PLUMETT

®CABLEJET

CABLE FEEDER

Operating and maintenance manual

PLUMETTAZ S.A.

Zone industrielle "En Vannel C"

CH-1880 BEX

Switzerland

Tel. + 41-24 463 06 06

Fax +41-24 463 06 07

Internet: http://www.plumettaz.ch

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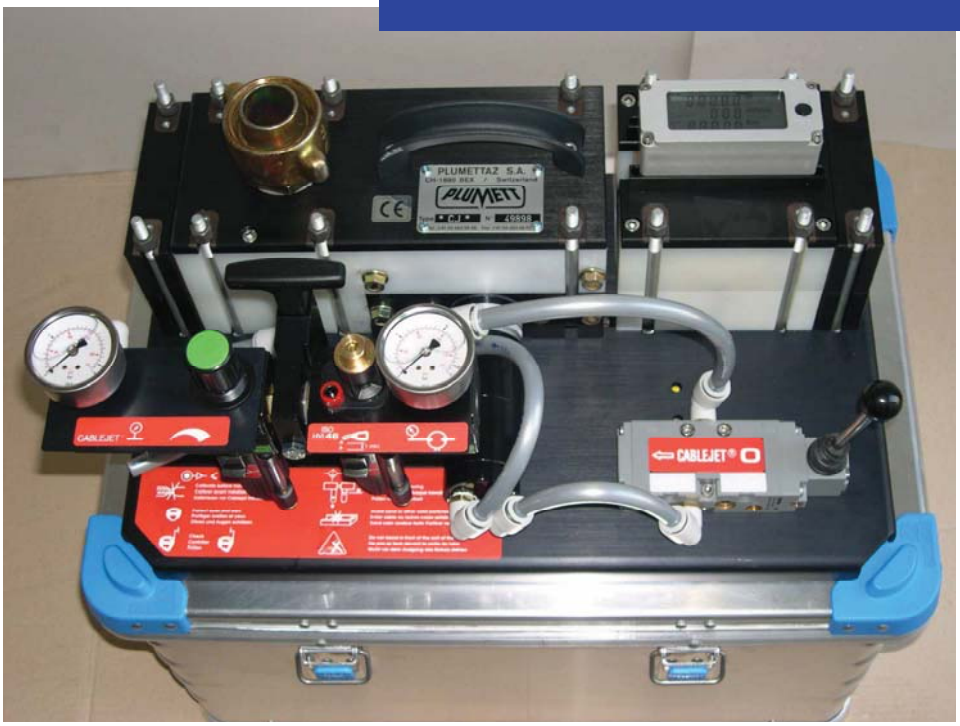
CABLEJETTING / 01



DEFINITION / 01.1

"CABLEJETTING" or "JETTING" is a method of installing fibre optic or conventional telecommunication cables. A stream of compressed air with a very high rate of flow pushes the cable through a guide and protection duct. This cable feeding by compressed air is supported by an additional mechanical pushing force, whitch is essential for optimal results.

ADVANTAGES / 01.2

- "JETTING" permits an even distribution of pushing forces along the whole length of the cable.
- Due to the absence of traction forces, heavy friction forces occurring in bends with conventional installation methods are avoided.
- Due to its simplicity, maximum safety for both the operating staff and the cable is ensured.
- Cost savings on infrastructure and work force increase the daily installation rates and reduce the on-site working time.

ON THE WORK SITE / 01.3

- "JETTING" permits the installation of very long uninterrupted sections of cable (1000 to 3000 m) without traction armouring.
- Cables can be directly installed through several intermediate chambers without manual intervention to the cable itself.
- The straightness of the course is no longer a constraint, the protection duct can be buried directly.
- Subducting operations are possible (simultaneous installation of several subducts) without disturbing the bunching of conductors in the main duct.
- The daily installation rate can be kept regular, whatever the nature and the complexity of the cable route.
- Cables can be changed easily and simply by coupling the new cable to the old one.

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UTILISATION LIMITS / 01.4

CABLE*JET* can be used within the following limits:

- **Cables: diameter from 9 to 18 mm ***
- **Ducts: external diameter from 20 to 63 mm**

* an optional set of accessories permits the installation of cable with a diameter between 6 and 9 mm - see §02.5.

The installation distances achieved with CABLE*JET* depend on the characteristics of the cable and the duct. The interactions between weight, dimensions, rigidity and materials, also the characteristics of the compressed air supply must be carefully defined.

Be sure to consult us before installing cables or using ducts which are outside the above limits.

For all other applications, do not use CABLE*JET* without our written authority. Please be sure to contact our After-Sales Service.

The following conventions are used throughout this manual to draw the attention of operators:

Message of attention:

Warning, take care.

Safety message:

DANGER, safety rules for which non-compliance can result in injury to users and damage to equipment. Compliance with these instructions is obligatory.

DESCRIPTION / 02

GENERAL POINTS / 02.1

The CABLE*JET* comprises four main parts:

EXHAUST UNIT / 02.1.1

Function: guides the cable at the inlet of the CABLE*JET* and secures the mechanical connection between the CABLE*JET* and the upstream duct. The exhaust unit comprises:

- Both the distance measuring and installation speed indicator when CABLE*JET* is operating single or as the first unit when operating in cascade mode.
- And an exhaust unit to permit the evacuation of air when the CABLE*JET* is operating in cascade or downstream of another CABLE*JET.*

The duct inserts (with cascade installation) are of blue anodised aluminium.

CABLE PUSHER / 02.1.2

Function: guarantees the introduction of the cable into the duct and provides for additional pushing force.

- It comprises 8 pinchwheels mounted in pairs on 4 spindles driven by an air motor.
- The pinchwheels are pressed against one another by springs to ensure the transmission of the pushing force to the cable. Spacer elements located between the pinchwheels are positioned according to the cable diameter in order to protect it from damage due to the slipping of the pinchwheels.

- **Maximum pushing force:..... 300 N**
- **Mean linear pressure of the pinchwheels on the cable:..... 100 N/cm**
- **Recommended installation speed (continuously adjustable):..... 60 m/min**

AIR INLET UNIT / 02.1.3

Function: guides the air flow which pushes the cable, to guarantee the mechanical link between the CABLE*JET* and the downstream duct; it is fitted with a valve and a threaded connector 1.1/2" for connection to the compressor air hose.

