Product: Fiatallis 645 Wheel Loader Service Repair Manual
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INDEX

# 645 WHEEL LOADER SERVICE MANUAL SET FORM NO. 73058627

| Service manual set is arranged in the following order | Individual manuals are also available in translation in form numbers listed below | | | |
|---|---|---|---|---|
| Service Manuals | ENGLISH Form No. | ESPAÑOL (Spanish) | PORTUGUES (Portuguese) | FRANCAIS (French) |
| Engine | 70650824 | 70690760 | 70663050 | 70690761 |
| Turbocharger (Used prior to engine s/n 3D-10049) | 70649088 | 70668380 | 70668381 | |
| Turbocharger (eff with engine s/n 3D-10049) | 70687805 | 70679633 | 70679634 | 70679635 |
| Transmission, Torque Converter, Charging Pump (Used prior to transmission s/n 35207) | 73044122 | 73052630 | 73052631 | |
| Transmission, Torque Converter, Charging Pump (Eff with transmission s/n 35207) | 73059226 | 73061831 | | 73061844 |
| Axles | 73053547 | 73061828 | 73051866 | 73061841 |
| Brakes(used prior to s/n 2032) | 73047530 | 73052634 | 73052635 | |
| (used s/n 2032 thru 2700, 24S02701 & up,56C02701 & up) | 73057214 | 73061835 | 73052638 | 73061848 |
| Power Steering | 73068993 | 73061832 | 73052639 | 73061845 |
| Loader Hydraulic systems | 73124400 | 73061829 | 73052636 | 73061842 |
| Bucket & Chassis | 73055458 | 73061830 | 73054308 | 73061843 |
| Electrical System | 73146366 | 73053922 | 73054307 | |

**The following additional Service Manuals, in English, are not included in the Manuals set, but may be ordered from a Fiatallis dealer.**

Injection Nozzles and Holders.....70682797
Injection Pump (Bosch PSB).....73111954

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Cut along the dotted lines and insert in spline of binder

645 WHEEL LOADER | SERVICE MANUAL SET | FORM 73058627

index card 75124845

Sample of manual. Download All 1267 pages at:
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FIATALLIS®

# 3500
# 3500 MKII
# 670 T

## ENGINES

## SERVICE MANUAL

Form 70650824 English
1/89

# AVOID ACCIDENTS

Most accidents, whether they occur in industry, on the farm, at home or on the highway, are caused by the failure of some individual to follow simple and fundamental safety rules or precautions. For this reason MOST ACCIDENTS CAN BE PREVENTED by recognizing the real cause and doing something about it before the accident occurs.

Regardless of the care used in the design and construction of any type of equipment there are conditions that cannot be completely safeguarded against without interfering with reasonable accessibility and efficient operation.

A careful operator is the best insurance against an accident.
The complete observance of one simple rule would prevent many thousand serious injuries each year.
That rule is:

*Never attempt to clean, oil or adjust a machine while it is in motion.*

## WARNING

On machines having hydraulically, mechanically, and/or cable controlled equipment (such as shovels, loaders, dozers, scrapers, etc.) be certain the equipment is lowered to the ground before servicing, adjusting and/or repairing. If it is necessary to have the hydraulically, mechanically, and/or cable controlled equipment partially or fully raised to gain access to certain items, be sure the equipment is suitably supported by means other than the hydraulic lift cylinders, cable and/or mechanical devices used for controlling the equipment.

**CALIFORNIA**

**Proposition 65 Warning**

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

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# 3500
# 3500 MKII
# 670 T

## ENGINES

## SERVICE MANUAL

FORM 70650824 English

**WARNING**

STUDY THE OPERATION AND MAINTENANCE INSTRUCTION MANUAL THROUGH BEFORE STARTING, OPERATING, MAINTAINING, FUELING OR SERVICING THIS MACHINE.

The Operation and Maintenance Instruction Manual provides the instructions and procedures for starting, operating, maintaining, fueling, shutdown and servicing that are necessary for properly conducting the procedures for overhaul of the related components outlined in this Service Manual.

This symbol is your safety alert sign. It MEANS ATTENTION! BECOME ALERT! YOUR SAFETY IS INVOLVED.

Read and heed all safety instructions carrying the signal words WARNING and DANGER.

Machine mounted safety signs have been color coded yellow with black borders and lettering for warning and red with white borders and lettering for danger points.

SUPPLEMENT NO. 5
SERVICE MANUAL
FORM 70650824
3500,3500 MARKII, 670T ENGINES

(3/84)

**ATTENTION: Insert this sheet in the front of publication as record of receipt. Replace or add pages in the publication according to instructions below.**

**Additional copies of this supplement are available. Please direct your request to:**

FIATALLIS NORTH AMERICA - Publications Services Dept.,
3000 South 6th Street - Springfield, Il 62710 U. S. A.
or
FIATALLIS EUROPE S. p. A. - Magazzino Stampati
Viale Torino, 2 - 10040 Stupinigi (TO) Italy

Replace the following like pages:

Sect. 1 page 3 (Revised)

Sect. 4 page 1 (Revised)
page 2 (No change)

Reason: To clarify engine and fuel inj[illegible]se and timing.

NOTICE
THESE CHANGES ARE INCLUDED IN THIS COPY

NOTE: Pages 6and 7, Sect. 7 -- Revised cylinder head capscrew torque.

Page 5, Sect. 17 -- Valve seat insert information.

Any product change described in this publication is part of the continuing effort of Fiatallis to make its product responsive to customer need and is not to be construed as a field campaign. A product change may be incorporated with or without prior notice and without obligation to Fiatallis or its affiliates.

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# SUPPLEMENT NO. 4
# SERVICE MANUAL
# FORM 70650824 (English)
# 3500 AND 3500 MARK II ENGINES

( 3-80 )

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*3000 South 6th Street, Springfield, Illinois 62710 U.S.A.*
*or*
*Fiat-Allis M.M.T. S.p.A. - MAGAZZINO STAMPATI - Viale Torino, O*
*STUPINIGI (Torino) - Italy*

**Replace** the following pages:

Section 17, Page 1 (Revised)
Section 17, Page 2 (Revised)

Section 17, Page 3 (Revised)
Section 17, Page 4 (Revised)

Section 17, Page 5 (Revised)
Section 17, Page 6 (Revised)

Section 17, Page 7 (Revised)
Section 17, Page 8 (Revised)

Section 17, Page 9 (Revised)
Section 17, Page 10 (Revised)

Section 19, Page 1 (Revised)
Section 19, Page 2 (Revised)

NOTICE
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**Reason:**

Update Service Tool list and part no's.
Update Fits and Tolerance Section.
Update Torque Specifications

NOTE: Please refer to this supplement to verify that specifications and tools listed in body of manual text are correct.

