# Pneumatically actuated clutches one, two and three plate version

Series 0-442
Edition 09.1987

Two plate version

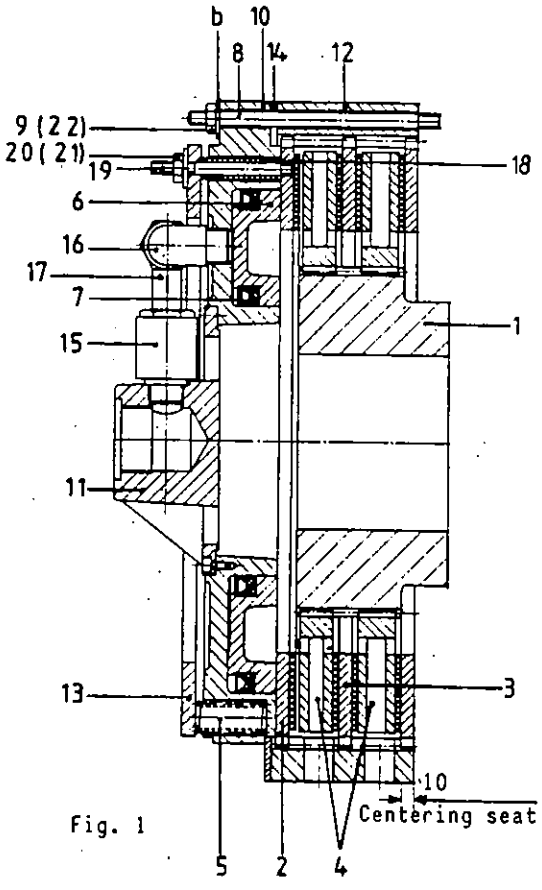


Fig. 1

## 1. Operation

The housing (12) is centered on the flywheel or gear or, if the clutch is used as a brake, on the machine frame. It is secured with studs (8), which should be secured with Loctite, and hexagonal nuts (9) and, if possible, dowelled. The housing (12) is internally splined to accept the pressure plate (2) and outer plates (3). The inner plates (4) fit on the splined hub (1) and are arranged alternately between the outer plates (3), which are lined with friction material. The piston (6) moves axially within the cylinder (10) and is sealed with U-rings (7) to prevent loss of air. When air (operating pressure 5.5 bar, max. permissible pressure 6 bar) is fed into the cylinder (10) via the inlet boss (11), the piston is displaced axially and presses the plate pack together so that a frictionally-connected link is produced and the torque is transmitted. When the pressure is released, the springs (5) bring the pressure plate (2) and piston (6) back to their disengaged position.

## 2. Installation

The hub (1) is mounted on the shaft and secured to prevent axial displacement After the studs (8), which should be secured with Loctite, have been screwed into the flywheel or gear, the housing (12) is slid on up to its centering. Starting with an outer plate (3), which is lined on one side, slide the outer and inner plates (4) alternately into the housing or hub. Set the actuator unit, consisting of pressure plate (2) with studs (19), bushes (18), end plate (13), lockwasher (21) and hexagonal nuts (20), piston (6) with

| Table 1 | Clutch size | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Individual parts | 43 | 51 | 59 | 66 | 72 | 75 | 78 | 80 | 84 | 85 | 90 | 91 |
| 1 Hub<br>2 Pressure plate<br>3 Outer plate<br>4 Inner plate<br>5 Pressure spring<br>6 Piston<br>7 U-ring<br>8 Stud | | | | | | | | | | | | |
| 9 Hexagonal nut $M_A$ in Nm | 8.5 | 14 | 35 | 69 | 69 | 120 | 120 | 190 | 295 | 295 | 580 | 580 |
| 10 Cylinder<br>11 Flange<br>12 Housing<br>13 End plate | | | | | | | | | | | | |
| 14 Shim | no fitted on single plate version | | | | | | | | | | | |
| 15 Rotating union<br>16 Angle union<br>17 Connecting pipe<br>18 Bush<br>19 Stud | | | | | | | | | | | | |
| 20 Hexagonal nut $M_A$ in Nm | 2.9 | 6 | 10 | 25 | 49 | 25 | 86 | 49 | 86 | 86 | 210 | 210 |
| 21 Lockwasher<br>22 Lockwasher | | | | | | | | | | | | |

U-rings (7), cylinder (10) with boss (11)as well as the springs (5) on to the studs (8) and secure firmly to the housing with hexagonal nuts (9), applying the tightening torque $M_A$ specified in table 1. After the erection has been completed, it must be possible to turn the housing easily when the clutch is not engaged.

### 3. Adjustment

On single plate clutches,maximum wear is reached when the gap between the end plate (13), which is linked rigidly to the pressure plate (2), and the cylinder (10) reduces to zero. The outer plates (3) and the pressure plate (2) must now be replaced.

