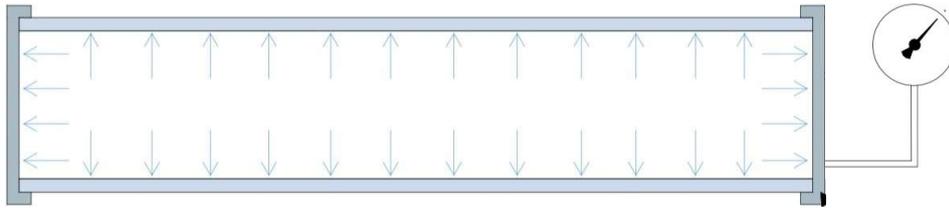
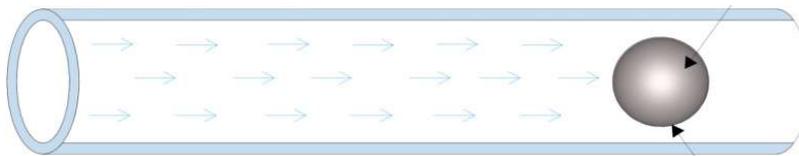


1. Prepare the duct system accordingly

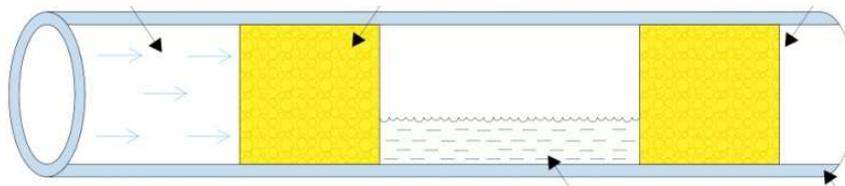
- a. check the tightness of the duct (conduct a leak test).



- b. check the patency and geometry of the duct (Perform the calibration by blowing steel balls with a diameter of 0.8-0.9 of the inside diameter of the pipe).

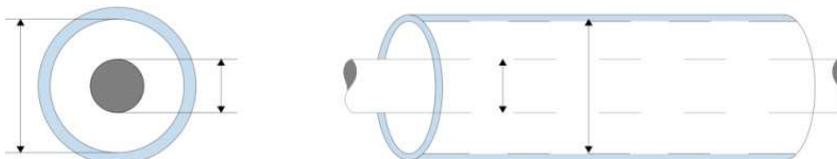


- c. clean and lubricate the duct by blowing through sponges wet in a suitable lubricant.



2. Select the suitable cable diameter for the existing duct system

- a. the ratio of the outer diameter of the cable to the inner diameter of the duct should be close to 60%. With this value, the greatest blowing distance is achieved.



3. Choose the right compressor

- a. for ducts $D = 32 \text{ mm}$ to $D = 50 \text{ mm}$, large compressors are needed with a capacity of $8-11 \text{ m}^3 / \text{min}$ and an operating pressure of $8-10 \text{ bar}$.
- b. for ducts with diameters of $12 \text{ mm}-20 \text{ mm}$, a compressor with a pressure of 15 bar and capacity up to $2 \text{ m}^3 / \text{min}$ is needed.
- c. for pipes with diameters of $7 \text{ mm}-12 \text{ mm}$, a compressor with a pressure of 15 bar and capacity of $1 \text{ m}^3 / \text{min}$ is needed.
- d. for microducts with diameters up to 7 mm , compressors with a pressure of $10-12 \text{ bar}$ and capacity of 0.1 to $0.5 \text{ m}^3 / \text{min}$ are needed.



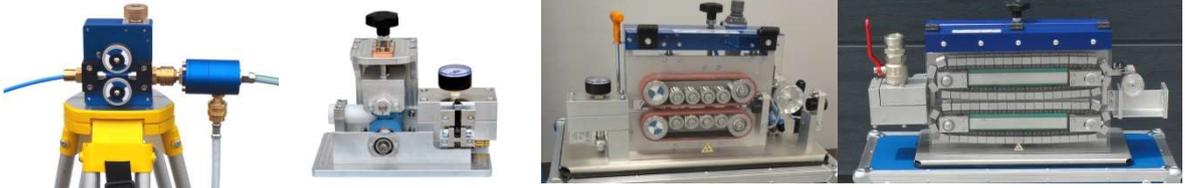


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4. Select the right blowing machine

- tubes up to 12 mm - BDJ Budget
- tubes up to 20 mm - BDJ Mini, BDJ Standard
- tubes up to 50 mm - BDJ Max, BDJ Hydro, BDJ Hydro Chain
- microduct blowing - BDJ Multitube, BDJ Multitube Belt



5. Choose the right equipment

- equipment for compressors: air coolers, air dryers, air heaters.
- equipment for fiber blowing: Y connectors, blowing heads.
- cable equipment: cable trailers, stands for cable pay-off, cable storage device for uncoiling excess cable (Twister, Figaro).
- accessories for tubes and microducts: trailers and unwinders, cutters, leak testers, calibrators, location probes.

6. Take care of the organization of the construction site

- assure free cable unwinding with the ability to control the unwinding speed.
- place the blowing machine on a secure and stable stand.
- make sure that the cable drum, blowing machine and duct are in line as much as possible.
- make sure that the outgoing air and the outgoing cable cannot hit anyone at the end of the blowing route.

