Atlas Copco  Air dryers
FD90, FD110, FD130, FD170 and FD230

Instruction book

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- This instruction book meets the requirements for instructions specified by the machinery directive 98/37/EC and is valid for CE as well as non-CE labelled machines.

No. 2920 1390 02
Replaces No. 2920 1390 01

Registration code: APC FD / 38 / 975

2001-12

Web-site: http://www.atlascopco-compressors.com
This instruction book describes how to handle and operate the subject machine(s) to ensure safe operation, optimum working economy and long service life.

**Read this book before putting the machine into operation** to ensure correct handling, operation and proper maintenance from the beginning. The maintenance schedule contains a summary of the measures for keeping the dryer in good repair. The maintenance procedures are simple but must be carried out regularly.

Keep the book available for the operator(s) and make sure that the dryer is operated and that the maintenance actions are carried out according to the instructions. Record all operating data, maintenance work effected, etc. in an operator's logbook available from Atlas Copco. Follow all applicable safety precautions, amongst others those mentioned in this book.

Repair operations should be performed by trained personnel from Atlas Copco who can also be contacted if any further information is desired.

In all correspondence always mention the dryer type and the complete serial number, shown on the data plate.

For all specific data not mentioned in the text, consult sections "Maintenance" and "Principal data".

**The company reserves the right to make changes without prior notice.**

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**Contents**

1 Leading particulars ........................................ 3
   1.1 General description .................................... 3
   1.2 Air circuit ............................................ 3
   1.3 Refrigeration circuit .................................. 3
   1.4 Automatic regulation system ............................ 4
   1.5 Electrical system ..................................... 4

2 Installation .................................................. 9
   2.1 Dimension drawings .................................... 9
   2.2 Installation proposal .................................. 11
   2.3 Installation instructions .............................. 12
   2.4 Pictographs ........................................... 13

3 Operating instructions ...................................... 13
   3.1 Initial start .......................................... 13

3.2 Starting .................................................. 13
3.3 During operation ....................................... 14
3.4 Stopping ................................................ 14

4 Maintenance ................................................ 14

5 Settings .................................................... 14

6 Problem solving .......................................... 14

7 Principal data ............................................. 15
   7.1 Limitations/nominal conditions ....................... 15
   7.2 Specific data of FD90, FD110 and FD130 ............ 15
   7.3 Specific data of FD170 and FD230 ................... 16

8 Conversion list of SI units into British units .......... 16
1 LEADING PARTICULARS

1.1 General description

The FD air dryers remove moisture from compressed air by cooling the air to near freezing point. This causes water to condense. The condensate is automatically drained. The air is warmed up before leaving the dryer.

1.2 Air circuit (Fig. 1.2)

Compressed air enters heat exchanger (13) and is cooled by the outgoing, cold, dried air. Water in the incoming air starts to condense. The air then flows through heat exchanger/evaporator (11) where the refrigerant evaporates causing the air to be further cooled to close to the evaporating temperature of the refrigerant. More water in the air condenses. The cold air then flows through separator (3) where all the condensate is separated from the air. The condensate collects in condensate trap (4) and is automatically drained. The cold, dried air flows through heat exchanger (13), where it is warmed up by the incoming air to approx. 10 degrees Celsius below the incoming air temperature. Condensation in the air net cannot occur unless the air is cooled to below the pressure dewpoint indicated by gauge (1).

1.3 Refrigeration circuit (Fig. 1.2)

Compressor (M1) delivers hot, high-pressure refrigerant gas which flows through condenser (9) where most of the refrigerant condenses.

The liquid flows through liquid refrigerant dryer/filter (12) to capillary tube (7). The refrigerant leaves the capillary tube at evaporating pressure.

The refrigerant enters evaporator (11) where it withdraws heat from the compressed air by further evaporation at constant pressure. The heated refrigerant leaves the evaporator and is sucked in by the compressor via accumulator (14).