In the case of two and three plate versions,the plates have reached only half maximum wear at this point. The clutch can be reset as described below:

Slacken the hexagonal nuts (9). Take out the shims (14) and slide them in at point "b" in front of the cylinder. Tighten up the hexagonal nuts (9) again with the tightening torque $M_A$ in table 1. Max. wear is reached when the gap between the end plate (13) and the cylinder (10) again reduces to zero. The outer plates (3) and the pressure plate (2) must now be replaced.

### 4. Replacement of the linings

When the wear on the linings can no longer be compensated for by adjustment, the outer plates (3) and the pressure plate (2) must be replaced. When removing the pressure plate, care must be taken that the hexagonal nuts are slackened in a crosswise manner since they are under pressure from the spring. In the case of sizes up to and including 85, the outer plates and the pressure plate must be replaced complete since the linings are glued on. From size 90 new linings can be riveted on the outer plates and pressure plate.

### 5. Switching of a clutch in combination with a pneumatically released brake.

Clutch and brake must not overlap during the switching process since otherwise wear and heating-up of the plates will be unnecessarily high. Should the compressed air fail, the brake will be automatically applied as the result of the spring pressure acting on it. The brake is released when compressed air is applied. The following circuits are possible:

#### 5.1 Arrangement with one valve (spring return pressure acting on clutch and brake equal)

When the solenoid valve is opened, the cylinder spaces of the brake and of the clutch are linked with the compressed air line. The pressure springs of the clutch are dimensioned in such a way that the clutch engages when the brake has been released. The spring return pressure acting on the brake must therefore either be equal to or it can be up to 0.2 bar lower than the spring return pressure acting on the clutch. Thus this arrangement prevents the clutch and brake engaging at the same time.

#### 5.2 Arrangement with two valves (spring return pressure acting on clutch and brake not equal)

If the spring return pressure acting on the brake is larger than that acting on the clutch, overlapping can be prevented by the use of pressure-sequence-controlled valves. In the case of the valve control system shown in fig. 2, clutch and brake are controlled electrically by separate 3-way distributor valves. Pressure switches are provided in the control lines between valve and clutch/brake which introduce the switching on or switching off function of the other working element at preset pressure.

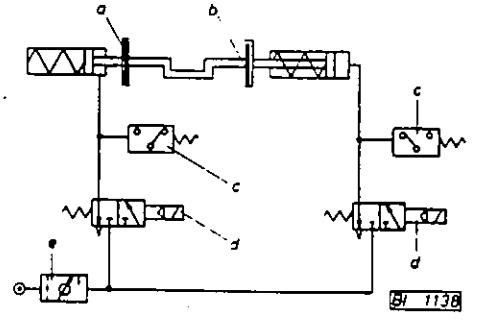


Fig. 2

a Brake
b Clutch
c Pressure switch
d 3/2 way valve
e Air preparation-unit

### 6. Faults and their elimination

**Clutch does not engage fully and slips:**
Clutch plates are too worn and must be renewed. The air pressure is too low. Unless otherwise prescribed, the clutch needs an air pressure of 5.5 bar.

Table 2

| Clutch size | | 43 | 51 | 59 | 66 | 72 | 75 | 78 | 80 | 84 | 85 | 90 | 91 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total wear of the plates | Single plate version | 3 | 3 | 3.75 | 4.35 | 5.35 | 5.5 | 5.3 | 6.5 | 7 | 7.5 | 8 | 8.5 |
| | Two and three plate versions | 6 | 6 | 7 | 7.6 | 9.8 | 9.8 | 9.8 | 12 | 13 | 14 | 15 | 16 |

The clutch overheats:
If the heat is arising in the housing bearings, check that the bronze bushes, roller bearings or similar are being adequately lubricated. At high engagement frequencies or where large masses have to be braked, heating up of the clutch is inevitable since the work of friction is released as heat. If temperatures in excess of 80° C on the cylinder or 100° C on the housing are found, steps must be taken to lead the heat away better. If the above temperatures are exceeded for longer periods of time, the U-rings will vulcanise and become hard and brittle. They will then no longer be airtight and must be renewed. Overlapping of clutch and brake. This must be prevented as described in para. 5.

7. Spare parts (see fig. 1)
When ordering spare parts, please always quote the serial number of the clutch which is to be found on the housing or hub in addition to the number of the spare part. In order to avoid the wrong parts being delivered, please always submit your orders in writing.

8. Accessories

8.1 Compressed air supply system
If no compressed air network is available, the size of the compressor must be calculated from the clutch's air consumption. See table 3 for the cylinder volumes. In addition, the internal volume of the lines up to the valve must be taken into account. The amount of air required is then:

Q = 1.5 · V · p · z = quantity of air sucked in from the compressor (l/min).
V = cylinder volume + volume of line between clutch and valve in litres.
p = max. operating pressure in bar.
z = max. number of engagements per minute.
1,5 = factor for losses from leaks (depends on the particular operating conditions).

