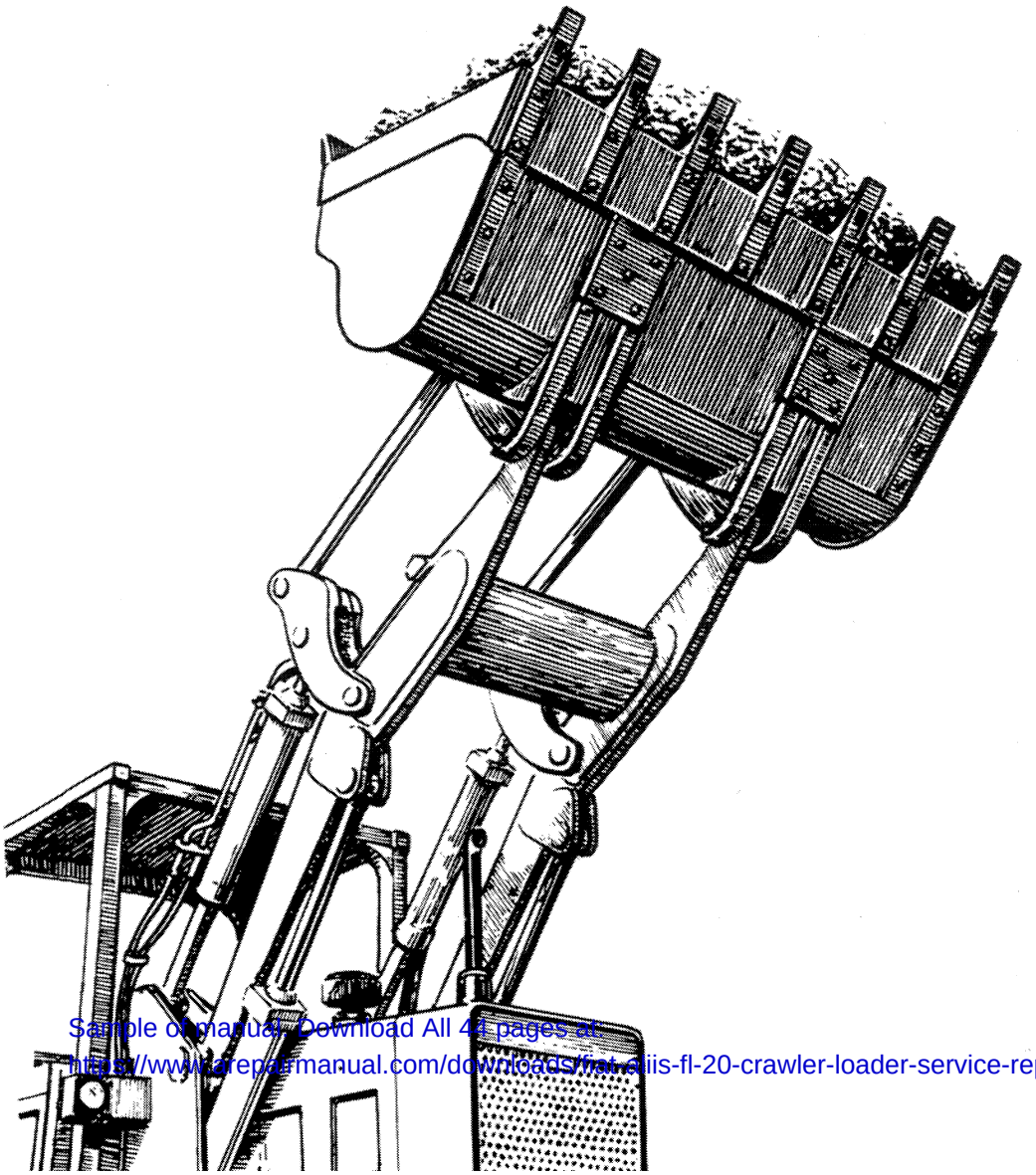
FIATALLIS®

FL 20



Service manual

GENERAL

ENGINE RELATED COMPONENTS

60406241

Reprinted

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.

FIAT-ALLIS

FL 20

crawler loader

Service manual

GENERAL
ENGINE RELATED COMPONENTS

Form 604.06.241 - 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 border and lettering for WARNING and red with white border and lettering for DANGER points.

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 optional items. These changes may affect procedures outlined in this manual. If variances are observed, verify the information through your Dealer.

NOTE

Additional plublications pertaining to this model and to all other Fiat-Allis products are available through Fiat-Allis dealers. Publications are generally available in several languages. Refer to Service Publications Index for all such publications; this index is available free from Fiat-Allis.

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 borders and lettering for warning and red with white borders and lettering for danger points.

No unauthorized personnel should be allowed to service or maintain this machine. Do not perform any work on equipment that is not authorized. Follow the Maintenance and Service procedures. Study the Operation and Maintenance Instruction Manual before starting, operating, maintaining, fueling or servicing this machine

Always wear safety glasses with side shields.

Do not wear rings, wrist watches, jewelry, or loose or hanging apparel, such as ties, torn clothing, scarves, unbuttoned, or unzipped jackets that can catch on moving parts. Do 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 use controls or hoses as handholds when climbing on or off machine. Hoses and controls are movable and do not provide a solid support. Controls may also be inadvertently moved causing accidental machine or equipment movement.

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

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.

Keep operator's compartment, stepping points, grab-rails and handles clean of foreign objects, oil, grease, mud or snow accumulation to minimize the danger of slipping or stumbling.

Never attempt to operate the machine or its tools from any other position than seated in the operator's seat.

Keep operator's compartment clear of loose objects.

If movement of an attachment by means of the machine's hydraulic system 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 attachment or tool, make sure to set brakes, sound horn and call for an all clear. Raise attachment slowly.

Always block with external support any linkage or part on machine that requires work under the raised linkage, parts, or machine per OSHA 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.

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

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

When servicing or maintenance requires access to areas that cannot be reached from the ground, use a ladder or step platform that meets OSHA requirements to reach the service point. If such ladders or platforms are not available, use the machine handholds 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 OSHA requirements.

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

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

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

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.

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 drawbars, cables or chains under load.

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.

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

Remove sharp edges and burrs from reworked parts.

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

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.

Never place gasoline or diesel fuel in an open pan.

Safety Rules

GENERAL (Continued)

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

When using compressed air for cleaning parts use safety glasses with side shields or goggles. Limit the pressure to 30 psi according to OSHA requirements.

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

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

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

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

When making equipment checks that require running of the engine, have an operator in the operator 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. Shut off engine and disengage the Power Take-Off lever before attempting adjustments or service.

Never use the bucket as a man lift.

The articulation point between frames will not clear a person. Stay clear when engine is running. Support, using device provided when servicing. Return support to carry position and secure before moving machine after servicing. See Operation and Maintenance Instruction Manual.

Use linkage safety support provided to secure linkage in the raised position. Secure supports immediately after use and transporting. Do not substitute any other device in the places provided. See the Operation and Maintenance Instruction Manual.

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.

Guard against kinking chains or cables. Do not lift or pull through a kinked chain or cable. 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 COMPARTMENTS OF MACHINES INVOLVED ARE PROPERLY GUARDED against accidental cable or chain backlash.

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

DO NOT pile oily, greasy rags — they are a fire hazard. Store in a closed metal container.

Before starting machine or moving attachment check and adjust and lock operator's seat. Be sure all personnel in the area are clear before starting or moving machine and any of its attachments. Sound horn.

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

Do not carry loose objects in pockets that might fall unnoticed into open compartments.

Keep clutches and brakes of machine and attachments such as Power Control Units, winches and master clutches adjusted according to Operation and Maintenance Instruction Manuals of the manufacturer at all times. DO NOT adjust machine with engine running except as specified.

