

Chapter 30

PUMP, FUEL, TYPES CH.4 AND CH.A.4

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Introduction

1. Type CH.4 and CH.A.4 types of fuel supply pump are electrically driven and are designed to deliver fuel at high pressure to the aircraft combustion heaters. The pumps are installed in the base of the combustion heater fuel supply tank; the pump and the enclosed electric motor being submerged in the fuel.

mounting ring, and carries the fuel outlet, gland drain and electrical connection. The gear pump unit is housed in a recess in the pump base and secured in position by a flanged cover which is bolted to the base casting.

5. Pumping is effected by two stainless steel gears running in mesh between two

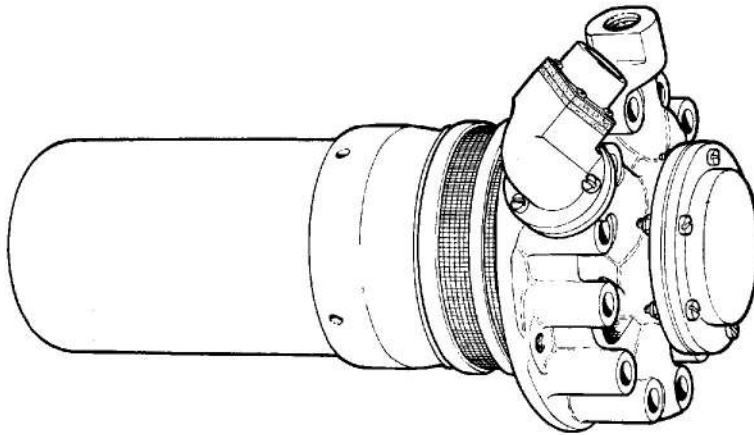


Fig. 1. External view of typical CH.4 series pump

2. The CH.4 and CH.A.4 are almost identical with one another with the exception of the method of mounting the electrical connection. On a CH.4 pump the electrical connection is fitted at the end of a short elbow casting, and on a CH.A.4 it is mounted directly on the base casting. Details of the differences between the mark numbers of each type together with the Leading Particulars are given in an appendix to this chapter.

DESCRIPTION

General

3. The pump consists of three main sub-assemblies as follows:—

- (1) Pump base (lower), pump unit and relief valve.
- (2) Pump base upper.
- (3) Motor unit.

Pump base (lower) assembly

4. The pump base (lower), which is the only part of the installed pump assembly to project outside the fuel tank, is provided with twelve 2-B.A. clearance holes, for attachment of the pump to the fuel tank

steel plates which are faced with poly-tetra-fluoro-ethylene. The drive to the gear unit is direct from the armature shaft through a semi-flexible coupling. Two aluminium alloy discs are fitted with carbon inserts which serve as gear bearings; the discs back up the faced plates, which are spaced by a tungum piece machined to contain the two gears and provide an outlet to the fuel delivery line. The whole assembly is dowelled and held together as a complete unit between two light alloy cover plates.

6. The relief valve, which limits the delivery pressure to a pre-set figure is fitted on the upper face of the pump base, within the fuel tank and in the line of the delivery outlet.

Pump base (upper)

7. The pump base (upper) comprises two circular end plates separated by two cored pillars, one which serves as a conduit for the electrical leads while the other serves as a gland drain. The base casting locates the base of the motor unit and a metallic bellows gland, which seats on a carbon insert in the vapour assister to prevent ingress of fuel to the motor unit. A vapour

