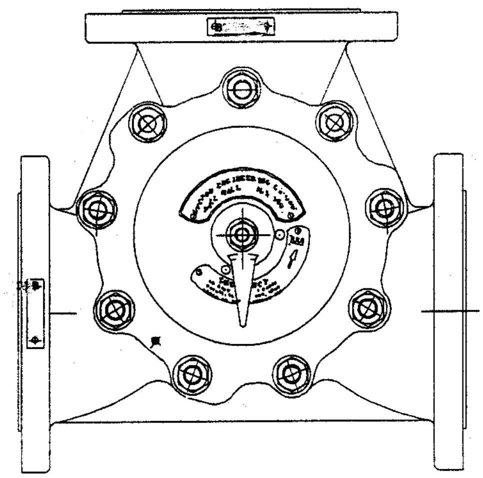
walton

TEMPERATURE CONTROL SYSTEMS

Direct Operated (Rotary)
Fail-Safe



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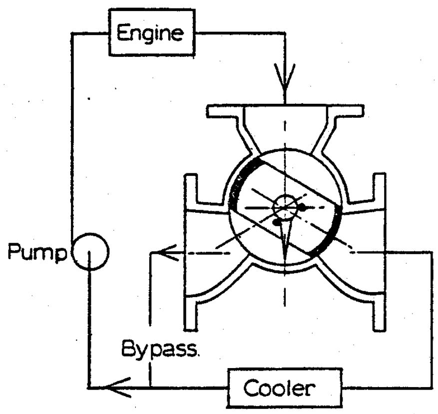
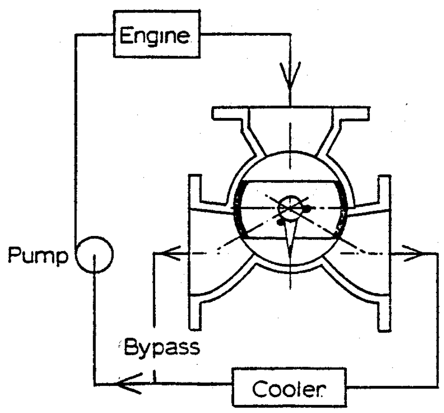
The following Walton Instruction Manuals are available:

Direct Operated (Rotary)	MANUAL\DIRECT01
Direct Operated (25mm Linear)	MANUAL\DIRECT02
Direct Operated (Twin)	MANUAL\DIRECT03
Direct Operated (Rotary) Fail - Safe	MANUAL\DIRECT04
Direct Operated (15-25mm Linear)	MANUAL\DIRECT05
Pneumatically Operated	MANUAL\PNEU01
Electrically Operated (Series 500 Actuator)	MANUAL\ELEC01
Electrically Operated (Series 3000 Actuator)	MANUAL\ELEC02
Electrically Operated (Special Integral Function)	MANUAL\ELEC03
Gas Operated (Rotary)	MANUAL\GAS01
Gas Operated (Linear)	MANUAL\GAS02

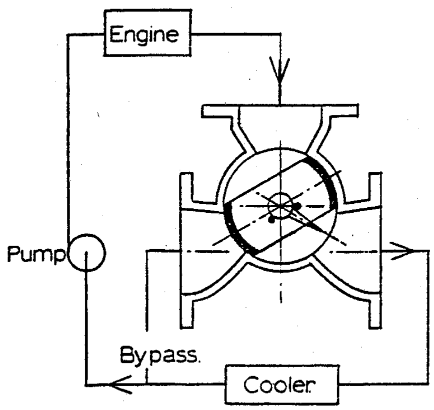
Contents



Fluid temperature below operating range — no flow to cooler



Fluid temperature in operating range — flow proportioned between bypass and cooler



External lever in 'full flow to cooler' position.

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FIG.01/DIRECT

General Description

Walton direct operated temperature control valves are powered by the high volumetric expansion which occurs over the melting ranges of specially prepared wax mixtures.

The wax is enclosed in a sealed copper capsule, the expansion is transmitted through a plunger and linkage to a rotor operating in a 3-port valve body. The rotor controls the degree of opening of the two lower ports of the valve. (See Fig. 01/DIRECT.)

The valve may be installed as either flow diverting or mixing valve. When installed as a flow diverting valve and at temperatures below the operating range, the rotor directs all the fluid to bypass the cooler, while at temperatures above the operating range, all the fluid is directed through the cooler. During normal operation the flow is automatically proportioned between the bypass and cooler to maintain the incoming fluid within the range of the temperature sensitive element with which the valve is fitted.