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.

Wear welder's protective equipment such as dark safety glasses, helmets, protective clothing, gloves and safety shoes when welding. Wear dark safety glasses near welding. — DO NOT LOOK AT ARC WITHOUT PROPER EYE PROTECTION.

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 for the jack at the machine and under the jack is appropriate and stable. Any equipment up on a jack is dangerous. Transfer load to authorized blocking as a safety measure before proceeding with service or maintenance work per OSHA requirements.

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

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.

START UP

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

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

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 recommendation of the manufacturer for storage and disposal.

ENGINE

Turn radiator cap slowly to relieve pressure before removing. Add coolant only with engine stopped or idling and if hot. See Operation and Maintenance Instruction Manual.

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.

ENGINE (Continued)

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

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

Never lubricate a machine with the engine running.

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

ELECTRICAL

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.

Always turn the master switch (key switch if so equipped) to the off position when maintaining or servicing machine.

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.

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

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.

Disconnect batteries before working on electrical system.

HYDRAULIC

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 cardboard 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.

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

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

ATTACHMENTS

Keep head, body, limbs, feet, hands and fingers away from blade, bucket or ripper when in raised position. Use authorized blocking as a safety measure before proceeding with service or maintenance per OSHA requirements.

If movement of an attachment by means of the machine's hydraulic system 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, make sure to set brakes, sound horn and call for an all clear. Raise attachment slowly.

Do not use machine to carry loose objects by means other than attachments for carrying such objects.

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

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

TIRES (APPLICABLE MACHINES)

Be sure tires are properly inflated to the manufacturer's spe-cified pressure. Inspect for damage periodically.

Stand to one side when changing inflation of tires.

Check tires only when the machine is empty and tires are cool to avoid overinflation. Do not use reworked wheel parts. Improper welding, heating or brazing weakens them and can cause failure.

Never cut or weld on the rim of an inflated tire. Inflate a spare tire only enough to keep rim parts in place — a fully inflated tire might fly apart when it is not installed on a machine.

Use care if you must transport (haul) a fully inflated tire.

When servicing tires block the machine in front and back of all wheels. After jacking up, place blocking under machine to protect from falling per OSHA requirements.

Deflate tires before removing objects from the tread.

Never inflate tires with flammable gases. Explosion and personal injury could result.

FIAT-ALLIS

FL 20

crawler loader

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Study SAFETY RULES in the front of this manual thoroughly for the protection of machine and safety of personnel.

1. GENERAL

1.1 PRINCIPAL DATA

IDENTIFICATION AND TYPE

Technical identification of frame 623.800.001
Type of Fiat engine 8215.22.520

DIMENSIONS AND WEIGHT

Dimensions . . . . . see Figs. 1-1 and 1-2
Weight of unit (with fuel, operatore and ROPS safety structure):

- Angledozer. . . . . .23885 kg (52.657 lbs)
- Bulldozer . . . . . .24000 kg (52.910 lbs)

ENGINE

Fuel supply

Air cleaning: dry filter (DONALDSON type) with automatic draun precleaner incorporated and safety cartridge with clog indicator light on dash.

Fuel cleaning: two filters in series on fuel pump delivery side with filter elements of cloth and paper fitted with transmitter for clog signalling.

R. BOSCH injection unit consisting of:

- fuel pump (piston type) with cup filter, type FP/K22P5
- injection pump with speed regulator (at all working revs) type PE6P120A720RS214
- automatic advance variator type . . . . . .PAV6°500-1000CRD18

The injection pump is lubricated with engine oil directly from the filter.

Fuel supply pressure . . . . 1.1 – 1.4 bar (16 – 20 psi)

Fixed advance injection pump delivery start . . . . . 22° ± 1°

Firing order 1-5-3-6-2-4

Injectors with 3-hole nozzles and spray angle of . .140°

Injector calibration pressure . . . . . 192 – 201 bar (2787 – 2918 psi)

Turbocharging

Turbocharging system by means of a turbocharger driven by exhaust gases.

Cooling

Water pressure type with centrifugal pump, radiator (6 rows of pipes), copper fins and double pitch pusher fan.

Corrosion inhibitor filter with paper element.

Temperature regulation by two parallel thermostats for radiator circulation.

Features of thermostats:

- temperature start of opening . . . . . .74 ± 2°C
- maximum opening temperature . . . . . 89°C

Cooling sustem calibration pressure . . . . . 0.74 bar (approx) (10.74 psi)

TORQUE CONVERTER

16'' monostage, hydraulic:

- torque ratio at stall . . . . . .2.6 :1

Transmission fhaft between converter and gearbox with two universal joints.

TRANSMISSION

Total power-shift gearbox with three forward and three reverse speeds obtained by five multi-plate clutch engagements, in oil, hydraulically controlled. Single gear lever on left hand side of operator.

Speeds k.p.h. (m.p.h.)	I	II	III
Forward	0–3.83 (0–2.38)	0–6.36 (0–3.95)	0–9.87 (0–6.13)
Reverse	0–4.32 (0–2.68)	0–7.13 (0–4.43)	0–10.90 (0–6.77)

Lever safety device which, when lowered to permit driver to get in or out, puts the gear lever into neutral and interrupts the engine start circuit.

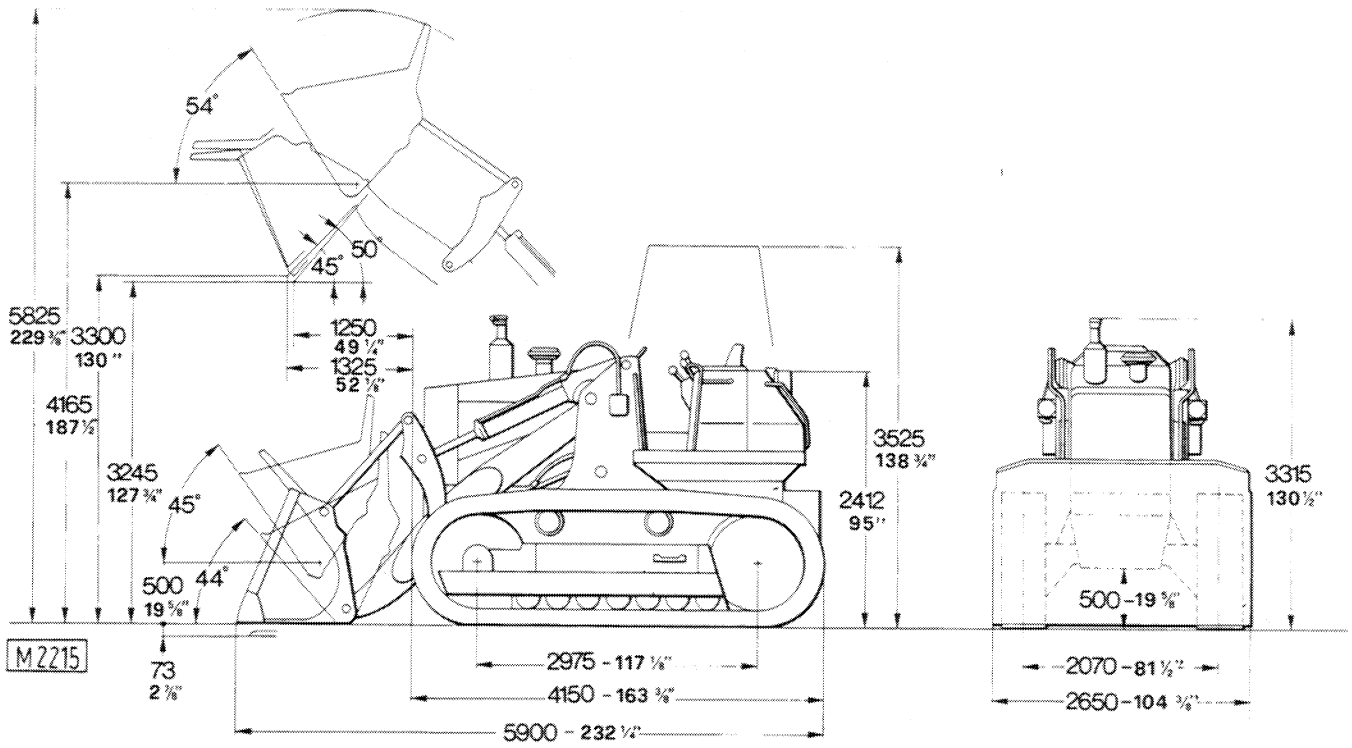


Fig. 1-1 - FL 20 Crawler loader (with ROPS structure) - Main dimensions.

