



**EN**

# **Manual**

**Air Operated Drilling Unit**

**Series BE 21**



Read this manual before installation and  
commissioning of the product.  
Keep for future reference.

MAN033 - Manual BE 21, EN, ORIGINAL Rev. 03.doc

**E2 Systems**  
A DIVISION OF TUBEX AB

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**DECLARATION OF INCORPORATION OF  
PARTLY COMPLETED MACHINERY  
ORIGINAL**

**According to the EC's Machinery Directive 2006/42/EC, Annex 2B**

We,

E2 Systems a division of Tubex AB  
Strömslundsgatan 3  
507 62 Borås  
Sweden,

declare that the partly completed machinery:

**Model: BE21x**

\* Is designed to be embedded in a larger machinery or assembled with another machine, which together will constitute machinery covered by Directive 2006/42/EC "Machinery Directive" and which shall be constructed in compliance with this directive, and

\* Must not be put into service until the machinery, which the partly completed machinery must be part of, has been found and thus as a whole is declared in accordance with the "Machinery Directive and national legislation. We also confirm:

\* That the item 1 and 2.3 from the "Machinery Directive" Annex 1 concerning essential health and safety issues in the design of machines, which are reported in the manual for the above partly completed machinery, have been performed, and

\* That the relevant technical documentation is compiled in accordance with Annex 7, Section B of the Directive 2006/42/EC

At the substantiated request of national authorities will relevant documents on the partly completed machinery be handed over.

Following other directive and harmonized standards, including appendix, has been applied:

EN ISO 12100:2010 Safety of machinery -- General principles for design -- Risk assessment and risk reduction.

SIS ISO TR 14121-2:2007 Safety of machinery -- Risk assessment -- Part 2: Practical guidance and examples of methods.

SS EN ISO 4414:2010 Pneumatic fluid power -- General rules and safety requirements for systems and their components.

Borås: 2009-12-18



Krister Johansson  
CEO Tubex AB



Andreas Gabrielsson  
responsible for the technical file

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### **WARNING!**

- Ensure that the operator has read and understood this manual before the drilling unit is in use.
- For security reasons, any modification of the drilling unit and its accessories, which may affect product safety, must be approved by the manufacturers technical manager.
- The unit is intended for drilling, countersinking and reaming and should not be used for any other application, unless approved by the manufacturers technical manager
- Always follow local security regulations regarding installation, operation and maintenance.
- The drilling unit must be securely fixed and the installation instructions must be strictly observed.
- The drilling unit must be protected against splash of emulsions, etc. This is to ensure the drilling units function as the lid for the micro-switches is not sealed against dust or liquid.
- When installing the unit on a stand or in a complete machine tool, necessary protective devices must be fitted to prevent injury caused by crushing (squeezing) or any other type of personal injury that might be caused by the unit or its rotating tool.
- All protective devices that are designed to prevent personal injury must be mounted in their intended position during the operation.
- When servicing or repairing the unit, the electrical system must be switched off and the pneumatic system depressurized.
- If the drilling unit is fitted with electrical limit switches, before any adjustment to the switches disconnect from the main electric supply.
- Beware of hands, hair and loose fit clothing – Watch out for rotating parts.
- Never operate the drilling unit without any eventual safety arrangements – Beware of risk for crushing.
- Make sure that all hoses and electrical wires are safely fastened – Beware of risk for crushing.
- Ignoring the instruction may invalidate the warranty.

**More detailed information regarding risks related to the unit described below.**

According to Machinery Directive 2006/42/EC the unit is a “partly completed machine”. Thereby the manufacturer of the machine is responsible for the overall safety. This device should not be operational within EU before the machine, in which the device must be integrated in, assured to meet the Machinery Directive 2006/42/EC. This manual is developed according to Machinery Directive and also includes additional information to make it easy for the manufacturer of the machine to meet the Machinery Directive and the end user to maintain a high level of security

The machine is intended for use by a person with knowledge and experience of using a machine of this type, and without limited physical ability in arms and hands as well as fully sighted. The machine is designed to be serviced by a trained / qualified operator following the instructions provided in the manual. The accidents that are likely still might occur, is when the machine is running without protection or with inadequate protection, without a fence, clamps or jigs. Ill health may arise from issues or material used, for example:

- Noise generated during the drilling / threading;
- Drilling dust / chips;
- Fumes and substances released during drilling of impregnated or treated material.

### **General recommendations**

- Apply a system for monitoring the tool in the machine. If no such system is at hand, we recommend user/operator to frequently control the tool. To ensure that no damages occurred.

### **Thorough review of the unit**

Visual control of any external damages. Ensure there is possibility to quickly turn off the motor and air-supply and run a normal cycle without tool and material (to avoid further damages at the material and unit). Listen for noise from bearings and also control the run-out at the spindle nose. If not ok, unit has to be repaired and a new control for damages will be necessary. If a unit seems ok, perform a normal cycle and evaluate the processed result.

### **If accident or breakdown occurs:**

When accident or breakdown occurs as results in damages, or risk for accident, should the unit be transferred to workshop or similar to ensure that unit can be repaired in a safe place. An accident or breakdown will assume that the entire machine is affected. Therefor is it up to the machine supplier to describe the work method when accident or breakdown occurs. E2 Systems will give the machine constructor best possible opportunity for this work in this manual.