![Diagram of the air dryer system](image)

M1. Refrigerant compressor
S3. Fan control switch
S7. High pressure shut down switch
1. Control panel
2. Condenser
3. Hot gas by-pass valve
4. Liquid refrigerant dryer/filter

Fig. 1.1 General view of FD90
1.4 Automatic regulation system (Fig. 1.2)

The condenser pressure must be kept as constant as possible to obtain stable operation, therefore, fan control switch (S3) stops and starts the cooling fan.

When, at partial or no load, the evaporator pressure drops to 2.25 bar(e), the by-pass regulator opens and hot, high pressure gas is fed to the evaporator circuit to prevent the evaporator pressure from dropping any further.

1.5 Electrical system (Figs. 1.3 up to 1.6)

FD170 60Hz and FD230 60Hz dryers are 3-phase units, all other FD dryers are single-phase units.

The refrigerant compressors (M1) of FD170 and FD230 dryers are equipped with a crankcase heater (Rs). When voltage is supplied, the heater is energized. It keeps the oil in the crankcase warm to prevent condensing of refrigerant in the compressor housing, which could result in serious damage of the compressor at start (liquid knock).
C1. Start capacitor
C3. Run capacitor
F0. Main fuses, local installation (customer's installation)
H1. Indicator lamp, VOLTAGE ON
H2. Indicator lamp, DEWPOINT ALARM (optional)
K1. Timer (optional)

M1. Compressor motor
M2. Condenser fan motor
R. Resistor
R1. Temperature sensor, dewpoint (optional)
S0. Main switch (customer's installation)
S1. Button, ON-OFF
S3. Fan control switch
S4. Electronic thermostat with display (optional)
S7. High pressure shut down switch
T1. Transformer (optional)
Y1. Solenoid valve, interval drain (optional)

Fig. 1.3 Electrical diagram of FD90 up to FD130

Fan control switch (S3) starts fan motor (M2) as soon as the condenser pressure reaches the upper set point of the switch and will stop the fan motor when the condenser pressure decreases to its lower set point.

High pressure shut-down switch (S7-Fig. 1.1) stops the compressor motor when the pressure in the refrigerant circuit reaches the upper set point of the switch. After tripping, it must be reset manually by pressing its reset knob.

The compressor motor has a built-in thermic protection. If the compressor motor stops without apparent reason, it will probably be the thermic protection which has tripped. In such case, the compressor will restart when the motor windings have cooled down, which may take up to 2 hours.
B1. Electronic condensate drain (optional)  
C1. Run capacitor  
C3. Start capacitor  
F0. Main fuses, local installation (customer's installation)  
H1. Indicator lamp, VOLTAGE ON (optional)  
H2. Indicator lamp, DRYER RUN  

H3. Indicator lamp, DEWPOINT ALARM (optional)  
RS. Crankcase heater  
S1. Button, ON-OFF  
S3. Fan control switch  
S4. Electronic thermostat with display (optional)  
S7. High pressure shut down switch  
T1. Transformer (optional)  

Fig. 1.4 Electrical diagram of FD170 50Hz and FD230 50Hz

F0. Main fuses, local installation (customer's installation)  
F3/4. Fuses  
F8. Thermal overload, fan motor  
H1. Indicator lamp, VOLTAGE ON  
H2. Indicator lamp, DRYER RUN  
H3. Indicator lamp, DEWPOINT ALARM (optional)  
K1. Contactor, compressor motor  
K2. Contactor, fan motor  
M1. Compressor motor  
M2. Condenser fan motor  
Q1. Circuit breaker  
Q2. Circuit breaker  
R1. Temperature sensor, dewpoint (optional)  
RS. Crankcase heater  
S0. Main switch (customer's installation)  
S1. Button, ON-OFF  
S2. High pressure shut down switch  
S3. Fan control switch  
S4. Electronic thermostat with display (optional)  
T1. Transformer (optional)  
1x1. Terminal strip  
1x2. Terminal strip