DUCT INSERTS / 02.1.3.1

Function: ensures the mechanical link and the sealing between the CABLEJET and the duct.
Dimensions available:

external Ø (mm):	**20**	**25**	**28**	**32**	**34**	**35**	**36**	**37**	**40**	**42**	**44**	**46**	**48**	**50**
	57	**60**	**63**											

CABLE INSERTS / 02.1.3.2

Function: ensures the cable guidance and the sealing between the CABLEJET and the cable.
Dimensions available:

Ø (mm)	**9-11**	**11-12,5**	**12,5-14**	**14-15,5**	**15,5-18**

The duct and cable inserts of the air inlet chamber are of red anodised aluminium.

CONTROL, SUPPLY AND BASE-PLATE / 02.1.4

Function: monitors the pressurizing of the duct, controls the operation, the speed and stopping of the motor.
The base-plate carries all the elements of the CABLE*JET*.
The actual control comprises:

- a pressure gauge for the air inlet unit;
- a water separator;
- a gravity lubricator with lubricant reservoir and setting screw;
- an air motor control unit
- a motor supply pressure gauge.

To ensure optimal operation, each CABLE*JET* must be supplied from a compressor having the following characteristics (see §03.3.2):

- Rated pressure: **10 - 12 bar**
- Minimum rate of flow:

ducts up to 27 mm external Ø:	**4**	m^3/min
ducts up to 32 mm external Ø:	**5**	m^3/min
ducts up to 40 mm external Ø:	**7**	m^3/min
ducts up to 50 mm external Ø:	**10**	m^3/min
ducts from 50 to 63 mm external Ø:	**15**	m^3/min

For safety reasons, any compressor with a rated pressure in excess of 12 bar must be fitted with a device restricting this pressure to 12 bar.

Where the ambient temperature exceeds 25°C, it is strongly recommended to use an aftercooler which will consume approx. 1 m3/min, which is to be added to the above minimum flow rates.

DIMENSIONS AND WEIGHTS / 02.2

CABLE*JET*:	Length 520 x width 320 x height 230 mm	Weight: **21** kg
CABLE*JET* with case:	Length 550 x width 350 x height 400 mm	Weight: **30** kg
Case of tools & accessories:	Length 550 x width 350 x height 250 mm	Weight: **17** kg

CONFORMITY WITH REGULATIONS / 02.3

Construction and safety is in conformity with EC Machines Directive No. 89/932/EU and its annexes.

STANDARD EQUIPMENT / 02.4

Each CABLE*JET* is delivered with:

- a case for the CABLE*JET*
- a case for the tools, inserts and consumable items (seals, lubricant etc.)
- a compressed air connection set 1 1/2" with valve and 10 m tubing
- a distance and installation speed indicator
- an exhaust pipe
- an operating and maintenance manual
- a list of spare parts

Ensure that the compressor is provided with the following connectors:

- **air supply for CABLE*JET:*** **threaded female union 1.1/2 " or 2" BSP.**
- **air supply for the air-gun:** **European bayonet connector Ø 42 acc. to DIN 3481 or DIN 3482.**

OPTIONAL ACCESSORIES / 02.5

- FIGARO cable coiling buffer EC 225/55
- AHP 400 aftercooler with water separator
- Sonic heads for ducts with diameters below 26-32 ; 32-40 and 40-51 mm.
- "Y" connector for "jetting" a second cable.
- duct inserts (other than the 3 inserts supplied as standard):
  Ø 20, 25, 28, 32, 34, 35, 36, 37, 40, 42, 44, 46, 48, 50, 57, 60 and 63 mm
- Pushing mechanism and special inserts for cable Ø 6-9 mm
- Cleaning and lubrication plugs Ø 64, 80, 100 mm
- Lubricant "Jetting Lube" (batch of 12 95 cl bottles)
- Calibration equipment for ducts
- Special connectors for ducts

- "JET PLANNER" calculation software for optimal installation lengths. Determine section lengths as a function of the parameters, duct, cable, terrain etc. (basic config. Win 3.1 ; Win 95).

REFERENCE DOCUMENT / 02.6

The above characteristics originate from document PLUMETTAZ No. 298.061 which is continuously subject to amendments. It is obtainable from your nearest agent or from PLUMETTAZ SA.

PREPARATION / 03

SAFETY / 03.1

- **Prior to any cable installation using CABLEJET, all persons involved are to be fully trained in the preparation procedures and the "JETTING" operations using CABLEJET.**
- **The understanding and the putting into practice of the safety instructions detailed in this manual are to be periodically checked by the work site supervisors.**

SAFETY INSTRUCTIONS / 03.1.1

The wearing of eye protection, ear defenders, a hard hat and protective overalls is mandatory, subject to the regulations applicable locally. Depending on the nature of the site, the use of a breathing mask with filter is recommended.

- Operators are to ensure the availability of a sufficient area around CABLE*JET* to guarantee their stability and balance so as to avoid falls or other potential causes of accidents.

The communication between the different work stations must be tested and safety signals / messages such as "RUN" and "STOP" are to be perfectly understood by the operators.

Whilst installing a cable, operators must be sure to advise the downstream operators from the instant that the duct is pressurised.

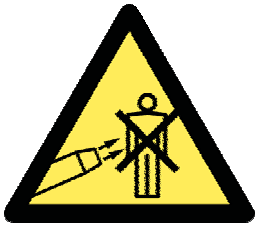
- Before all tests and start-ups, operators must make certain that no person not taking part in their activities can obstruct their work or that such persons are kept at a sufficient distance to eliminate all risks of accident.

- The CABLE*JET* is supplied with compressed air at an operating pressure of maximum 12 bar. The pipelines and unions in use must be dimensioned accordingly.

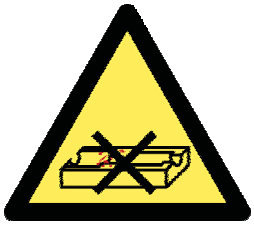
Prior to any connecting or disconnecting operations, the pressure in the supply or exhaust pipelines must be reduced to atmospheric pressure.

- The time taken for pressures to equalise varies depending on the length and cross section of the duct. The operator must ensure that this equalisation has taken place before any intervention.

- Before the progressive opening of the compressor valve, carefully check that the valve of the CABLE*JET* is closed, that all connectors and unions are in place and locked and that all pipes are free of bends or abnormal torsion forces.