CONVERTER-TRANSMISSION HYDRAULIC SYSTEM

Fed by a pump with three pairs of gears, two which for feeding the transmission-converter unit and the third for scavenging oil from the transmission gear recess.

– ratio engine revs/pump revs 1:1.238

Rated total capacity at maximum pump revs (2604 rpm) or single sections:

– transmission-converter supply section
96.5 l/min (25.5 g/min)

– converter supply section
65.5 l/min (17.30 g/min)

– oil scavenging from transmission gear recess section
193 l/min (51 g/min)

Cleaning of oil: a metal cartridge filter with magnetic plug located on the transmission-converter feed pump suction side;
a metal cartridge filter with safety valve on the delivery side of the transmission-converter feed pump;
a mesh filter on the converter oil scavenge pump suction head;
a filter with metal fabric filter element and magnetic plug on the suction head of the transmission gear recess oil scavenge pump.

Hydraulic gear selection distributor; incorporates converter-transmission circuit pressure regulation and moderator valves for gradual clutch engagement.

Pressure of clutch engagement:

12 - 15.7 bar (174 – 228 psi)

Converter pressure regulation valve:

– calibration pressure . 0.8 – 1.2 bar (11.6 – 17.4 psi)

Torque converter safety valve:

– calibration pressure . . . . . 7 – 9 bar (101–130 psi)

Lubrification oil pressure limitation valve:

– calibration pressure . . . . . .4 bar (58 psi)

Oil cooling by oil/water heat exchanger mounted on engine.

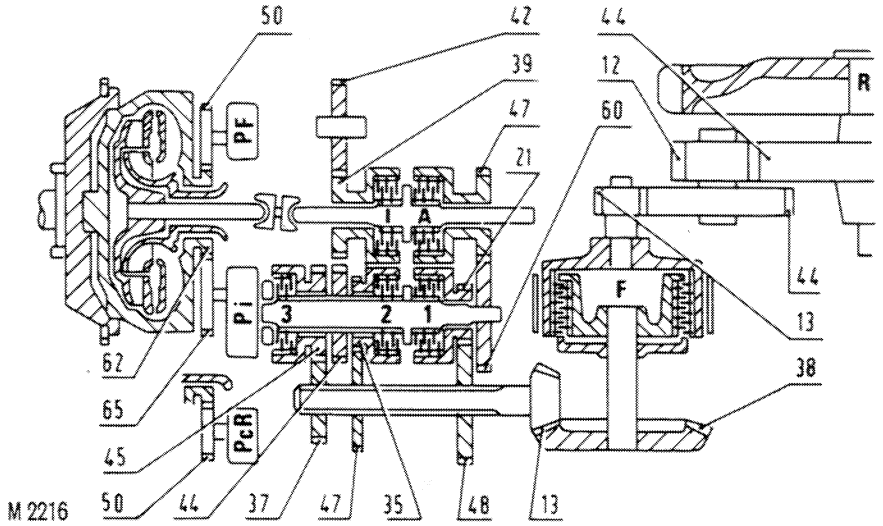


Fig. 1-2
Transmission schematic.

A. Forward speeds clutch - **F.** Steering clutches - **I.** Reverse speed clutch. **PcR.** Three-stage converter-transmission drive, converter supply and transmission oil scavenge from gear recess pump - **Pi.** Two-stage hydraulic system pump - **Pf.** Two-stage steering clutches-brakes and converter oil scavenge pump - **R.** Drive gear - **1.** 1st speed clutch - **2.** 2nd speed clutch - **3.** 3rd speed clutch.

BEVEL GEARING

Central reduction with helical bevel gears and one added bevel gear:

– reduction ratio (13/38) . . . . . 1 : 2.923

STEERING CLUTCHES

Hydraulically controlled multiple plate clutches in oil operated through two independent side pedals that successively actuate the brakes for steering.

– quantity of friction plates for each clutch. 15

BRAKES

Service

Band brakes, in oil bath, acting on outside drums of steering clutches, with hydraulic servo operated by a single central pedal.

– diameter of drums . . . . . .406 mm (15.98 in)

– width of bands . . . . . .120 mm (4.72 in)

Parking

Same parts as the service brakes controlled mechanically by the central pedal and with tension maintained by a locking lever.

HYDRAULIC SYSTEM
STEERING-BRAKE CLUTCHES

Fed by a hydraulic gear pump driven by a gear pair deriving its motion from the converter pump impeller:

– pump rotation (seen from the drive side) clockwise

– engine revs/pump revs ratio . . . . . 1 : 1.24

– rated capacity of pump at maximum rotation revs (2604 rpm) . . . . . 49.6 l/min (13.10 g/min)

– maximum operating pressure . . . . . 30.4 bar (441 psi)

Oil cleaning: suction filter with magnetic plug, full flow on pump intake and filter with changeable paper element on oil return pipe in rear transmission box, fitted with safety valve and clog signalling transmitter.

Hydraulic distributor incorporating servovalve, spool valve and check valve for regulating oil flow of steering clutches disengagement and brakes servo drive:

– steering clutches disengagement drive valve calibration . . . . . 22.5– 23.5 bar (326 – 341 psi)

– brake circuit overpressure valve calibration . . . . . 26.4– 30.4 bar (383 – 441 psi)

Independent brake servo cylinders, one for each brake.

FINAL DRIVES

Straight toothed gear side reduction with double final reduction:

– reduction ratio . . . . . 1 : 2.4

SPROCKETS

With replaceable crown gear in nine sectors of three teeth each

– number of crown gear teeth. 27

– basic diameter. . . . . .936 mm (36.9 in)

– width of toothing . . . . .94 – 96 mm (3.7 – 3.8 in)

UNDERCARRIAGE

Track frames connected at front and rear by two rigid cross beans, being integral part of machine frame

– number of shoes per track. 40

– width of shoes (standard) . . . . .500 mm (19.68 in)

– ground contact area . . . . .29,750 cm^2 (4,611 sq in)

Each frame is fitted with 7 track rollers (4 double flange and 3 single flange) and 2 carrier rollers.

Lubrication of rollers and idlers with long-life seals.

Single spring idlers with hydraulic adjustment of tracks:

– over-pressure valve calibration
. . . . . .980 – 1030 bar (14227.6 – 14953.5 psi)

FRONT SUSPENSION

Rigid cross beam.

REAR SUSPENSION

Rigid cross beam.

LOADER EQUIPMENT

Equipment

One-piece booms, in special boron steel connected at front with a boxed structure cross beam.

Lift cylinders (double acting). 2

– Bore and stroke. . . 180 x 918 mm (7.08 x 36.14 in)

Dump cylinders. 2

– Bore and stroke. . . 150 x 845 mm (5.90 x 33.27 in)

Hydraulic system

Feeded by a twin type gear pymp with built in recirculating valve which automatically cuts of pump large output when pressure builds up.