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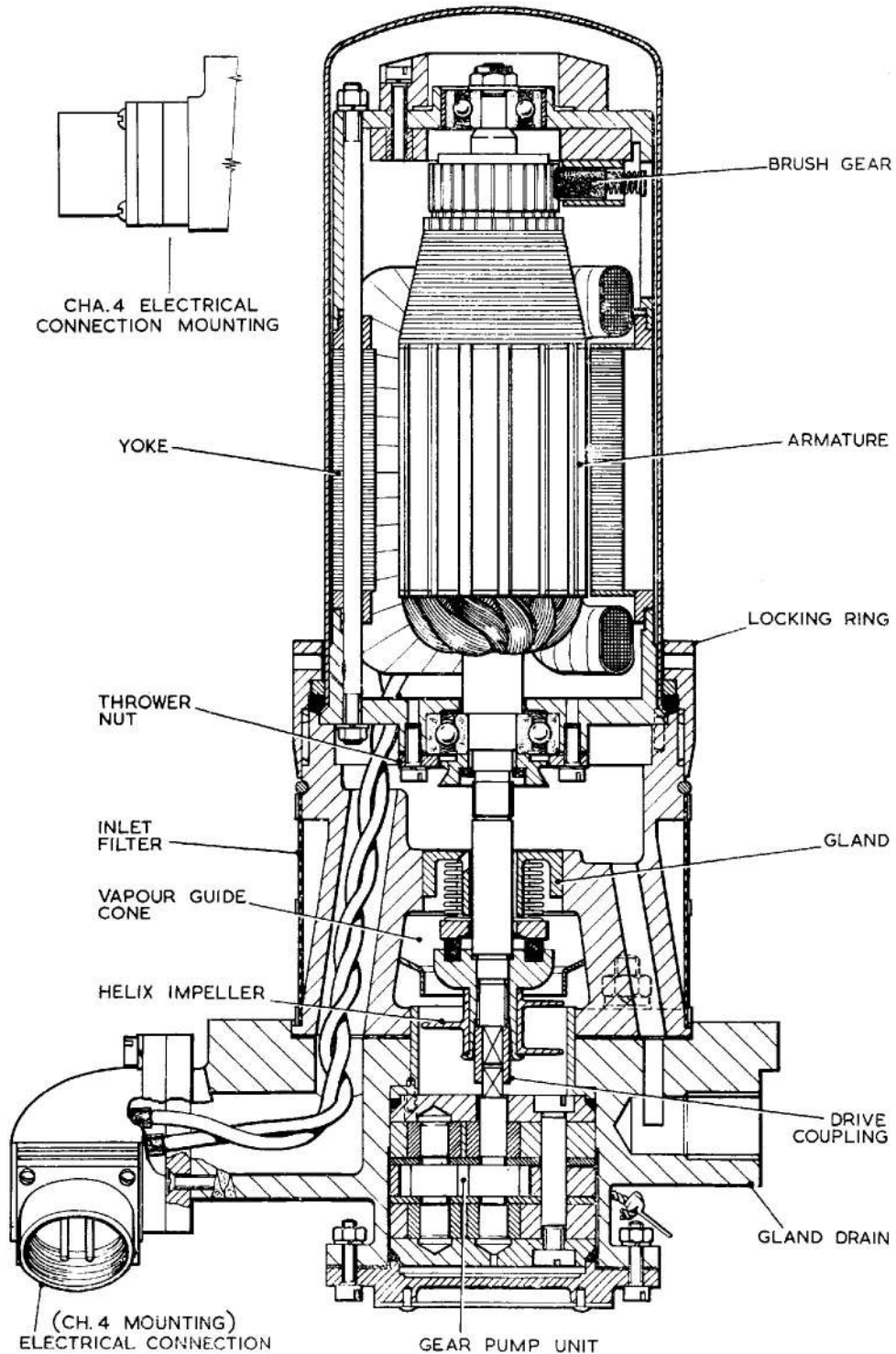


Fig. 2. Sectional view of CH.4/CH.A.4 pump

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guide cone is arranged around the fuel inlet to assist in the dissipation of any fuel and air vapour which may be evolved during flight.

8. The upper base is surrounded by a composite 50-mesh filter overlaid below the level of the outer rim of the vapour cone, with a 240-mesh filter. This is to prevent particles of dirt or foreign matter, which tend to settle at the bottom of the fuel tank, from entering the pump unit and fouling the closely confined pump gears.