Do not pass or stand in front of the outlet of the duct when it is under pressure.



The presence of any kind of dust or dirt in the CABLEJET can interfere with its function and possibly cause damage to the cable and to CABLEJET.

The different notices and labels mounted on CABLEJET or on the transport case, also on the tool case are always to be perfectly legible and comprehensible.

If this is not so, they are to be replaced.

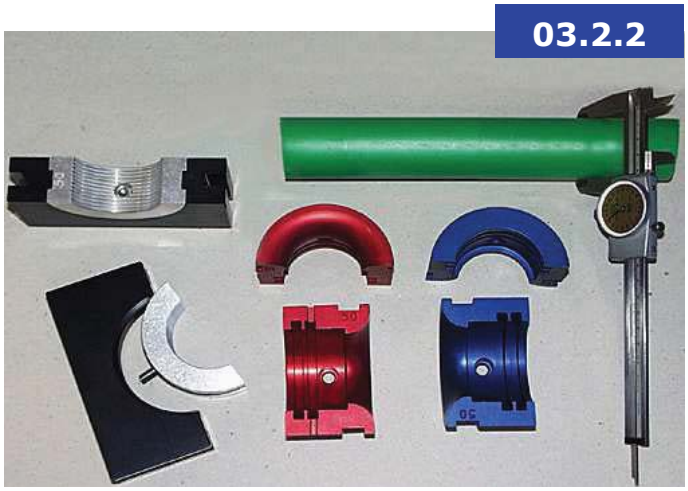
The non-compliance with safety instructions detailed above and in this manual, likewise the failure to comply with local safety regulations is the sole responsibility of the user.

- The manufacturer and its agents are in a position to reply to questions that these instructions might raise on their being applied.

EQUIPMENT / 03.2

PREPARATION "STEP BY STEP" / 03.2.1

- The preparation of CABLE*JET* is broken down into numbered steps and clearly illustrated to permit a fast understanding of the process. Be sure to follow the steps in the order shown, to assist your work and avoid errors which can lead to safety hazards for the operator and for CABLE*JET* and result in reduced output and quality of the installation work.



ADAPTING TO THE DUCT / 03.2.2

- Measure the external Ø (**DE**) of the duct and select the appropriate jaws and duct sealing inserts. The nominal diameter (**DN**) is engraved on the jaws and inserts.
- Limits of utilisation:

  - for jaws (natural aluminium):

  DN within **DE + 1** mm and **DE - 1** mm.

  - for duct inserts (upstream: blue, downstream: red):

  DN within **DE + 3** mm and **DE - 1** mm.

Duct external Ø		Duct inserts	
Ø mm	**Ø inch**	**N°**	**Order N°**
19-21	0.75-0.83	**20**	N270.104
24-26	0.94-1.02	**25**	N270.105
27-29	1.06-1.14	**28**	N270.102
29-31	1.14-1.22	**30**	N270.271
31-33	1.22-1.30	**32**	N270.066
33-35	1.30-1.38	**34**	N270.067
34-36	1.34-1.42	**35**	N270.260
35-37	1.38-1.46	**36**	N270.234
36-38	1.42-1.50	**37**	N270.068
39-41	1.54-1.61	**40**	N270.069
41-43	1.61-1.69	**42**	N270.070
43-45	1.69-1.77	**44**	N270.249
45-47	1.77-1.85	**46**	N270.173
47-49	1.85-1.93	**48**	N270.071
49-51	1.93-2.01	**50**	N270.072
56-58	2.20-2.28	**57**	N270.235
59-61	2.32-2.40	**60**	N270.073
62-64	2.44-2.52	**63**	N270.100

The duct insert set comprises:

• jaw	**natural aluminium**	**4 pieces**
• upper duct sealing insert / air inlet unit	**anodised red**	**1 piece**
• lower duct sealing insert / air inlet unit	**anodised red**	**1 piece**
• half cable seal / exhaust unit	**anodised blue**	**2 pieces**

FIXING OF THE DOWNSTREAM DUCT / 03.2.3

- Insert the jaw in the lower jaw-holder and lock with the screw.
- Repeat the operation to mount the jaw in the upper jaw-holder.

Do not place elements such as adhesive tape between the jaws and the duct. The quality of the mechanical connection between CABLEJET and the duct will no longer be secured.

MOUNTING THE DOWNSTREAM DUCT SEALING INSERT / 03.2.4

- Make certain that the housing for the insert and the seal are free of dirt.
- Introduce the lower insert to its housing and lock with the screw.

Only the lower insert has a groove in the seal face.

This groove must correspond with that in the seal face of the air inlet unit.

MOUNTING THE SEALS / 03.2.5

- Place the round rubber cord Ø 6 mm in the two grooves provided and cut these off parallel to the seal face and approximately 1 mm above this to ensure effective sealing.

If the duct diameter falls between two insert sizes, use the next higher size and compensate for the difference by adhesive tape wrapped around the end of the duct engaged in the insert in order to obtain a diameter which will secure satisfactory sealing.

- Repeat the operation to mount the upper insert in the air inlet unit.

MOUNTING THE CABLE SLIDE / 03.2.6
Front CABLE*JET*

- **Make certain that the insert housing is free of dirt.**
- Place the cable slide in its housing, ensure that the flat surface is parallel to the seal face and lock the insert with the screw.
- The preparation is completed and the distance and speed indicator can be mounted.

MOUNTING THE UPSTREAM DUCT SEALING INSERT / 03.2.7
Intermediate CABLE*JET*

- **Make certain that the insert housing is free of dirt.**
- Place the lower upstream duct sealing insert in its housing; ensure that its flat surface is parallel to the seal face and lock the insert with the screw.
- Repeat the operation to mount the upper insert.
- The preparation is completed and the exhaust unit can be mounted.

To guarantee safety, it is imperative that the air expelled from the exhaust unit is conveyed to the outside of the manhole by an adequately dimensioned pipe.

DISMANTLING THE INSERTS / 03.2.8

- Unscrew the insert fixing screw and remove it to a safe place.
- Insert the extractor screw into the bore of the fixing screw, turning it clockwise until it rests on the body of the CABLE*JET*, give a few more turns to free the insert.
- Remove and keep the extractor screw in a safe place for subsequent use.