Pump drive: torque converter impeller driven.

– Engine rpm/pump rpm ratio . . . . . 1 : 0.953

– Nominal capacity at maximum rating :
0 to 140 bar (0 to 2030 psi) . 370 l/min (97.7 gpm)
140 to 170bar(2030 to 2465 psi).185 l/min(48.9gpm)

– System pressure setting...135–145bar(1950–2130psi)

Oil cleaning: by means of two filters, one with magnetic plug and metal filter element on pump suction head and the other on the pump return, with paper element, fitted with by-pass valve to exclude filter in event of clogging, and clog signal transmitter.

Hydraulic control valve alongside operator, incorporating three spool control rods for:

– raising

– dumps

– ripper or additional equipment functions (optional).

The control valve is also fitted with a main relief valve, safety valves, reflow and check valves independent for each circuit.

– system main relief valve calibration pressure
. . . . . .170 bar (2465 psi)

– calibration pressure of safety valves incorporated in the multiple valves
bucket dump . . . . . 130 bar (1885 psi)
bucket retract. . . . . 180 bar (2610 psi)

– calibration pressure of safety valves:
ripper circuit . . . . . 180 bar (2610 psi)
boom lift circuit . . . . . 230 bar (1885 psi)

Boom control lever (raising and lowering):

– calibration pressure of retarder valve
. . . . . .200 bar (2900 psi)

Oil cooling by means of aliminium radiator installed on the oil return line from control valve to tank.

Hydraulic devices

– Automatic boom kick-out

– Automatic bucket leveler mounted on the right dump cylinder.

– Lock-up valve installed on left lift cylinder, which prevents fall of loader equipment in case of piping failure when the control lever is in lift or neutral position, and allows rapid lowering of equipment with lever in lowering position.

Ripper (optional)

Model PL 20: parallelogram with two double acting vertical cylinders, and three shanks.

ELECTRIC SYSTEM

Voltage . . . . . 24 V

Two batteries in series:

– MARELLI type . . . . . 6 ATP 33

– discharge capacity in 20 hours . . . . . .176 Ah

Three-phase self-rectifying alternator:

– MARELLI type . . . . . A-A 125 28V 30A

– maximum current . . . . . 38 A

Electronic voltage regulator (incorporated in the alternator):

– type . . . . . .FIM-RTT 114 B

Starter motor with electromagnetic engagement control and coupling with free wheel device.

– Delco Remy type . . . . . 300-50 MT

– rated power . . . . . 9.5 kW (12 hp)

1.2 NOTES FOR SPARES

To guarantee perfect machine operation, remember that replacements should be made exclusively with original parts.

When ordering, specify:

– the type and number of frame (Figs. 1-3)
– the type and number of engine (Figs. 1-4)
– the catalog part number of the part requested.

When attachment (bucket and ripper) parts are required, also indicate the type and number of the attachment (Figs. 1-6).

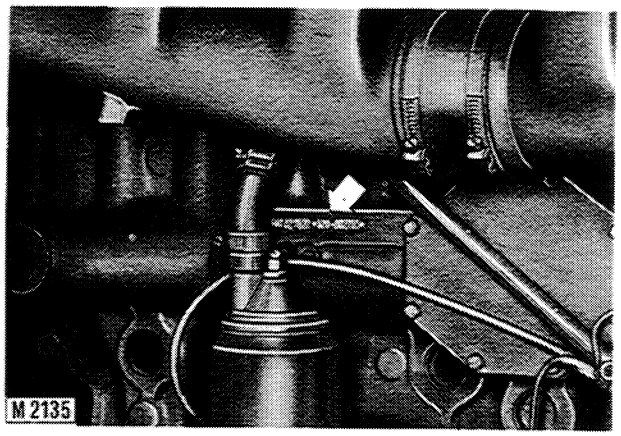


Fig. 1-4 - Type and serial number of engine.

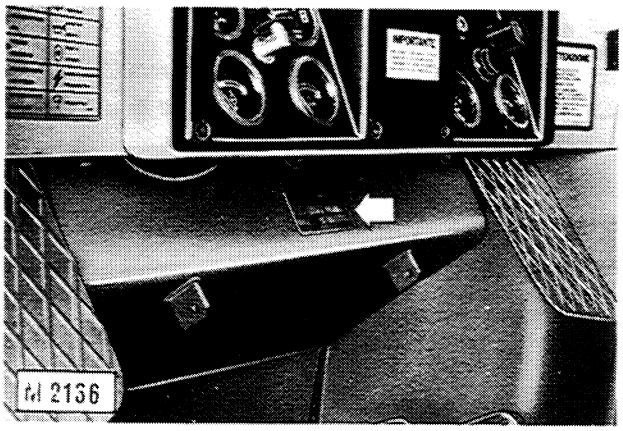


Fig. 1-5 - Frame and engine type data plate.

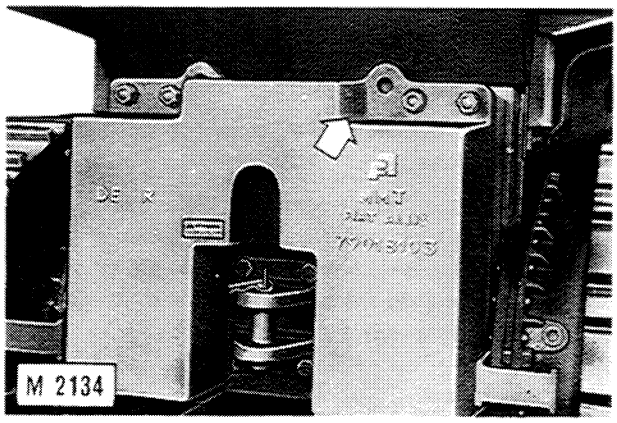


Fig. 1-3 - Type and serial number of frame (stamped on transmission housing).

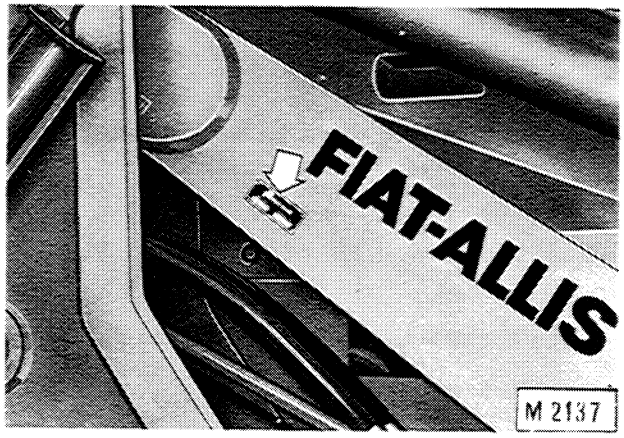


Fig. 1-6 - Type and number of loader (for ripper attachment see plate applied to respective frame).

1.3 CAPACITIES

ITEM	QUANTITY litres	QUANTITY U.S. gal	FIAT PRODUCT
Cooling system	66	17.4	Water and FIAT fluid mixture "**PARAFLU 11**" at 50 % (1)
Fuel tank	470	124	Decanted and filtered fuel oil
Engine	31	8.19	Oliofiat **AGERTER** (2)
Converter/transmission circuit	39	10.3	Oliofiat **GI/M**
Bevel gearing, steering clutches and brakes	64,5	17	For temperatures above 0°C; oliofiat **AGERTER 30** (SAE 30) For temperatures below 0°C: oliofiat **AGERTER 10 W** (SAE 10 W)
Final drives (each)	46	12.1	Oliofiat **AW 90/M**
Hydraulic system for equipment	75	19.8	For temperatures above 0°C: oliofiat **AP 51** For temperatures below 0°C: oliofiat **AP 31**
Supplement for ripper	12	3.17	

The oil quantities indicated are those required at periodic changes.