Motor unit

9. The motor unit is a 26V d.c., flame-proof compound wound machine, with brush gear of unit construction to facilitate assembly. The armature spindle, extending through the metallic bellows gland, carries the vapour assister complete with carbon insert which makes a seal against the face of the metallic bellows unit. The impeller helix is peened to the stem of the vapour assister. A square-section sleeve connects the end of the armature spindle to the pump unit central gear shaft.

10. The armature shaft is supported by two ball bearings, both of which are pre-packed during manufacture, with an anti-freeze/high melting point grease, and cannot be relubricated. The inner race of the drive end bearing is locked in the armature assembly with a screwed ring incorporating a thrower, which flings off any slight oil leakage past the main gland.

OPERATION

11. When the pump motor is energised, fuel from the tank enters the pump through the wire gauze filters and is directed by the action of the impeller helix into the gear pump chamber, from which it is forced through two small outlets into the delivery line.

12. Under conditions in which the pump is supplying fuel in excess of heater requirements, the gear pump unit continues to deliver fuel but the pressure in the delivery line is held within pre-determined limits by the action of the relief valve.

REMOVAL AND INSTALLATION

Removal

13. Before attempting to remove a pump,

ensure that the tank has been drained of fuel by easing and removing the tank drain plug. Switch off the electrical supply to the pump.

14. The precise method of removing a CH.4 or CH.4.A pump is detailed in the appropriate Aircraft Handbook. In general terms it will consist of disconnecting the fuel delivery and gland pipes and the electrical connection socket. The pump can then be removed by releasing the twelve nuts securing it to the tank mounting ring. Support the weight of the pump during this operation. Two $\frac{1}{4}$ in. B.S.F. screws can be used, if necessary, in the pump base casting tapped flange holes to assist in breaking the joint with the tank mounting ring.

Pre-installation checks

15. The installation of all new pumps should be preceded by the following checks:

(1) Ensure that the pump has not been stored for longer than the specified maximum period (i.e. 12 months in the original packing and carton as supplied by the manufacturers, or 3 years where special packing has been provided). Pumps stored for periods in excess of these maxima must not be used without being dismantled, examined and tested as detailed in Vol. 6.

(2) Inspect exterior of pump for evidence of damage, security of locking wires, general cleanliness and corrosion. Blend out slight areas of corrosion with an approved protective finish to the unprotected area.

(3) Check that transit plugs have been removed from the delivery outlet, gland drain and electrical connection and remove any tape or other protective material from the wire mesh filter.

(4) It is advisable to make a starting check on the pump before installation. Apply a 26V d.c. electrical supply through the electrical connection. The pump must start immediately. Repeat the test several times. If the pump fails to start immediately on any of the checks it must be returned to an overhaul base for further serviceability testing using approved equipment.