The duct inserts and the cable slide (blue) do not require seals.

The duct inserts (blue) can be mounted to the upper or lower exhaust units.

ADAPTING TO THE CABLE / 03.2.9

- Measure the cable and select the appropriate set of cable inserts. The nominal in mm is engraved on the inserts.
- Use a set of inserts with a diameter slightly larger than that of the cable.

Ensure that the cable runs freely in the selected insert. If the is close to the upper permissible limit it is preferable to select the next higher set.

Example:
cable Ø 10.8 mm = insert 11-12.5

Cable Ø		Set of cable inserts		Set of half cable seals (20 pieces)	
Ø mm	**Ø inch**	**Engraved N°**	**Order N°**	**Dimensions**	**Order N°**
9 - 11	0.35 - 0.43	**9 - 11**	N270.074	Ø 10 (16x4)	N270.123
11 - 12.5	0.43 - 0.49	**11 - 12.5**	N270.075	Ø 12 (18x4)	N270.124
12.5 - 14	0.49 - 0.55	**12.5 - 14**	N270.076	Ø 14 (22x4)	N270.125
14 - 15.5	0.55 - 0.61	**14 - 15.5**	N270.077	Ø 15 (22x4)	N270.126
15.5 - 18	0.61 - 0.70	**15.5 - 18**	N270.099	Ø 16 (26x5)	N270.151
				Ø 19 (26x5)	N270.127
6 - 9	0.25 - 0.35	**6 - 9**	N270.106 *	Ø 7 (15x5)	N270.169 *
				Ø 10 (15x5)	N270.170 *

* Delivered with the optional set "Special pusher" to order separatly.
Order N°: **N270.106 + N270.148**.

The set of cable inserts comprises:

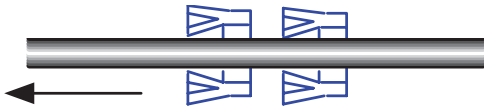
Upper cable insert	**anodised red**	**1 piece**
Lower cable insert	**anodised red**	**1 piece**
Seals	**(acc. to Ø)**	**1 or 2 sets**

MOUNTING THE CABLE INSERT / 03.2.10

- Make certain that the housing for the insert and the round seal are free of dirt.
- Place the lower cable insert in its housing; ensure that the flat surface is parallel to the seal face and lock the insert with the screw.
- Only the lower insert has grooves on its flat face for the seal.

HALF CABLE SEALS / 03.2.11

- Insert the 2 half cable seals taking care that the sealing lips are facing downstream.
- Repeat the operation to mount the half cable seals on the upper cable insert in the air inlet unit.



HORIZONTAL SEAL / 03.2.12

- Insert the round rubber cord Ø 4 mm in the groove of the cable insert and the grooves on the seal face of the air inlet chamber; cut it perpendiculary at each end; ensure that each end is butting against adjacent seals.

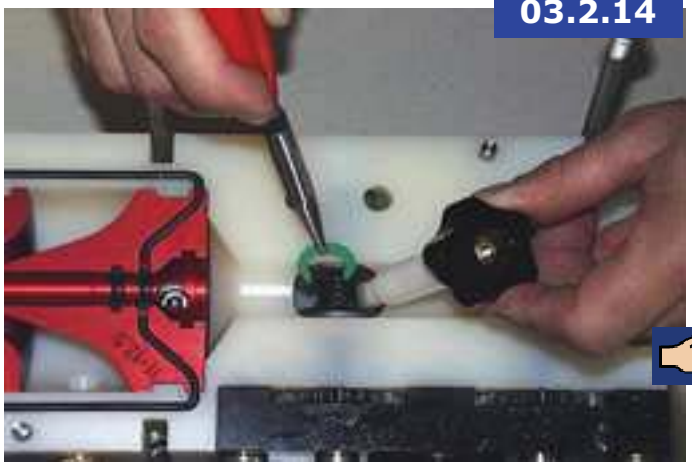
The upper duct sealing insert and the upper cable insert fixed to the air inlet unit do not have grooves for the circular seal.

- The air inlet unit is ready and can be closed.

CABLE GUIDE ON CABLE PUSHER / 03.2.13

- Insert the cable guide in its housing and lock with the screw.
- Repeat the operation to mount the cable guide in the upper pusher block.

Cable Ø	Cable guide	
	N°	Order N°
< 12	12	P270.225
12 - 15	15	P270.226
> 15	-	-



SPACERS ON PUSHER UNIT / 03.2.14

- Select the spacer combination according to the cable (see table) and prepare 4 identical sets.
- Insert the spacer key between the pinchwheels and turn them a 1/4 of a turn; remove the existing spacers using pliers and replace with those previously prepared.
- Repeat the operation on the other pinchwheels.

Check that the spacing is identical on the four pinchwheels.

Set of spacers order N°: N270.120

thickness: 1 mm : ☐ 8 pieces

thickness: 2 mm : ■ 8 pieces

thickness: 5 mm : ■ 8 pieces

Cable Ø:			
9.0 - 9.6 :	-		
9.7 - 10.5 :	☐		
10.6 - 11.4 :	■		
11.5 - 12.2 :	☐	■	
12.3 - 13.0 :	■	■	
13.1 - 13.8 :	■		
13.9 - 14.6 :	☐	■	
14.7 - 15.4 :	■	■	
15.5 - 16.3 :	☐	■	■
16.4 - 17.2 :	■	■	■
17.3 - 18.0 :	■	■	

CHECK / 03.2.15

- Close the pusher unit, check that there is no gap between the upper half and lower half of the pusher unit and test, by moving by hand the cable back and forth, wether the pusher unit is correctly assembled. This is confirmed if the pinchwheels are driven by the cable (listen for motor noise); if they do not turn, open the pusher unit and take out one of the spacers.

Inadequate spacing can result in damage to the cable sheathing.

- On completion of these operations the CABLE*JET* is ready for use.

WORK SITE / 03.3

PREPARING FOR INSTALLATION / 03.3.1

- Prior to the actual installation work, you are recommended to check the preparation of the work site with the aid of the checklist according to § 7.03. This document reminds those responsible for the site of all necessary equipment and information for the correct on-site working procedure. Keep the attached copy in a safe place and use photocopies to assist your on-site preparations. After this preparation, keep this checklist with the other documents required for preparing and checking an installation site.
- To assist you in the preparation work the optional software "*JET*-PLANNER" can determine the maximum lengths of sections as a function of the parameters terrain, duct, cable etc.