(1)The mixture has anti-oxidising, anticorrosive, anti-foam, antifouling properties and will not condense at - 35°C.

(2) **Type of oliofiat for engines, depending on outside temperature**		
AGERTER 10 W (SAE 10 W)	Minimum below −15°C	
AGERTER 20 W (SAE 20 W)	Minimum between −15°C and 0°C	
AGERTER 30 (SAE 30)	Max below 35°C	Minimum above 0°C
AGERTER 40 (SAE 40)	Max above 35°C	

LUBRICANT FEATURES

Item	Fiat product	
	Identification	International classification
TRANSMISSION-CONVERTER	GI/M	ATF Type A - Suffix A
ENGINE-BEVEL GEARING STEERING CLUTCHES-BRAKES	AGERTER	MIL-L-2104 C or Service API CD
ROLLERS-IDLERS	AGERTER 30	idem SAE 30
FINAL DRIVES	AW 90/M	SAE 80 W/90 EP or MIL-L-2105 C
HYDRAULIC SYSTEM	AP 31	Oil for hydraulic circuits, containing grease, anti-oxidising and antiwear additives SAE 10 W
	AP 51	idem SAE 20 W
GREASE FITTINGS	G 9	Lithium-calcium base grease, resistant to water, high loads or high temperatures with N.L.G.I. rating 2

1.4 GENERAL FITTING NOTES

1.4.1 FLOATING RING SEALS

Carefully examine metal rings **M** ensuring that their sealing surfaces are free from score marks, dents or wear due to misalignment or flatness errors.

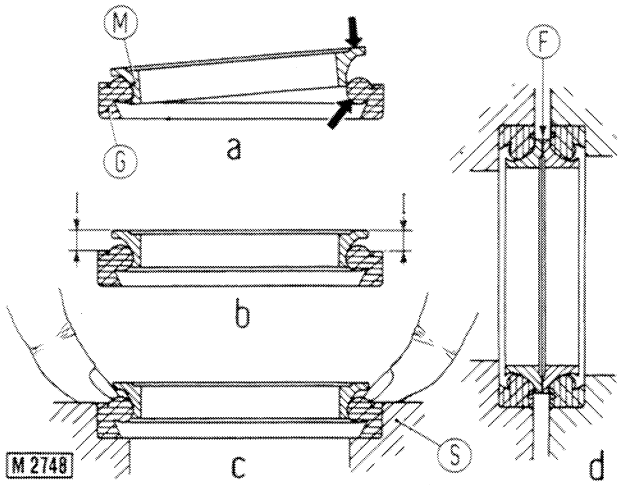
Both metal rings, and rubber seals **G**, should be renewed together, even if only one is found to be defective.

Do not pair new and worn metal rings together, nor used rings of different pairs.

If necessary, rubber seals **G** may be renewed without changing the metal rings.

To fit a seal proceed as follows:

- remove all sharp corners and burrs, and carefully clean the rubber seal housings;
- throughly clean the rubber seals;
- couple each metal ring **M** to the associated rubber seal **G** as shown in **a**, pushing and pressing as indicated by the arrows;
- Ensure that each metal ring is correctly seated. Dimension **l** (see detail **b**) should be equal all round;
- place each seal assembly in position by depressing the rubber ring as shown in detail **c**;
- before pairing the seal assemblies (see detail **d**) clean sealing faces **F** using a lint-free cloth and smear a light coat of thin oil over the contact surfaces.



1.4.2 ROTARY SHAFT SEALS

To fit rotary shaft seals proceed as follows:

- prior to fitting soak the seals for at least half an hour in the fluid to be retained;
- carefully clean the shaft and ensure that the contact surface is free from damage;
- turn the end of the sealing lip towards the fluid to be retained; if of the thrower lip type, turn the grooves so that during shaft rotation the fluid tends to be thrown back;
- smear the sealing lip with a very thin coat of lubricant (oil is better than grease) and pack the space between sealing lip and dust shield with grease (applicable to double lip seals);
- fit the seals into their housing using a flat ended tool or ram. Under no circumstances fit with a drill and hammer;
- avoid entry of the seal into the recess in a tilted position. Exert a firm and uniform pressure squarely on it and ensure that the seal is pressed fully home;
- to prevent sealing lip damage during fitting, use some sort of protection before sliding over the shaft;

1.4.3 O-RINGS

Lubricate each ring prior to fitting and, on reassembly, slide over the part but do not twist, otherwise leakage will result.

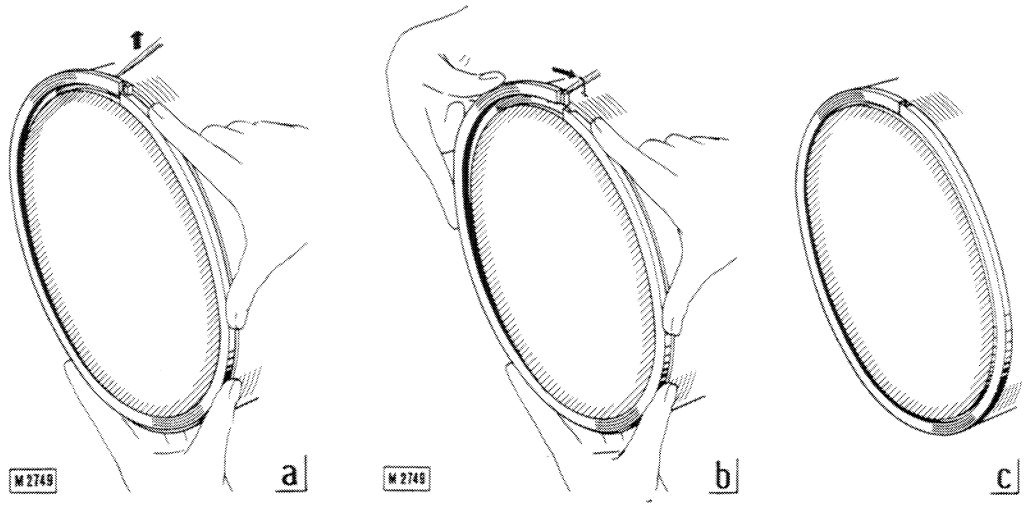
1.4.4 FACE SEALING RINGS

To remove proceed as follows:

- depress one end of the ring (see **a**);
- hold in position and insert a scriber point beneath the other end to separate the interlocking ends as shown.

To refit adopt the following procedure;

- re-position the seal and depress one end of the ring (see **b**).



– hold in position and lift the free end (see **b**) until the two ends lock together correctly (see **c**).

1.4.5 ADVICE FOR DISASSEMBLING AND ASSEMBLING GROUPS

The purpose of the following general information is to help you disassemble and assemble groups. Keep it in mind when carrying out the work.

CLEANING

After removing the electric system, carefully clean the parts to be disassembled, preferably with a jet of steam.

Many repair or service shops use caustic compounds to remove traces of grease, dirt, paint and remains of gaskets, etc. from parts. Such compounds are extremely useful and effective if employed correctly, but they may cause considerable damage to certain materials.

Materials such as aluminium, rubber, fibres, sintered bronze and binding agents are particularly sensitive to all high concentration caustic compounds.

Certain heat exchangers and radiators are made with aluminium tabs. To clean both inside and outside of these parts we recommend the use of solvents that do not react with aluminium.

DISASSEMBLY

Whenever you work with the engine or other parts removed from the machine, it is always advisable to use appropriate stands. Keep baskets or other containers at hand for holding small disassembled parts. Pay particular attention to machined surfaces and, after disassembly, rest them on shelves or blocks of wood.

When disassembling identical parts, such as tappet valves etc., place them in suitable containers so that they can be refitted in the right order.