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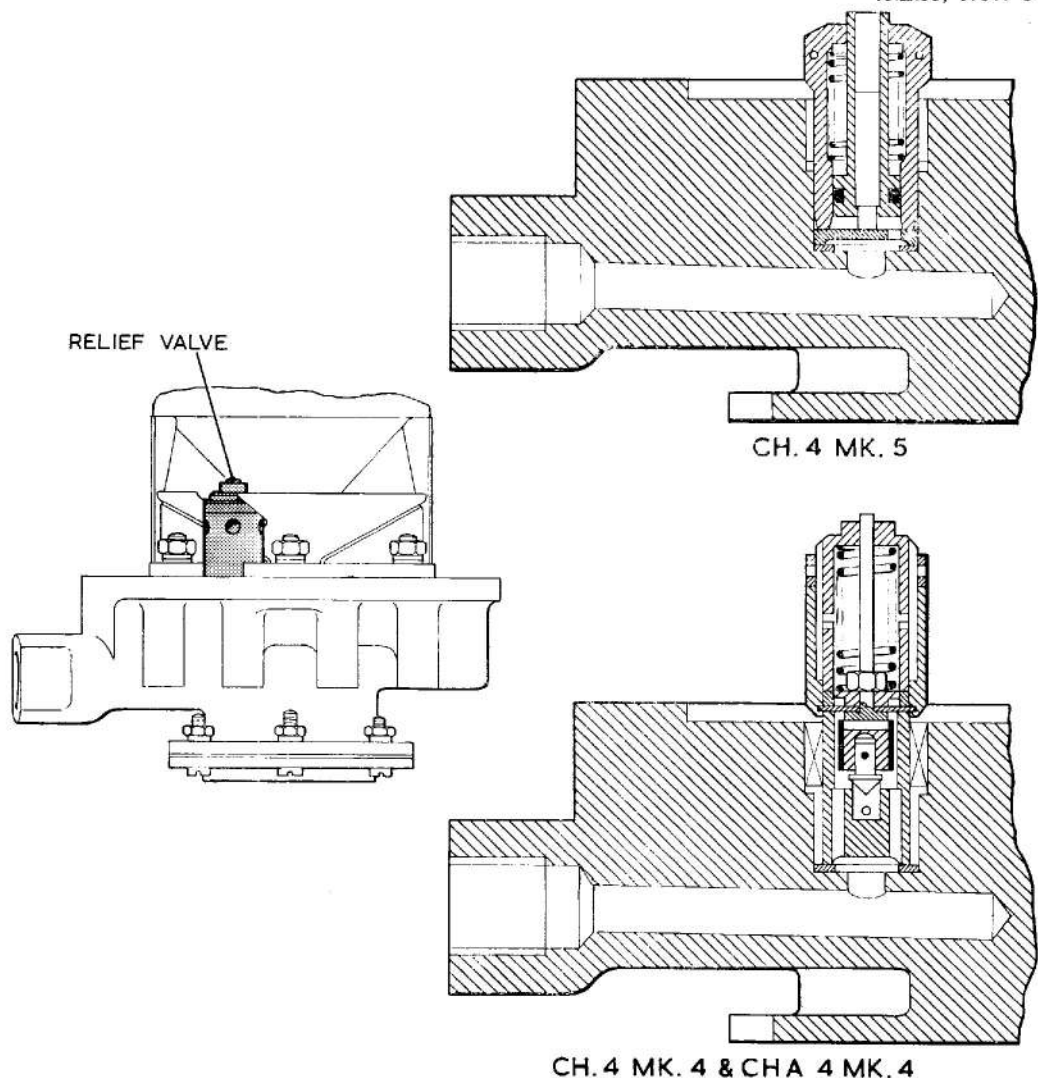


Fig. 3. Sectional view of relief valves

Installation

16. The above pre-installation checks apply to all aircraft installations of these pumps. For detailed procedure covering installation in a particular aircraft, reference should be made to the relevant Aircraft Handbook.

17. As a general example, installation in the aircraft will comprise the following operations:

(1) Fitting a new joint washer between the pump base mounting flange and the tank stud ring, using an ap-

proved jointing compound on both surfaces of the washer.

(2) Securing the pump unit to the stud ring with twelve lock-nuts.

(3) Reconnecting the fuel delivery and gland drain pipes, ensuring when relevant that the open end of the latter is in a low pressure area to avoid possible pressurisation in flight.

(4) Reconnecting the electrical supply plug to the pump socket.

(5) Wire locking all pipe connections, union nuts, etc.

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SERVICING

Routine inspection

18. At routine inspections the following procedure applies :

(1) Inspect all the pipe connections and wire-locking to the pump unit. Check the joint between the pump and the fuel tank for leakage. Correct as necessary.

(2) Test the pump as detailed in para. 20-26. If the pump performance is found to be unsatisfactory in any way, the pump must be removed from the aircraft and a new or reconditioned unit fitted. No in-situ maintenance is possible.

19. At the periods laid down in the appropriate Servicing Schedules, all pumps are to be replaced by new or reconditioned units drawn from Stores. Faulty and time expired pumps must be returned to a Maintenance Unit or the manufacturer for repair.

Electrical test

20. A routine electrical test in accordance with the appropriate Servicing Schedule should be made to ascertain that the motor unit is functioning satisfactorily. These tests must be made with the motor unit on load, i.e. immersed in and pumping fuel. The pump must be replaced by a new or reconditioned unit if there is any indication of erratic performance such as excessive current consumption.