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# SUPPLEMENT NO. 3

## SERVICE MANUAL FORM 0650824-6

## 3500 ENGINE

( 5-72 )

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**Write in** the following changes (changes are underlined)

| | | | |
|---|---|---|---|
| Sect. 4, pg. 1 | Title | Title | SECTION 4 - FUEL SYSTEM (With Roosa Master Fuel Injection Pump) |
| Sect. 7, pg. 4 | paragraph B. 4 | | . . . . Tighten the long capscrew . . . to a torque of 150 lbs. ft. and tighten the 3/8 . . . . |

**Replace** the following like pages:

Index pg. 3 (Revised)
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Sect. 1 Pg. 3 (Revised)
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Sect. 2 Pg. 3 (Revised)
Sect. 2 Pg. 3a (Revised)
Sect. 2 Pg. 3b (Revised)
Sect. 2 Pg. 4 (Revised)
Sect. 2 Pg. 5 (Revised)
Sect. 2 Pg. 6 (Revised)
Sect. 2 Pg. 7 (No change)
Sect. 2 Pg. 7a (Added)
Sect. 2 Pg. 7b (Added)
Sect. 2 Pg. 7c (Added)
Sect. 2 Pg. 7d (Added)
Sect. 2 Pg. 8 (Revised)
Sect. 3 Pg. 1 (Revised)
Sect. 3 Pg. 2 (No change)
Sect. 3 Pg. 3 (No change)
Sect. 3 Pg. 4 (Revised)
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Sect. 4 Pg. 6 (Revised)
Sect. 4 Pg. 7 (No change)
Sect. 4 Pg. 7a (Revised)
Sect. 4 Pg. 7b (Revised)
Sect. 4 Pg. 8 (No change)
Sect. 4 Pg. 15 (No change)
Sect. 4 Pg. 16 (Revised)
Sect. 4a Pg. 1 (Added)
Sect. 4a Pg. 2 (Added)
Sect. 4a Pg. 3 (Added)
Sect. 4a Pg. 4 (Added)
Sect. 4a Pg. 5 (Added)
Sect. 4a Pg. 6 (Added)
Sect. 4a Pg. 7 (Added)
Sect. 4a Pg. 8 (Added)
Sect. 4a Pg. 9 (Added)
Sect. 4a Pg. 10 (Added)
Sect. 4a Pg. 11 (Added)
Sect. 4a Pg. 12 (Added)
Sect. 5 Pg. 3 (Revised)
Sect. 5 Pg. 3a (Revised)
Sect. 6 Pg. 3 (Revised)
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Sect. 7 Pg. 1 (Revised)
Sect. 7 Pg. 2 (Revised)

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Sect. 7 Pg. 5 (No change)
Sect. 7 Pg. 6 (Revised)

Sect. 7 Pg. 7 (Revised)
Sect. 7 Pg. 8 (No change)

Sect. 7 Pg. 13 (Revised)
Sect. 7 Pg. 14 (No change)

Sect. 8 Pg. 3 (Revised)
Sect. 8 Pg. 3a (No change)

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Sect. 9 Pg. 1 (Revised)
Sect. 9 Pg. 2 (Revised)

Sect. 9 Pg. 3 (Revised)
Sect. 9 Pg. 4 (Revised)

Sect. 9 Pg. 5 (Added)
Sect. 9 Pg. 6 (Added)

Sect. 10 Pg. 3 (Revised)
Sect. 10 Pg. 4 (No change)

Sect. 10 Pg. 4a (Revised)
Sect. 10 Pg. 4b (Added)

Sect. 10 Pg. 5 (Revised)
Sect. 10 Pg. 6 (Revised)

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Sect. 10 Pg. 5b (Delete)

Sect. 10 Pg. 5c (Delete)
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Sect. 10 Pg. 7 (Revised)
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Sect. 11 Pg. 8 (Added)

Sect. 12 Pg. 3 (Revised)
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Sect. 12 Pg. 6 (Revised)

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Sect. 17 Pg. 8 (Revised)

Sect. 17 Pg. 9 (Added)
Sect. 17 Pg. 10 (Added)

**NOTICE**
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**Reason**: This supplement adds the Simms fuel injection pump data and other miscellaneous changes.

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REPLACEMENT PAGES FOR

650824 (10-65)

SERVICE MANUAL

3500 ENGINES

CONSTRUCTION MACHINERY DIVISION

Mailing No. 2

The following replace like pages:

Sect. 10 Pg. 5b (No change)
Sect. 10 Pg. 5c (Revised)

Sect. 10 Pg. 5d (Revised)
Sect. 10 Pg. 6 (No change)

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**This mailing contains additional oil pump assembly information.**

Litho in U. S. A.

Issued 1-69

Mailing No. 1

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Sect. 3 Pg. 1 (No change)
Sect. 3 Pg. 2 (Revised)

Sect. 4 Pg. 1 (Revised)
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Sect. 4 Pg. 3 (No change)
Sect. 4 Pg. 4 (Revised)

Sect. 4 Pg. 5 (Revised)
Sect. 4 Pg. 6 (Revised)

Sect. 4 Pg. 7 (Revised)
Sect. 4 Pg. 7a (Added)

Sect. 4 Pg. 7b (Added)
Sect. 4 Pg. 8 (No change)

Sect. 4 Pg. 13 (Revised)
Sect. 4 Pg. 14 (No change)

Sect. 4 Pg. 15 (Revised)
Sect. 4 Pg. 16 (Revised)

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Sect. 5 Pg. 3 (Revised)
Sect. 5 Pg. 3a (Added)

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Sect. 8 Pg. 3a (Added)

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Sect. 8 Pg. 6 (No change)

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Sect. 10 Pg. 1 (Revised)
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Sect. 10 Pg. 3 (No change)
Sect. 10 Pg. 4 (Revised)

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Sect. 10 Pg. 5 (Revised)
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Sect. 10 Pg. 6 (No change)

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Sect. 11 Pg. 6 (No change)

Sect. 12 Pg. 1 (No change)
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Sect. 17 Pg. 2a (Added)
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Sect. 17 Pg. 6b (Blank)

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This mailing incorporates recent engine changes.

LITHO. IN U.S.A.

ISSUED 8-68

# SAFETY RULES

## GENERAL

Study the Operation and Maintenance Instruction Manual before starting, operating, maintaining, fueling, or servicing machine.

Read and heed all machine-mounted safety signs before starting, operating, maintaining, fueling or servicing machine.

Machine-mounted safety signs have been color coded yellow with black border and lettering for ***WARNING*** and red with white border and lettering for ***DANGER*** points.

Never attempt to operate the machine or its tools from any position other than seated in the operator's seat. Keep head, body, limbs, hands and feet inside operator's compartment at all times to reduce exposure to hazards outside the operator's compartment.

Do not allow unauthorized personnel to operate service or maintain this machine.

Always check work area for dangerous features. The following are examples of dangerous work areas: slopes, over hangs, timber, demolitions, fire, high walls, drop off, back fills, rough terrain, ditches, ridges, excavations, heavy traffic, crowded parking, crowded maintenance and closed areas. Use extreme care when in areas such as these.

An operator must know the machine's capabilities. When working on slopes or near drop offs be alert to avoid loose or soft conditions that could cause sudden tipping or loss of control.

Do not jump on or off machine. Keep two hands and one foot, or two feet and one hand, in contact with steps grab rails and handles at all times.

Do not use controls or hoses as hand holds when climbing on or off machine. Hoses and controls are movable and do not provide a solid support. Controls also may be inadvertently moved causing accidental machine or equipment movement.

Keep operator's compartment, stepping points, grab-rails and handles clear of foreign objects, oil, grease, mud or snow accumulation to minimize the danger of slipping or stumbling. Clean mud or grease from shoes before attempting to mount or operate the machine.

Be careful of slippery conditions on stepping points, hand rails, and on the ground. Wear safety boots or shoes that have a high slip resistant sole material.

For your personal protection. Do not attempt to climb on or off machine while machine is in motion.

Never leave the machine unattended with the engine running.

Always lock up machine when leaving it unattended. Return keys to authorized security. Heed all shut down procedures of the Operation and Maintenance Instruction Manual. Always set the parking brake when leaving the machine for any reason.

Do not wear rings, wrist watches, jewelry, loose or hanging apparel, such as ties, torn clothing, scarves, unbuttoned or unzipped jackets that can catch on moving parts. Wear proper safety equipment as authorized for the job. Examples: hard hats, safety shoes, heavy gloves, ear protectors, safety glasses or goggles, reflector vests, or respirators. Consult your employer for specific safety equipment requirements.

Do not carry loose objects in pockets that might fall unnoticed into open compartments. Do not use machine to carry loose objects by means other than attachments for carrying such objects.

*DO NOT CARRY RIDERS* unless the machine is equipped for carrying people to reduce personal exposure to being thrown off.