## **Information about the manufacturer**

Drill and thread unit is manufactured and supplied by E2 Systems a division of Tubex AB. E2 Systems are specialized in constructing and manufacturing drill and thread units. The units are compact and have a robust design constructed to be easy to use and have a long life-span with high precision. More of E2 Systems collection you will find at [www.e2systems.com](http://www.e2systems.com). If you would like to come in contact with E2 Systems regarding questions or comments on our products or documentation, our contact information follows:

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## **Device management**

The BE21-series weight is between 2,8-3,3kg. Thereby can the unit be carried of one person, BE21- series weight laterally is symmetrical. Since the unit is compact designed, there is a risk of crushing injury and other consequential damages due to the weight of the falling unit. Therefore, the unit has to be mounted at fixed position or be laid down on the page, prior to settings of pneumatic connection is made.

## Description of the drilling unit

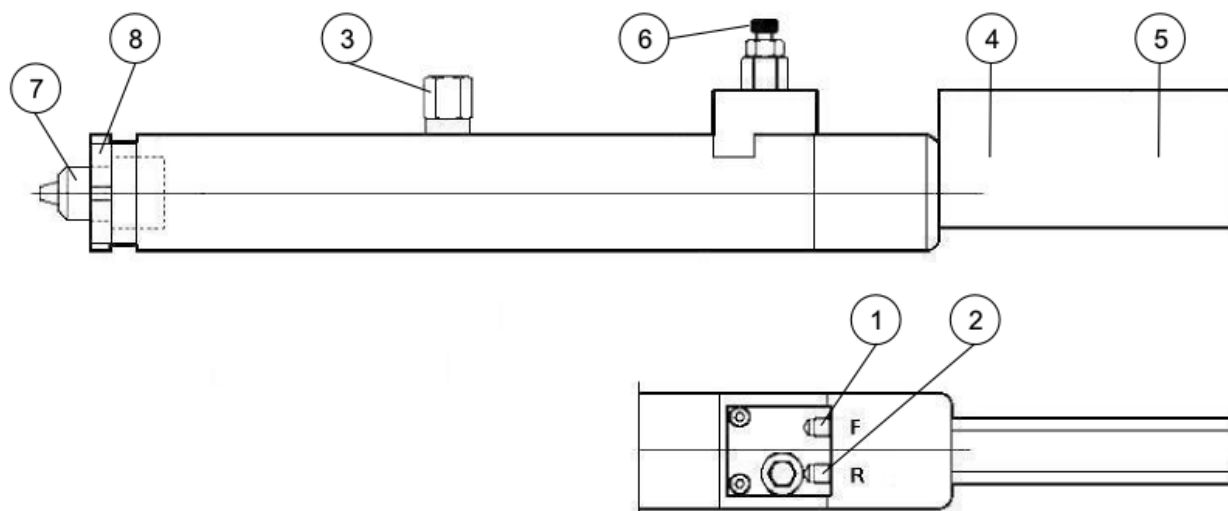
The **BE21** is an air operated drilling unit with a feed. The design of the BE21 makes it very suitable for drilling blind holes, reaming and the like.

Type and speed: See data label on drilling unit  
Serial number: See data label on drilling unit



### **Description:**

1. Main inlet port, G1/8" (NPT) for forward feed.
2. Main inlet port, G1/8" (NPT) for return feed.
3. Air motor directed exhaust port, G1/4" (NPT).
4. Adjustment nut for drilling depth/return position.
5. Adjustment nut for indication of home position.
6. Adjustment screw for working feed rate.
7. Key Chuck or Collet Chuck.
8. Front nut for mounting.



## Installation of the drilling unit

This Drilling and Tapping Unit is only intended for use in machinery which applies to the Machine Directive 2006/42/EC. This Drilling and Tapping Unit is designed for normal drilling, countersinking, reaming and tapping. In applications requiring high-precision hole placement or when drilling into rounded or slanted surfaces, drill bushings must be used.

To be able to use the unit, it must first be installed and fitted with control equipment. Regardless of how simple the installation is performed, the unit must be fitted with necessary protective devices to avoid personal injury. Special precaution must be taken to eliminate the risk of clothing, gloves, hair, etc. being caught in the rotating tool. The unit should always be mounted to a flat surface and be attached in a stable construction. Avoid adjacent parts enhancing resonance noise and vibrations wherever it is possible, which can create a resonance box effect.

The unit consists of many components and preassembled parts, the reliability of which is dependent upon proper maintenance. The pneumatic systems include a number of seals. It is essential to keep moving seal surfaces clean and free of marks and scratches.



### WARNING!

Never use the drilling unit without being securely fastened and that appropriate security arrangements have been organised.  
Be careful with rotating and moving parts, to avoid personal injuries.  
Ensure that the drilling unit is disconnected from the main air-supply, before any maintenance.

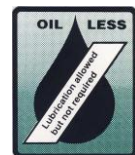
If the user feels the need to control the operation of this unit before it is installed in the machine, this is done AT YOUR OWN RISK

### Air supply:

A complete air preparation unit (FRL unit) with a flow capacity exceeding 0,3 Nm<sup>3</sup>/min (12 Cfm), air-filter with 5 µm (2500 mesh) filtration, pressure regulator and oil-mist lubricator shall be placed within 5 meters (16,4 Ft) of the drilling unit to provide clean and lubricated air to the drilling unit. The main pipe which the FRL unit is connect to should have a pipe dimension of 1 1 / 2 - 2". The oil-mist lubricator should be set to provide approx. 1 drop/10-20 cycles. 1 drop = 15 mm<sup>3</sup> (.000528 fl.oz. (UK), .000507 fl.oz. (US))  
The oil/air mix ratio should be 50 mm<sup>3</sup> (.00176 fl.oz. (UK), .00169 fl.oz. (US)) per 1000 liter (219.97 Gallons (UK), 264.17 Gallons (US)) consumed air.  
The lubricating oil viscosity should be between 50 and 300 cSt at the air motor operating temperature.  
Recommended lubricant: Mineral based lubrication oil.