Note . . .

The following 'No fuel flow' electrical test is only applicable to aircraft with the necessary instrumentation. Where no test panel is provided, particular attention should be paid to the Electrical test (para. 20) and Operational test (para. 24).

"No fuel flow" test

21. Ascertain the position of the aircraft pump test socket and switches by reference to the relevant Aircraft Handbook. Proceed as follows :

(1) Close all fuel cocks between the pump and heater unit to ensure that no fuel can flow.

(2) Connect a suitable portable ammeter to the socket on the test panel.

Note . . .

When using a clip-on type ammeter the tongs should be opened and closed smartly prior to use to reduce the hysteresis error.

(3) Switch on the pump by depressing the switch on the test panel. Observe the ammeter reading for a period of not less than 30 seconds.

22. Interpret the readings as follows :

(1) A steady reading not exceeding that indicated by the graph (Fig. 4) for the measured applied voltage, indicates that the motor is functioning satisfactorily.

Note . . .

The graph (Fig. 4) is provided as a guide to pump performance under no-flow conditions: the figures derived from it are not to be interpreted as forming a part of the approved Acceptance Test Specification for the pump.

(2) Current consumption in excess of the graph reading indicates either a faulty motor unit, a rise in torque loading due to the obstruction of moving parts, or a restriction of the fuel flow.

(3) A fluctuating reading indicates faulty contacts, defective brushes, faulty commutation or that bearings or other rotating parts are binding.

(4) A zero reading indicates an open circuit and is consistent with a blown fuse, faulty wiring, defective switch or a complete motor failure.

23. When the above tests have been completed, release the test switch and disconnect the ammeter.

Operational test

24. Subject to the electrical test being completed satisfactorily, the pump should be tested where the installation instrumentation is suitable for proof of performance and checked against the performance figures quoted in the appropriate Appendix to this chapter. Refer to the relevant Aircraft Handbook for procedure details. Possible causes of failure, to obtain the required performance, are given in Table 1.

Gland leakage

25. During the above tests an examination

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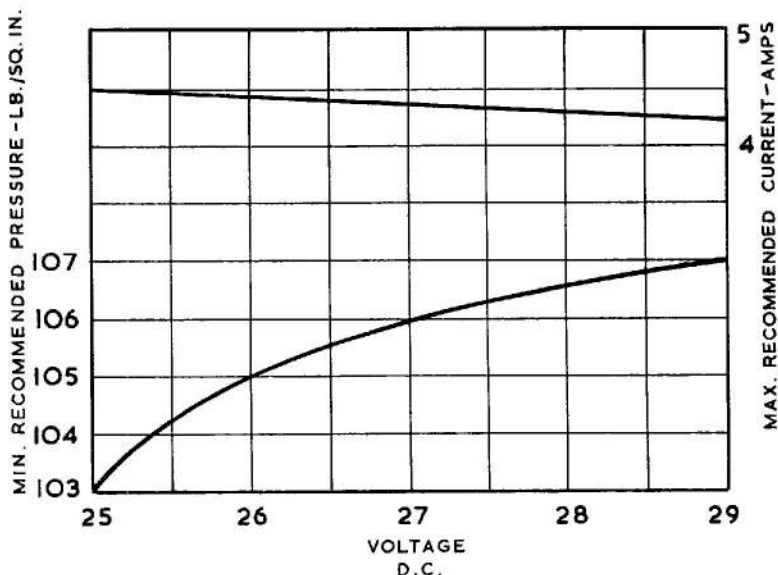


Fig. 4. "No fuel flow" electrical test graph

should be made of the gland drain exit for fuel leakage. The leakage must not exceed two drops per minute while the pump is running, or, one drop per minute while stationary. Any leakage in excess of these figures will necessitate removal of the pump from the aircraft.

Insulation resistance test

26. Using a 500 volt insulation resistance

tester, measure the insulation resistance between the socket pins and earth. When a new pump is drawn from Stores the insulation resistance must be not less than 2 megohms. After installation, due to the humidity conditions prevalent in aircraft at dispersal points, the minimum permissible insulation resistance is 50,000 ohms.