ASSEMBLY

Carefully clean all parts to be refitted as described in the manual. We recommend the use of the special tools illustrated. Whenever possible, drive in bushes to their correct position, using a press. If it is necessary to use a hammer to fit the bush, employ a suitable punch to prevent damage to it.

Lubricate ball bearings before assembly and bushes prior to fitting their pins. Lubricate the sealing lip on all seals before installing (see chap. 1.4.2).

Wherever possible, use new seals. Cylinder head gaskets should always be new.

Use screws with the dimensions and characteristics indicated, making reference to part numbers in the Spares Catalog.

Where indicated, use safety washers, cotter pins, locking wire, etc.

Respect specified torque loadings as indicated in the appropriate section of this manual, using a suitable torque wrench.
Self-locking nuts should be replaced every time a disassembly operation is carried out so as to guarantee a constantly good seal at slackening.

1.5 TROUBLESHOOTING

1.5.1 GENERAL

For speedy detection of trouble, we recommend you to abide by the following rules:

a) Knowledge of the machine

It is impossible to look for causes and arrive at a solution without having a thorough knowledge of the machine. We therefore recommend you to study the descriptions contained in service manuals on the make up and operation of assemblies.

b) Check-up with operator

A lot of trouble is caused by ill-considered usage or inadequate maintenance. Check with the operator whether the machine has already suffered from similar trouble and whether repairs were carried out with suitable equipment and original spares. Also check the machine's environmental and operating situation and see how normal service operations are carried out.

c) Operating the machine

The best way for monitoring machine condition is to try it under effective working conditions. On that occasion, check:

- that instruments are working properly;
- that the machine is performing as specified;
- if there are noises other than normal operating noises, identify their origin and the operating conditions under which they occur.

d) Inspecting the machine

After the control outlined at point c, stop the machine adn make a visual check-up around it. See whether there are any fluid leaks, loose bolts, breakages or deformations, etc.

e) Troubleshooting

Once the fault has been identified, make a list of possible causes with the aid of suggestions in the respective section of the manual and identify the correct one by means of practical tests, starting with the most likely causes and the most easily performed tests.

Circuit	Ref. Fig. 1-7	Standard values
Engine lubrication	A	4.75 – 5.25 bar
Engine supercharging	B	326–392 m. bar (245–295 mm Hg) (1)
Engine drainage	C	500–550°C (1)
Torque converter	D	2.5 bar (neutral) 3.5 bar (gear engaged) (1)
Transmission lubrication	E	1.7 – 2.6 bar
Attachment control	F	160 bar (2)
Brakes	G	26.47–30.41 bar (3)
Steering clutches	H-I	22.55–23.53 bar (4)
Transmission	L-M-N-O-P O	12 – 16 bar [gear engaged] 3 – 4 [in neutral]

(1) Measured with converter stalled.

(2) Overpressure valve calibration pressure with bucket return control at limit.

(3) Measured with brake pedal right down.

(4) Measured after disengaging corresponding steering clutch.

1.5.2 MEASURING PRESSURES IN THE HYDRAULIC CIRCUITS FOR TROUBLESHOOTING PURPOSES

To help troubleshooting of the various component assemblies of the machine, pressure measurement points are provided. These offer a quick, easy and comprehensive picture of the situation without major disassembly operations.

The table shows:

- identification letters for the pressure points shown in Fig. 1.7;
- the name of the pressure points;
- normal pressure with the engine running at 2100 rpm and oil at normal operating temperature (other operating conditions are specified in special notes).

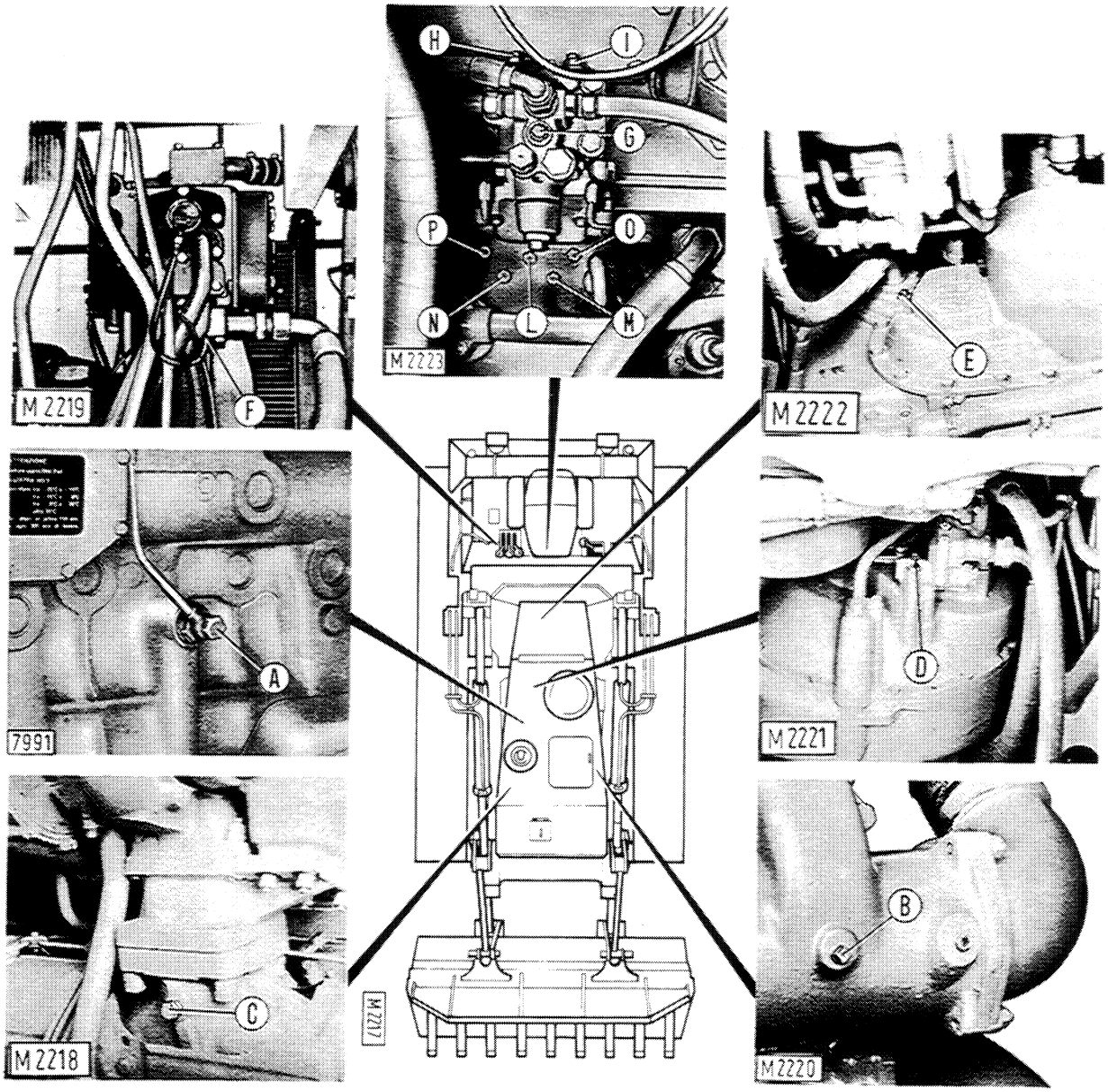


Fig. 1.7 - Schematic and pictures of troubleshooting check points.

A. Engine lubrication circuit - **B.** Engine supercharging circuit - **C.** Engine exhaust circuit - **D.** Torque converter circuit (seen from below) - **E.** Transmission lubrication circuit (seen from below) - **F.** Attachment control circuit - **G.** Brakes circuit - **H-I.** Right and left steering clutches circuit - **L.** Reverse speed circuit - **M.** Forward speed circuit - **N.** 1st speed circuit - **O.** 2nd speed circuit - **P.** 3rd speed circuit.