Do not operate machinery in a condition of extreme fatigue or illness. Be especially careful towards the end of the shift.

Roll Over Protective Structures are required on wheel loaders, dozer tractors, track type loaders, graders and scrapers by local or national requirements. *DO NOT* operate this machine without a Roll Over Protective Structure.

Do not operate a machine without a falling object protective structure (FOPS).

Do not operate this machine without a rear canopy screen when machine is equipped with rear mounted towing winch.

Seat belts are required to be provided with roll over protective structures or roll protection cabs by local or national regulations. Keep the safety belt fastened around you during operation.

Where noise exposure exceeds 90 dBA for 8 hours, wear authorized ear protective equipment per local or national requirements that apply.

Keep clutches and brakes on machine and attachments such as power control units, winches and master clutches adjusted according to Operation and Maintenance Instruction Manuals of the manufacturers at all times. *DO NOT* adjust machine with engine running except as specified.

Do not operate a machine with brakes out of adjustment. See the Operation and Maintenance Instruction Manual.

Move carefully when under, in or near machine or implements. Wear required protective equipment, such as hard hat, safety glasses, safety shoes, ear protectors.

To move a disabled machine, use a trailer or low boy truck if available. If towing is necessary, provide warning signals as required by local rules and regulations and follow Operation and Maintenance Instruction Manual recommendations. Load and unload on a level area that gives full support to the trailer wheels. Use ramps of adequate strength, low angle and proper height. Keep trailer bed clean of clay, oil and all materials that become slippery. Tie machine down securely to truck or trailer bed and block tracks (or wheels) as required by the carrier.

# SAFETY RULES

To prevent entrapment in cabs or mounted enclosures, observe and know the mechanics of alternate exit routes.

On machines equipped with suction radiator fans, be sure to periodically check all engine exhaust parts for leaks as exhaust gases are dangerous to the operator. Keep a vent open to outside air at all times when operating within a closed cab.

*STARTING FLUID IS FLAMMABLE.* Follow the recommendations as outlined in the Operation and Maintenance Instruction Manual and as marked on the containers. Store containers in cool, well-ventilated place secure from unauthorized personnel. *DO NOT PUNCTURE OR BURN CONTAINERS.*

Follow the recommendations of the manufacturer for storage and disposal.

Wire rope develops steel slivers. Use authorized protective equipment such as heavy gloves, safety glasses when handling.

## OPERATION

Before starting machine, check, adjust and lock the operator's seat for maximum comfort and control of the machine.

*DO NOT START OR OPERATE AN UNSAFE MACHINE.* Before working the machine, be sure that any unsafe condition has been satisfactorily remedied. Check brakes, steering and attachment controls before moving. Advise the proper maintenance authority of any malfunctioning part or system. Be sure all protective guards or panels are in place, and all safety devices provided are in place and in good operating condition.

Check instruments at start-up and frequently during operation.

Do not run the engine of this machine in closed areas without proper ventilation to remove deadly exhaust gases.

Be sure exposed personnel in the area of operation are clear of the machine before moving the machine or its attachments. *WALK COMPLETELY AROUND* the machine before mounting. Sound horn. Obey flag man, safety signals and signs.

Know the principles of cross steering of crawler tractors. Read section in Operation and Maintenance Instruction Manual on cross steering.

Keep engine exhaust system and exhaust manifolds clear of combustible material. Equip machine with screens and guards when working under conditions of flying combustible material.

If engine has a tendency to stall for any reason under load or idle, report this for adjustment to a proper maintenance authority immediately. Do not continue to operate machine until condition has been corrected.

Never use bucket as a man-lift.

Use recommended bucket for machine and material load ability and heaping characteristics of material, terrain, and other pertinent job conditions.

Avoid abrupt starts and stops when transporting a loaded bucket.

Inspect your seat belt webbing and hardware at least twice a year for signs of fraying, wear or other weakness that could lead to failure.

Use only designated towing or pulling attachment points. Use care in making attachment. Be sure pins and locks as provided are secure before pulling. Stay clear of draw bars, cables or chains under load.

When pulling or towing through a cable or chain, do not start suddenly at full throttle. Take up slack carefully. Guard against kinking chains or cables. Inspect carefully for flaws before using. Do not pull through a kinked chain or cable due to the high stresses and possibility of failure of the kinked area. Always wear heavy gloves when handling chain or cable.

Be sure cables are anchored and the anchor point is strong enough to handle the expected load. Keep exposed personnel clear of anchor point and cable or chain. *DO NOT PULL OR TOW UNLESS OPERATOR'S COMPARTMENT OF MACHINES INVOLVED ARE PROPERLY GUARDED AGAINST POTENTIAL CABLE OR CHAIN BACKLASH.*

During operation always carry ripper in full raised position when not in use and lowered to ground when parked.

When counterweights have been provided, do not work machine if they have been removed unless their equivalent weight has been replaced. See the Operation and Maintenance Instruction Manual.

When operating a machine know what clearances will be encountered, overhead doors, wires, pipes, aisles, roadways; also the weight limitations of ground, floor, and ramps.

Know bridge and culvert load limits and do not exceed them. Know machine's height, width, and weight. Use a signal person when clearance is close.

Be sure that the exact location of gas lines, utility lines, sewers, overhead and buried power lines, and other obstructions or hazards are known. Such locations should be precisely marked by the proper authorities to reduce the risk of accidents. Obtain shut-down or relocation of any such facilities before starting work, if necessary.

Be certain to comply with all local, state, and federal regulations regarding working in the vicinity of power lines.

When roading find out what conditions are likely to be met - clearances, congestion, type of surface, etc. Be aware of fog, smoke or dust element that obscure visibility.

When backing, always look to where the machine is to be moved. Be alert to the position of exposed personnel. *DO NOT OPERATE* if exposed personnel enter the immediate work area.

# SAFETY RULES

Never travel a machine on a job site, in a congested area, or around people without a signal person to guide the operator.

In darkness, check area of operation carefully before moving in with machine. Use all lights provided. Do not move into area of restricted visibility.

Maintain clear vision of all areas of travel or work. Keep cab windows clean and repaired. Carry blade low for maximum visibility while traveling. Obtain and use fan blast deflectors where tractors are used a pusher tractors in tandem.

Transport a loaded bucket with the bucket as far tipped back and in as low a position as possible for maximum visibility, stability, and safest transport of the machine. Carry it at a proper speed for the load and ground conditions.

Carry the bucket low when traveling with a load.

Maintain a safe distance from other machines. Provide sufficient clearance for ground and visibility conditions. Yield right-of-way to loaded machines.

Avoid going over obstacles such as rough terrain, rocks, logs, curbs, ditches ridges, and railroad tracks whenever possible. When obstructions must be crossed, do so with extreme care at an angle if possible. Reduce speed - down-shift. Ease up to the break over point - pass the balance point slowly on the obstruction and ease down on the other side.

Cross gullies or ditches at an angle with reduced speed after insuring ground conditions will permit a safe traverse.

Be alert to soft ground conditions close to newly constructed walls. The fill material and weight of machine may cause the wall to collapse under the machine.

Operate at speeds slow enough to insure complete control at all times. Travel slowly over rough ground, on slopes or near drop offs, in congested areas or on ice or slippery surfaces.

Be alert to avoid changes in traction conditions that could cause loss of control. *DO NOT* drive on ice or frozen ground conditions when working the machine on steep slopes or near drop offs.

Keep the machine well back from the edge of an excavation.

Be especially careful when traveling up or down slopes. Position the bucket in such a way as to provide a possible anchorage on the ground in case of a slide.

When proceeding across a hill side proceed slowly. Never turn sharply up hill or down hill.

Avoid side hill travel whenever possible. Drive up and down the slope. Should the machine start slipping sideways on a grade, turn it immediately downhill.

