discharge handle **and** by a valve on the right side directly above the discharge. The valve is marked the same as the left discharge on the left side and "OPEN" (left side) and "CLOSED" (right side) on the right side of the vehicle. The discharge is equipped with a gauge, located immediately to the right of the left discharge gauge (one side only), which registers 0-400 PSI. The discharge has been fitted with a gated valve.

2. 1½-inch preconnects — There are two; one on each side of the vehicle. Both preconnects swivel, and have been fitted with 1½- to 1-inch reducers to allow for use with 1-inch forestry hose. Both preconnects are controlled by pull type handles located on the upper right hand corner of the pump panel and are marked (from left to right) "LEFT PRECONNECT"

3. Tank dump

Do this **slowly** so as to prevent a "water hammer".

(e) Pump and Roll

If either was used.

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1. Purpose
2. Operation

Ensure that transmission is in neutral (N) and parking brake is set prior to proceeding with the following steps.

NOTE
Relief valve should be preset to proper operating pressure before beginning pump and roll operations.

((a)) Close all drain and outlet controls
((b)) Open TANK TO PUMP valve
((c)) Open desired discharge valve
((d)) Ensure relief valve control is ON
((e)) Place transmission in (1)
((f)) Engage pump and roll rocker switch

Located on the emergency warning light cluster, above the windshield. It is marked "PUMP AND ROLL", and will illuminate when activated. If it does not, repeat engagement steps.

((g)) Disengage the parking brake
((h)) Use throttle control knob to accelerate engine

Located below the ignition key. It is marked "THROTTLE CONTROL". Rotate clock-wise to increase speed.

CAUTION
DO NOT, under any circumstance, accelerate the vehicle with the accelerator pedal while the vehicle is in the pump and roll mode.

CAUTION
DO NOT slow vehicle speed with the service brakes. This will cause rapid overheating of the transmission. Use only the throttle control knob. Use the brake pedal only momentarily to stop the pump and roll mode.

NOTE
The use of the service brakes during pump and roll will result in the illumination of a red warning light, located above the air restriction gauge. The light has a plate underneath it that displays a warning concerning the use of the service brakes.

To disengage:

((i)) Engage parking brake
((j)) Shut down pump by using throttle control knob to throttle down engine speed
((k)) Disengage pump and roll switch
((l)) Place transmission into neutral (N)
((m)) Close discharge valve control handles and TANK TO PUMP
((n)) Turn relief valve to OFF

and "RIGHT PRECONNECT". Both have pressure gauges, located directly above their respective pull type handles, that register 0-400 PSI.

Although this is not a discharge (in fact, it is to be **used only as a method of rapidly emptying the tank**), it will be mentioned here. The tank dump is located in the rear of the vehicle, to the left of the tank fill. It is controlled by a pull type handle that is marked "TANK DUMP". There is no GPM flow listed in the T.O.

(f) Fire Fighting System Inspections

1. Check underside of vehicle for leaks in piping or drain valves
2. Ensure water level is at full capacity
3. Ensure no discharges are uncapped or open prior to pump engagement

To allow for a mobile fire fighting operation.

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4. Ensure all suction caps are in place and hand tight	Replace missing or damaged suction caps. Check tightness of suction caps, loosen if necessary.
5. Check to ensure all accessory equipment (mallets, spanner wrenches, etc.) are in place and work	Utilize the equipment checklist. Replace missing or damaged equipment and attempt to repair or service inoperable equipment.
6. Check fire pump for proper operation	This includes stationary and pump and roll engagement. Annotate any discrepancies on AFTO 1812 and notify the A/C. Vehicle Maintenance should be contacted immediately.
7. Check relief valve for proper operation	Annotate any discrepancy on AFTO 1812 and notify the A/C. Vehicle Maintenance should be contacted immediately.
8. Check for proper gauge readings while operating the fire pump and discharges	Annotate any discrepancies on AFTO 1812 and notify the A/C.
9. Check fire fighting equipment for damage or defects	Have defective or inoperative equipment replaced or repaired. Remember, all power tools (saws, etc.) are to be operational tested once a week, as a minimum, on Mondays. Do not annotate any discrepancies on the AFTO 1812, as this is not a Vehicle Maintenance area. However, do notify the A/C.
10. Check to ensure that all removable caps are no tighter than hand tight	

The light should go out.

Try to isolate the leak. Annotate on AFTO 1812 and notify the A/C.
Reservice the tank, if necessary.
Replace missing or damaged discharge caps.

12. PRESENTATION: <u>ADDITIONAL ITEMS</u>

a. Objective: Given an A/S32P-18 tanker, T.O. 36A12-23-19-1, and an informal lecture, locate components of the Additional Items of the A/S32P-18 and provide information, with at least 80% accuracy and no instructor assists.