PREPARATION OF COMPRESSOR(S) AND PIPES / 03.3.2

- Ensure the availability of adequate compressors for CABLE*JET*. Each compressor must have the necessary pipes and unions.
- The compressors are to be dimensioned according to the following specifications (see §02.1.4):
  - Rate pressure: **10 - 12 bar**
  - Minimum rate of flow:

ducts up to 27 mm external Ø:	**4**	m^3/min
ducts up to 32 mm external Ø:	**5**	m^3/min
ducts up to 40 mm external Ø:	**7**	m^3/min
ducts up to 50 mm external Ø:	**10**	m^3/min
ducts from 50 to 63 mm external Ø:	**15**	m^3/min

Temperature: For the protection of the cable when the ambient temperature exceeds 25°C (maximum temperature of the air leaving the compressor): 50 °C), ensure that an air aftercooler is available for each compressor.

CHECKING THE ROUTE / 03.3.3

- Check that the duct has been calibrated, is fully connected and sealed, open at each location at which an intermediate CABLE*JET* is to be placed and at the end of the section. The distance between two duct sections necessary for inserting an intermediate CABLE*JET* must be 37 cm.
- Standby ducts must be hermetically sealed at each end.
- Make sure that the length [LN] per duct section does not exceed the capacity of CABLE*JET.*

  [LN]: Nominal length: nominal distance achieved with one CABLE*JET* on a horizontal route with a defined cable and a compressor, in a duct of given dimensions, this being installed according to defined quality criteria (see "*JET*-PLANNER" software).
- Make sure that average route will permit the cable to be installed on a descending and not an ascending gradient.

CHECKING THE CABLE*JET* / 03.3.4

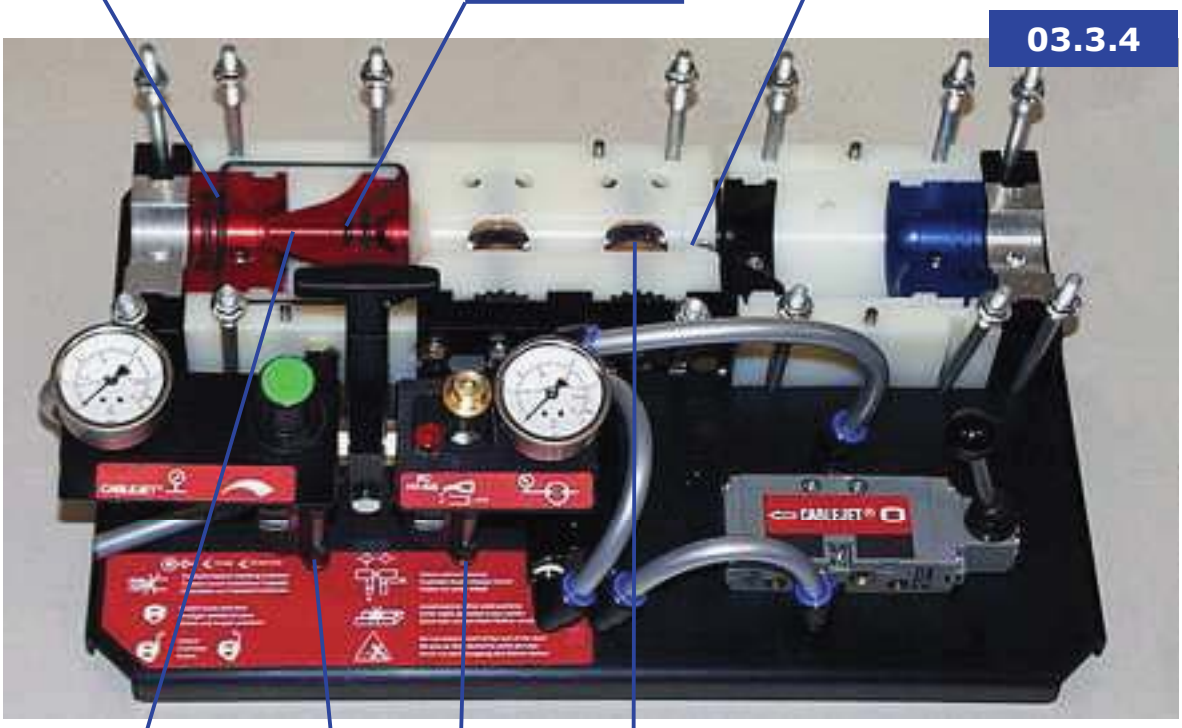
- The following points must be checked before installation on-site, even if the preparation was carried out in the workshop:

CLEANLINESS: **the material and equipment must be perfectly clean. Use an air gun to blow off any dirt.**

SEALS:
- Ø 4 mm round rubber cord (horizontal separation)
- duct insert seal (Ø 6 mm round rubber cord)
- cable seals

SLEEVES:
- cable inserts

Only the front CABLE*JET* requires entry guidance.



INSERTS:
- cable insert
- cable guide
- downstream duct insert
- upstream duct insert

The upstream and downstream duct inserts are different.

PUSHER:
Spacing of the upper and lower pinchwheels is identical and in accordance with the diameter of the cable to be installed.

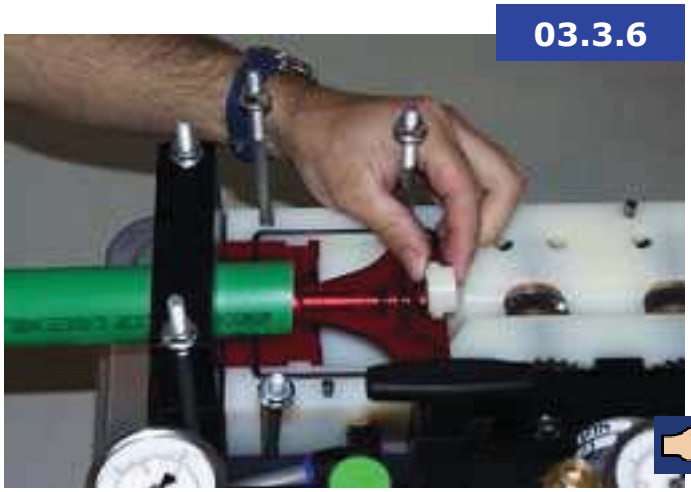
Inadequate spacing of the pinchwheels can cause damage to the cable on closing the CABLE*JET* or cause the pinchwheels to slip. For the correct spacing, see §03.2.14 of the CABLE*JET* preparation section.