In steep down hill operation, do not allow engine to over speed. Select proper gear before starting down grade.

There is no substitute for good judgement when working on slopes.

The grade of slope you should attempt will be limited by such factors as condition of the ground, load being handled, the type of machine, speed of machine and visibility.

*NEVER COAST* the machine down grades and slopes with the transmission in neutral on power shift machines, or clutch disengaged on manually shifted machines.

To reduce the danger of uncontrolled machine, choose a gear speed before proceeding down grade that will hold machine to proper speeds for conditions.

Operating in virgin rough terrain that includes previously mentioned hazards is called pioneering. Be sure you know how this is done. Danger from falling branches and upturning roots is acute in these areas.

When pushing over trees, the machine must be equipped with proper over head guarding. Never allow a machine to climb up on the root structure particularly while the tree is being felled. Use extreme care when pushing over any tree with dead branches.

Avoid brush piles, logs or rocks. *DO NOT DRIVE THE MACHINE ONTO BRUSH PILES, LOGS, LARGE ROCKS* or other surface irregularities that break traction with the ground especially when on slopes or near drop offs.

Avoid operating equipment too close to an over hang or high wall either above or below the machine. Be on the look out for caving edges, falling objects and slides. Beware of concealment by brush and under growth of these dangers.

Park in a non-operating and non-traffic area or as instructed. Park on firm level ground if possible. Where not possible, position machine at a right angle to the slope, making sure there is no danger of uncontrolled sliding movement. Set the parking brake.

Never park on an incline without carefully blocking the machine to prevent movement.

If parking in traffic lanes cannot be avoided, provide appropriate flags, barriers, flares and warning signals as required. Also provide advance warning signals in the traffic lane of approaching traffic.

Move the machine away from pits, trenches, overhangs and over head power lines before shutting down for the day.

When stopping operation of the machine for any reason, always return the transmission or hydrostatic drive control to neutral and engage the control lock to secure the machine for a safe start up. Set parking brake, if so equipped.

Never lower attachments or tools from any position other than seated in operator's seat. Sound the horn. Make sure the area near the attachment is clear. Lower the attachment slowly. *DO NOT USE* float position to lower hydraulic equipment.

# SAFETY RULES

Always before leaving the operator's seat and after making certain all people are clear of the machine, slowly lower the attachments or tools flat to the ground in a positive ground support position. Move any multi purpose tool to positive closed position. Return the controls to hold. Place transmission control in neutral and move engine controls to off position. Engage all control locks, set parking brake, and open and lock the master (key, if so equipped) switch. Consult Operation and Maintenance Instruction Manual.

Always follow the shut down instructions as outlined in the Operation and Maintenance Instruction Manual.

**MAINTENANCE**

Do not perform any work on equipment that is not authorized. Follow the Maintenance or Service Manual procedures.

Machine should not be serviced with anyone in the operator's seat unless they are qualified to operate the machine and are assisting in the servicing.

Shut off engine and disengage the Power Take Off lever if so equipped before attempting adjustments or service.

Always turn the master switch (key switch if so equipped) to the *OFF* position before cleaning, repairing, or servicing and when parking machine to forestall unintended or unauthorized starting.

Disconnect batteries and *TAG* all controls according to local or national requirements to warn that work is in progress. Block the machine and all attachments that must be raised per local or national requirements.

Never lubricate, service or adjust a machine with the engine running, except as called for in the Operation and Maintenance Instruction Manual. Do not wear loose clothing or jewelry near moving parts.

Do not run engine when refueling and use care if engine is hot due to the increased possibility of a fire if fuel is spilled.

Do not smoke or permit any open flame or spark near when refueling, or handling highly flammable materials.

Always place the fuel nozzle against the side of the filler opening before starting and during fuel flow. To reduce the chance of a static electricity spark, keep contact until after fuel flow is shut off.

Do not adjust engine fuel pump when the machine is in motion.

Never attempt to check or adjust fan belts when engine is running.

When making equipment checks that require running of the engine, have an operator in the operator's seat at all times with the mechanic in sight. Place the transmission in neutral and set the brakes and lock. *KEEP HANDS AND CLOTHING AWAY FROM MOVING PARTS.*

Avoid running engine with open unprotected air inlets. If such running is unavoidable for service reasons, place protective screens over all inlet openings before servicing engine.

Do not place head, body, limbs, feet, fingers, or hands near rotating fan or belts. Be especially alert around a pusher fan.

Keep head, body, limbs, feet, fingers, or hands away from bucket, blade or ripper when in raised position.

If movement of an attachment by means of machine's hydraulic system or winches is required for service or maintenance, do not raise or lower attachments from any position other than when seated in the operator's seat. Before starting machine or moving attachments or tools, set brakes, sound horn and call for an all clear. Raise attachments slowly.

Never place head, body, limbs, feet, fingers, or hands into an exposed portion between uncontrolled or unguarded scissor points of machine without first providing secure blocking.

Never align holes with fingers or hands - Use the proper aligning tool.

Disconnect batteries before working on electrical system or repair work of any kind.

Check for fuel or battery electrolyte leaks before starting service or maintenance work. Eliminate leaks before proceeding.

*BATTERY GAS IS HIGHLY FLAMMABLE.* Leave battery box open to improve ventilation when charging batteries. Never check charge by placing metal objects across the posts. Keep sparks or open flame away from batteries. Do not smoke near battery to guard against the possibility of an accidental explosion.

Do not charge batteries in a closed area. Provide proper ventilation to guard against an accidental explosion from an accumulation of explosive gases given off in the charging process.

Be sure to connect the booster cables to the proper terminals (+ to +) and (- to -) at both ends. Avoid shorting clamps. Follow the Operation and Maintenance Instruction Manual procedure.

Due to the presence of flammable fluid, never check or fill fuel tanks, storage batteries or use starter fluid near lighted smoking materials or open flame or sparks.

Rust inhibitors are volatile and flammable. Prepare parts in well ventilated place. Keep open flame away - *DO NOT SMOKE.* Store containers in a cool well ventilated place secured against unauthorized personnel.

Do not use an open flame as a light source to look for leaks or for inspection anywhere on the machine.

*DO NOT* pile oily or greasy rags - they are a fire hazard. Store in a closed metal container.

# SAFETY RULES

Never use gasoline or solvent or other flammable fluid to clean parts. Use authorized commercial, non-flammable, non-toxic solvents.

Never place gasoline or diesel fuel in an open pan.

Shut off engine and be sure all pressure in system has been relieved before removing panels, housings, covers, and caps. See Operation and Maintenance Instruction Manual.

Do not remove hoses or check valves in the hydraulic system without first removing load and relieving pressure on the supporting cylinders. Turn radiator cap slowly to relieve pressure before removing. Add coolant only with engine stopped or idling if hot. See Operation and Maintenance Instruction Manual.

Fluid escaping under pressure from a very small hole can almost be invisible and can have sufficient force to penetrate the skin. Use a piece of card board or wood to search for suspected pressure leaks. *DO NOT USE HANDS.* If injured by escaping fluid, see a doctor at once. Serious infection or reaction can develop if proper medical treatment is not administered immediately.

Never use any gas other than dry nitrogen to charge accumulators. See Operation and Maintenance Instruction Manual.

When making pressure checks use the correct gauge for expected pressure. See the Operation and Maintenance Instruction Manual or Service Manual for guidance.

For field service, move machine to level ground if possible and block machine. If work is absolutely necessary on an incline, block machine and its attachments securely. Move the machine to level ground as soon as possible.

Brakes are inoperative when manually released for servicing. Provision must be made to maintain control of the machine by blocking or other means.

Block all wheels before bleeding or disconnecting any brake system lines and cylinders.

Never use make shift jacks when adjusting track tension. Follow the Undercarriage Service Manual.