When operating as a mixing valve, the hot and cold fluid streams enter the lower ports in a proportion determined by the position of the rotor and maintain the temperature of the fluid leaving the upper port within the operating range of the element.

The temperature range of a particular valve is fixed during the manufacture and cannot be altered except by substituting the temperature sensitive element for one having a differing temperature range.

An external lever allows the automatic mechanism to be overridden and the temperature to be controlled manually. The ability to control manually at a temperature lower than that being automatically maintained is of particular value when an individual section of the system is running ‘hot’, or in the unlikely event of an element failure.

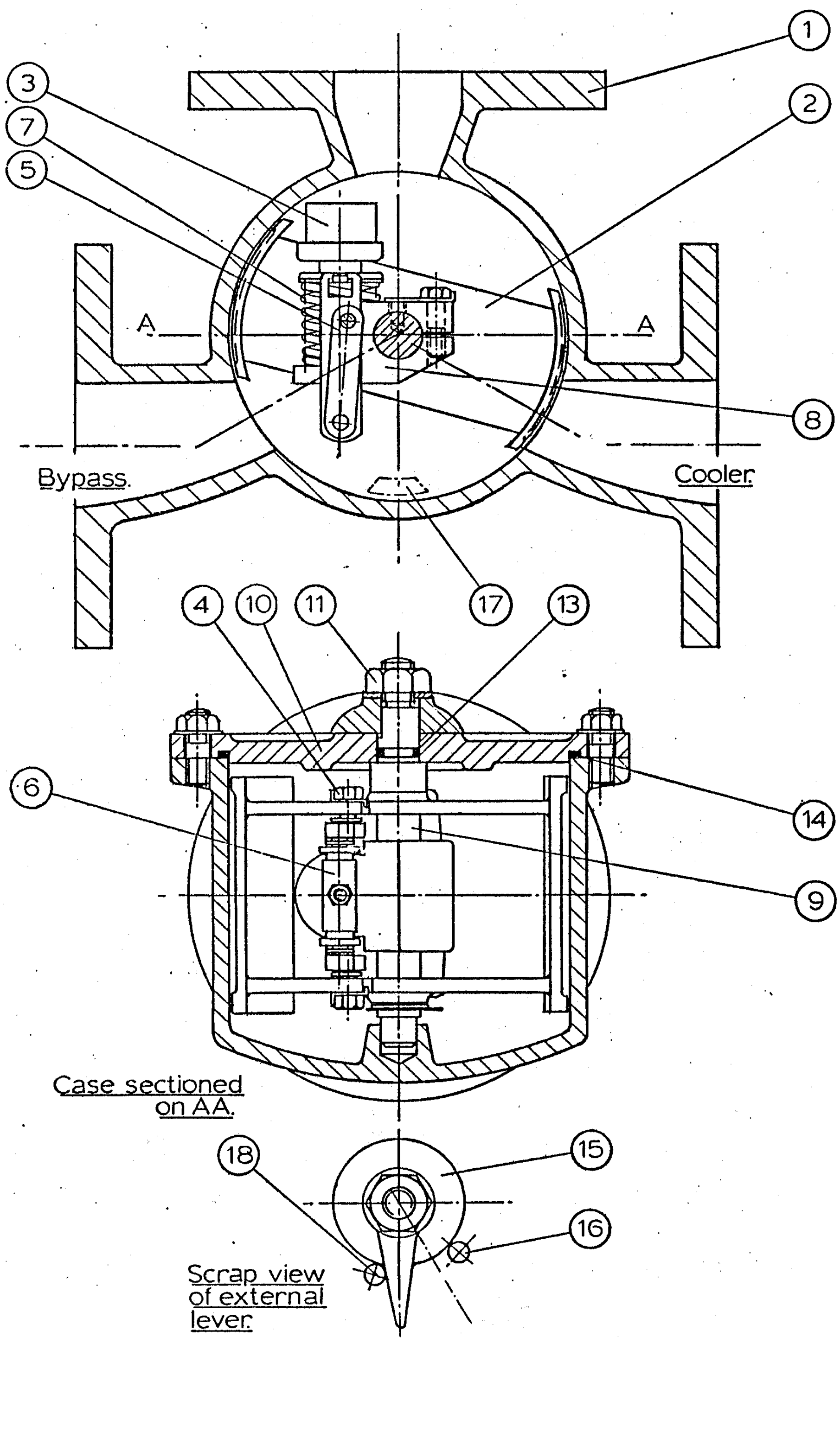

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FIG.02/DIRECT

25–80mm Bore Diameter Valves

Valves of this range of bore sizes are fitted with a direct action mechanism as shown in Fig. 02/DIRECT.