AIR TREATMENT
- **Lubricating oil reservoir replenished**
- **Water separator drained and filter is clean**

INSTALLATION OF THE CABLE*JET* / 03.3.5

- Position the CABLE*JET* in relation to the direction of the duct axis, ensure that it is stable and that access to the different parts of the CABLE*JET* is secured.
- By means of screw, position the air treatment unit so that it is horizontal (maximum deviation: ± 15°).

CHECKING THE DUCT / 03.3.6



- **Prelubricated duct**
- Connect the duct by pushing it as far as it will go into the duct insert on the air inlet side and then securely tighten the jaws by means of the two nuts.
- Blank off the cable insert with an appropriate white blind washer.
- If the route requires the installation of several intermediate CABLE*JET*, proceed in the same fashion, not forgetting to connect the upstream duct in the same way as the downstream duct.

Make sure that the air inlet and exhaust units, also the pusher unit are properly closed.

- Connect the compressed air pipeline to the air inlet unit.

Before starting the compressors:

Check all the compressed air pipelines.

Check that all the pneumatic unions are correctly fixed and locked.

Check that the downstream duct clamping insert is properly tightened.

Check that the air admission valve is closed.

Warn all persons downstream of the imminent flow of compressed air.

DUCT CHECKING PROCEDURE / 03.3.7

- With the device in running mode, open the air supply at the nominal pressure.

  A) Check whether the air flow at the end of the duct section appears adequate.
  B) Check whether the air pressure in the inlet unit is also correct.

- If the inlet air pressure and the outlet flow appear correct (at the level expected by a trained operator), send through a piece of foam to get rid of any water or dust trapped along the duct run.

- If the air flow appears insufficient, check the pressure in the inlet unit to obtain the following information:

- A pressure reading **equivalent** to the maximum level of the compressor indicates the presence in the duct of either:

  C) an obstruction in the duct.
  D) a severe section restriction, a crushed or kinked duct.
  E) a water siphon.
  F) the duct section is too long.

- A pressure reading **below** the expected level means either:

  G) a substantial air leakage, a faulty seal.
  H) an undersized or faulty compressor.
  I) the duct section is short.

- The locating of suspected section restrictions or obstructions is to be determined by conventional field practice.

- The presence of siphons is generally evidenced by water being expelled by the air flow. Siphons are emptied by sending a compressed foam plug through the duct. This operation is to be repeated until water is no longer expelled by the air flow. This procedure takes only a few minutes.

- Air leakages are located by pressurizing the duct section, inspecting all coupling locations (noise in manholes, or air showing up on the ground surface - In the case of buried ducts) and checking for air flow at the extremities of the main duct (in the case of subducted systems).

LUBRICATION / 03.3.8

- **Duct dry:**
- On completion of the duct checking procedure detailed above, and the performance of any correction:
- If the duct is not prelubricated, introduce the lubricant (selected according to the manufacturer's recommendations) into the duct at the rate of 0.25 to 0.5 liter per 500 m according to the duct internal diameter.

Do not pour the lubricant into the air inlet unit, but always directly into the duct.

ATTENTION: Over-lubrication of the duct can reduce the performance of the CABLE*JET*.

SENDING THROUGH A SPONGE / 03.3.9

- If the lubricant has a tendency to flow back due to the positioning of the duct, bend it up, pour in the necessary quantity of lubricant and immediately introduce a foam plug into the duct.
- Introduce the duct into the duct insert and the jaws and close these using the appropriate screws.
- Distribute the lubricant uniformly by sending the foam plug through the duct. This will be expelled by the air flow on activating the CABLE*JET*.

ATTENTION: Do not stand in front of the duct outlet after opening the air flow !

REMOVAL OF THE BLIND WASHER / 03.3.10

- After these checking and lubricating operations, open the CABLE*JET* and take out the cable insert blind washer. The duct and the CABLE*JET* are now ready for the actual installation.

INSTALLATION / 04

04.1

INTRODUCING THE CABLE / 04.1

- Round off the end of the cable with the aid of a knife or screw on a rounded cap.
- Introduce the cable to the duct by hand, if possible by at least ten metres, close the CABLE*JET* and tighten the nuts on their bolts.
- Manually move the cable back and forth to check the adequate gripping of the cable by the pinchwheels.
- Listen to the sound of the motor: (if it does not turn when the cable is being moved, the gap between the pinchwheels is too wide. Adjust by removing one spacer on each of the 4 drive spindles) - see also §03.2.14.

04.1.1

CABLE MARKINGS / 04.1.1

To assist detection and locating of any obstacle to the cable installation, do not forget to read the length marking printed on the cable nearest to the head of the cable.

04.2

SAFETY / 04.2

Before starting the compressors:

Check that all the pneumatic unions are correctly fixed and locked;

Check that the downstream duct clamping insert is properly tightened;

Check that the air admission valve is closed;

Warn all persons downstream of the imminent flow of compressed air.

Never be present opposite the outlet of a duct when the air is turned on and during all installation operations.

DUCT MARKING / 04.3

- After opening the main air valve and pressurizing the device:
- Check that the downstream duct is not slipping out of its fixing clamp;
- A good way of checking this is to mark the duct with adhesive tape, paint or other marker.

PRESSURIZING / 04.4

- **Front CABLE*JET***
- Announce the arrival of the air - by radio or other means - to the next downstream station.
- After confirmation of the reception of this duct pressurizing warning, open the main air valve and allow the pressure to increase (15 - 30 sec.) without activating the motor. The CABLEJET is then ready for installation.

STARTING THE INSTALLATION / 04.5

- Check that the motor controller is at "0" (motor control knob fully unscrewed), move the control lever to "Forward" and start the installation by screwing the motor control knob in progressively until the cable moves forward at the desired speed.
- Note the pressure and the speed and pass this on to the following station.

Attention: The motor pressure control knob has a locking device: lift the knob before turning it.

CHECKING THE REEL / 04.6

- At the start of the installation it may be necessary to assist the unwinding. However, under good conditions and with the appropriate accessories, this can be dispensed with (ask your agent for a list of accessories).