(1) Purpose: To equip the Trainee with the knowledge on location and information on additional items of the P-18. Additional items in this section are items that were neglected to be mentioned in earlier sections.

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(a) Air Restriction Indicator — Utilizes a push type reset button.

1. Purpose — Indicates the amount of the engine air cleaner filter that has been used and how much remains.
2. Location — Upper middle section of the dashboard.
3. Operation — 3 to 15 in. H_2O vacuum is normal. When the indicator reaches 20 in. H_2O, which is indicated by the placement of the disc in relation to the markings (horizontal lines), it is time to reservice the air filter. 25 in. H_2O represents maximum vacuum (the disc is showing red) and the filter has reached it's limit. Whenever the indicator is above 15 in. H_2O, contact Vehicle Maintenance to have the filter serviced or replaced.

(b) Power Divider

1. Purpose — Controls the distribution of torque to the rear axles.
2. Location
   - ((a)) Power divider unit — Mounted to the front-rear axle.
   - ((b)) Control lever — Located on the upper left hand side of the dashboard. The lever is marked "POWER DIVIDER" and has two positions; they are IN (left position) and OUT (right position). The lever is stored in the OUT position when the use of the power divider is not needed.
3. Operation — When the Driver/Operator selects the IN (left) position on the power divider select lever, power divider unit sends the torque to the side of the axles that can use it. When the power divider is engaged, a red indicator light, located to the left of the contra lever, will illuminate. When
4. Engagement cautions

References:

T.O. 36A12-23-19-1
A/S32P-18 2,000 Gallon Water Tanker lesson plan.

(c) Additional Items Inspections

1. Air restriction indicator

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no further action is required. If disc does not lower, annotate on AFTO 1812 and notify the A/C. Have Vehicle Maintenance contacted to have air cleaner serviced.

2. Power divider

Inspect for engagement of power divider. Accomplish this by moving the power divider select lever to the IN (left) position. If indicator light does not illuminate, annotate on AFTO 1812 and notify the A/C.

13. PRESENTATION: DRIVER/OPERATOR INSPECTION AND ORGANIZATIONAL MAINTENANCE

a. Objective: Given an A/S32P-18 Tanker, T.O. 36A12-23-19-1, and an informal lecture, perform Inspection/ Organizational Maintenance as a Driver/Operator IAW the T.O. and lesson plan, with at least 80% accuracy and no instructor assists.

(1) Purpose: To equip the Trainee with the knowledge necessary to perform inspection/maintenance on the P-18 2,000 gallon water tanker.

References:
T.O. 36A12-23-19-1
A/S32P-18 2,000 Gallon Water Tanker lesson plan

(a) Utilize AFTO Form 1812.

illuminated, this indicator light will read P.D.L. (power divider locked).
Before engaging the rear differential power divider, the Driver/Operator **must** ensure that the rear wheels are not spinning, there is no torque condition present (accelerator pedal depressed), and the vehicle is at a slow speed. There is no specific speed at which the power divider should be engaged listed in the T.O. The power divider must not be used on a hard, dry surface. Use **only** where additional traction is required.

NOTE

All checkouts should be done utilizing the items found on "ITEMS TO CHECKED" section of the AFTO Form, in addition to the specified checks listed in the preceding area's INSPECTIONS.

NOTE

In addition to the AFTO card, utilize the vehicle's equipment checklist to ascertain if any equipment is missing

Check daily for location of indicator disc. If the disc is showing red or indicates a vacuum of greater than 15 in. H_2O attempt to reset the indicator by pushing in the reset button (red button). If disc returns to under 15 in. H_2O and remains,

NOTE

Corrosion control must be performed daily.
CLEAN THE VEHICLE AND KEEP IT THAT WAY!

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14. Administer CerTest Evaluation	Trainee must receive no less than 80% in order to attain a PASS. A PASS must be earned before progression to the Practical Objective portion is allowed.
15. Administer Practical Objective Evaluation	Utilize the performance checklist found on Practical Objective Evaluation 45G, which is the Driving Obstacle Course Evaluation. Annotate grade the Driver Trainee's Evaluation Checklist, which is kept in the Training Computer and in the Trainee's training folder.
16. Administer Pump and Roll Evaluation	A Practical Objective Evaluation, based on PASS/FAIL criteria. The Trainee must successfully and properly perform an engagement of the P-18 pump and roll mode while a simulated natural cover fire fighting operation is simulated.

All discrepancies are either Driver/Operator maintenance (you fix it, and don't bother Vehicle Maintenance) which is NOT to be placed on an AFTO 1812, or it is a reportable (to Vehicle Maintenance) discrepancy in which case it BETTER show up on the AFTO 1812.