Where a number of clutches may be switched at the same time, the air requirement will be correspondingly higher.
Attention: use only filtered air.

8.2 Air accumulator
At high switching frequencies, it is advisable to put an appropriately sized accumulator into circuit in front of the valve so there is sufficient air available during the switching process. The volume of the accumulator must be some 3 to 4 times that of the cylinder with worn plates (table 3) plus that of the line times the operating pressure.

$$V_{Dr} = 3 \text{ to } 4 \cdot p \cdot V$$

It is of advantage to install a pressure gauge for the checking of the operating pressure. If the pressure is too low, the clutch can slip and fail as the result of extreme overheating or wear. When switching, the air pressure directly in front of the clutch should not fall below 90% of the operating pressure.
Operating pressure necessary = 5.5 bar.
Max. permissible operating pressure = 6 bar.

8.3 Pipelines
For high switching frequencies as in presses, the internal cross-sections of the lines must be the same as connection "A" of the air intake since otherwise exact switching will not be achieved. The lubricator (3, fig. 3) must be set in such a way that it delivers 1 to max. 3 drops of oil per m³ air.

| Size | Cylinder volume in litres when new | with max. wear |
|---|---|---|
| 43 | 0.024 | 0.052 |
| 51 | 0.055 | 0.102 |
| 59 | 0.084 | 0.169 |
| 66 | 0.177 | 0.340 |
| 72 | 0.243 | 0.507 |
| 75 | 0.277 | 0.603 |
| 78 | 0.350 | 0.769 |
| 80 | 0.379 | 0.970 |
| 84 | 0.511 | 1.268 |
| 85 | 0.798 | 2.230 |
| 90 | 1.053 | 2.438 |
| 91 | 1.761 | 3.680 |

Table 3

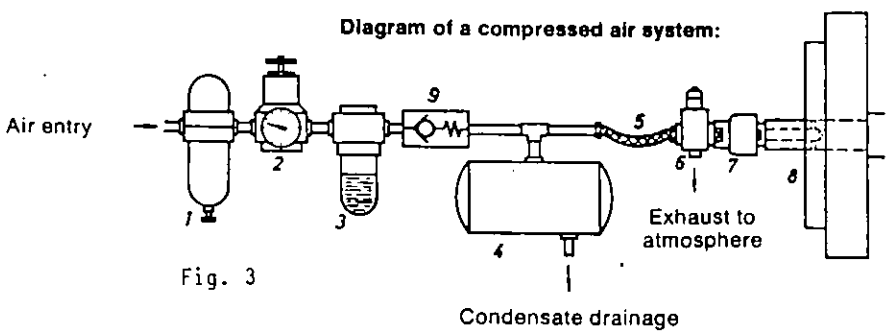


Fig. 3

1 = Compressed air filter
2 = Pressure reducing valve
3 = Lubricator
4 = Air accumulator
5 = Flexible metal hose
6 = Three way solenoid valve or press safety valve
7 = Air inlet adaptor
8 = Clutch
9 = Check valve

## 8.4 Air intakes

Air intakes can be supplied. Care must be taken that these are connected in a true and airtight manner to the clutch flange. Satisfactory function and long service life can only be guaranteed when this is done. Lines should only be connected via a flexible metal hose at least 300 mm long in order to prevent stress in the lines.

Max. operating pressure = 6 bar.
Maintenance: top up with 6 to 8 g roller bearing grease after some 7,000 operating hours.

**Version I**
Straight connection

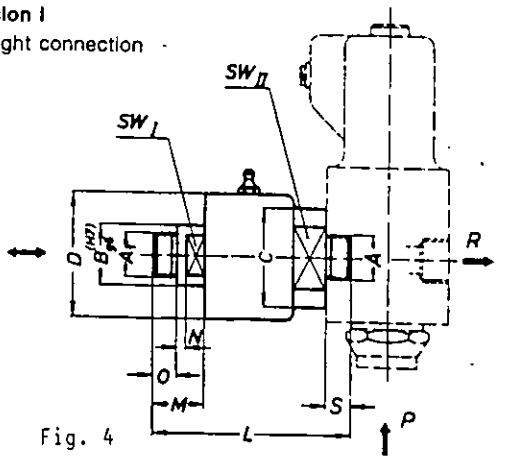


Fig. 4

**Version II**
Angle connection 90°

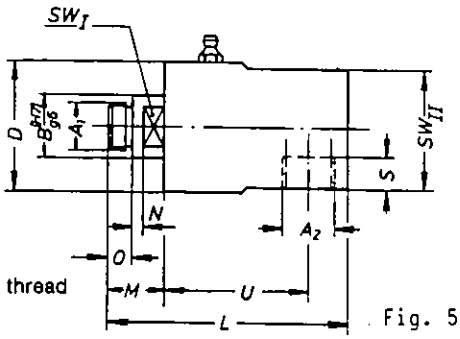


Fig. 5

Note that a conical thread should be used for connection $A_2$.