The following description assumes that the valve is being used in a diverting application with cooler.

The body of the valve (1) is provided with three similar elongated ports spaced at 120 degrees. The fluid enters the valve and is directed to either ‘bypass’ (if the fluid is below the temperature range) or to ‘cooler’ (if the fluid is above the temperature range). In normal operation, the fluid is proportionately divided between bypass and cooler to maintain the temperature practically constant irrespective of any change in the heating or cooling capacity of the circuit.

The rotor (2), shown in the cold position, controls the flow diversion, its position being determined by the plunger extension of the wax filled temperature sensitive element (3).

The outward movement of the element plunger when the wax expands during melting is transmitted to the rotor through the pivot screws (4), screwed into the rotor webs, and the swing links (5). The housing (6) is directly connected to the element plunger. Element springs (7) power the rotor on the return stroke during periods when the temperature is reducing.

The element barrel is screwed into a bracket (8) clamped and dowelled to the shaft (9) which is itself clamped into the top cover (10) by the nut (11). The shaft is sealed in the top cover by synthetic rubber ‘O’ ring (13) and the top cover sealed with an ‘O’ ring (14). Locating the shaft’s angular position relative to the body is the external lever (15), shown in the ‘normal running’ position against stop (18).

Slackening nut (11) allows the external lever to be rotated to the stop (16) and gives full flow to the cooler independent of the position of the element plunger. The lever may be locked in any intermediate position to give the desired temperature.

A stop cast (17) into the top cover positively prevents the rotor cutting off the inlet port under any circumstances.