If multiple drilling units are used, each unit must have a separate air supply.

The drilling unit can be ordered with an air motor for lubrication free operation, without oil-mist lubrication, and is marked with a label. In this case an air preparation unit with (FR), in this case an air filter and a pressure regulator is only required.



We recommend that this unit is installed in a place with clean air and an ambient temperature between +10° - +40° C. (+50° - +104° F).

### Connection:

Connection (1) (F) is for forward feed of the drilling unit.

Hoses and couplings must maintain a flow area equivalent to at least an inside diameter of ø6 mm (1/4"). No additional pneumatic devices, controllers, etc. may be fed from this line.

Connection (2) (R) is for return feed of the the drilling unit.

Hoses and couplings must maintain a flow area equivalent to at least an inside diameter of ø6 mm (1/4"). No additional pneumatic devices, controllers, etc. may be fed from this line.

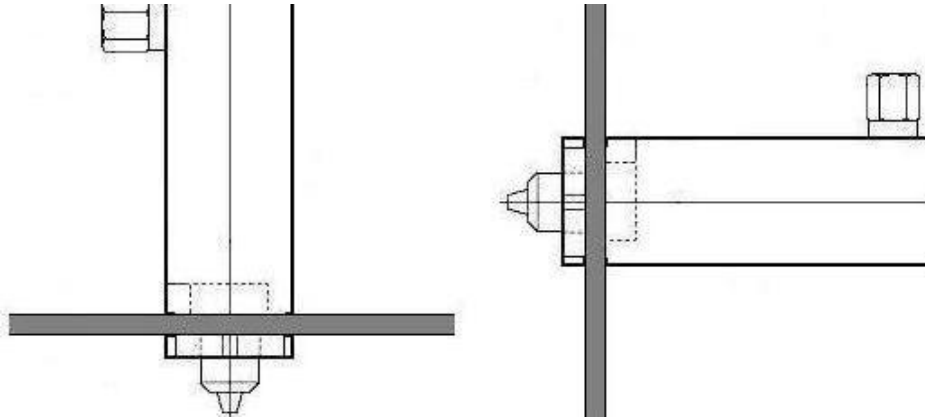
Connection (3) is for air motor exhaust, is normally equipped with a silencer, but can also be used to blow away chippings or led off with a longer hose. For lowest noise level, use an external silencer.

Before start up, check that the FRL unit (set at 6 – 7 Bar (87 – 100.5 Psi)) is connected correctly, a filter cartridge is mounted in the air-filter and the oil-mist lubricator is set correctly.



## Attachment

The use of E2 Systems mounting clamps and brackets for drilling units is recommended. If other way of attachment is desired the front nut as shown in the below example shall be used. The drilling unit can be mounted vertically or horizontally. When attaching the drilling spindle upwards the feed force can be affected. Optional attachment should be discussed with E2's technician.



## Mounting of cutting tools

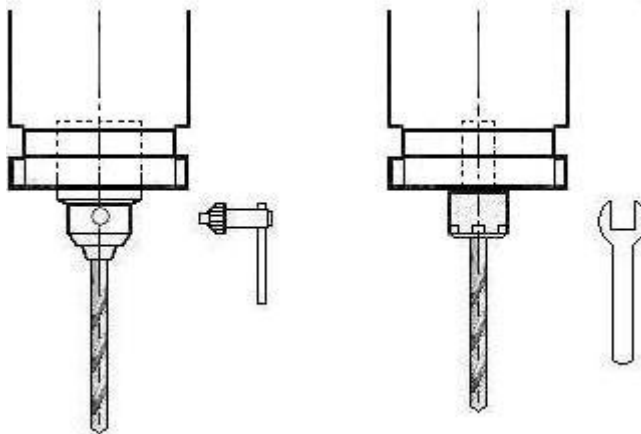
The following cutting tools can be used with drilling unit:

Drills, core drills, shank end mills, countersinkers, reamers or broaches.

The drilling unit can be fitted with either key chuck or collet chuck.

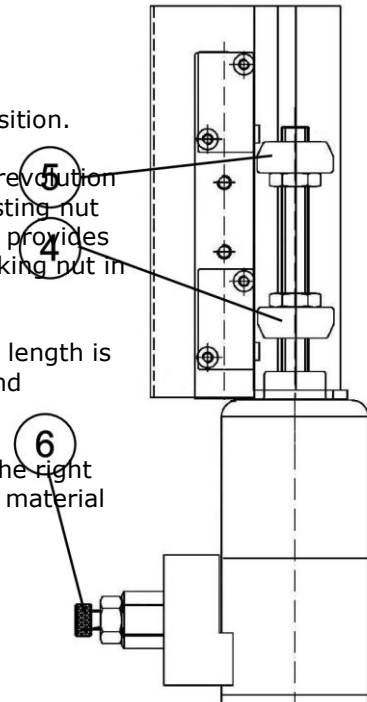
Key Chuck:

Collet Chuck:



## Setting

1. Ensure that the FRL unit is working properly.
2. The desired home position is set with adjusting nut (5). One revolution on the adjusting nut is 1 mm (.039 In). Adjusting nut (5) is locked with the locking nut in the set position.
3. The desired drilling depth is set with adjusting nut (4). One revolution on the adjusting nut is 1 mm (.039 In). Screwed down adjusting nut provides a short drilling depth and screwed up adjusting nut provides a long drilling depth. Adjusting nut (4) is locked with the locking nut in the set position.
4. The total stroke length is 50 mm (1 5/16"), if shorter stroke length is required this can be altered by resetting adjusting nut (4) and adjusting nut (5) together.
5. The working feed rate is set by adjusting screw (6) so that the right feed rate is obtained in relation to the drill diameter and the material to be processed.