Figs. 1.5 and 1.6
Fig. 1.5 Electrical diagram of FD170 220/440V/60Hz and FD230 220/440V/60Hz

Fig. 1.6 Electrical diagram of FD170 575V/60Hz and FD230 575V/60Hz
An electronic thermostat (Fig. 1.7) with display and alarm functions is available as an option. Display (3) shows the pressure dewpoint. The set point value, i.e. the pressure dewpoint at which the alarm indicator lamp lights up, can be checked by pressing key (5); the value will blink for approx. 5 seconds on the display. The differential value, i.e. the temperature difference between alarm on and alarm off, can be checked by pressing key (4); the value will blink on the display for approx. 5 seconds.

Altering the set point value (indicated "L1")
- Press key (5); the current value blinks on the display.
- Press the up (1) or down (2) key until the desired value is reached.
- To store the new value, press key (5) or wait a few seconds.

Altering the differential value (indicated "HY1")
- Press key (4); the current value blinks on the display.
- Press the up (1) or down (2) key until the desired value is reached.
- Press key (5) or wait a few seconds to store the new value.

If the temperature increases above the preset value, the alarm indicator lamp will light up.

1. Key, value up
2. Key, value down
3. Display
4. Key, differential value
5. Key, set point of maximum pressure dewpoint

Fig. 1.7 Detail of electronic dewpoint indicator (optional)
2 INSTALLATION

2.1 Dimension drawings (Figs. 2.1 and 2.2)

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### Table: Type of Driver and Net Mass Arrival

<table>
<thead>
<tr>
<th>Type of Driver</th>
<th>Net Mass Arrival (kg)</th>
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<td>FD 90 - 50Hz</td>
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<td>119 kg</td>
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<td>FD 110 - 50Hz</td>
<td>122 kg</td>
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<td>FD 110 - 60Hz</td>
<td>122 kg</td>
</tr>
<tr>
<td>FD 130 - 50Hz</td>
<td>122 kg</td>
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<tr>
<td>FD 130 - 60Hz</td>
<td>122 kg</td>
</tr>
</tbody>
</table>

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Fig. 2.1 Dimension drawing of FD90 up to FD130
Fig. 2.2 Dimension drawing of FD170 up to FD230
2.2 Installation proposal (Fig. 2.3)

Fig. 2.3 Installation proposal

1. FD dryer  
2a. DD-type general-purpose prefilter  
2c. PD-type afterfilter  
3. Air receiver with condensate drain  
4. Pressure gauge  
5. Drain pipe  
6. Dryer outlet valve  
7. By-pass system  
8. By-pass valve  
9. Dryer inlet valve

Fig. 2.4 Side view

1. Insulating block with heat exchangers  
2. Condenser  
3. Condensate separator  
4. Condenser cooling fan  
5. Accumulator
1. Pictograph, manual condensate drain
2. Manual condensate drain valve
3. Pictograph, automatic condensate drain
4. Automatic condensate drain

Fig. 2.5 Rear view

2.3 Installation instructions

1. Install the dryer where the ambient air is as clean as possible and where the temperature of the air will never exceed the limits (see section 7). Keep the ventilation gratings of the dryer free. If necessary, take action to avoid external influences (wind, draughts, etc.) through the ventilation gratings of the dryer, as they may disturb the cooling air flow.

2. Connect the compressed air lines to the marked inlet and outlet pipes of the dryer (Figs. 2.1 and 2.2). Provide an air inlet valve and outlet valve. If a by-pass pipe and valve are installed, the dryer can be serviced while by-passing the dryer.

3. Fit manual condensate drain valve (2-Fig. 2.5). Lay out the condensate drain hoses via a funnel towards a drain collector to allow visual inspection. The hoses must slope downwards. For draining of pure condensate, install an oil/water separator; consult Atlas Copco. If the condensate drain has been led down outside the compressor room where it may be exposed to freezing temperatures, it must be insulated.

4. A sticker dealing in short with the operating instructions and explaining the pictographs is delivered with the literature set. Affix the sticker next to the control panel. Make yourself familiar with the instructions and pictographs explained.