1.6 MEASUREMENT UNITS

The measurement units employed in this manual are those adopted by the International System (I.S.) instead of the mks. system used previously.

Force:
decanewton (daN), replaces kilograms (kg)

Pressure: bar substitutes kg/cm^2

Torque:
decanewton x mètre (daN.m) replaces kg.m

Apply the following table to convert measurement units:

	multiply	**by**	**to obtain**
Force	kg	0,9807	daN
Pressure	kg/cm^2	0,9807	bar
Torque	kg.m	0,9807	daN.m

NB: For everyday repair requirements, the following equivalences can be considered valid:
kg = daN
kg/cm^2 = bar
kg.m = da N.m

2. ENGINE RELATED COMPONENTS

Note: The data, features and repair instructions contained in the present manual refer exclusively to the assemblies and components fitted to engine 8215.22.520 installed on the FL 20 crawler loader. Remaining engine parts are dealt with in the "Service manual - ENGINE 8215", publication no. 604.06.190.

WARNING

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.

WARNING

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.

WARNING

Use proper tools to bring holes into alignment. DO NOT USE FINGERS OR HANDS.

WARNING

Use linkage safety support provided whenever it is necessary to put linkage in the raised position for any reason. Implement must be empty when using safety supports. Remove support and secure immediately after use for operation and transporting according to the Operation and Maintenance Instruction Manual. Do not substitute any other device for these supports. Block up linkage with an external support capable of holding up the linkage when work is required under the linkage, according to local or national requirements.

2.1 REMOVING (INSTALLING) ENGINE - CONVERTER ASSEMBLY

2.1.1. REMOVING

1. – Raise bucket and install locking spacer on boom cylinders;
   - remove the side panels and engine bottom guards, converter and transmission housing bottom guard;
   - remove the exhaust silencer, the air pre-cleaner, the air cleaner complete with joints and cowling.
2. Drain:
   - the coolant from the radiator and crankcase;
   - the oil from converter-transmission hydraulic system;
   - the hydraulic oil from the equipment system.
3. – Remove the platforms from the driving position and operator's seat including its mounting; close the fuel tap on the tank and insulate the batteries' earth cable.
4. Remove:
   - the platform clamping members;
   - the steering clutch distributor linkage;
   - the brake pedal board.

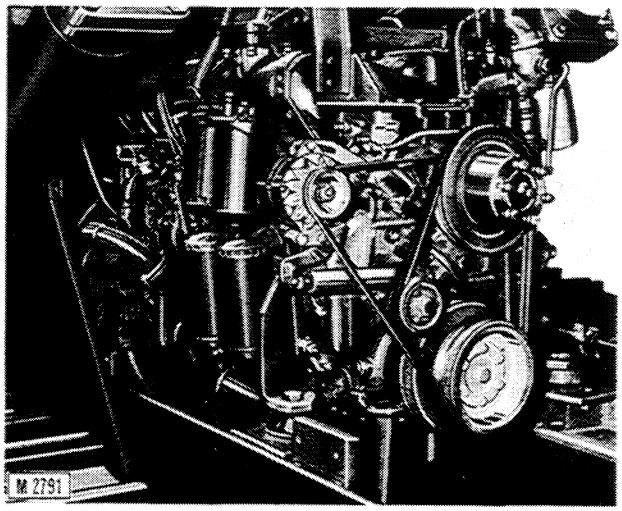


Fig. 2-1 - Right-hand side view of engine installed to machine.

5. To remove the radiator with shroud and air baffles proceed as follows:
   - remove the radiator guard from the top;
   - take off the fan guard;
   - remove the grill from the shroud and disconnect the hoses from radiator water inlet and outlet tubes;
6. Release the engine-converter group from pipings and cables connecting it to the machine frame.
7. Take off the universal joint transmitting motion from converter to transmission.
8. Remove the engine-to-frame pad mounting nuts and apply hook **75295500** as shown in Fig. 2-2, positioning front and rear hook eyes as illustrated in details **A** and **B**. Then lift the complete assembly.

2.1.2 OVERHAULING THE ENGINE

Remove the oil sump and clamp the engine-converter to a suitable rotary stand; then follow the instructions given in the "Engine 8215" service manual (form 604.06.190).

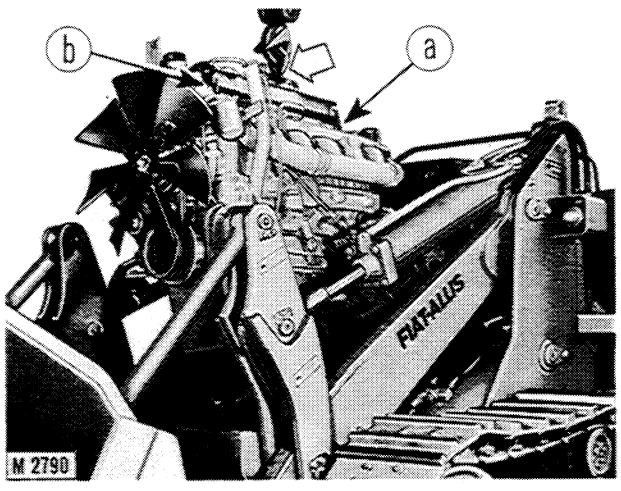
2.1.3 INSTALLING ENGINE

Reverse the order of the above operations:

- position the lifting hook **75295500** as shown in Fig. 2-2;
- remove the engine-converter assembly from the stand, raise it and position it on the machine;
- tighten the pad mounting nuts to suspension supports at a torque of 49 da N.m (361 ft eb).

2.2 ENGINE SUMP

Before removing the oil sump, with the engine still installed on the machine, remove the lower front guard; drain the engine oil, take out the dipstick, undo the mounting screws and remove the sump, supporting it with two cables between the engine and the frame members. Refit the sump in accordance with the instructions contained in chapter 2.2 of the "Engine 8215" service manual (form 604.06.190).



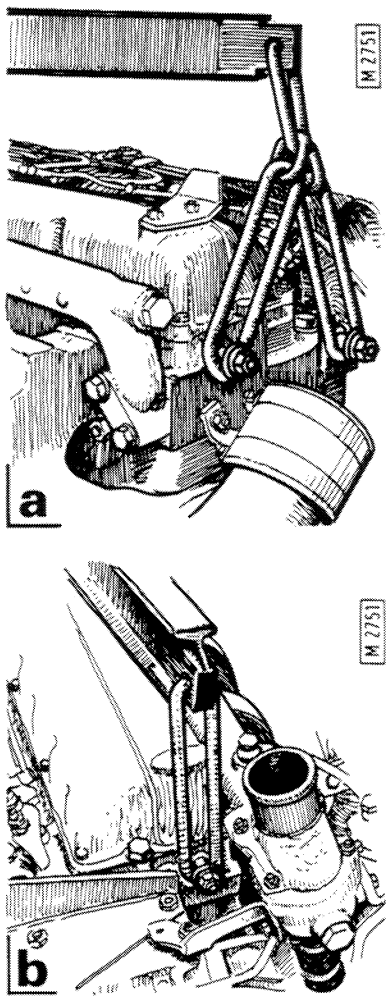


Fig. 2-2 - Removal (installation) of engine-converter assembly using lifting hook 75295500.

Details of lifting hook attachment points.

a. Rear fixing - **b.** Front fixing.

NB: The arrow indicates the hole where the lifting hook should be positioned.