## Description of limit switches, accessories

### Drilling unit BE 21 with pneumatic limit switch

16. 3 pcs air hoses, Polyamide  $\varnothing$  4/2,7 mm (5/32") and 1 pce Y-coupling.
17. 2 pcs pneumatic micro-valves (3-way), normally closed.  
V3 = upper micro-valve, actuated in rear spindle position = home position.  
V4 = lower micro-valve, actuated in front spindle position = return position.
18. 2 pcs Adjusting nuts with locking nuts.

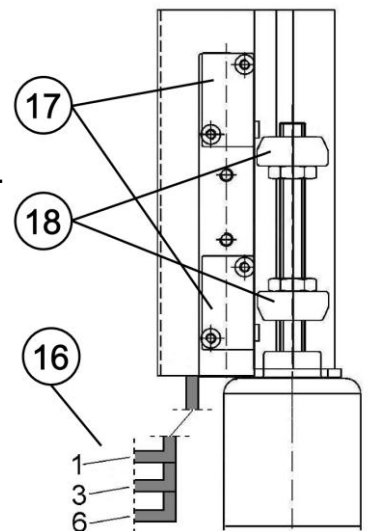
#### Installation and function:

Constant air supply, 3 - 7 Bar (44 - 101 Psi), filtered air, is connected to the common air hose marked (1). Oil-mist lubrication is not required. (If lubricated, too much lubrication can cause malfunction.)

The micro-valves provides pneumatic signals as follows:

V3 provides a pneumatic signal in the hose marked (3) when the drilling spindle is in home position.  
V4 provides a pneumatic signal in the hose marked (6) when the drilling spindle is in return position.  
This signal is generally used for the return of the drilling spindle to the home situation.

When the pneumatic signal is lost, the micro-valves vent through their exhaust ports.



## Drilling unit BE 21 with electric limit switch

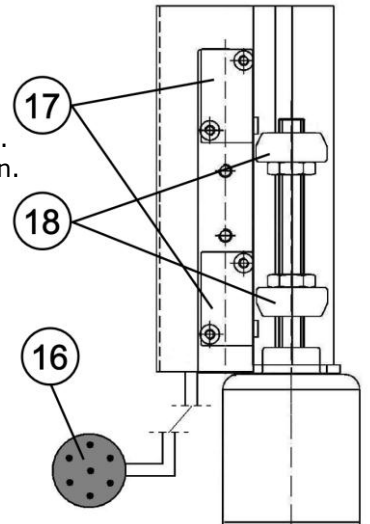
- 16. 1 pce 7-pole plug, male and female, with 2 m (6.56 Ft) cable.
- 17. 2 pcs electric micro-switches.
  - M1 = upper micro-switch, actuated in rear spindle position = home position.
  - M2 = lower micro-switch, actuated in front spindle position = return position.
- 18. 2 pcs Adjusting nuts with locking nuts.

### **Installation and function:**

The limit switches provides electrical signals in both home and return position the plug (16). The micro-switches are universally connected to a 7-pole male plug for normally closed and normally open functions and requires no internal access work. During installation, only the supplied plug has to be connected to desired connection for the desired function as below table:

Connection of plug. (See Example of connection)

- M1, Pin 1 – 2 normally closed
- M1, Pin 1 – 3 normally open
- M2, Pin 4 – 5 normally closed
- M2, Pin 4 – 6 normally open
- Centre pin is for earthing.