5. On single-phase dryers: Fit the electric plug to the voltage supply cable. Plug in the dryer.

On 3-phase dryers: Check that the primary side connections of transformer (T1-Figs. 1.5 and 1.6) correspond with the supply voltage. Check that the electrical installation corresponds to the local codes. The dryer must be earthed and protected against short circuits by fuses of the inert type in all phases. An isolating switch must be installed near the dryer.

C3. Run capacitor
M1. Refrigerant compressor
M2. Condenser fan motor
S3. Fan control switch
S7. High pressure shut down switch
1. Hot gas by-pass valve
2. Condenser
3. Condensate trap
4. Insulating block with heat exchangers
5. Liquid refrigerant dryer/filter
6. Cubicle

Fig. 2.6 Side view
2.4 Pictographs (Fig. 2.7)

1. Switch off and depressurize the dryer before starting maintenance or repairs
2. Manual condensate drain
3. Automatic condensate drain
4. Pressure dewpoint
5. Dryer on-off
6. Voltage on
7. Dewpoint alarm

Fig. 2.7 Pictographs

3 OPERATING INSTRUCTIONS

Safety precautions
The operator must apply all relevant safety precautions, including those mentioned in this book.

Altitude operation
Consult Atlas Copco if operating above 3000 m.

3.1 Initial start

1. At least 4 hours before starting, the mains supply to the dryer must be switched on to energize the crankcase heater of the refrigerant compressor.
2. On 3-phase dryers (see section 1.5), press on-off button (S1-Fig. 3.2). Check that the sense of rotation of fan motor (M2-Fig. 2.6) is correct. Cooling air must be drawn in through the condenser and blown over the refrigerant compressor to outside the dryer. If wrong, switch off the voltage and reverse two of the three phase connections at the mains terminals.

3.2 Starting (Figs. 3.1 and 3.2)

1. On FD170 and FD230, switch on the voltage 4 hours before starting to energize the crankcase heater. Voltage on lamp (H1) is alight.
2. If installed, close the dryer by-pass valve.
3. Press on-off button (S1).
4. Open the dryer air inlet valve (customer's installation).
5. Approx. 5 minutes later, open the dryer air outlet valve (customer's installation).
6. Approx. 10 minutes later, the nominal dewpoint will be reached.

Fig. 3.1 Control panel of FD90 up to FD130 (typical example)

1. Indicator lamp. VOLTAGE ON
2. Indicator lamp. DRYER RUN
3. Button, ON-OFF

Fig. 3.2 Control panel of FD170 and FD230 (typical example)

1. Pressure dewpoint indicator
2. Pictograph, pressure dewpoint
3. Pictograph, dryer on-off
4. Pictograph, dewpoint alarm
5. Pictograph, voltage on

Figs. 3.1 and 3.2
3.3 During operation

Regularly check:
1. Pressure dewpoint indicator (1-Figs. 3.1 and 3.2). 1)
2. That condensate is discharged (4-Fig. 2.5). The amount depends on the operating conditions.
3. Regularly open manual drain valve (2-Fig. 2.5) for approx. 10 seconds to discharge condensate and possible impurities.

3.4 Stopping (Figs. 3.1 and 3.2)

1. Close the dryer inlet and outlet valves (customer's installation).
2. Press on-off button (S1). The dryer stops. Voltage on lamp (H1) remains alight. On FD170 and FD230, the crankcase heater remains switched on. Leave the voltage on if the dryer has to remain stand-by.

4 MAINTENANCE

Cooling dryers of FD type contain refrigerant HFC.

Safety precautions
When handling refrigerant R404a, all applicable safety precautions must be observed. The following points are stressed:
- Contact of refrigerant with the skin will cause freezing. Special gloves must be worn and in case of contact, the skin should be rinsed with water. On no account may clothing be removed.
- Fluid refrigerant will also cause freezing of the eyes; therefore, safety glasses are a must.
- Refrigerant R404a is poisonous. Do not inhale refrigerant vapours. Check that the working area is adequately ventilated.

