

# **1988 SEAGRAVE TRIPLE**

Make SEAGRAVE TRIPLE Model HB-500CH Year 1988

Laden Weight 32.080 Front 13.880 Rear 17,760

Tire Size Front 12R-22.5 Rear 12R-22.5

Make of Engine CUMMINS Model NTC-400 Horsepower 400

No. of Cylinders 6 Cubic Inches 855

Capacity: Fuel 50 gal

Crankcase 36 qts SAE 15w-40 + 8 qts for filter

Transmission 5.1 gal SAE 50

Pump Transmission 22 pts SAE Dextron II

Differential 43-- pts SAE 90-140

Power Steering \*ar pts SAE 10w

Water Tank 500 gal

Transmission SPICER SST-2 1362-C 6 SPEED

Main Pump WATEROUS CMUYCX Type 2-STAGE CENTRIFUGAL

Rated Capacity 1500\_gpm @ 150\_psi

Priming Pump WATEROUS, Type -ROTARY VANE- POSITIVE DISPLACEMENT

\*As required

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## **ENGINE:**

Model.....	NTC – 400, Cummins, Diesel
Max. horsepower.....	400 hp at 2100 rpm
Peak torque.....	1245 ft. lbs. At 1350 rpm
Number of Cylinders.....	6
Base and stroke.....	5½” stroke, 6” stroke
Engine Displacement.....	855 cubic inches
Compression Ratio.....	13.9 to 1
Oil System Capacity.....	44 qts. total
Oil Pressure.....	35 psi at 1200 rpm 45 psi at 2100 rpm minimum 10 psi idle
Operating Range.....	1350 rpm to 2100 rpm
Engine Temperature Operating Range.....	160° to 190° degrees, don't exceed 200°
Engine Heater.....	120° to 140° F
Fire Pump.....	Waterous, 1500 gpm
Pump Gear.....	6 <sup>th</sup>
Relief Valve.....	Waterous, 75-300 psi
Primary Pump.....	Rotary Valve
Water Tank.....	500 gal; steel
Transfer Valve.....	Electric/manual
Transmission.....	6 speed manual
Start Gear.....	2 <sup>nd</sup>
Fuel Tank.....	50 U.S. Gal.
Starter Motor.....	12V, heavy duty
Batteries.....	Lead acid, 12 Volt
Alternator.....	160 amps @ 14 volts
Rear Axle.....	Rockwell, Model R-170
Gear Ratio.....	4.111 to 1

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## **ENGINE:**

- ◆ CUMMINGS NTC-400 diesel, 6 cylinder valve-in head type.
- ◆ 5½" bore and 6" stroke.
- ◆ 855 cubic inch.
- ◆ Compression ratio - 13.9 to 1
- ◆ Highest torque - 1245 ft. lbs. at 1350 RPM.
- ◆ Highest horsepower - 400 at 2100 RPM.
- ◆ Operating range - 1350 RPM to 2100 RPM.
- ◆ Engine operating speed should be maintained at 1900 RPM.
- ◆ Diesel engine should never be lugged. What is lugging?
- ◆ Can run an additional 7% on high idle. \*This can be very harmful if engine is cold.
- ◆ Engine temperature operating range – 160° to 190° degrees
- ◆ Red warning light set at 212 degrees, if possible don't allow engine temp. to exceed 200° F
- ◆ During prolonged idling - maintain at least **900 - 1100 RPM**
- ◆ After heavy use - idle for 3 to 5 minutes to cool engine prior to shutdown. Turbo temp. may be 100° F above engine temp. if shut down suddenly.
- ◆ Engine heater operates at 140° degrees. 120 volt –direct immersion type Kim Hotstart.

## **ENGINE LUBRICATION SYSTEM:**

- ◆ Force feed wet sump system. Lower case holds 28 qts. of oil.
- ◆ An oil cooler of the heat exchanger type is located on right side of engine block.
- ◆ Minimum 10 psi at idle.
- ◆ 35 psi at 1200 rpm.
- ◆ 45 psi at 2100 rpm.
- ◆ Because of impaired access to the oil filler hole, the use of flexible neck funnel is recommended.
- ◆ Oil filter is full flow

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## **ENGINE COOLING SYSTEM:**

- ◆ Water pump mounted on front of engine.
- ◆ Water pump has packless seal and requires no lubrication. Delivers 100 gpm at 2100 RPM.
  
- ◆ System Conditioner
  1. Filters
  2. Provides electrolytic protection
  3. Acts as a rust inhibitor
  
- ◆ Cooling fan -automatically engage by a “thermostatic sensor” @ approximately **190 degrees F.**
  
- ◆ BENDIX FD-3 belt-driven fan drive.
  