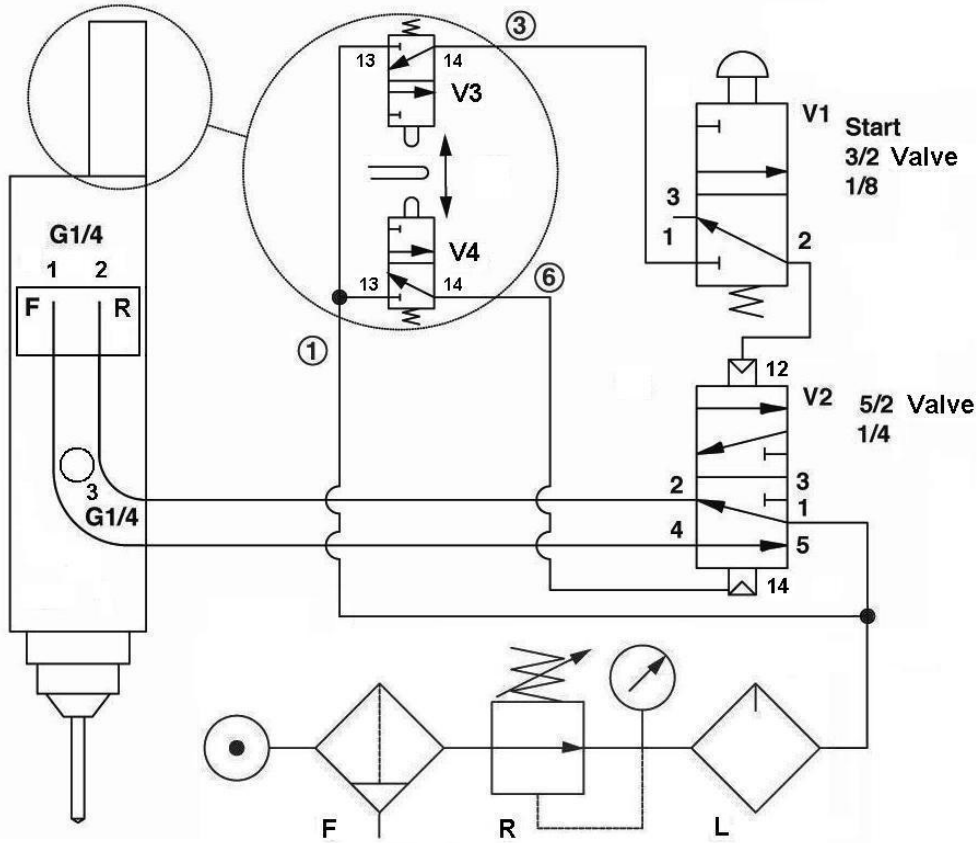


### **WARNING!**

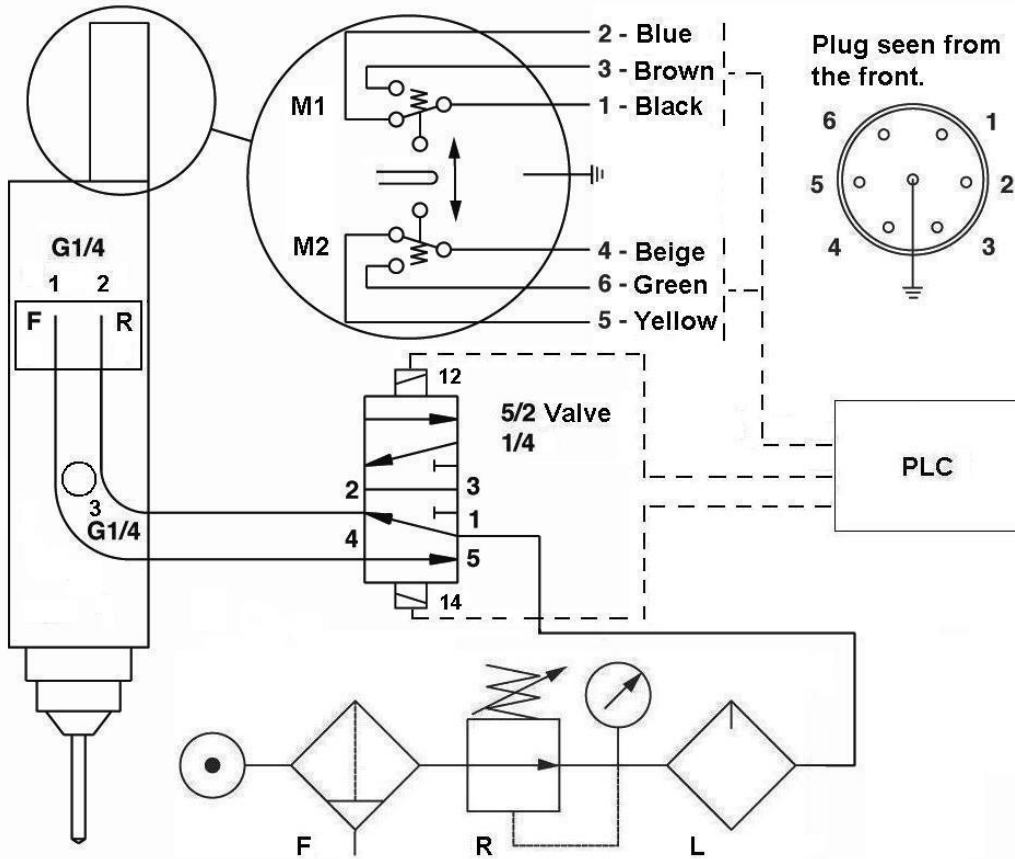
Before any adjustments are made, make sure that the electrical power to the limit switch is cut off.

# Example of connection with limit switch

Pneumatic:



Electric:



## Maintenance instruction

### Daily check:

- Check the air-pressure on the FRL-unit, 6 – 7 bar (87 – 101.5 Psi). Max 7 bar (101.5 Psi).
- Check for any leakages of air or oil. If a leakage is detected, contact service staff.

### Weekly check:

- Check that the oil-mist lubrication is working, approx. 1 drop/10-20 cycles. 1 drop = 15 mm<sup>3</sup> (.000528 fl.oz. (UK), .000507 fl.oz. (US))
- Check that the drilling unit is clean.

### Monthly check:

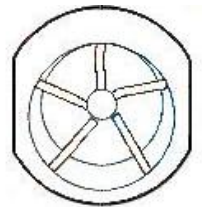
- Check that no abnormal play is present in the drilling spindle.
- Check that external silencer is not clogged.
- Check that the air filter in the FRL unit is working or replace the air filter.

### Every 12 months:

Perform overhauling and clean the air motor every 12 months alternatively after 1500 – 2000 working hours operation depending on which occurs first. Planetary gear, ball bearings and needle bearings are greased with ball bearing grease.

The air motor is of so called vane type. The air motors service life depends to a high degree on the air motors operating conditions. The vanes in an air motor intended for oil-mist lubrication have a life expectancy between 1500 to 2000 working hours at normal operation conditions. Other mechanical parts such as bearing have a service life between 3000 – 5000 hours.

The service life for an air motor intended for lubrication free operation is 1/3 of the service life compared with a lubricated air motor at normal operation.

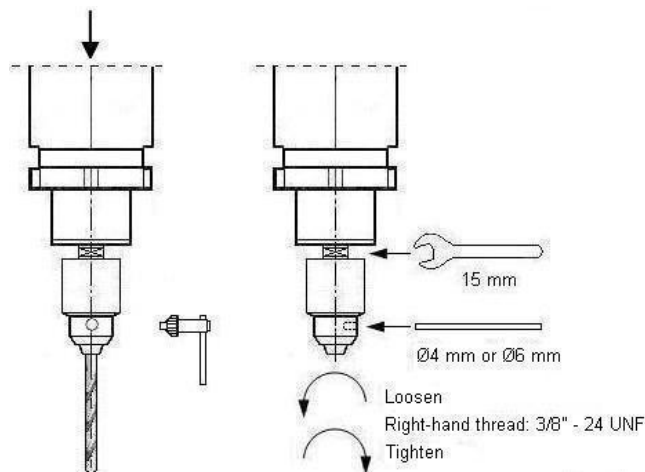


If hard operation, overhauling and cleaning should be performed with tighter intervals.