Know your jacking equipment and its capacity. Be sure the jacking point used on the machine is appropriate for the load to be applied. Be sure the support of the jack at the machine and under the jack is appropriate and stable. Any equipment up on a jack is dangerous. Transfer load to appropriate blocking as a safety measure before proceeding with service or maintenance work according to local or national requirements.

Always block with external support any linkage or part on machine that requires work under the raised linkage, parts, or machine per local or national requirements. Never allow anyone to walk under or be near unblocked raised equipment. Avoid working or walking under raised blocked equipment unless you are assured of your safety.

When servicing or maintenance requires access to areas that cannot be reached from the ground, use a ladder or step platform that meets local or national requirements to reach the service point. If such ladders or platforms are not available, use the machine hand holds and steps as provided. Perform all service or maintenance carefully.

Shop or field service platforms and ladders used to maintain or service machinery should be constructed and maintained according to local or national requirements.

Lift and handle all heavy parts with a lifting device of proper capacity. Be sure parts are supported by proper slings and hooks. Use lifting eyes if provided. Watch out for people in the vicinity.

In lifting and handling heavy parts, slings must be of adequate strength for the purpose intended and must be in good condition.

Handle all parts with extreme care. Keep hands and fingers from between parts. Wear authorized protective equipment such as safety glasses, heavy gloves, safety shoes.

When using compressed air for cleaning parts use safety glasses with side shields or goggles. Limit the pressure to 207 kPa (30 psi) according to local or national requirements.

Wear welders protective equipment such as dark safety glasses, helmets, protective clothing, gloves and safety shoes when welding or burning. Wear dark safety glasses near welding. *DO NOT LOOK AT ARC WITHOUT PROPER EYE PROTECTION.*

Replace seat belts every two years on open canopy units and every three years on machines with cabs or at change of ownership.

Wear proper protective equipment such as safety goggles or safety glasses with side shields, hard hat, safety shoes, heavy gloves when metal or other particles are apt to fly or fall.

Use only grounded auxiliary power source for heaters, chargers, pumps and similar equipment to reduce the hazards of electrical shock.

Keep maintenance area *CLEAN* and *DRY.* Remove water or oil slicks immediately.

Remove sharp edges and burrs from reworked parts.

Be sure all mechanics tools are in good condition. *DO NOT* use tools with mushroomed heads. Always wear safety glasses with side shields.

Do not strike hardened steel parts with anything other than a soft iron or non-ferrous hammer.

Do not rush. Walk, do not run.

Know and use the hand signals used on particular jobs and know who has the responsibility for signaling.

# SAFETY RULES

Face the access system when climbing up and down.

Apply the parking device and place the transmission in neutral before starting the machine.

Do not bypass the starter safety switch. Repair the starter safety controls if they malfunction.

Fasten seat belt before operating.

Steering should be checked to both right and left. Brakes should be tested against engine power. Clutch and transmission controls should be moved through or to neutral positions to assure disengagement. Operate all controls to insure proper operation. If any malfunctions are found, park machine, shut off engine, report and repair before using machine.

If the power steering or the engine ceases operating, stop the machine motion as quickly as possible. Lower equipment, set parking device and keep machine securely parked until the malfunction is corrected or the machine can be safety towed. Never lift loads in excess of capacity.

Should the machine become stuck or frozen to the ground, back out to avoid roll over.

Know and understand the job site traffic flow patterns.

Keep the machine in the same gear going down hill as used for going up hill.

When roading a machine, know and use the signaling devices required on the machine. Provide an escort for roading where required.

Always use the recommended transport devices when roading the machine.

Do not attempt repairs unless proper training has been provided.

Use extreme caution when removing radiator caps, drain plugs, grease fittings or pressure taps. Park the machine and let it cool down before opening a pressurized compartment.

Release all pressure before working on systems which have an accumulator.

When necessary to tow the machine, do not exceed the recommended towing speed, be sure the towing machine has sufficient braking capacity to stop the towed load. If the towed machine cannot be braked, a tow bar must be used or two towing machines must be used - one in front pulling and one in the rear to retard. Avoid towing over long distances.

Observe proper maintenance and repair of all pivot pins, hydraulic cylinders, hoses, snap rings and main attaching bolts.

Always keep the brakes and steering systems in good operating condition.

Replace all missing, illegible or damaged safety signs. Keep all safety signs clean.

Do not fill the fuel tank to capacity. Allow room for expansion.

Wipe up spilled fuel immediately.

Always tighten the fuel tank cap securely. Should the fuel cap be lost, replace it only with the original manufacturers approved cap. Use of a non-approved cap may result in overpressurization of the tank.

Never drive the machine near open fires.

Use the correct fuel grade for the operating season.

## FOREWORD

Always furnish serial number if making an inquiry to dealer or factory about this machine.

Many equipment owners employ the Dealer Service Department for all work other than routine lubrication and minor service. This practice is encouraged, as our Dealers are well informed and equipped to render efficient service by factory trained mechanics.

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Illustrations show standard and optional items.

## IMPORTANT

The information in this manual was current at the time of publication. It is our policy to constantly improve our product and to make available additional items. These changes may affect procedures outlined in this manual. If variances are observed, verify the information through your Dealer.

Fiatallis is not responsible for any liability arising from any damage resulting from defects caused by parts and/or components not approved by Fiatallis for use in maintaining and/or repairing products manufactured or merchandized by Fiatallis.

In any case, no warranty of any kind is made or shall be imposed with respect to products manufactured or merchandized by Fiatallis when failures are caused by the use of parts and/or components not approved by Fiatallis.

# SUBJECT INDEX

# SECTION 1—DESCRIPTION AND SPECIFICATIONS



# TOPIC 1—DESCRIPTION

## A. GENERAL

The 3500 engine is a four cycle, water cooled, overhead valve, turbocharged, compression ignition type diesel engine with six vertical in-line cylinders.

The fuel system consists of a combination primary and secondary fuel filter, differential needle type fuel injection nozzle holder assemblies, and a fuel injection pump with an integral fuel transfer pump and governor. The system cleans, prepares, and delivers accurately metered quantities of fuel under high pressure to the engine cylinders where it is ignited by heat of air compressed in the cylinders.

Proper lubrication is assured by a gear type lubricating oil pressure pump driven by a camshaft gear. Dual, full flow type oil filters keep the main oil gallery supplied with clean lubricating oil. Oil is pumped under 45 to 50 psi pressure from the main oil gallery to the crankshaft, connecting rods, idler gear, and rocker arm assembly. All other internal moving parts are lubricated by splash, spray, and oil in suspension.

A turbocharger is used to obtain greater power output of Model 3500 diesel engines over that of Model 3400 engines by increasing the supply of air of the cylinders.

The turbocharger responds to engine load demands by reacting to the flow of expanding exhaust gases and supplying a correlated volume of air to engine cylinders. During a heavy load/lugging operation, the increased flow of exhaust gases turns the turbine wheel faster, causing the compressor impeller to turn faster to supply more air to the intake manifold. Conversely, when engine load is light and the radial flow of gases within the turbine decreases, the turbocharger compressor reduces air supply to the intake manifold.

## B. ENGINE STROKE SEQUENCE

In a 4 cycle diesel engine, a power stroke is made by each piston every two complete revolutions of the crankshaft. Sequence of strokes is intake, compression, power, and exhaust.