7. Take care of equipment for workers

- all operating members must be trained to work on the operated machines.
- machines should be accompanied by operating manuals.
- the staff should be equipped with appropriate protective clothing ensuring safe work.
- keep workers connected at the beginning and end of the blowing route.
- after completing blowing in, reduce the pressure to atmospheric in all devices and lines.

8. Prepare the cable properly

- check that the cable is correctly coiled on the drum.
- check that the cable is not deformed or damaged .
- make sure the cable is not dirty.
- mount a suitable cap on the head of the cable.

9. Conduct a CRASH TEST

Attach a short (1.5 m for HDPE 32; 40; 50 mm, and 1 m for microducts) section of the duct , blinded at the end, to the blowing head. In the blowing machine's feeder, place a 3-4 m long cable section, and set the motors to low power (depending on the type of drive, by setting the pressure on pneumatic or hydraulic motors, or with the power potentiometer for electric motors). Then start the feeder so that the cable hits the end of the blanked conduit at the highest possible speed. Repeat the operation several times, increasing the power of the motors each time, until you make the cable



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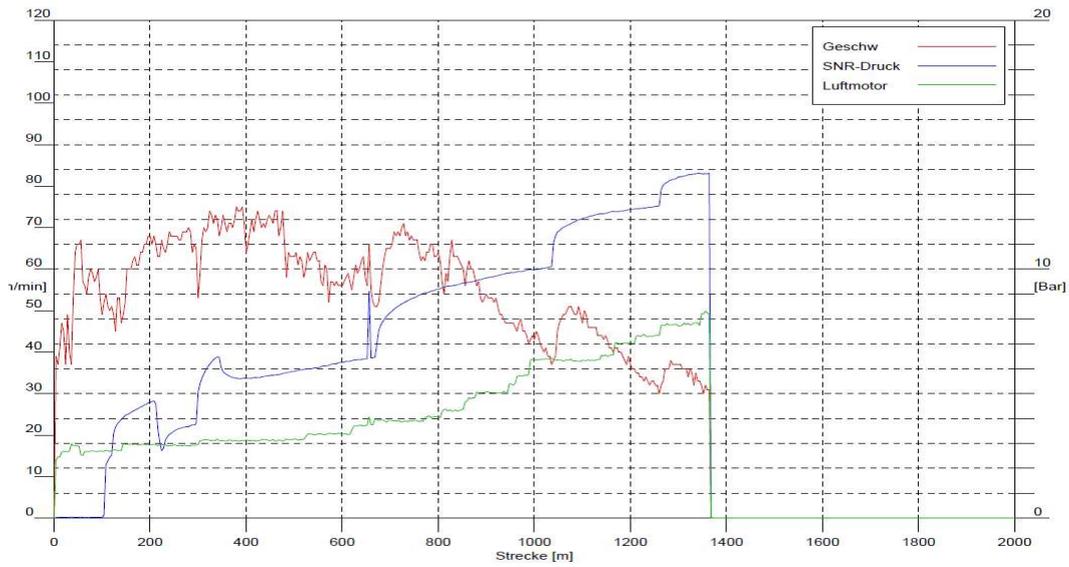
break. The maximum allowable pushing force will be the one from the last attempt, which did not damage the cable.

10. Carry out the blowing process correctly

- a. **The piston method** is only used for installation in tubes with internal diameters above 28 mm (external 32 mm). The piston should be mounted at the end of the cable with a special pulling grip for optical fiber cables. After putting the grip on the cable, in order to protect it from slipping, the last few centimeters should be wrapped tightly with a soft adhesive tape, so that the end of the stocking can be glued to the cable. The piston should slide smoothly inside the pipe. If necessary, the outer diameter of the gasket can be machined. Before inserting the piston with the cable into the pipe, about ½ l of the lubricant should be poured. After inserting the piston with the cable into the pipe and pushing it a few meters, pour another portion of the lubricant, about 1l per 1 km of the planned blowing route. Then connect the pipe with the cable to the blowing head. With the tracks (belts, wheels, rollers) of the drive raised, slowly supply compressed air, controlling the cable travel speed so that it does not exceed 120-130 m / min. If there are many turns at the beginning of the route, the speed should be limited to a maximum of 60 m / min. When the cable speed drops below 30 m / min, the feeder must be turned on. The optimal speed is 60-120 m / min. The pushing force cannot be greater than that determined during the **Crash-test**. Make sure that the pop-up piston does not hit anyone at the other end of the tube.
- a. **The jetting method** is used for cables from 0.5 mm in diameter and for ducts from 4 mm in diameter. Before inserting the cable into the pipe, the end of the cable should be secured with a special cap, or at least covered with a cigarette lighter so that it is round, without sharp edges. Then pour the appropriate amount of the lubricant into the duct. Manually insert the cable into the duct for several to several meters. Then install the duct with the cable in the blowing machine. After starting the feeder, without the air attached, push the cable into the duct as far as possible, at a speed of up to 60 m / min. When the speed starts to drop significantly, compressed air must be slowly fed to the head at a pressure of 1-2 bar. Make sure that the blowing speed does not exceed 120-150 m / min. As the resistance increases and the velocity decreases, the pressure of the blowing air should be increased smoothly by 1-2 bar. Avoid applying the maximum pressure too quickly, as this may create back pressure in front of the blown cable and consequently reduce the blowing distance. If the desired length is not achieved, stop blowing, bleed the pipe and try again after a few minutes, starting with the minimum pressure on the head. The operation can be repeated several times.



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The blue line in the diagram shows the correct way to pressurize the microduct