

**TROUBLESHOOTING GUIDE
AND MAINTENANCE HINTS**

V60391

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SECTION I - INTRODUCTION

1-1. GENERAL. The trouble shooting charts and maintenance hints that follow are of a general system nature but should provide an intuitive feeling for a specific system. The more general information is covered in the immediately following paragraphs. Effect and probable cause charts appear in Section II.

1-2. SYSTEM DESIGN. There is, of course, little point in discussing the design of a system which has been operating satisfactorily for a period of time. However, a seemingly uncomplicated procedure such as relocating a system or changing a component part can cause problems. Because of this, the following points should be considered:

A. Each component in the system must be compatible with and form an integral part of the system. For example, an inadequate size filter on the inlet of a pump can cause cavitation and subsequent damage to the pump.

B. All lines must be of proper size and free of restrictive bends. Undersize or restricted line results in a pressure drop in the line itself.

C. Some components must be mounted in a specific position with respect to other components or the lines. The housing of an in-line pump, for example, must remain filled with fluid to provide lubrication.

D. The inclusion of adequate test points for pressure readings, although not essential for operation, will expedite trouble-shooting.

1-3. KNOWING THE SYSTEM. Probably the greatest aid to trouble-shooting is the confidence of knowing the system. Every component has a purpose in the system. The construction and operating characteristics of each one should be understood. For example, knowing that a solenoid controlled directional valve can be manually actuated will save considerable time in isolating a defective solenoid. Some additional practices which will increase your ability and also the useful life of the system follow:

A. Know the capabilities of the system. Each component in the system has a maximum rated speed, torque, or pressure. Loading the system beyond the specifications simply increases the possibility of failure.

B. Know the correct operating pressures. Always set and check pressures with a gauge. How else can you know if the operating pressure is above the maximum rating of the components? The question may arise as to what the correct operating pressure is. If it isn't correctly specified on the hydraulic schematic, the following rule should be applied:

The correct operating pressure is the lowest pressure which will allow adequate performance of the system function and still remain below the maximum rating of the components and machine.

Once the correct pressures have been established, note them on the hydraulic schematic for future reference.

C. Know the proper signal levels, feedback levels, and dither and gain settings in servo control systems. If they aren't specified, check them when the system is functioning correctly and mark them on the schematic for future reference.

1-4. DEVELOPING SYSTEMATIC PROCEDURES. Analyze the system and develop a logical sequence for setting valves, mechanical stops, interlocks, and electrical controls. Tracing of flow paths can often be accomplished by listening for flow in the lines or feeling them for warmth. Develop a cause and effect troubleshooting guide similar to the charts appearing in Section II. The initial time spent on such a project could save hours of system down-time.

1-5. RECOGNIZING TROUBLE INDICATIONS. The ability to recognize trouble indications in a specific system is usually acquired with experience. However, a few general trouble indications can be discussed.

A. Excessive heat means trouble. A mis-aligned coupling places an excessive load on bearings and can be readily identified by the heat generated. A warmer than normal tank return line on a relief valve indicates operation at relief valve setting. Hydraulic fluids which have a low viscosity will increase the internal leakage of components resulting in a heat rise. Cavitation and slippage in a pump will also generate heat.

B. Excessive noise means wear, mis-alignment, cavitation or air in the fluid. Contaminated fluid can cause a relief valve to stick and chatter. These noises may be the result of dirty filters, or fluid, high fluid viscosity, excessive drive speed, low reservoir level, loose intake lines, or worn couplings.

1-6. MAINTENANCE. Three simple maintenance procedures have the greatest effect on hydraulic system performance, efficiency, and life. Yet, the very simplicity of them may be the reason they are so often overlooked. What are they? Simply these:

A. Maintaining a clean sufficient quantity of hydraulic fluid of the proper type and viscosity.

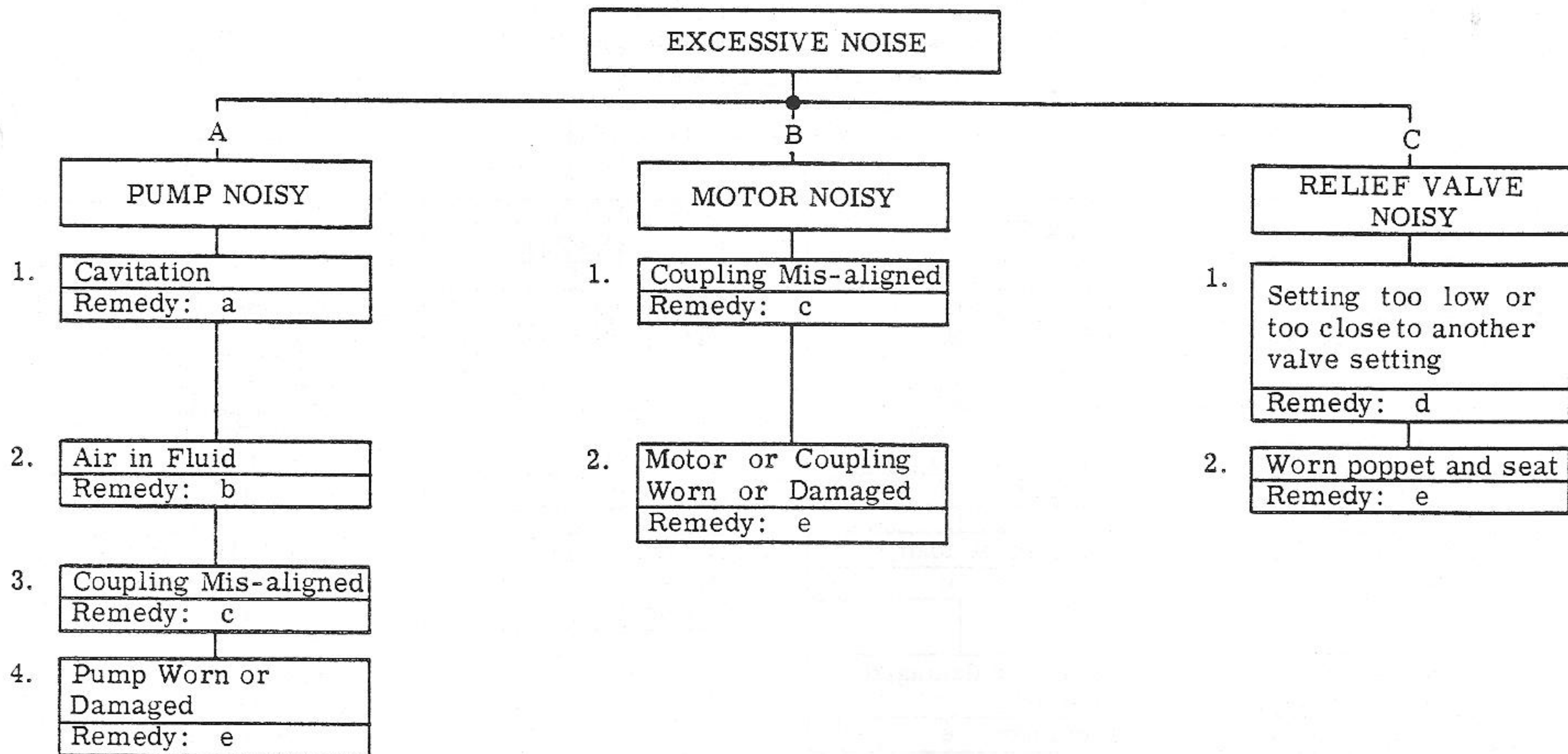
B. Changing filters and cleaning strainers.

C. Keeping all connections tight, but not to the point of distortion, so that air is excluded from the system.

SECTION II - TROUBLE-SHOOTING GUIDES

2-1. The following charts are arranged in five main categories. The heading of each one is an effect which indicates a malfunction in the system. For example; if a pump is exceptionally noisy, refer to Chart I titled EXCESSIVE NOISE. The noisy pump appears in Column A under the main heading. In