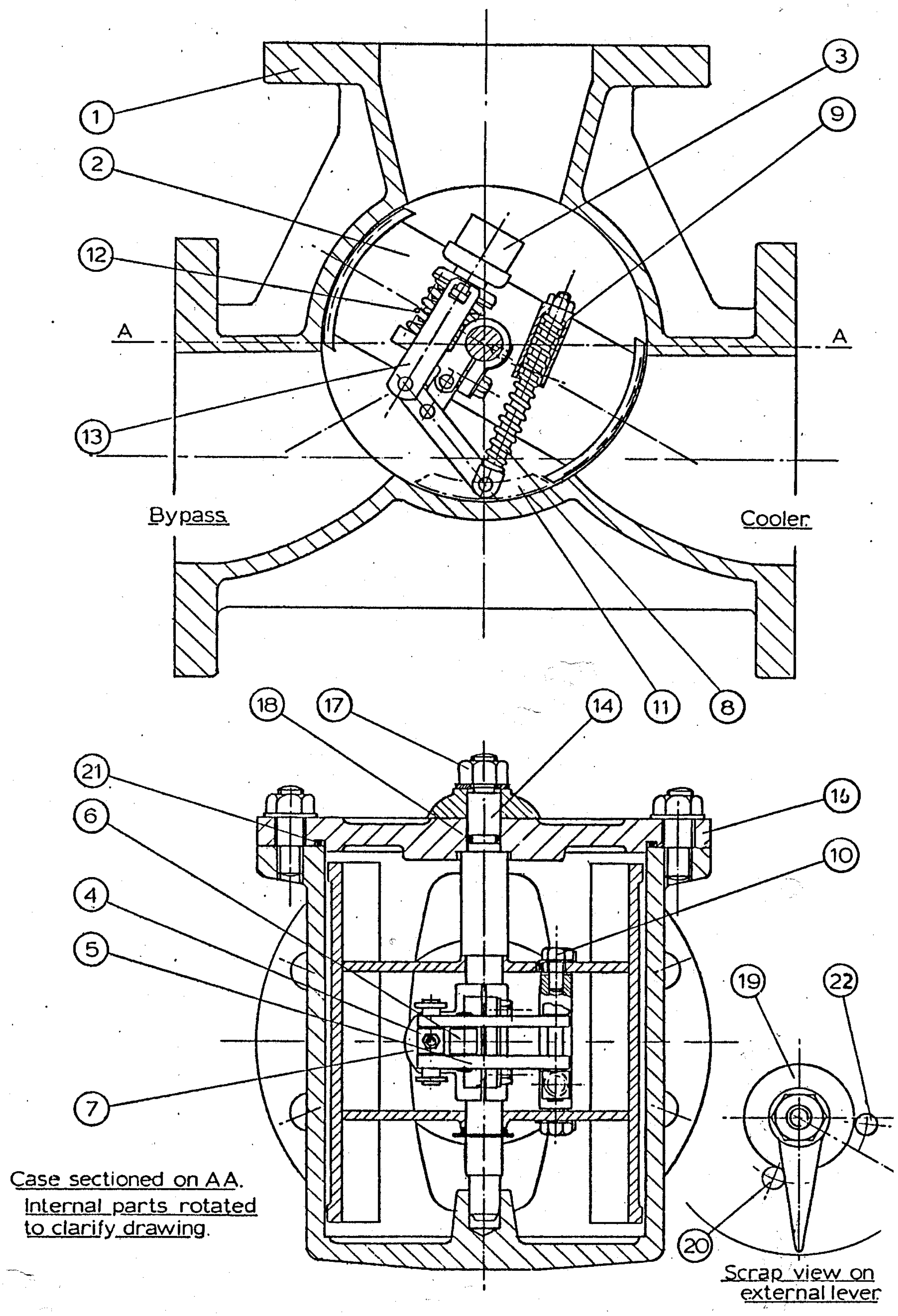

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FIG.03/DIRECT

100–150mm Bore Diameter Valves

Valves of 100mm to 150mm bore and over are fitted with a lever mechanism generally as shown in Fig. 03/DIRECT. The following description assumes that the valve is being used in a diverting application with cooler.

The body of the valve (1) is provided with three similar oval ports spaced at 120 degrees. The fluid enters the valve and is directed to either ‘bypass’ (if the fluid is below the temperature range) or to ‘cooler’ (if the fluid is above the temperature range). In normal operation, the fluid is proportionately divided between bypass and cooler to maintain the temperature constant irrespective of any change in the heating or cooling capacity of the circuit. The rotor (2), shown in the cold position, controls the flow diversion and its position is determined by the plunger of the wax filled temperature element (3).

The outward movement of the plunger when the wax expands during melting is transmitted to the housing (4) and then two lever links (5) pivoted on a swing (6) attached to the element bracket (7). The links transmit the movement to the rotor (2) through override springs (8) and crosspiece (9) which is engaged by pivot screws (10) screwed into the rotor webs. The function of the override springs (8) is to prevent damage to the element should the external lever be set in ‘full flow to cooler’ position when the element is operating normally. Under these conditions, the rotor is held against the stop (11) and the element travel taken up by compression of the override springs.

During the outward movement of the element plunger the return springs (12) are compressed through the straps (13) and these springs power the rotor on the return stroke of the element during ‘temperature reducing’ conditions.

The element is screwed into the element bracket (7) which is clamped and dowelled to the shaft (14), which is clamped into the top cover (16) by the nut (17) and sealed by synthetic rubber ‘O’ ring (18). The top cover is sealed with rubber ‘O’ ring (21).

Locating the shaft’s angular position relative to the body is the external lever (19) which in normal operation is set against stop (20) and locked by nut (17). Slackening the nut allows the external lever to be rotated to the stop (22) and gives full flow to the cooler irrespective of the position of the element plunger. A stop (11) cast into the top cover positively prevents the rotor cutting off the inlet port under any circumstances.