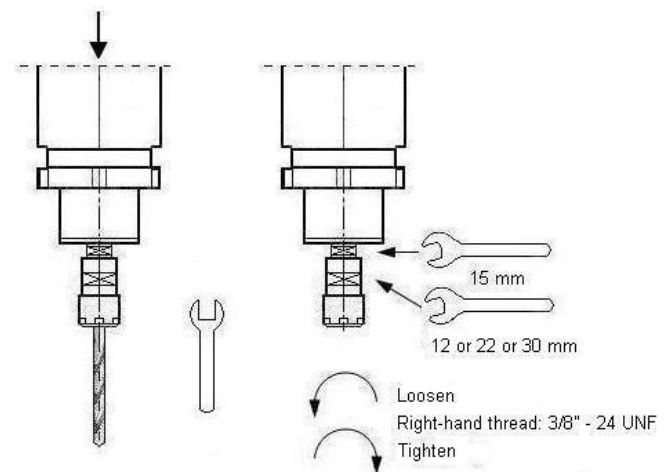
## Replacement of chuck

1. Start the drilling unit and quickly turn off the air supply to the drilling unit when the key chuck or collet chuck and quill is visible.
2. Remove eventual cutting tool from the key chuck or collet chuck.
3. Remove and replace the key chuck or collet chuck as shown below.
4. Remount the cutting tool.
5. Turn on the air supply to the drilling unit again.

Key Chuck:



Collet Chuck:



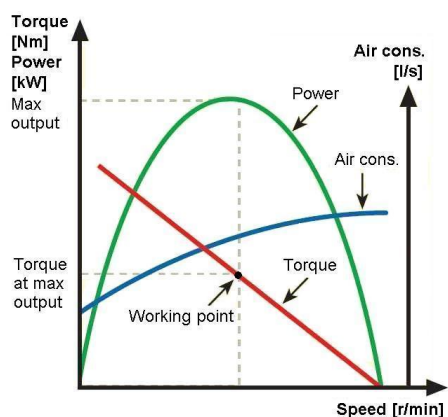
## Technical information

### Technical features, at 6,3 Bar (91.35 Psi):

Thrust, axial force	: Max. 665 N (150 Lbf)
Power, air motor	: See Power table below.
Stroke	: Max. 50 mm (1 5/16")
CC spindle spacing	: Min. 45 mm (1 3/4")
Run-out at spindle nose	: Max. 0,05 mm (.002 In)
Depth, accuracy	: +/- 0,01 mm (.0004 In)
Working pressure range	: 6 – 7 bar. Max 7 bar (85 – 100 Psi. Max. 101.5 Psi)
Air consumption	: < 0,3 Nm <sup>3</sup> /min (< 12 Cfm)
Ambient temperature	: +10° - +40° C. (+50° - +104° F)
Sound level	: 70 dB(A)
Spindle thread for chuck	: 3/8" – 24 UNF
Chuck	: As standard the drilling unit is fitted with an ordinary key chuck Ø 0,5 – 6,5 mm (.02 – 1/4"). A larger key chuck and collet chuck with collets are available as an option.
Electric limit switches	: Micro-switch: 10A 125V AC / 10A 250V AC

### Power, at 6,3 Bar (91.35 Psi):

Type	Power, kW	Power, Hp
BE 215	0,25	0,33
BE 218	0,25	0,33
BE 2111	0,25	0,33
BE 2122	0,25	0,33
BE 2136	0,25	0,33
BE 2149	0,25	0,33
BE 21220	0,25	0,33



Typical air motor characteristics.

### Speed and torque, at 6,3 Bar (91.35 Psi):

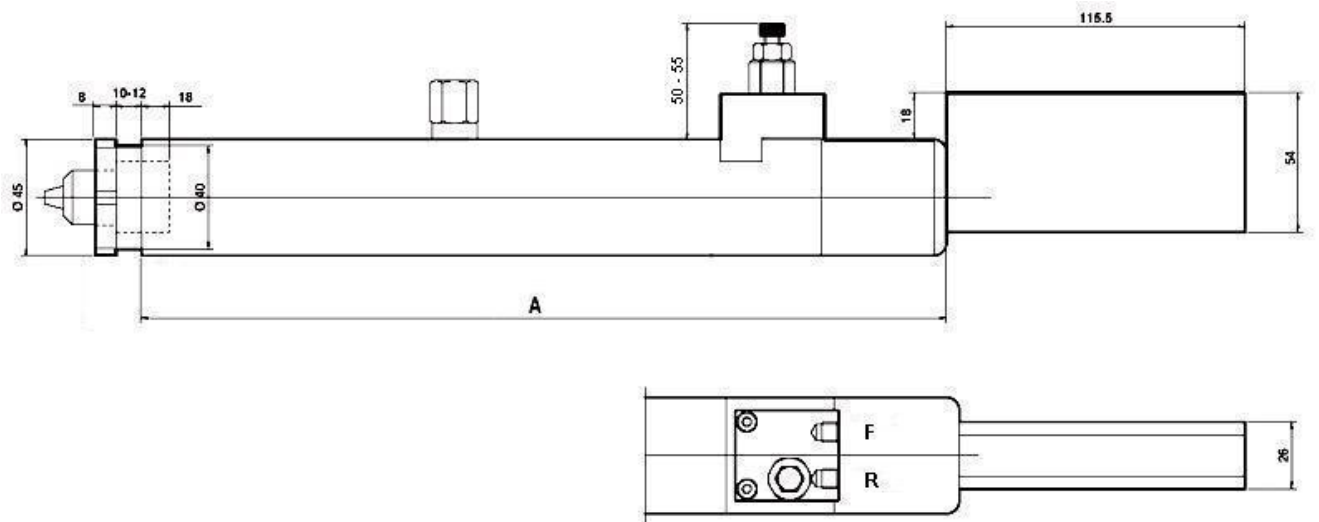
Type	Speed * (idle) Rpm	Speed (at max power) Rpm	Torque (at max power) Nm	Torque (at max power) Lbf-in
BE 215	500	250	9,9	87,62
BE 218	800	400	6,0	53,10
BE 2111	1100	550	4,3	38,06
BE 2122	2200	1100	2,4	21,24
BE 2136	3600	1800	1,5	13,28
BE 2149	4900	2450	1,1	9,74
BE 21220	15000	7500	0,25	2,21