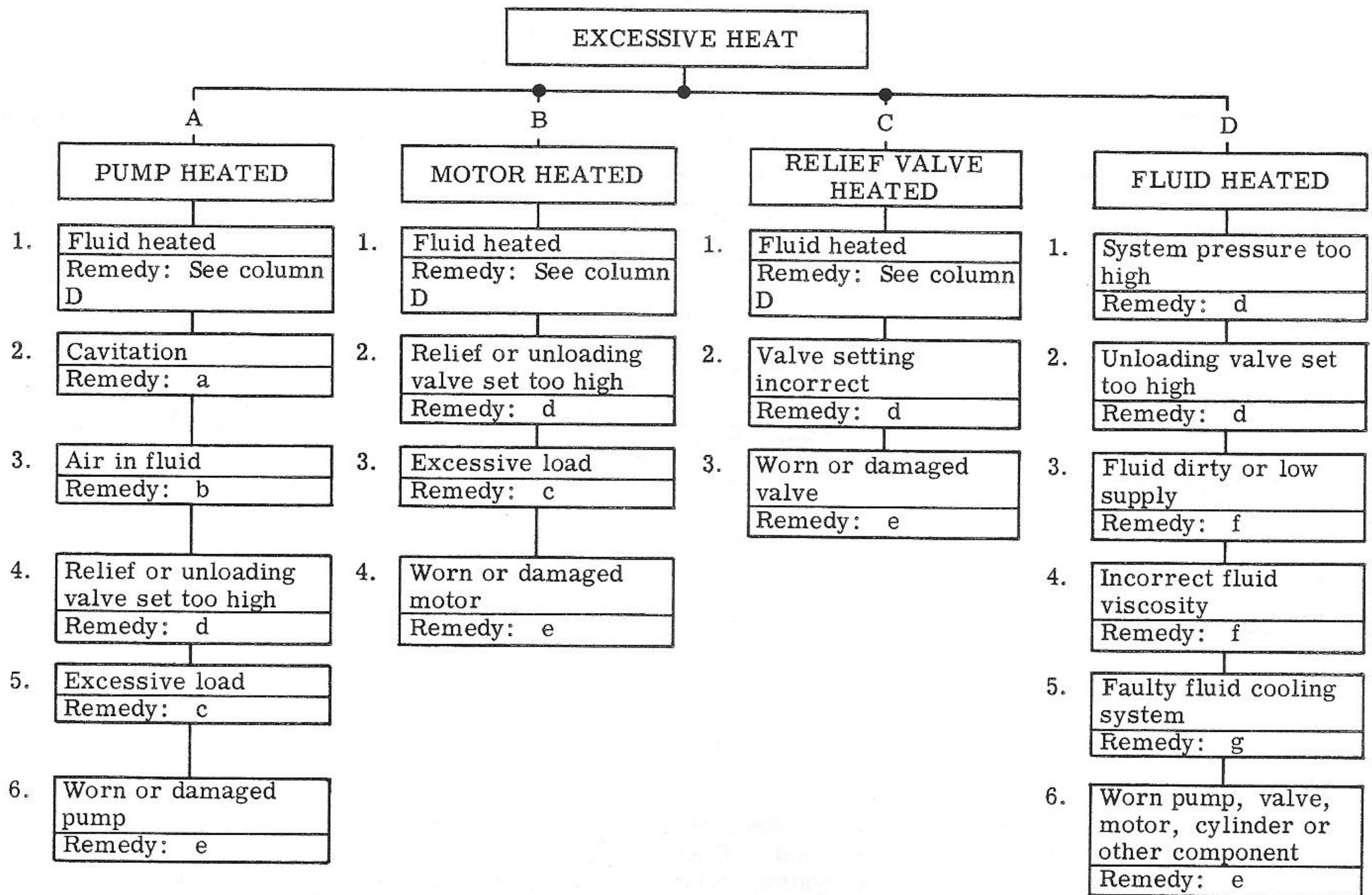
Column A there are four probable causes for a noisy pump. The causes are sequenced according to the likelihood of happening or the ease of checking it. The first cause is cavitation and the remedy is "a". If the first cause does not exist, check for cause number 2, etc.



REMEDIES:

- a. Any or all of the following: Replace dirty filters - Wash strainers in solvent compatible with system fluid - Clean clogged inlet line - Clean reservoir breather vent - Change system fluid - Change to proper pump drive motor speed - Overhaul or replace supercharge pump - Fluid may be too cold
- b. Any or all of the following: Tighten leaky inlet connections - Fill reservoir to proper level (with rare exception all return lines should be below fluid level in reservoir) - Bleed air from system - Replace pump shaft seal (and shaft if worn at seal journal)
- c. Align unit and check condition of seals, bearings and coupling
- d. Install pressure gauge and adjust to correct pressure
- e. Overhaul or replace