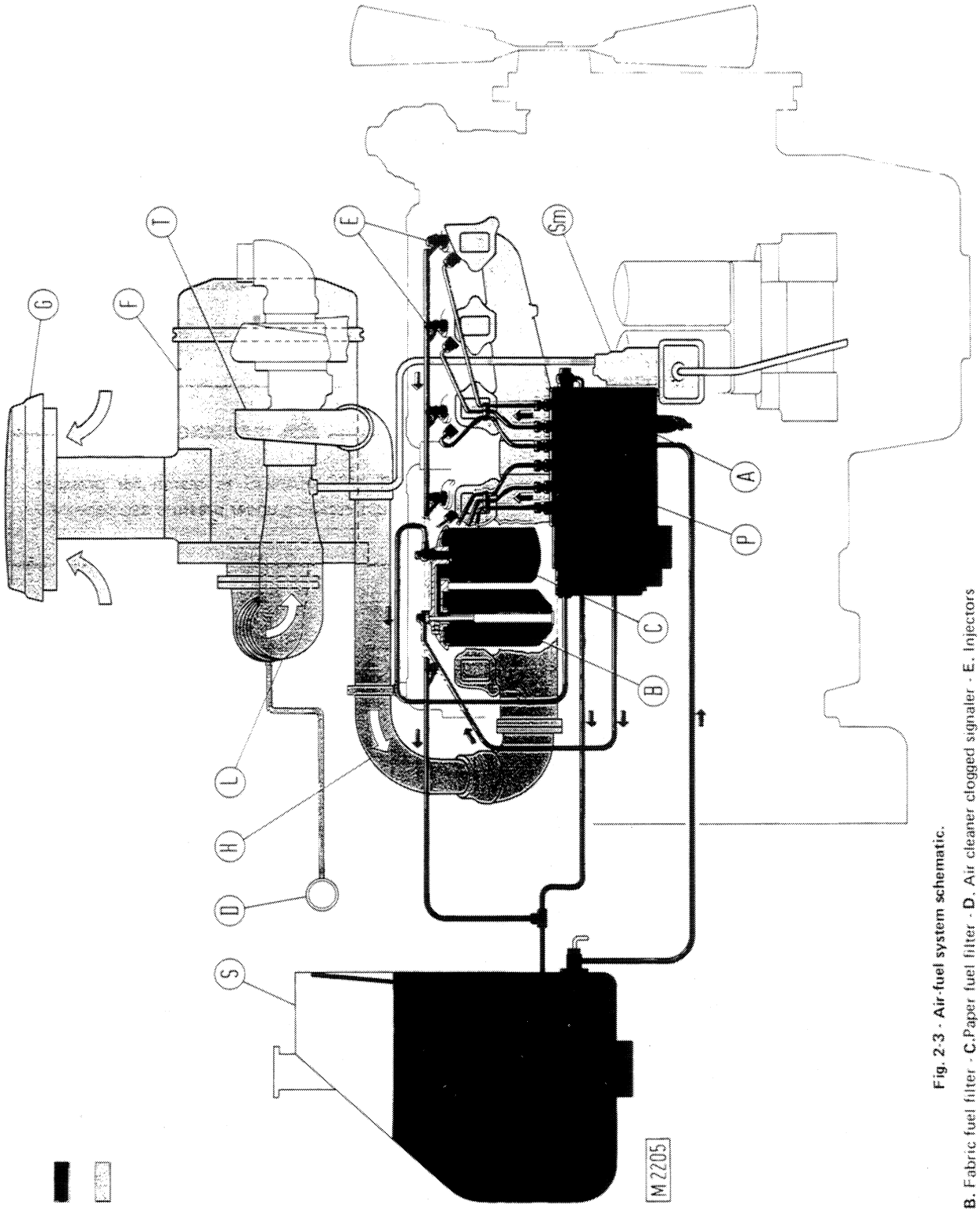


Fig. 2-3 - Air-fuel system schematic.

A. Fuel pump - **B.** Fabric fuel filter - **C.** Paper fuel filter - **D.** Air cleaner clogged signaler - **E.** Injectors - **F.** Dry air cleaner (Donaldson) - **G.** Centrifugal precleaner - **H.** Supercharging pipe - **L.** Intake pipe - **P.** Injection pump - **S.** Fuel tank - **Sm.** Engine oil gas blow-by (recycled in intake) - **T.** Turbocharger.

2.3 FUEL SUPPLY

WARNING

For instructions regarding standard maintenance operations, such as cleaning the dry air filter and the fuel tank, replacement of fuel filters and bleeding air from the fuel circuit, please see the OPERATION AND MAINTENANCE INSTRUCTION MANUAL supplied with all machines.

2.3.1 AIR FILTER

Cleaning of air for the cylinders is done by means of a DONALDSON or WHITEHEAD MOTOFIDES dry filter fitted with an incorporated automatic discharge prefilter and safety cartridge. A light on the dashboard connected to the fuel supply manifold, upstream from the turbocompressor indicates when filter cartridges are clogged.
Take down and reassemble the various parts of the air filter by referring to Fig. 2-4.

2.3.2 INJECTION ASSEMBLY

WARNING

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

2.3.2.1 General

WARNING

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

WARNING

DO NOT USE HANDS to search for pressure leaks. Fluid escaping under pressure can penetrate the skin.

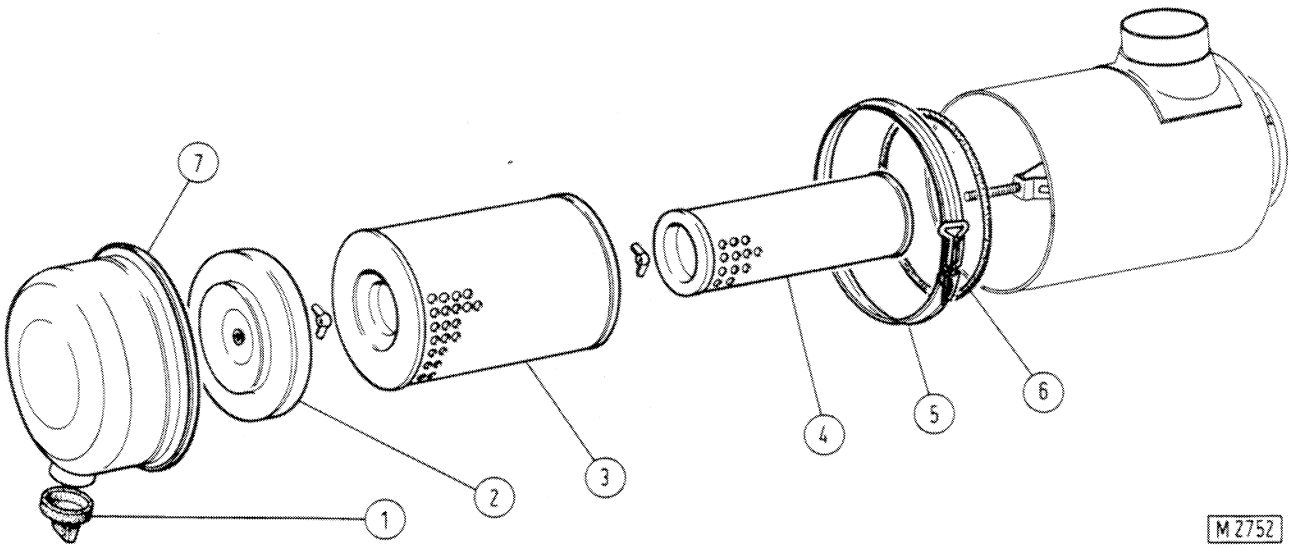


Fig. 2-4 - Exploded view of air cleaner (DONALDSON).

1. Dust discharge valve - **2.** Cover - **3.** Outside filter element - **4.** Internal filter cartridge
5. Outside cover clamp - **6.** Snap ring - **7.** Outside cover.