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TABLE 1

Faults, possible causes and rectification

Fault	Possible cause	Rectification
Gland leakage	(1) Bad finish between gland seal faces. (2) Insufficient pressure between gland seal faces.	All these conditions require that the pump is removed from the aircraft and returned to a Maintenance Unit or to the pump manufacturer for re-conditioning.
Excessive current	(1) Excessive loading on metallic bellows gland. (2) Faulty motor unit. (3) Fouling of geared pump unit by foreign matter.	
Low delivery pressure	(1) Faulty motor unit. (2) Excessive wear in gear pump unit chamber.	
Pressure surge	(1) Tight or pre-loaded bearings. (2) Excessive loading on metallic bellows gland.	
Low insulation resistance	(1) Dampness in motor windings.	

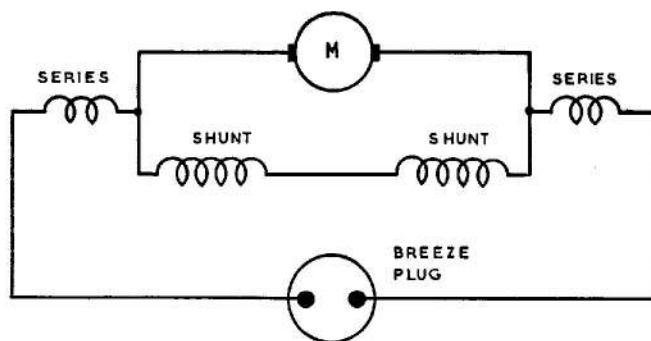


Fig. 5. Circuit diagram

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Appendix 1

PUMPS, COMBUSTION HEATER FUEL SUPPLY, TYPE CH.4 MK. 3, 4 AND 5 AND TYPE CH.A.4 MK. 3 AND 4

Pump, combustion heater fuel supply, Type CH.4 Mk. 3	Ref. 5UE/6341
Pump, combustion heater fuel supply, Type CH.4 Mk. 4	Ref. 5UE/6720
Pump, combustion heater fuel supply, Type CH.4 Mk. 5	Ref.
Pump, combustion heater fuel supply, Type CH.A.4 Mk. 3	Ref.
Pump, combustion heater fuel supply, Type CH.A.4 Mk. 4	Ref.
Voltage limits	25.0/29.0V d.c.
Rated voltage	26V d.c.
Rated output at 26V d.c.	10.0 gal./hr. min.
Delivery pressure at rated voltage/output	100 lb./in ² .
Maximum current consumption at rated voltage/output	4.25A.
Maximum no-flow delivery pressure at 29.0V d.c. (controlled by relief valve)	120 lb./in ² .
Minimum no-flow delivery pressure	See Fig. 4 basic chapter
Electrical connection (Plessey 2CZ.140052)	Ref. No. 5X/6720
Delivery outlet tapping	$\frac{1}{4}$ in. B.S.P.
Gland drain tapping	$\frac{1}{4}$ in. B.S.P.
Weight of pump	5.7 lb. (CH.A.4) 5.8 lb. (CH.4)