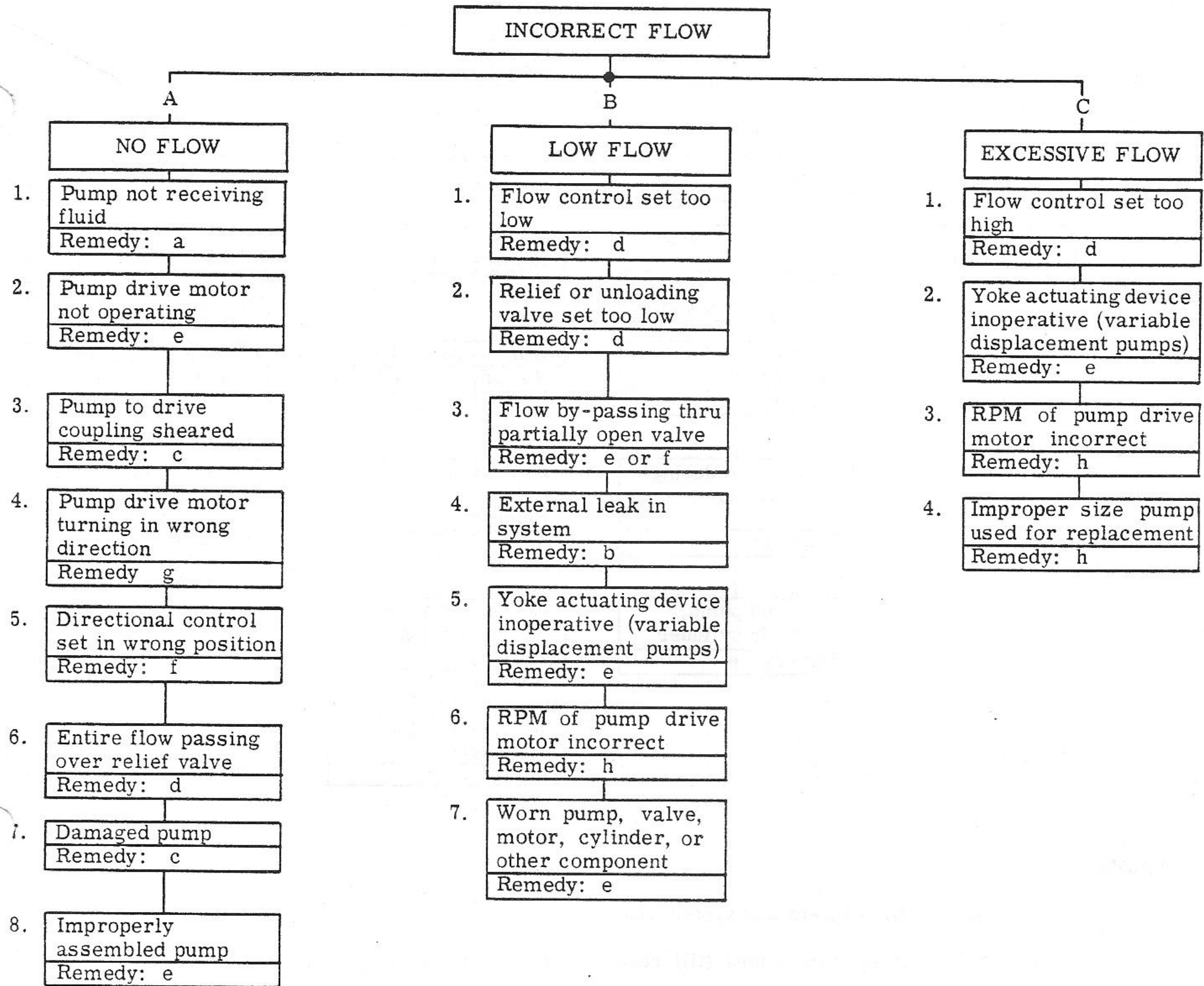
II



REMEDIES:

- a. Any or all of the following: Replace dirty filters - Clean clogged inlet line - Clean reservoir breather vent - Change system fluid - Change to proper pump drive motor speed - Overhaul or replace supercharge pump
- b. Any or all of the following: Tighten leaky inlet connections - Fill reservoir to proper level (with rare exception all return lines should be below fluid level in reservoir) - Bleed air from system - Replace pump shaft seal (and shaft if worn at seal journal)
- c. Align unit and check condition of seals and bearings - Locate and correct mechanical binding - Check for work load in excess of circuit design
- d. Install pressure gauge and adjust to correct pressure (Keep at least 125 PSI difference between valve settings)
- e. Overhaul or replace
- f. Change filters and also system fluid if of improper viscosity - Fill reservoir to proper level
- g. Clean cooler and/or cooler strainer - Replace cooler control valve - Repair or replace cooler