Local legislation may impose that:
- work in the refrigerant circuit of the cooling dryer or on any equipment which influences its function should according to the law be executed by an authorized control body.
- the installation should according to the law be checked once a year by an authorized control body.

General
- Keep the dryer clean.
- Brush or blow off the finned surface of condenser (2-Fig. 1.1) regularly.
- Once every six months inspect and clean the inner components of condensate trap (3-Fig. 2.6).

5 SETTINGS

The regulating and safety devices are factory-adjusted to obtain optimum performance of the dryer. Do not alter the setting of any of the devices.

6 PROBLEM SOLVING (Fig. 1.2)

1. Pressure dewpoint too high
   a. Air inlet temperature too high
   b. Ambient temperature too high
   c. Air inlet pressure too low
   d. Increase inlet pressure
   e. Dryer capacity exceeded
   f. Reduce air flow
   g. Shortage of refrigerant
   h. Evaporator pressure too high
   i. See 3
   j. Condenser pressure too high
   k. See 2

2. Condenser pressure too high or too low
   a. Fan control switch (S3) out of order
   b. Fan or fan motor out of order
   c. Ambient temperature too high
   d. Check and correct, if necessary, draw cooling air via a duct from a cooler place or relocate dryer
   e. Condenser externally clogged
   f. Clean condenser

3. Compressor stops or does not start
   a. Electric power supply to compressor is interrupted
   b. Thermic protection of refrigerant compressor motor (M1) has tripped
   c. Motor will restart when motor windings have cooled down

4. Condensate trap remains inoperative
   a. Automatic drain system clogged
   b. Flush the assembly by opening manual drain valve. Have system inspected

Footnote chapter 3

1) The pressure dewpoint will deviate from nominal if the air inlet conditions or volume flow differ from nominal.
5. Condensate trap continuously discharges air and water  
a. Automatic drain system out of order  
a. Have system checked  

6. Evaporator pressure is too high or too low at unload  
a. Hot gas by-pass valve incorrectly set or out of order  
a. Have hot gas by-pass valve adjusted  
b. Condenser pressure too high or too low  
b. See 2  
c. Shortage of refrigerant  
c. Have circuit checked for leaks and recharged  

7 PRINCIPAL DATA  

7.1 Limitations/nominal conditions  

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<th>Nominal conditions</th>
<th>50 Hz</th>
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<td>Compressed air inlet temperature</td>
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<td>Ambient temperature</td>
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<td>Inlet relative vapour pressure</td>
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7.2 Specific data of FD90, FD110 and FD130  

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<td>60 Hz l/s</td>
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<td>60 Hz kW</td>
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<td>2.30</td>
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<td>Refrigerant</td>
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<tr>
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<td>R404a</td>
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<td>R404a</td>
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<td>Total charge, approx.</td>
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7.3 Specific data of FD170 and FD230 1)

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**Refrigerant**

- Tetrafluoroethane CH₂FCF₃
- Total charge, approx.

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**Footnote chapter 7**

1) At nominal conditions

8 CONVERSION LIST OF SI UNITS INTO BRITISH UNITS

- 1 bar = 14,504 psi
- 1 g = 0.035 oz
- 1 kg = 2.205 lb
- 1 km/h = 0.621 mile/h
- 1 kW = 1.341 hp (UK and US)
- 1 l = 0.264 US gal
- 1 l = 0.220 Imp gal (UK)
- 1 m = 3.281 ft
- 1 mm = 0.039 in
- 1 m³/min = 35.315 cfm
- 1 mbar = 0.401 in wc
- 1 N = 0.225 lbf
- 1 Nm = 0.738 lbf.ft
- x degrees Celsius = (32 + 1.8x) degrees Fahrenheit

**Footnote chapter 8**

1) A temperature difference of 1 degree Celsius – a temperature difference of 1.8 degrees Fahrenheit