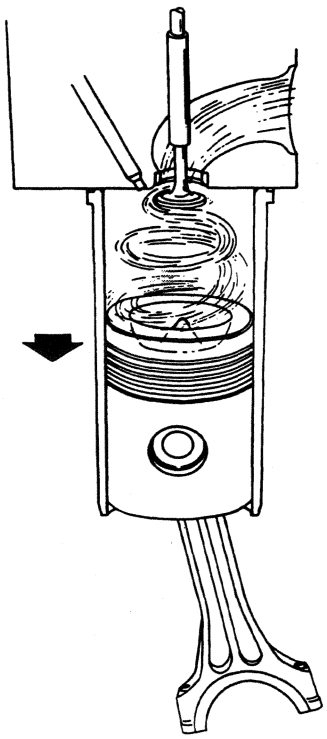

Fig. 1 -- Intake Stroke
(T-52046)

1. INTAKE STROKE

As the piston moves downward on the first, or intake stroke, air enters the cylinder through the air intake manifold and intake valve, which start to open a few degrees before the piston reaches top dead center. The intake charge, consisting of air only, rushes into the cylinder and is given a swirling motion by directional ports in the cylinder head.

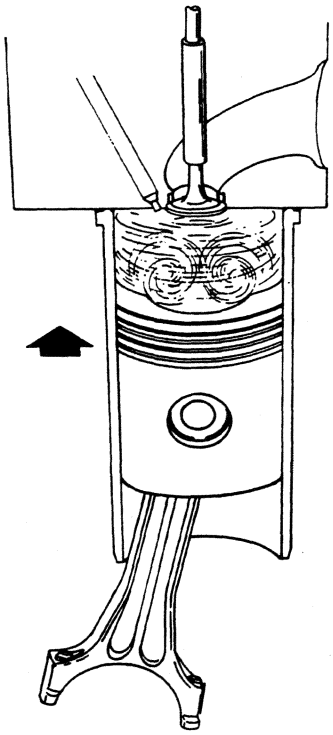

Fig. 2 -- Compression Stroke
(T-52045)

2. COMPRESSION STROKE

Shortly after the piston starts to move upward on the second, or compression stroke, the intake valve closes. The swirling motion of air admitted on the intake stroke is intensified during the compression stroke and its temperature is raised to approximately 1000°F. The contoured piston top compresses and simultaneously forces the air toward its center, giving it an additional rolling motion and greater velocity. At the proper instant during the compression stroke, a metered quantity of fuel is injected into the combustion chamber in a four-jet pattern under extremely high pressure. When the finely atomized fuel has mixed thoroughly with the turbulent air it is ignited by heat of the compressed air and immediately starts to burn.

3. POWER STROKE

Because the fuel and air is thoroughly mixed in the cylinder, it burns smoothly and evenly. As the burning gases expand they force the piston downward on its third, or power stroke. Near bottom of the power stroke the exhaust valve starts to open.

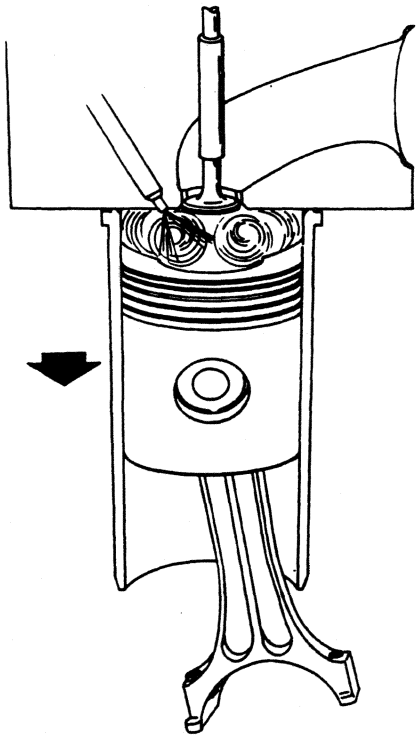

Fig. 3 -- Power Stroke
(T-52044)

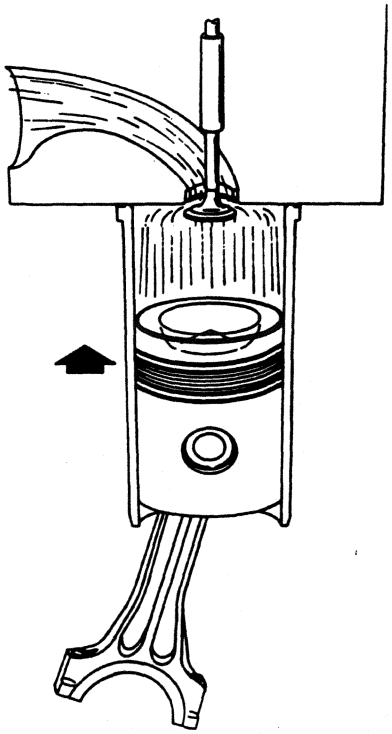

Fig. 4 -- Exhaust Stroke
(T-52043)

4. EXHAUST STROKE

As the piston moves upward on the fourth or exhaust stroke, the exhaust valve opens and burned gases are forced out of the cylinder by the upward travel of the piston. Shortly before the piston reaches top dead center, the intake valve starts to open to admit a fresh charge of air to the cylinder. A few degrees after the piston reaches top dead center, the exhaust valve closes completely, denoting the end of one cycle and begining of the next.

# TOPIC 2—SPECIFICATIONS

## A. BASIC ENGINE

Model . . . . . 3500,670T
Type . . . . . .4 cycle
Number of Cylinders . . . . . .6
Firing Order . . . . . 1-5-3-6-2-4
Bore . . . . . 4-1/4"
Stroke . . . . . 5"
Cubic Inch Displacement . . . . . 426
Crankshaft Rotation (viewed from fan end) . . . . . Clockwise
Number of Main Bearings . . . . . 7
Compression Ratio (nominal) . . . . . 16:1
Compression Pressure at Sea Level, 600 rpm, hot . . . . . 500 psi + or - 15 psi
Maximum Permissible Exhaust Restriction . . . . . 1" Hg

## B. COOLING SYSTEM

Stabilized Coolant Temperature (minimum) . . . . . 180°F
Water Pump Type. Centrifugal, Belt Driven
Radiator, Pressurized . . . . . 7 psi

## C. LUBRICATING SYSTEM

Type System . . . Full Flow, Circulating Pressure
Oil Pump Type . . . . . Gear, Positive Displacement
Oil Pressure Range, hot at full throttle . . . . . 30 - 55 psi
Pressure regulation governed by . . . . . Regulation Valve
Lubricating Oil Filters . . Dual Full Flow

## D. FUEL INJECTION SYSTEM

1. ROOSA MASTER DC F.I.PUMP

Nozzle opening pressure. 3100 -- 3150 psi
Fuel pump timing to engine (engine stopped);

Models with automatic advance
7GB Prior to engine S/N 3D-09890 . . . . . 22° BTDC
Effective with engine S/N 3D-09890 . . . . . 24° BTDC
645 Prior to engine S/N 3D-10184 . . . . . 22° BTDC
Effective with engine S/N 3D-10184 . . . . . 24° BTDC

Models without automatic advance . . . . . 34° BTDC

Fuel injection pump speed to crankshaft ratio . . . . . 5 to 1

2. SIMMS FUEL INJECTION PUMP

Nozzle opening pressure. 3800 to 3850 psi
Fuel pump timing to engine (engine stopped) . . . . . 32° BTDC
Fuel injection pump speed to crankshaft ratio . . . . . .5 to 1

3. ROOSA MASTER DM4 F.I.PUMP
645-B Effective engine:
S/N 3D-56914 (static) .. 16°BTDC
S/N 70-1634 (static) .. 16°BTDC

## E. VALVE DATA

1. Valve lash adjustment
Intake valve clearance (hot) . . . . 0.015"
Exhaust valve clearance (hot) . . 0.015"
2. Valve Timing
Exhaust valve (with 0.0195" tappet clearance)
Opens BBDC . . . . . 56°
Closes ATDC . . . . . 16°
Duration . . . . . 252°
Intake valve (with 0.0195" tappet clearance):
Opens BTDC . . . . . 20°
Closes ABDC . . . . . 48°
Duration . . . . . 248°

**CAUTION**

Tappets must be set with 0.0195" clearance to obtain proper valve opening and closing in degrees tabulated for the camshaft. Do not confuse this setting with valve lash adjustment data.