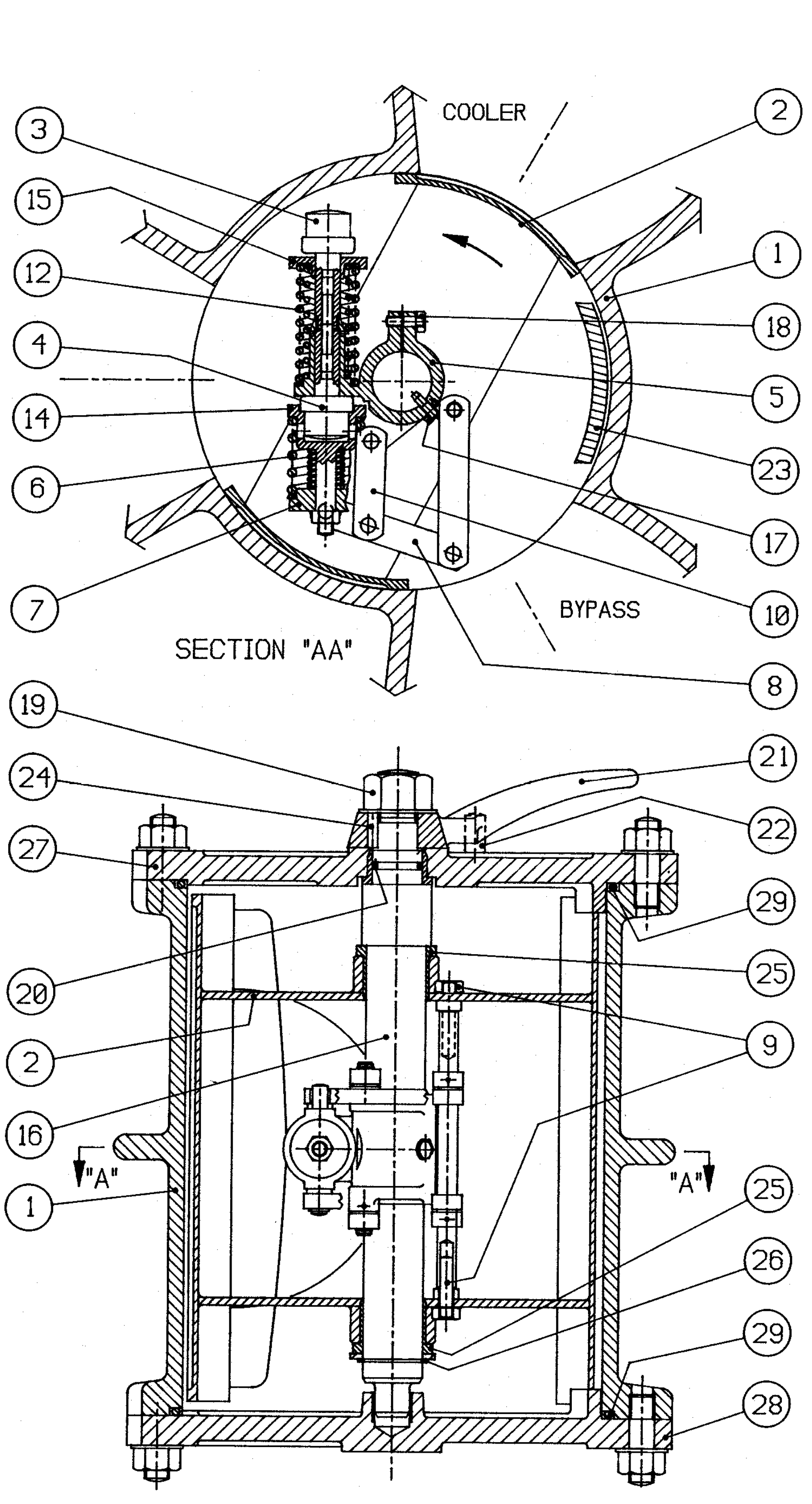

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FIG.04/DIRECT

175–250mm Bore Diameter Valves

Valves of these sizes utilize a tandem element pattern unit as shown on Fig. 04/DIRECT, all sizes using the same element assembly. The 175mm and 200mm bore valves are the single rotor type while the 250mm bore valve has two rotors operating independently on the same shaft. The single rotor assembly of 175mm bore valve is identical to each of the two rotor assemblies used for 250mm bore valves.

The general design principle of three equi-spaced ports and a balanced rotor is similar to those used in other Walton valves. The particular operating mechanism arrangement is shown in Fig. 04/DIRECT.

The body of the valve (1) is provided with three similar elongated ports spaced at 120 degrees. Assuming the valve is installed as a diverting valve, the operation is as follows. The fluid enters the top port and is directed either to bypass (if the fluid is below the temperature range) or to cooler (if the fluid is above the temperature range). In normal operation the fluid is proportionately divided between bypass and cooler to maintain the temperature constant irrespective of any change in the heating or cooling capacity of the circuit.