\* Lubrication free air motors have 95% of shown idle speed.

Maximum power is produced when the drilling spindle during operation rotates at half speed max speed.

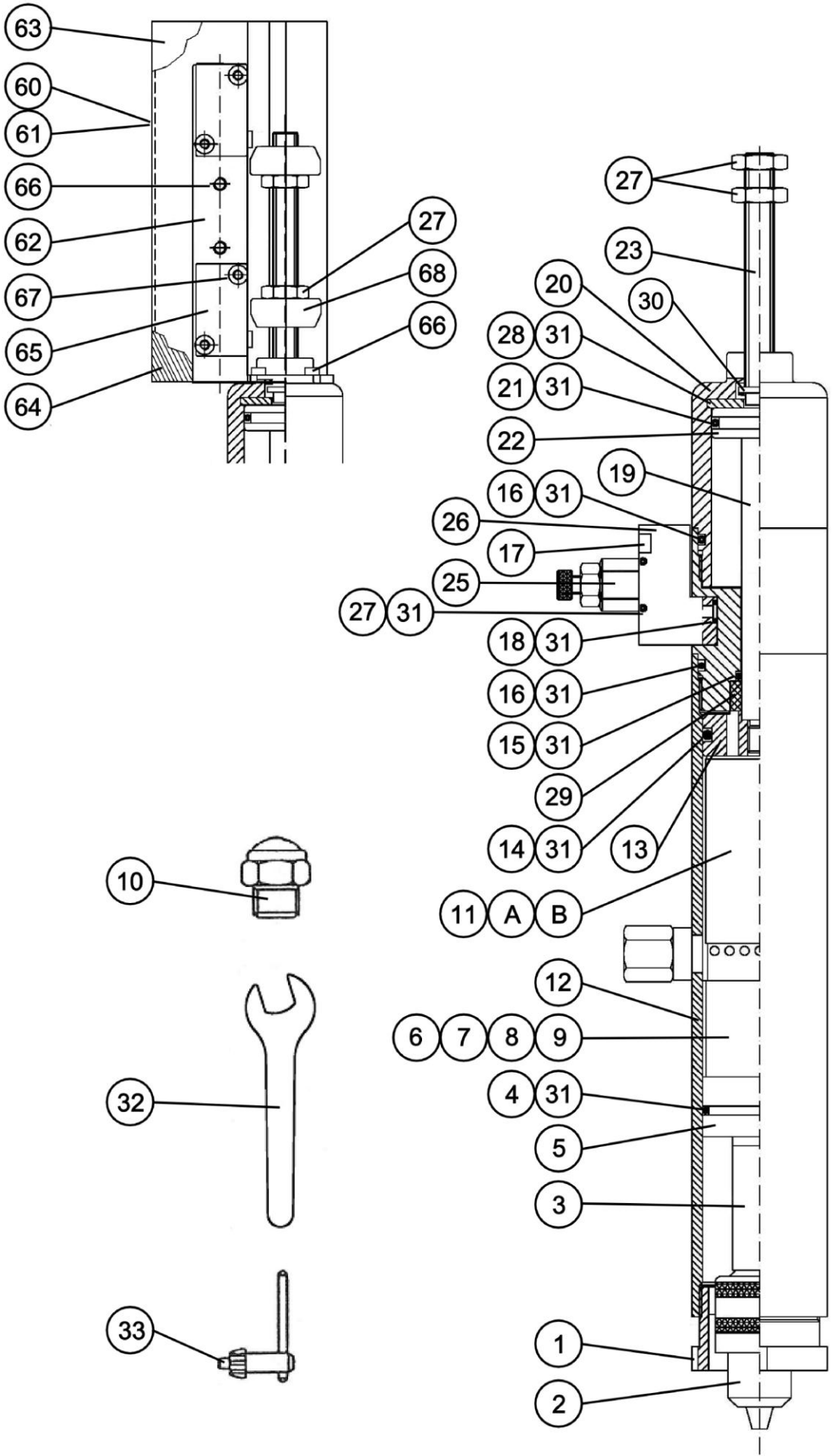
For other data such as drilling capacity we refer to our website [www.e2systems.com](http://www.e2systems.com).