## F. ENGINE SPEEDS

For specified high and low idle engine speeds, which vary depending upon the unit in which the engine is used, refer to the Operator's Manual furnished with the unit.

# SECTION 2—COOLING SYSTEM



# TOPIC 1—GENERAL

The engine cooling system includes the water pump, radiator, water inlet piping, thermostat, thermostat housing, oil cooler, hoses, engine coolant temperature gauge, cooling fan, and water passages in the cylinder block and cylinder head.

A double acting valve is provided in the radiator filler cap for relieving air pressure due to heat expansion and allowing atmospheric pressure to enter when cooling contraction occurs.

The water pump draws coolant from the bottom of the radiator and circulates it thru the water passages in the cylinder block and cylinder head. The coolant is discharged from the cylinder head thru the thermostat housing and radiator inlet hose into the upper part of the radiator. As the coolant passes from the top to the bottom of the radiator, the coolant dissipates its heat to the atmosphere by air drawn or pushed thru the radiator core by the cooling fan.

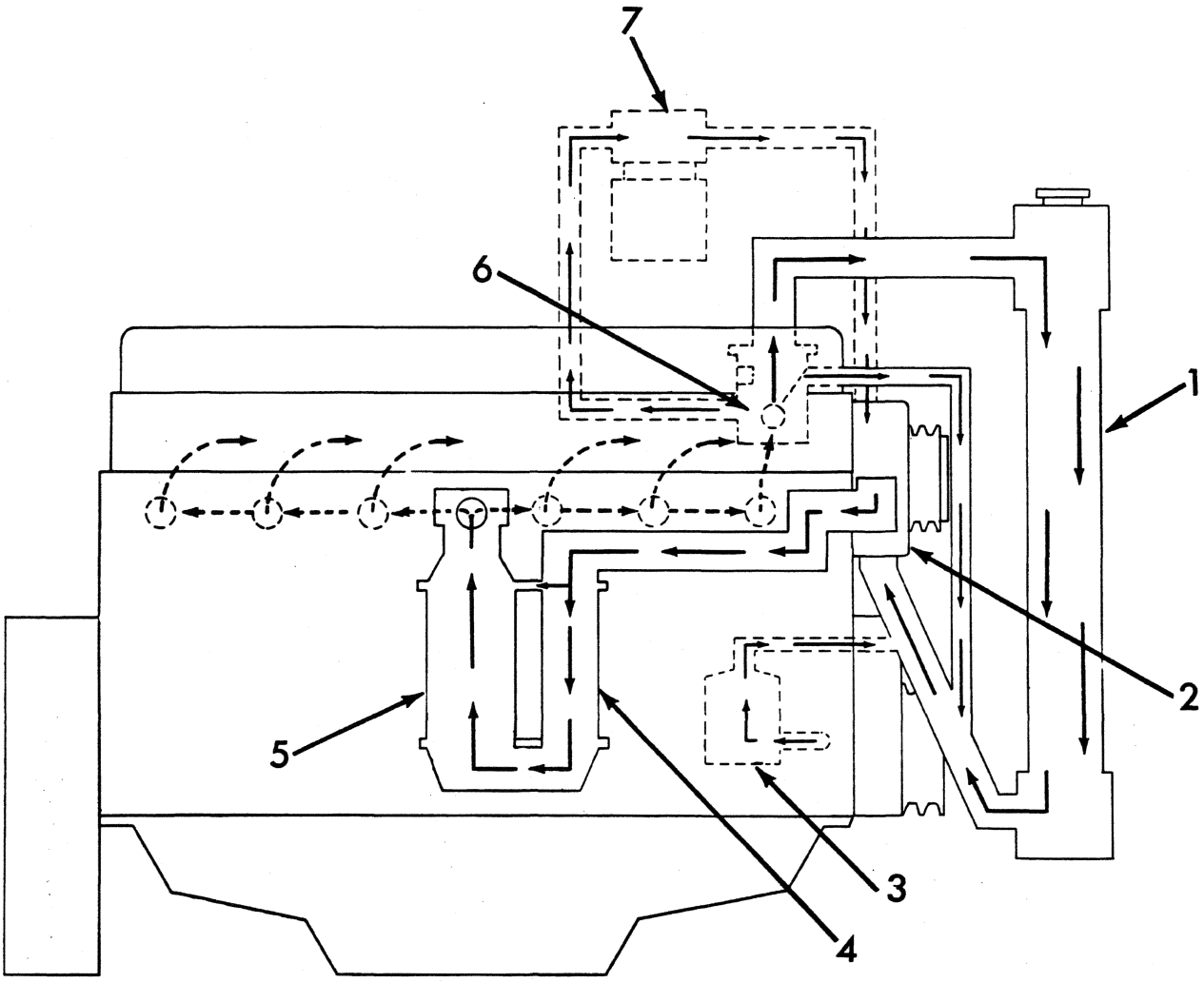


Fig. 1 -- Flow of Coolant -- Schematic Diagram
(T-51303)

1. Radiator
2. Water Pump
3. Coolant Filter (Special Equipment)
4. Engine Oil Cooler
5. Transmission Oil Cooler
6. Thermostat Housing
7. Air Compressor

# TOPIC 2—RADIATOR

## A. GENERAL

The radiator is of the fin and tube type and is properly positioned on the radiator support in relation to the cooling fan.

The radiator is bolted to the radiator support and rubber washers are used with each mounting bolt to reduce vibration and shock.

## B. RADIATOR REMOVAL

1. Drain cooling system.
2. Remove the fan guard.
3. Loosen the clamps on the upper and lower radiator hoses and disconnect both hoses from the radiator.
4. Remove the radiator grill (also remove radiator guard from crawler loaders).
5. Remove the nuts, plain washers, rubber washers, and capscrews attaching the radiator support and remove the radiator.

## C. RADIATOR INSPECTION AND REPAIR

1. Thoroughly clean exterior of radiator removing all foreign material from between cooling cores and fins. Be careful not to bend the fins, straightening any that may be bent.

2. Inspect radiator for clogging or leakage. Test radiator under water with 4 to 5 lbs. of air pressure. Note the source of the air bubbles and solder the leaks. Be sure to wash off the acid after soldering as the acid will eat into the tubes if not washed off. The radiator should be repaired only by qualified personnel.

3. Inspect the hoses for deterioration or damage. Replace as necessary.

## D. RADIATOR INSTALLATION

1. Install the radiator by a direct reversal of the removal procedure.

2. Close the cooling system drain cocks. Fill system with coolant and check for leaks.

# TOPIC 3—FAN, FAN BELTS, FAN SPACER, AND FAN PULLEY

## A. GENERAL

The engine may be equipped with either a pusher type or suction type fan depending upon the application. The fan pushes or pulls (according to the type used) air thru the radiator and the engine coolant is cooled as it circulates from the top to the bottom of the radiator core. The fan, fan spacer, and water pump fan pulley are bolted to the hub which is pressed on the water pump shaft. The fan is driven from the crankshaft pulley by a pair of matched "V" type bolts.

## B. FAN BELT ADJUSTMENT

Inspect drive belts frequently. Replace belts if they are damaged, badly worn, or soaked with oil and grease. Even though only one belt may need replacement because of damage or excessive wear, it is imperative that both belts be replaced to obtain satisfactory belt life. After replacement, approximately 24 hours operating time is required to properly seat a new pair of belts.

1. WHEEL LOADERS (WITH GENERATOR)

   Drive belts are properly adjusted when they can be depressed .19" to .50" (4,82 to 12,70 mm) halfway between the generator pulley and the crankshaft pulley. Refer to Fig. 2, and adjust belts as follows:

   a. Loosen the generator adjusting brace capscrew (1) and mounting capscrews (2); move generator in or out as required.

   b. Retighten the adjusting brace capscrew and mounting capscrews.