The rotors (2) shown in the cold position control the flow diversion and are positioned by movement of the temperature sensitive elements (3 and 4) mounted back to back with plungers abutting. The outer element (3) is screwed into a tabular extension of the bracket (5). The inner element (4) slides within the extension and transmits movement through the override springs (6) to thrust plate (7) which is connected to the rotor (2) through the linkage (8) and the pivot screws (9). The function of the override springs (6) is to prevent damage to the elements should the external lever be set to the “full flow to cooler” position when the elements are operating normally. Under these conditions the rotor is held against the stop (23) and the element travels taken up by compression of the override spring. The link (8) is supported by pivot link (10) attached to bracket (5).

During outward movement of the elements the return springs (12) are compressed through straps fitted between the element extensions (14) and the spring plates (15). The element springs power the rotor during cooling periods when the elements retract.

The bracket (5) is located on shaft (16) by screw (17) and secured by clamp screws (18). The shaft (16) is clamped into the top cover (27) by nut (19) and sealed by a synthetic rubber ‘O’ ring (20). The angular location of the shaft is determined by the lever (21) which is secured against stop (22) fitted in the top cover. A second stop allows the lever (after slackening nut [19]) to be moved to a position in which the rotors fully uncover the cooler port and close the bypass port. The lever is located on the shaft by axial dowels (24).

Stops (23) cast into top and bottom covers positively prevent the rotor cutting off flow through the inlet port under any circumstances.

The rotors (2) are carried on the shaft in non-metallic bushes (25) and located axially by a shaft collar at the upper end and a circlip (26) at the lower end.

The top cover (27) and the bottom cover (28) are sealed by synthetic rubber ‘O’ rings (29).