- ◆ Clutch is pneumatically operated and thermostatically controlled. During pumping mode, air pressure is exhausted causing full fan operation. Fan clutch is controlled by a temperature sensitive air valve installed in the engine block, senses coolant temperature.
  
- ◆ If grease fitting is noted lube with two cubic inches of general purpose greases every 15,000 miles.
  
- ◆ Water circulates through the oil cooler until temperature reaches about 170° degrees, then water circulates from top to bottom of radiator.
  
- ◆ Radiator Cap is pressure relief type with 7 lbs. rating. This allows the coolants temperature to rise to 233 degrees before boiling.
  
- ◆ **Deaeration tank** purges air, which could become trapped in the cooling system from circulating through the system.

## **FUEL SYSTEM:**

- ◆ Shut-off is mounted forward of the fuel tank above the rear axle.
  
- ◆ Fuel pump is equipped with a knurled knob mechanical valve for opening an emergency.
  
- ◆ Ignition switch on instrument panel operates fuel pump with a solenoid valve.
  
- ◆ To insure correct fuel temperature a full fuel tank should be maintained.

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## **THREE STAGES OF FILTRATION**

- ◆ “RAYCOR” fuel filter/water separator.
  - Filter is located inside of door on engineers panel.
  - Three stages, in series, that progressively clean fuel.
  - First two stages remove virtually all water and solid contamination.
  - Effective life of third stage (fine micron replaceable element) is 2 to 3 times larger than standard filters.
  
- ◆ Primary Stage (Separation)
  - No moving parts
  - Contaminants 30 microns and larger are separated out by centrifugal action created by the turbine centrifuge.
  - Contaminants heavier than fuel, fall to bottom of bowl.
  
- ◆ Secondary Stage (Coalescing)
  - Minute particles (lighter than fuel) flow with fuel into blower part of filter/separation shell.
  - Minute particles accumulate on inner wall of shell and a specially treated replacement element.
  - As particles/beads accumulate they become larger, heavier, and fall to bottom of filter/separator bowl.
  
- ◆ Third Stage (filtration)
  - Fuel flows through the replacement element where minute solids are removed.
  - Change element @ 8 to 15 inches of restriction.
  - Warning light on left side of dash indicates fuel filter/water.
  - If water is not drained it can enter engine.
  - Check separation bowl, drain daily.
  - Drain filter/separation bowl prior to contaminants reaching bottom of centrifuge assembly.

## **ELECTRICAL SYSTEM:**

- ◆ **REFER TO TRAINING BULLETIN #65**
  
- ◆ Negative poles are grounded.
  
- ◆ When shutting down engine, do not switch battery master switch to "off" position until engine is completely stopped.
  
- ◆ Turning switch "OFF" while engine is still in operation can damage the voltage regulator and destroy the alternator's diodes

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- ◆ Ignition switch on instrument panel turns on fuel pump solenoid which pumps fuel into injectors. When ignition switch is shut-off, engine is deprived of fuel.
- ◆ Fuses and breakers protect electrical system. Operating and cooling of breakers will produce clicking sound. Notify shops.
- ◆ 12 volt starting motor - Do not crank over 30 seconds. Hesitate about 30 seconds before retrying.
- ◆ Alternator capacity of 160 amps at 14 volts Built in rectifier changes AC to DC.
- ◆ Idling slightly above idle speed will be enough to supply the electrical system with adequate voltage.

### **VOLTMETER READING:**

Ignition on, battery on, engine off:

12.2 – 12.8	Battery ok
below 12.2	Recharge battery

Engine running (1 min. or more) @ 1000 rpm; no load

13.8 – 14.8	Charging System ok
below 13.8	Check belts/alternator

Engine running (1 min. or more) @ 1000 rpm; with load

13.5 – 14	Charging System ok
below 13.5	Check belts, alternator

### **BRAKE SYSTEM:**

- ◆ Dual brake system (also called split brake system)
- ◆ E-8 Brake application valve by BENDIX-WESTINGHOUSE
- ◆ Anchorlock spring brake system on rear brakes only. Brake is applied by absence of air by spring pressure.

### **Three Primary Uses of the Spring Brake:**

1. Emergency brake
2. Parking brake
3. "Low pressure starting" protective device

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## ◆ Brakes are SELF-ADJUSTING

### Adjusting procedure:

1. Start engine and achieve full system pressure (120 psi)
2. Depress brake pedal fully and hold for one second.
3. **Repeat four or more times.**
4. Remeasure slack adjuster travel.