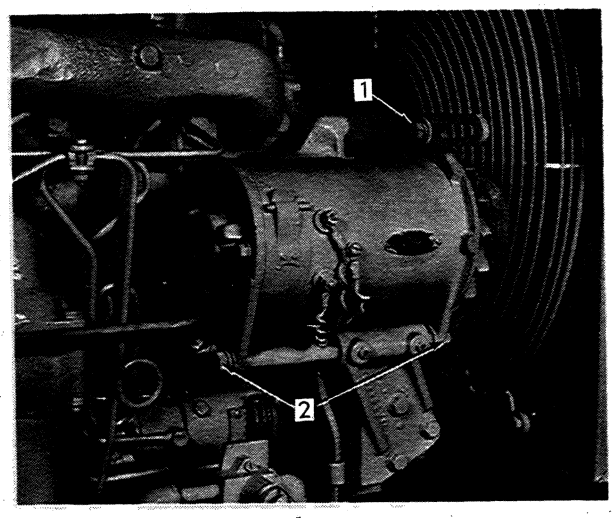


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FIG. 2 BELT ADJUSTMENT (WHEEL LOADERS WITH GENERATOR)

1. Adjusting brace capscrew
2. Mounting capscrews

2. WHEEL LOADERS (WITH ALTERNATOR)

   The belts, Fig. 2a, are properly adjusted when they can be depressed .18" to .50" (4,57 -- 12,70 mm) at a point halfway between the alternator pulley and the crankshaft pulley. A belt tension gauge provides another method by which the belt tension can be most consistently set. Correct tension is 80 -- 100 lbs. (36,29 -- 45,36 kg) as shown on gauge. Refer to Fig. 2a and adjust belts as follows:

Product: Fiatallis 645 Wheel Loader Service Repair Manual
Full Download: https://www.arepairmanual.com/downloads/fiatallis-545-545h-wheel-loaders-transmission-service-repair-manual/

a. Loosen adjusting brace capscrew (1) and alternator mounting capscrew (2).

b. Move the alternator in or out until correct tension has been obtained; then tighten capscrews (1) (2).

3. CRAWLER LOADERS (PRIOR TO ENGINE S/N 15109)

Belts are properly adjusted when they can be depressed .25" to .38" (6,35 -- 9,65 mm) halfway between fan belt tightener pulley and fan pulley. Refer to Fig. 2b, and adjust fan drive belts as follows:

a. Loosen nut on belt tightening capscrew.

b. Pry belt tightening brace up or down as necessary to obtain proper tension.

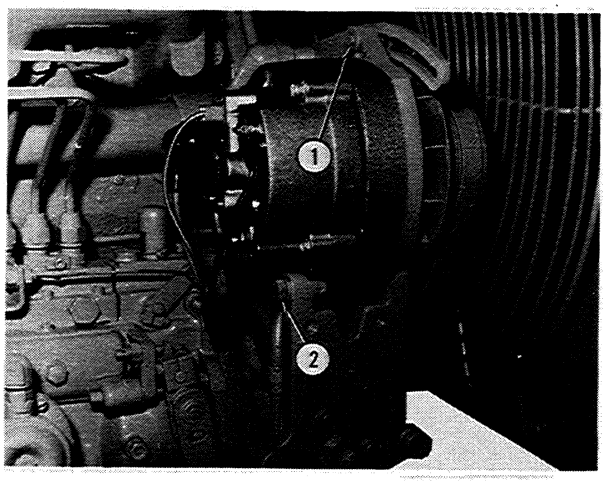


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FIG. 2a BELT ADJUSTMENT
(WHEEL LOADERS WITH ALTERNATOR)
1. Adjustment capscrew 2. Mounting capscrew

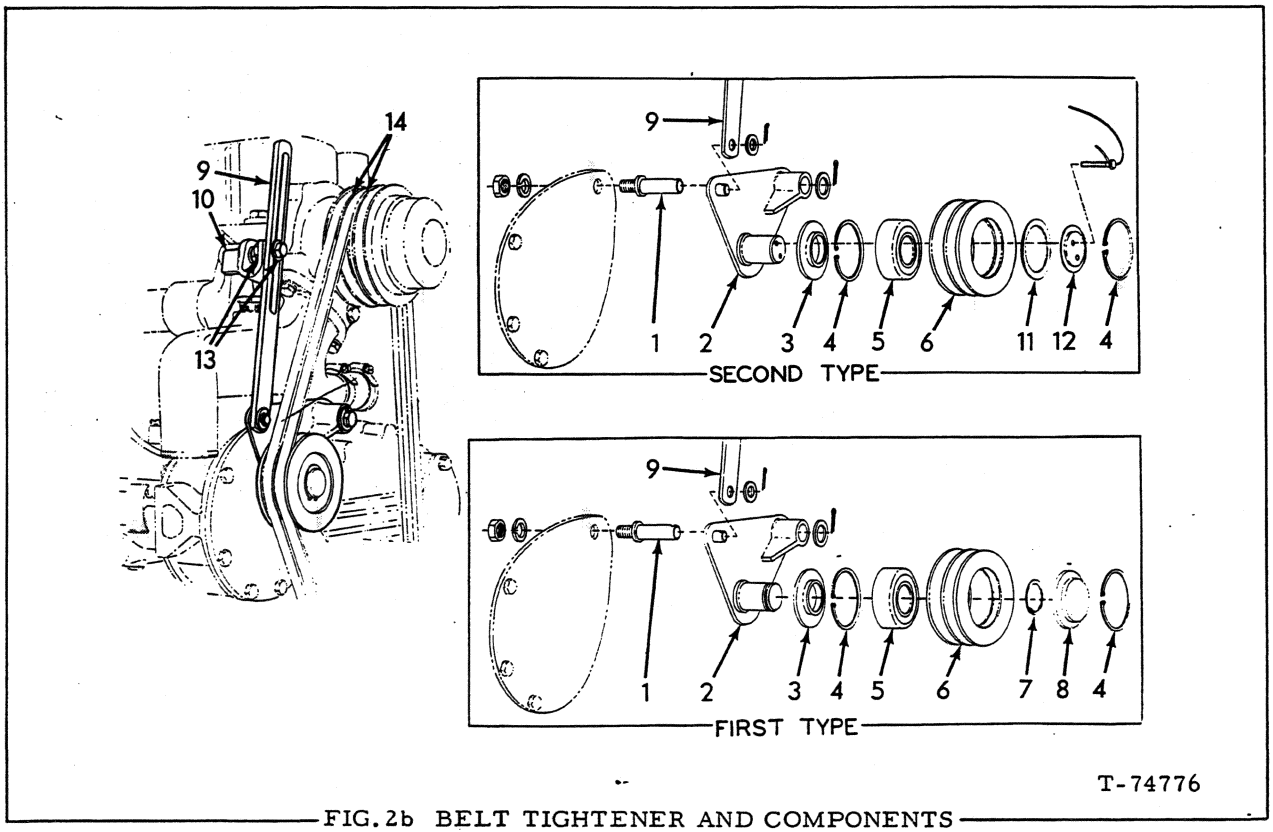


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FIG. 2b BELT TIGHTENER AND COMPONENTS
(CRAWLER LOADER PRIOR TO ENGINE S/N 15109)

1. Bracket pivot pin
2. Pivot bracket
3. Pulley bearing spacer
4. Snap ring
5. Bearing
6. Pulley
7. Snap ring
8. Cover
9. Belt tightener brace
10. Bracket
11. Spacer
12. Washer
13. Capscrew and nut
14. Fan drive belts

Sample of manual. Download All 1267 pages at:
https://www.arepairmanual.com/downloads/fiatallis-545-545h-wheel-loaders-transmission-service-repair-manual/