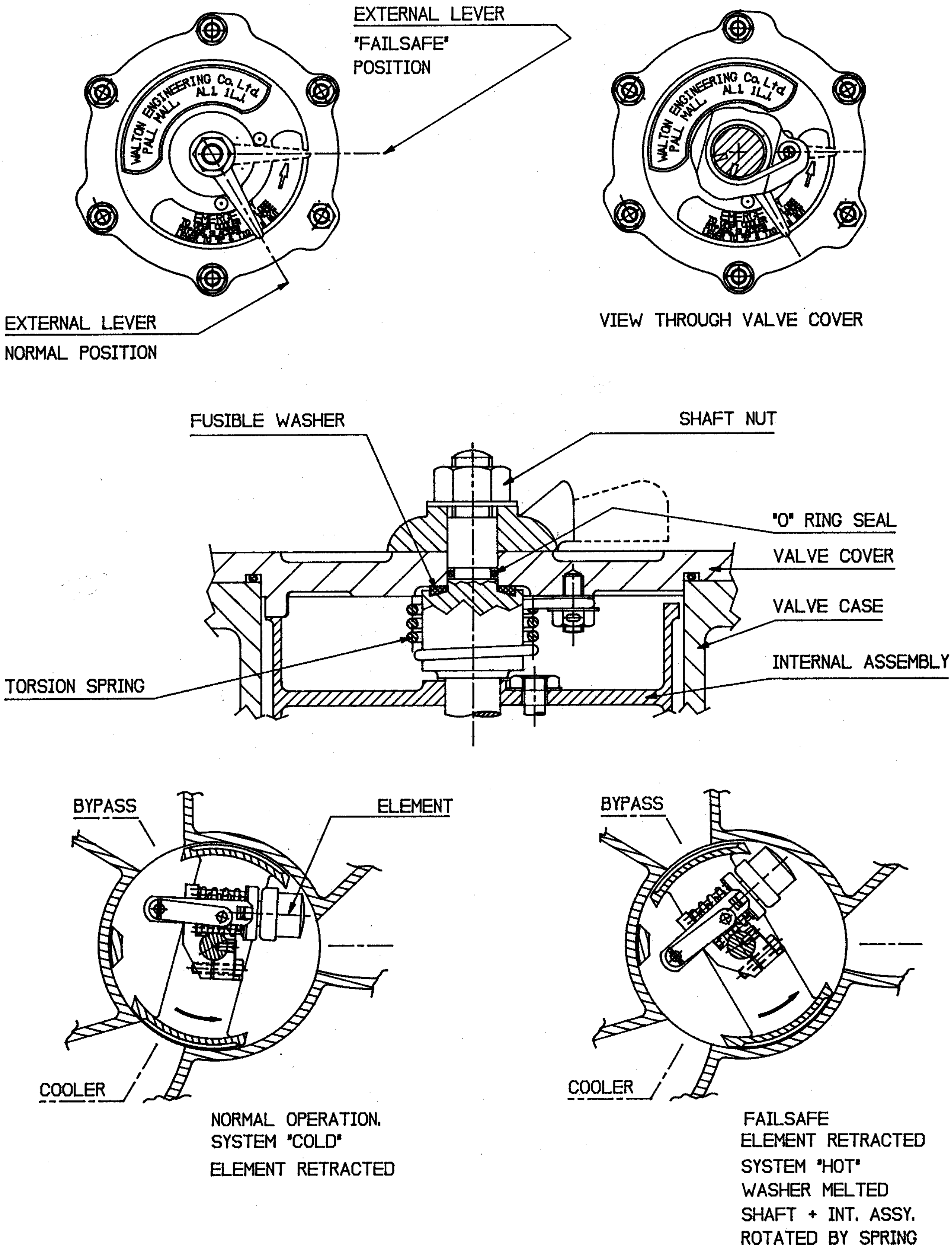

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FIG.05/DIRECT

Fail-Safe Device

General

The Standard range of **WALTON Direct Operated Valves** will fail to **Bypass** in the event of a problem occuring with the Temperature Sensitive Element.

By providing the valve with a simple Fail-Safe Arrangement in the event of overheating the valve will fail to Cooler and all fluid will be directed through the cooler.

Normal Operation

(Refer FIG.05/Direct)

During assembly of the valve the external lever is rotated into the normal operating postition which tensions the internal torsion spring. The shaft nut is then tightened which compresses a fusible washer and clamps the external lever and shaft to the valve cover. The internal assembly then operates on the shaft, powered by the element.

Fail-Safe

In the event of a problem occurring with the element and the Internal Assembly does not operate to open the Cooler port of the 3-way valve, the system may overheat. At a pre-determined temperature the fusible washer will melt activating the torsion spring and allowing the Internal Assembly of the valve to move to the full open to cooler position.

Once the cause of the overheating has been established and rectified it will be necessary for the fusible washer to be replaced and the external lever to be rotated back to the normal operating position as describe above.

Installation

The light weight and compact design of the Walton Temperature Control Valve enables it to be installed in the piping system without the necessity for special mounting brackets. The design of the valve, with its deep ports and centre stiffening webs, results in a very rigid body. If, however, the valve is to be coupled up to rigid pipes, care must be taken that the pipes are accurately positioned, and that the final bolting up of the flanges does not distort the valve body. It has been found desirable to have a degree of flexibility in at least one of the connecting pipes, although if care is taken on installation, this is not essential. The mounting of the valve should be such that it is not subjected to excessive vibration under running conditions.

The valve may be installed with its axis in any position, gravity having no effect on its operation.

Complete accessibility to the working parts of the valve is obtained by withdrawing the front cover complete with internal mechanism and without breaking the pipe connections. The withdrawal of the internal mechanism requires a clear space in front of the valve approximately equal to the length of the valve body.

After bolting the flanges, check that the rotor is free by releasing the centre nut and rotating the external lever between the stops. The resistance to movement should be negligible.

Before running, ensure that all flanges are securely bolted, and that the external lever is clamped in the “normal running” position.

During flushing or chemical cleaning of the system, it is recommended that the internal mechanism of the valve be removed. The procedure for dismantling is dealt with under MAINTENANCE. Prior to reassembling the valve, ensure that the valve case is clean and free of foreign matter.

Maintenance

The following instructions assume that the valve is being used in a cooling water circuit but the remarks apply equally for valves installed in lubricating oil circuits.

Inspection Periods

It is advisable to inspect the valve by removing the front cover and internals after the first test run to check for any foreign matter that may have been in the system prior to the starting up of the engine. Thereafter, the valve should only require inspection at intervals of approximately 8,000 running hours in a closed fresh water system. On an open water system, it is advisable to inspect the valve at more frequent intervals, say 1,000 running hours or as indicated by experience.

Procedure for Dismantling

Ensure that the circuit is drained to below the valve level or that the valve is isolated from the circuit. Then, proceed as follows:

1. Leave the central locking nut tight.
2. Remove the front cover nuts.
3. The front cover complete with all internals can then be drawn and the necessary cleaning carried out.
4. Further dismantling of the valve should not be necessary.

On reassembling, care must be taken that parts are replaced in the same relative angular positions, ensuring that covers are fitted with cast stops located between the cooler/overboard and bypass ports.