New pads are different thickness

Outer pad - 9/16"

Inner pad - 7/8"

- ◆ Front pads are identical to rear pads

### WEEKLY:

Check outboard pad for wear.  
At least 4/32" of slide pin should show.  
Check rotors for checks and cracks.

### AIR RESERVOIR SYSTEM:

#### Components:

Brake chamber at each wheel,  
Check valves  
Compressor  
Dryer

Switch  
Quick release valves  
Reservoir tanks  
Safety valves

Air storage tanks: 4 total

1 primary  
3 secondary

@ 90 psi, the SECONDARY tanks begin to fill

- ◆ Apparatus may be moved when primary reaches 90 psi, however, only rear brakes have full braking power prior to secondary tanks reaching 90 psi.
- ◆ Steering column hand brake will not function unless secondary air system has reached 90 psi.
- ◆ Left gauge on dash indicates pressure in primary tank.

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- ◆ Right gauge indicator pressure in secondary system.
- ◆ Red lights and buzzer on dash will operate when pressure falls below 60 psi and ignition switch is on.
- ◆ Moisture Rejection System - Desiccant type
- ◆ Removes both liquid and water vapor from the compressor discharge before it reaches air brake reservoir.
- ◆ Serviced yearly in shops. Operate weekly by hand.

## **AIR FILTER:**

- ◆ Has an exterior "FARR" intake screen located on outside of apparatus behind transverse bed, on curbside of apparatus.
- ◆ Dry type, replaced or serviced yearly at shops
- ◆ Procedure for determining need to replace air filter
  1. Obtain reading on air restriction gauge at top governed RPM's under load when it is new.
  2. New filter should read @ 5".
- ◆ If dash gage reads 10" inches or above first check for restrictions at screen, such as lever or ashes. If screen appears clean call shops for immediate filter replacement lever.
- ◆ When washing apparatus avoid direct water into filter intake.
- ◆ An aftercooler (or intercooler, as it is sometimes called), is a device in the engine intake system designed to reduce intake air temperature and/or preheat intake air temperatures.

## **TRANSMISSION:**

- ◆ Spicer SST-2, 6 speed, manual shift, model 1362-C.

### **Maximum speed in each gear:**

1 <sup>st</sup> -	7.1 mph
2 <sup>nd</sup> -	12.4 mph
3 <sup>rd</sup> -	20.2 mph
4 <sup>th</sup> -	32.0 mph
5 <sup>th</sup> -	45.6 mph
6 <sup>th</sup> -	63.0 mph
Rev. -	7.1 mph

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- ◆ Ordinary starts are in second gear
- ◆ Shift to next gear at 2100 RPM. Operate at 1800 - 1900 RPM.
- ◆ Shifting down hill, governor WILL NOT control engine when descending hill. Back wheels are driving engine, 200-300 RPM above maximum range will **cause valves to float** which makes the valves come in contact with the pistons.

### **CLUTCH:**

- ◆ 15½ inches in diameter
- ◆ Spicer twin plate dry disc with clutch brake.
- ◆ Clutch brake should engage one inch above floor.
- ◆ When free travel or “lash” is reduced to 1” - call shops

### **FOOT THROTTLE:**

- ◆ Air actuated
- ◆ Requires 30 psi to be operational.

### **TURBOCHARGER:**

- ◆ Consists of a turbine wheel and a centrifugal blower, or compressor wheel, separately encased but mounted on and rotating with a common shaft.
- ◆ Forces additional air into engine so it can:
  1. Burn more fuel
  2. Develop more horsepower
  3. Maintain engine's efficiency
- ◆ The power to drive the turbine wheel, which in turn drives the compressor, is obtained from energy of engine exhaust gases.
- ◆ Is cooled and lubricated by engine lubricating oil.
- ◆ Rotation speed or turbine changes as the energy level of fuel changes. Turbine can reach speeds up to 60,000 rpm.
- ◆ Do not shut down the engine while it is hot. This may cause temperature of the turbocharger to rise 100° above engines temperature – will damage bearings.
- ◆ Oil lag or oil starvation to the turbo will cause premature wear on the bearings.

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- ◆ Monthly inspect the connections, clamps, and couplings between the air cleaner and the turbocharger.
- ◆ **Do not over rev the engine on cold starts oil lag to turbo bearings.**

### **STEERING:**

- ◆ **Ross hydropower** integral power steering gear. Maximum operating pressure - 2000 psi. maximum flow rate is 6 rpm.
- ◆ This system can steer a vehicle with a front end weight rating of about 14000 lbs. through a turn at low speed and engine idle.
- ◆ The recommended minimum flow at 1½ hand wheel turns/second must be no less than 2.9 gpm.