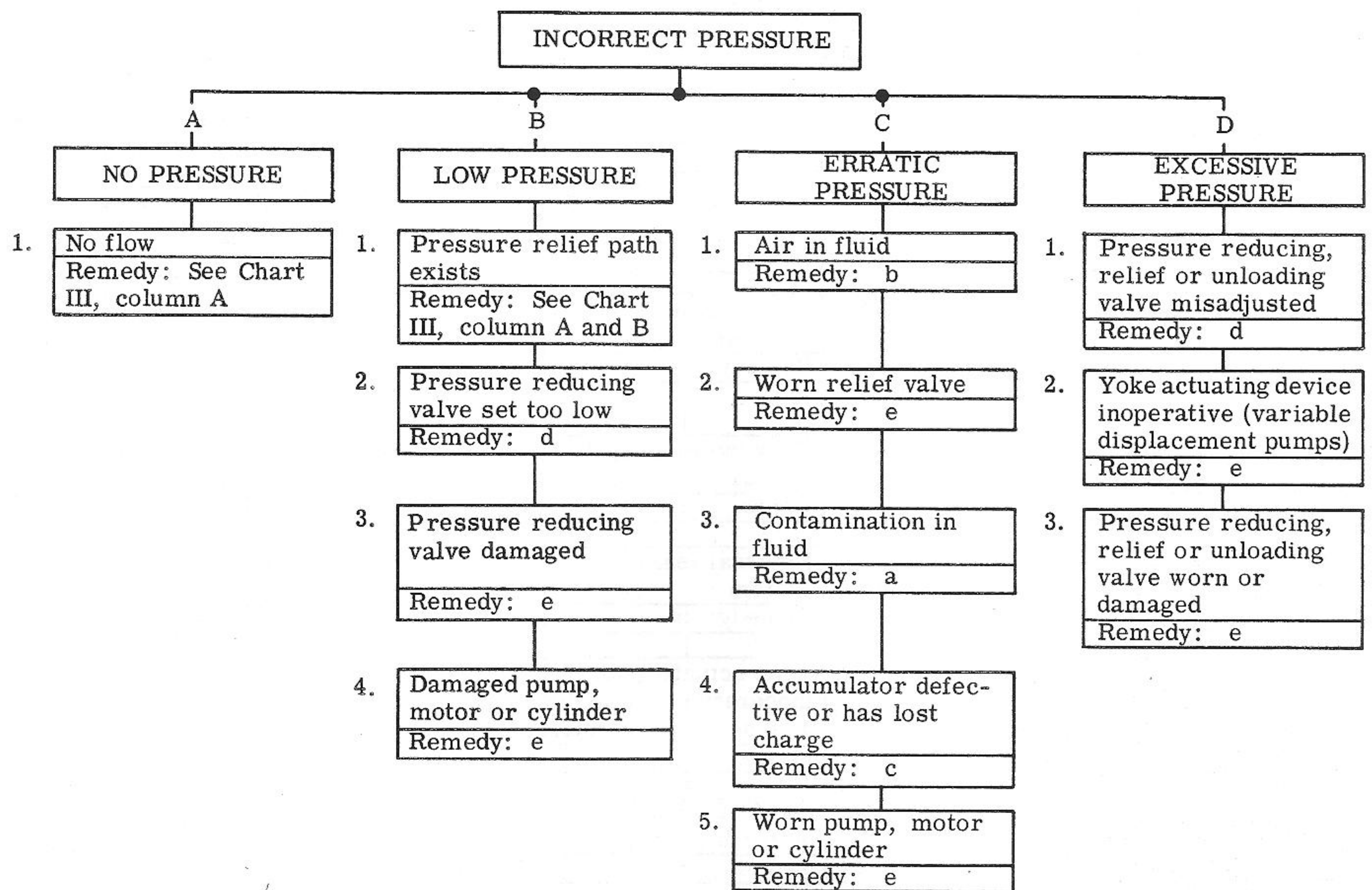
III



REMEDIES:

- a. Any or all of the following: Replace dirty filters - Clean clogged inlet line - Clean reservoir breather vent - Fill reservoir to proper level - Overhaul or replace supercharge pump
- b. Tighten leaky connections - Bleed air from system
- c. Check for damaged pump or pump drive - replace and align coupling
- d. Adjust
- e. Overhaul or replace
- f. Check position of manually operated controls - Check electrical circuit on solenoid operated controls - Repair or replace pilot pressure pump
- g. Reverse rotation
- h. Replace with correct unit

IV



REMEDIES:

- a. Replace dirty filters and system fluid
- b. Tighten leaky connections (fill reservoir to proper level and bleed air from system)
- c. Check gas valve for leakage - Charge to correct pressure - Overhaul if defective
- d. Adjust
- e. Overhaul or replace