In no circumstances should any attempt be made to dismantle the operating unit incorporating the wax element.

Commissioning

It is possible to ascertain valve position and check the operation of the valve as follows:

1. System ‘Cold’ – Fluid temperature below minimum value of wax element range.
    - 1.1 Slacken external lever nut.
    - 1.2 Move external lever from normal stop pin to ‘E’ emergency stop pin position. This will rotate the internal mechanism to close bypass and open cooler port and will demonstrate that the rotor is able to move freely in the valve body.
    - 1.3 Return external lever to normal position and tighten nut.

2. System ‘Controlling’ – Fluid temperature between minimum and maximum values of wax element range.
    - 2.1 Slacken external lever nut.
    - 2.2 Move external lever from normal stop pin towards ‘E’ emergency stop pin position until resistance is felt.

      Note: At this point the position of the lever in relation to the stop pins is proportional to the openings of the bypass and cooler ports, e.g. lever moved ¾ distance toward ‘E’ stop pin then bypass port is ¼ open and cooler port is ¾ open.
    - 2.3 Return external lever to normal position and tighten nut.

3. System ‘Hot’ – Fluid temperature above maximum value of wax element range
    - 3.1 Slacken external lever nut.
    - 3.2 It should not be possible to move the external lever toward the ‘E’ emergency position because the internal mechanism will be fully expanded and the rotor held against the internal stop with the bypass fully closed and the cooler port fully open.

      If the system is overheating and if after leaving the external lever in ‘full flow to cooler’ position for a few minutes, the temperature does not fall, it indicates that the cause of overheating is not due to faulty valve operation. In this circumstance, return the lever to its ‘normal running’ position and check for faults in the other components of the system.
    - 3.3 If it is possible to move the lever toward the ‘E’ emergency stop pin then the operation of the internal mechanism should be investigated.
    - 3.4 Return external lever to normal position and tighten nut.

      Note: Care should be taken when using the external lever and it may be prudent to apply an extension to facilitate controlled movement of the valve when the system is operating and flow forces are acting on the rotor.

      All steps should be taken to minimize the effort required to move the external lever in order that, when the rotor contacts the internal stops, the override springs (not applicable to 40–80mm bore valves) are not then compressed simulating further rotor movement.

4. If for any reason it is necessary to reduce the temperature of the system below that which is being automatically maintained, release the centre nut and rotate the external lever locking the shaft in the extreme position to obtain maximum cooling or in any intermediate position such as will maintain the required temperature.

   It will be appreciated that the function of the temperature control valve is to regulate the flow of water through the cooler, and if the cooler has insufficient cooling capacity, the valve will react by passing all the circulating water through the cooler but thereafter will have no control over the temperature which will continue to rise until the cooler is able to dissipate the heat being generated.

Limitations

The Walton automatic temperature control valve is a 3-way valve which can be used in either diverting or mixing applications.

On lubricating oil systems the valve is normally fitted to mix the fluid passing through the cooler and the bypass to give a controlled inlet temperature.

On closed fresh water systems the valve is fitted as a diverter through or round the cooler.

On sea water systems in which control is arranged by discharging water overboard, the valve is fitted as a diverter to discharge overboard or recirculate water to the pump suction.

Temperature Range

The temperature is sensed and the valve powered by a wax filled temperature sensitive element available in the ranges shown on Data Sheet No. 62. At the lower limit of the range the cooler will be fully bypassed, and at the higher, all the fluid will pass through the cooler. Provided the cooler has sufficient heat dissipation capacity an equilibrium temperature between the two limits will be maintained.

Handing

The valve can be supplied to any one of the six possible handings shown on Data Sheet No. 62. On sea water circuits the handing is shown on Data Sheet No. 207.

Flow Rates

If good regulation is to be obtained the flow rates should be within the limits shown on Chart No. 556 (sea water and fresh water) and Chart No. 557 (lubricating oil).

Maximum Pressures

The standard range valves are suitable for working pressures of up to 7 bar.

Differential Temperature

On mixing valves it is recommended that difference in temperature between the two fluids should be limited to 75°C.

Valve Pressure Loss

It is recommended that the pressure loss of fluid at full flow through the valve does not exceed 0.7 bar unless previously agreed with Walton.

Mounting of Valve

Gravity having no effect on the operation of the valve, it may be mounted in any attitude. The valve being of light and rigid construction, no special supports are required.