Watch the reel closely and be ready to brake it if necessary (a runaway situation is always a possibility).

If not monitored, a reel can cause accidents and damage to the cable.

LUBRICATING THE MOTOR / 04.7

- Check the oil flow rate and if necessary regulate it to 1 to 2 drops per minutes.
- Lubrication must be continuous, also during the pauses in the installation process.

A lubrication fault, even if brief can lead to the destruction of the air motor.

AIR TREATMENT / 04.8

- Monitor the level of the filter water during the cable installation and drain the reservoir manually at regular intervals.

The air motor can be destroyed if draining is not carried out in time.

STOPPING THE INSTALLATION / 04.9

(end of a section or any other reason)

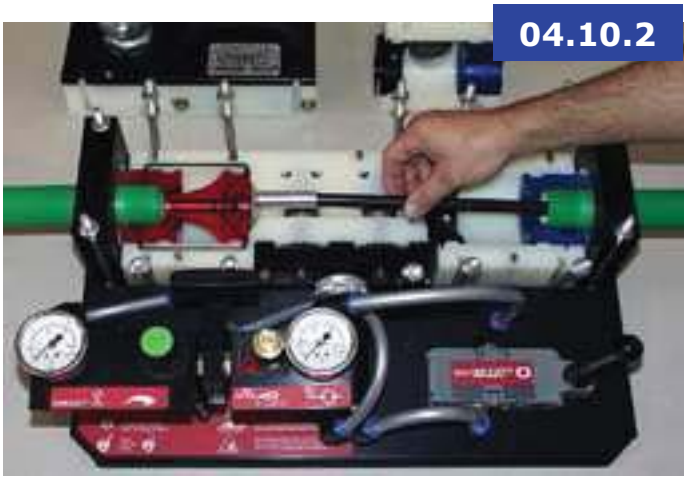
- On the announcement of the arrival of the cable at the end of the section (or in the case of an obstacle), stop the installation by placing the control lever to "Stop" and resetting the motor controller to "0" (fully unscrewing the control knob whilst observing the pressure gauge), and close the main valve of the CABLE*JET*.

INTERMEDIATE CABLE*JET* / 04.10

PREPARING FOR INSTALLATION / 04.10.1

- During the installation of the first section, carry out the preparatory work and lubrication of the following section(s) as described under § 03.3.6-9.
- Leave the inlet and exhaust units open, ready to be closed.

When working in a chamber, bring the exhaust pipe out to the open air using a suitable flexible hose.



CROSSING / 04.10.2

- **Front CABLE*JET*:**
  Monitor the forward movement on the distance counter and when the front end of the cable is 50 metres from the intermediate CABLE*JET*, reduce the speed gradually to 20 m/min.
- **Intermediate CABLE*JET*:**
  On the arrival of the cable, guide the end manually through the CABLEJET, into the downstream duct and announce the crossing of the intermediate point to all the preceding stations.
- **Front CABLE*JET*:**
  Allow the cable to continue its forward movement until its speed falls below 9 m/min. Then stop the installation (according to §04.9).

END OF THE CROSSING / 04.10.3

- **Intermediate CABLE*JET*:**
  After the cable has fully come to rest, close the CABLE*JET* and continue the procedure according to §04.5, then advise the front CABLE*JET* station that this device is ready to continue the installation.

STARTING UP AFTER A PAUSE / 04.11

Do not forget to announce the arrival of the air downstream and await confirmation of the reception of this warning by the intermediate stations.

- Once the order to start is given to continue the installation, place the control lever of the front CABLE*JET* to the "Forward" position and give the order for the same action to the downstream CABLE*JET*.
- Monitor the motor control pressure; it must remain identical to the set-point pressure.

END OF INSTALLATION / 04.12

- As the cable emerges, allow it to advance to provide sufficient length for splicing, before braking it by hand and giving the order to stop installation to the front CABLE*JET*.

Note: Nothing is more frustrating than having to repeat the starting procedure due to having stopped just a few metres too soon !

Never attempt to pull the cable by hand :this risks the cable becoming jammed irretrievably in the duct.

TROUBLESHOOTING / 05

The table below permits the simple and speedy rectification of the most frequently encountered cable laying faults. Most of these are avoidable if the preparation of the CABLE*JET* is performed and checked according to the rules.

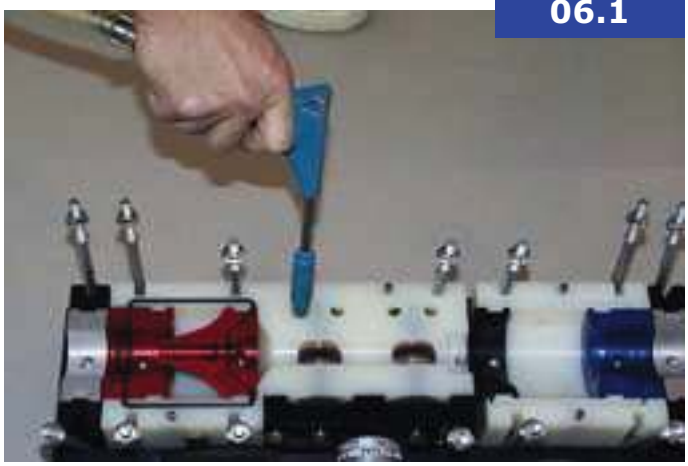
• PROBLEMS

	POSSIBLE CAUSES:	REMEDIES:
	• CABLE NOT FEEDING	**/ 05.1**
05.1.1	Obstruction in duct:	• Clear the obstruction. • If necessary, repair the duct or seal.
05.1.2	Lubrication absent or insufficient:	• Lubricate or replenish lubricant.
05.1.3	Air leak in duct:	• Check all the duct seals. • Repair or replace faulty seals.
	• CABLE ONLY FEEDING SLOWLY	**/ 05.2**
05.2.1	Insufficient lubrication:	• Add an additional dose of lubricant.
05.2.2	Overheating (exposure to the sun) of the cable, duct or the equipment:	• Protect the cable reel from the sun, allow the duct and equipment to cool down. • Lubricate lightly and restart.
05.2.3	Pressure in the air inlet unit too low (minimum 8 bar):	• Increase the compressor pressure or use another compressor.
05.2.4	The cable is sharply braked by excessively small cable seals:	• Insert adequately sized cable seals.
	• PINCHWHEELS SLIPPING	**/ 05.3**
05.3.1	Pusher overloaded:	• Reduce the motor pressure.
05.3.2	Pinchwheel spacing too large:	• Check the pinchwheel spacing and modify if necessary by introducing appropriate spacers.
05.3.3	Pinchwheels are worn:	• Replace pinchwheels.
	• PRESSURE TOO LOW OR PRESSURE LOSS IN THE AIR INLET UNIT	**/ 05.4**
05.4.1	Faulty compressor:	• Repair or replace compressor.
05.4.2	Leaks in the duct:	• Check the duct, seals etc. and repair or replace defective parts.
05.4.3	Duct length is very short in relation to the maximum blowable length:	• No action required if performance is normal.