Introduction

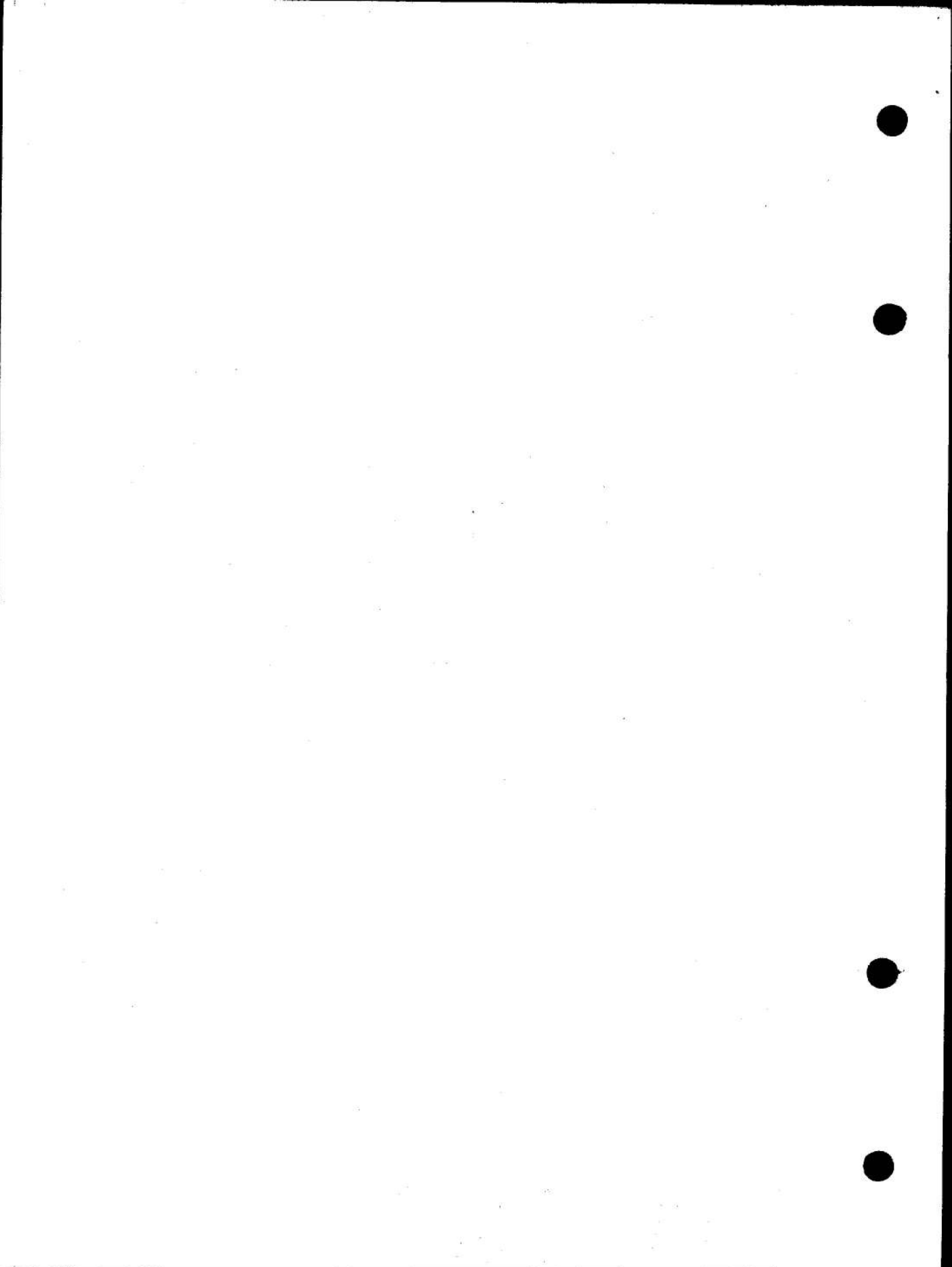
1. The type CH.4 and CH.A.4 pumps are basically similar to one another in all details except the method of mounting the electrical connection. On CH.4 pumps the electrical connection socket is mounted on a short elbow casting fixed to the base casting: on the CH.A.4 pump the socket is mounted directly on to the pump base.

Type differentiation

2. Basic differences between the various marks of CH.4 and CH.A.4 pumps covered by this appendix are as follows:—

- CH.4 Mk. 3. Basic production design covered in chapter.
- CH.4 Mk. 4. Generally similar to Mk. 3 pump but fitted with an improved design of relief valve.
- CH.4 Mk. 5. Generally similar to Mk. 4 pump but a new design of relief valve fitted.
- CH.A.4 Mk. 3. Basic production design covered in chapter.
- CH.A.4 Mk. 4. Generally similar to Mk. 3 pump but fitted with an improved design of relief valve.

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