### **PUMP:**

- ◆ Waterous Centrifugal - 2 stage pump
- ◆ Series/parallel type.
- ◆ Chain driven
- ◆ Capacity - 1500 gpm @ 150 psi.
- ◆ High pressure 150 gpm at 600 psi.
- ◆ Pump is hydrostatically tested at 600 psi.

### **PUMP TRANSMISSION:**

- ◆ Lubricating is provided to pump transmission by two methods.
  1. Splash system
  2. Externally mounted oil pump
- ◆ Splash system; lubricates lower section of the pump transmission when in “road” position.
- ◆ Externally mounted oil pump is connected to the pump shaft. Will supply oil to the upper section of the pump transmission at a very low pressure.
- ◆ Expect to see a transmission oil pressure reading of @ 2 to 5 psi on the transmission oil pressure gauge on the pump panel.

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## **PUMP PACKING:**

- ◆ Mechanical type - no adjustment

## **PRIMING PUMP:**

- ◆ Electric driven rotary vane priming pump.

## **TRANSFER VALVE:**

- ◆ Electric transfer valve with manual back up.
- ◆ Manual hand crank located below 4" suction inlet on engineer's panel,
- ◆ Manual operation is usually difficult unless pump pressure is below 100 psi.

## **RELIEF VALVE:**

- ◆ Waterous relief valve.
- ◆ A spring loaded, pressure actuated unit that is installed between the discharge and suction sides of the pump.
- ◆ WATEROUS relief valve system consists of two units:
  1. Relief valve proper
  2. Pilot valve (this controls the relief valves operation)
- ◆ Controls discharge of 75 psi to 300 psi.
- ◆ Can't control discharge pressure to an amount lower than suction pressure plus 75 psi.
- ◆ When operating from draft or tank no less than 50 psi.

## **WATER TANK:**

- ◆ 500 gallons 3/16" steel tank
- ◆ Flow capacity from tank to pump of 600 gpm.
- ◆ Internal tank is corrosion protected with six cathodic sacrificial rods
- ◆ Fill only through inlets with strainers.

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## **SUCTION INLETS:**

- ◆ Two 6" inlets, one on each side, reduced to 4"
- ◆ With 4" keystones attached, no friction loss
- ◆ 4" front suction 5 psi friction loss
- ◆ 3½" auxiliary inlets 50 psi FL plus 100 gpm less

## **FRONT SUCTION:**

- ◆ Air operated front section valve.
- ◆ Carried in closed positions with control handle in "neutral" position.
- ◆ This will prevent air leaks when using side suctions when pumping.

## **PUMPING PROCEDURES:**

1. Spot apparatus at hydrant and apply spring brake. Set chocks.
2. With engine at idle depress clutch pedal.
3. Shift gear selector lever to direct drive (6th gear).
4. Engage fire pump by raising pump shift lever handle high enough to allow lock pins to clear pin lock grooves, move shift lever forward until lock pins fall into forward pin grooves thus locking pump shift lever into pumping mode.
5. CAUTION: Do not open the throttle to start pumping unless the green light is on. indicates the pump shift has been completed into pump position and it is safe open throttle.
6. Close all discharge valves and drain openings. Close all valves between tank and pump.
7. Connect suction.
8. Open suction.
9. Transfer valve to desired setting.
10. Open discharge valves and accelerate engine to obtain desired pressure.

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## **MISCELLANEOUS INFORMATION:**

- ◆ BUDD CADGARD wheels when cleaning water is not to exceed 170 degrees F, DO NOT USE ABRASIVE CLEANERS
- ◆ When idling the engine for a long time, increase engine RPM with throttle to **900 to 1100 RPM**.
- ◆ Excessive idling creates two problems:
  1. Burning gas about 1/2 gal per hour.
  2. Causes engine to operate at dangerously low temperatures and this causes a build up of carbon deposits around injectors, valves, pistons and valve seats.

### **Jake brake with three positions - See handout**

Minimum - opens exhaust valves on two cylinders

Moderate - opens exhaust valves on four cylinders

Maximum - opens exhaust valves on six cylinders

- ◆ After drafting in salt water, handling chemicals, or dirty water, flush entire system with clean, fresh water for several minutes to remove all traces of impurities.
- ◆ Keep pump completely full or completely drained.