## Dimensional drawing



Type	A mm	Weight, Kgs	Weight, Lbs
<b>BE 215</b>	312	3,3	7,28
<b>BE 218</b>	312	3,3	7,28
<b>BE 2111</b>	312	3,3	7,28
<b>BE 2122</b>	282	3,1	6,83
<b>BE 2136</b>	282	3,1	6,83
<b>BE 2149</b>	282	3,1	6,83
<b>BE 21220</b>	282	3,1	6,83

**Spare parts drawing**





## Spare parts list

BE 21			
Pos.	Qty	Description	Part no.
1	1	Front nut	041V400505
2	1	Key Chuck, Ø 0,5 - 6,5 mm (.02 - 1/4"), (standard chuck).	041J004003
2	1	Key Chuck, Ø 0,8 - 10,0 mm (.03 - 3/8")	041J004002
2	1	Collet Chuck ER11, Ø 1,0 - 8,0 mm (.04 - 5/16")	040J000122
2	1	Collet Chuck ER20, Ø 1,0 - 15,0 mm (.04 - 9/16")	040J000121
2	1	Collet Chuck ER32, Ø 2,0 - 20,0 mm (.08 - 13/16")	040J000124
3	1	Spacer	041V400517
4	1	O-ring, Ø35,1x1,6 Nitril	See pos. 31
5	1	Quill	041V400510
6	1	End gear BE 215, 218, 2111, complete.	041R000507
6	1	End gear BE 2122, complete.	041R000513
6	1	End gear BE 2136, complete.	041R000514
6	1	End gear BE 2149, complete.	041R000515
6	1	End gear BE 21220, complete.	041R000516
7	1	Intermediate gear BE 215, complete.	041R000511
7	1	Intermediate gear BE 218, complete.	041R000512
7	1	Intermediate gear BE2111, complete.	041R000505
8	1	Bearing kit for gear BE 215, 218, 2111, complete.	041R000506
8	1	Bearing kit for gear BE 2122, 2136, 2149, 21220, complete.	041R000510
9	2	Spring washer BE 215, 218, 2111	042K000060
10	1	Silencer, G1/4"	057F000502
11	1	Air motor BE 218, 2136	042K000010
11	1	Air motor BE 215, 2111, 2122, 2149, 21220	042K000011
11A	1	Set of vanes for <b>oil lubricated</b> air motor, pos. 11, complete.	041R000030
11A	1	Set of vanes for <b>non-lubricated</b> air motor, pos. 11, complete.	041R000028
11B	1	Bearing kit for air motor, pos. 11, complete.	041R000032
12	1	Cylinder tube BE 215, 218, 2111, complete.	041R000503
12	1	Cylinder tube BE 2122, 2136, 2149, 21220, complete.	041R000509
13	1	Piston with cylinder tube, complete.	041R000508
14	1	O-ring, Ø31,34x3,53 Nitril	See pos. 31
15	1	O-ring, Ø11,3x2,4 Nitril	See pos. 31
16	2	O-ring, Ø34,2x3 Nitril	See pos. 31
17	2	Screw, MC6S 4x35	411A121106
18	2	O-ring, Ø4,1x1,6	See pos. 31
19	1	Piston rod	041V400507
20	1	Return cylinder	041V300238
21	1	O-ring, 26,2x3 Nitril	See pos. 31
22	1	Return piston	041V400509

Pos.	Qty	Description	Part no.
23	1	Stop rod, complete.	041R000504
24	1	O-ring, Ø12,1x1,6	See pos. 31
25	1	Adjustment screw, complete.	041R000500
26	1	Connection housing, complete.	041R000501
27	2	Adjustment nut, ML6M M10x1	041U000015
28	1	Cushioning washer	See pos. 31
29	1	Bushing	419B200005
30	1	Spring washer, FBB 6,1	414A122015
31	1	Seal kit, complete.	041R000502
32	1	Tool for chuck removal.	041J004047
33	1	Chuck Key for Key Chuck pos. 2. Ø 0,5 - 6,5 mm (.02 - 1/4")	041J004071
33	1	Chuck Key for Key Chuck pos. 2. Ø 0,8 - 10,0 mm (.03 - 3/8")	041J004072
33	1	Wrench for Collet Chuck Nut pos. 2. ER11.	041J004083
33	1	Wrench for Collet Chuck Nut pos. 2. ER20.	041J004084
33	1	Wrench for Collet Chuck Nut pos. 2. ER32.	043J000002
60	1	Electric limit switch assembly, complete.	041J000015
61	1	Pneumatic limit switch assembly, complete.	041J000025
62	1	Holder	041V400550
63	1	Cover, upper	041V400458
64	1	Cover, lower	041V400459
65	2	Micro-switch, for electric limit switch. 10A 125V AC / 10A 250V AC.	604A000012
65	2	Micro-switch, for pneumatic limit switch.	604A000011
66	4	Screw, MC6S 4x6 FZB	411A122015
67	4	Screw, MC6S 3x14	411A122047
68	2	Setting nut	041V400551
	1	Plug, 7-pole, male. 5 A 300V AC/DC.	504A000006
	1	Plug, 7-pole, female. 5 A 300V AC/DC.	504A000007
	1	Cable, 7x0,25, length 2,15 m (7.05 Ft).	514A000001

## Warranty conditions

The warranty period for the product is 4 000 000 drilling cycles or 12 months after installation/commissioning or 18 months after delivery, whichever of these occurs first, and provided that the product is installed/stored in a satisfactory manner and that the product is used in normal operation, the mounting/clamping and handling conditions. The warranty is not valid if unauthorized change/modification have been performed on the product and that this may make the product unsafe.

## Environmental declaration

Drilling unit, Type BE 21

Housing : Steel  
Quill : Brass  
Other parts : Aluminium, brass and steel  
Gaskets : Rubber

Housing, quill and other metallic parts : Dispose as metal waste; Aluminium, brass and steel.  
Gaskets : Dispose as combustible waste.

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