| Type | Series | A | $A_1$ *) | $A_2$ | B | C | D | $SW_I$ | $SW_{II}$ | L | M | N | O | S | U | n max $min^{-1}$ | Clutch size |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| I | 0-086-006-00-000 | G ¼ A | M 16x1,5 | Rp ¼ | 22 | 38 | 50 | 19 | 32 | 89 | 24 | 3 | 12 | 12 | – | 3150 | 43 |
| | 0-086-006-00-002 | | G ¼ B | | | | | | | | | | | | | | |
| | 0-086-006-01-000 | G ⅛ A | M 22x1,5 | Rp ⅛ | 30 | 48 | 62 | 24 | 41 | 97 | 25 | 3 | 12 | 12 | – | 2100 | 51/59 |
| | 0-086-006-01-002 | | G ⅛ B | | | | | | | | | | | | | | |
| | 0-086-006-02-000 | G ¾ A | M 27x1,5 | Rp ¾ | 35 | 52 | 70 | 27 | 46 | 114 | 30 | 3 | 15 | 15 | – | 1750 | 66 |
| | 0-086-006-02-002 | | G ¾ B | | | | | | | | | | | | | | |
| | 0-086-006-03-000 | G 1 A | M 35x1,5 | Rp 1 | 45 | 65 | 80 | 32 | 55 | 127 | 33 | 5 | 15 | 17 | – | 1450 | 72 |
| | 0-086-006-03-002 | | G 1 B | | | | | | | | | | | | | | |
| | 0-086-006-05-000 | G 1 ½ A | M 50x1,5 | Rp 1 ½ | 60 | 85 | 100 | 50 | 75 | 165 | 45 | 5 | 22 | 22 | – | 1000 | 75/78 80/84 |
| | 0-086-006-05-002 | | G 1 ½ B | | | | | | | | | | | | | | |
| | 0-086-006-06-000 | G 2 A | M 65x1,5 | Rp 2 | 75 | 105 | 125 | 65 | 95 | 200 | 52 | 5 | 25 | 25 | – | 750 | 85/90/91 |
| | 0-086-006-06-002 | | G 2 B | | | | | | | | | | | | | | |
| II | 0-086-006-00-020 | G ¼ A | M 16x1,5 | Rp ¼ | 22 | – | 50 | 19 | 45 | 86 | 24 | 3 | 12 | 12 | 50 | 3150 | 43 |
| | 0-086-006-00-022 | | G ¼ B | | | | | | | | | | | | | | |
| | 0-086-006-01-020 | G ⅛ A | M 22x1,5 | Rp ⅛ | 30 | – | 62 | 24 | 53 | 110 | 25 | 3 | 12 | 14 | 65 | 2100 | 51/59 |
| | 0-086-006-01-022 | | G ⅛ B | | | | | | | | | | | | | | |
| | 0-086-006-02-020 | G ¾ A | M 27x1,5 | Rp ¾ | 35 | – | 70 | 27 | 60 | 128 | 30 | 3 | 15 | 16 | 76 | 1750 | 66 |
| | 0-086-006-02-022 | | G ¾ B | | | | | | | | | | | | | | |
| | 0-086-006-03-020 | G 1 A | M 35x1,5 | Rp 1 | 45 | – | 80 | 32 | 70 | 147 | 33 | 5 | 15 | 18 | 86 | 1450 | 72 |
| | 0-086-006-03-022 | | G 1 B | | | | | | | | | | | | | | |
| | 0-086-006-05-020 | G 1 ½ A | M 50x1,5 | Rp 1 ½ | 60 | – | 100 | 50 | 85 | 195 | 45 | 5 | 22 | 20 | 112 | 1000 | 75/78 80/84 |
| | 0-086-006-05-022 | | G 1 ½ B | | | | | | | | | | | | | | |
| | 0-086-006-06-020 | G 2 A | M 65x1,5 | Rp 2 | 75 | – | 125 | 65 | 105 | 235 | 52 | 5 | 25 | 22 | 134 | 750 | 85/90/91 |
| | 0-086-006-06-022 | | G 2 B | | | | | | | | | | | | | | |

*) Tolerance for $A_1$:
"4d" according to DIN 13, page 15, for metric ISO threads and B according to ISO 228/I resp. BS 2779 for Whitworth-pipe threads.

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