• PROBLEMS

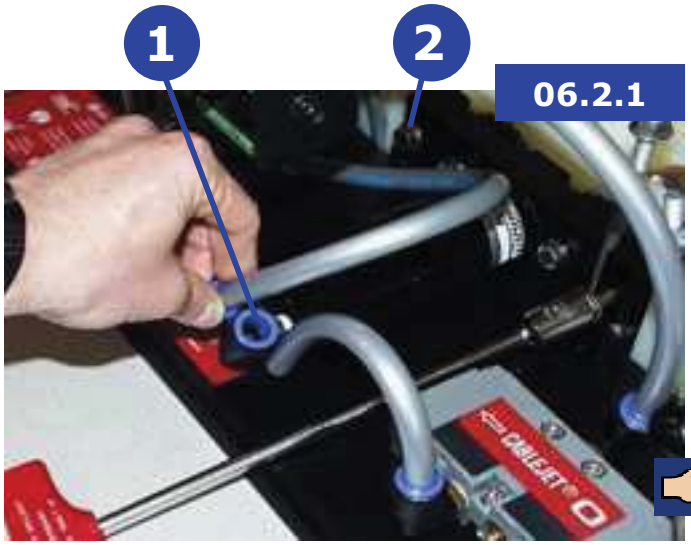
	POSSIBLE CAUSES:	REMEDIES:
	• LEAKS IN THE AIR INLET UNIT	**/ 05.5**
05.5.1	Incorrectly sized duct sealing insert:	• Check the duct diameter and replace the duct insert with an appropriately sized insert.
05.5.2	Duct diameter falls between two insert sizes:	• Select a duct insert of a size slightly larger than the duct; wrap around the duct a few layers of insulating cloth, adhesive tape or similar to achieve the desired diameter. • Do not place the insulating cloth in the zone of the duct clamped by the jaws.
05.5.3	Sealing elements incorrectly mounted or are worn:	• Check the condition of the circular rubber seal in the air inlet unit. • Check the condition of the circular rubber seal in the duct inserts. • Make certain that the ends of the circular rubber seal are cut off flush with the seal face. • Check the presence and/or condition of the half cable seals and the circular seal of the cable inserts.
05.5.4	No cable or blind washer present in the air inlet unit:	• Introduce a cable into the inlet unit or fit a blind washer.
	• PRESSURE INCREASES IN THE AIR INLET UNIT	**/ 05.6**
05.6.1	Obstruction in duct:	• Clear the obstruction; if necessary repair the seal or the duct.
05.6.2	Severe reduction in diameter of the duct, duct is folded or crushed:	• Repair, making certain that the part repaired/replaced is leaktight.
05.6.3	Water present in the system:	• Blow through with air, then send through foam plugs until no more water is present in the duct. • Lubricate the duct.

CLEANING AND MAINTENANCE / 06



GENERAL CLEANING / 06.1

- After installing a cable, the CABLE*JET* is to be completely cleaned prior to being placed in store or its preparation for another work site.
- Eliminate all heavy soiling by blowing off, dismantle the body, inserts and seals and clean carefully.
- Where necessary, protect against corrosion with a suitable product.
- Also clean, inspect and put away the various ancillary tools and equipment.
- Check whether any items such as oil, plugs, seals etc. must be restocked.



PUSHER UNIT / 06.2

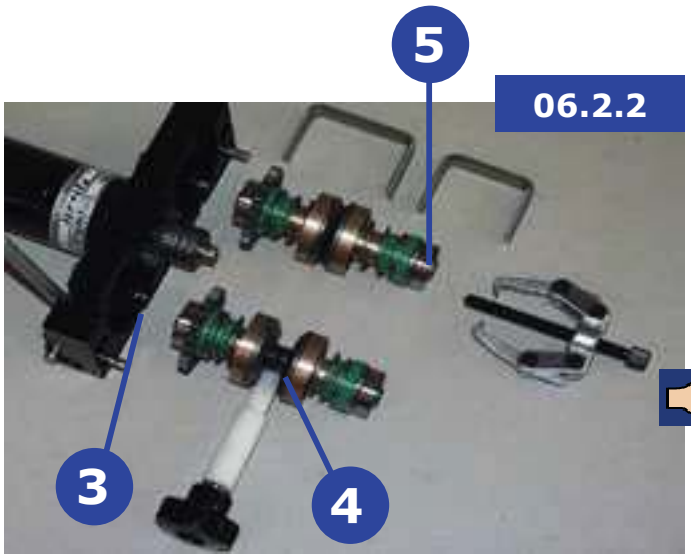
Periodic maintenance

- The inspection period is highly dependent on the working conditions.
  Intervention is necessary in the following three cases:
- Lateral movement is difficult or pinchwheels are blocked.
- Rotation difficult or pinchwheels are blocked.
- Pinchwheels are worn.

Dismantling and cleaning:

For the following operations, use tool set N° N270.094:

- Press on the ring (1) and disconnect the motor supply pipelines.
- Unscrew the two screws (2) in order to extract the bearing with the two bottom drive spindles.
- Clean the housings in the plastic element.
- Clean the water evacuation grooves (3), the roller bearings, the pinchwheels and the hidden part of the spindle after moving the pinchwheels apart (4). Apply grease AVIACAL 2LD (Avia).
- If the pinchwheels are worn, or if cleaning does not produce satisfactory results, use the special tools to remove the circlips (5) to extract the pinchwheels.



ATTENTION: The system is assembled under a tension of approximately 10 kg !

- Clean or replace the rollers.
- Repeat these operations on the upper part of the pusher unit.

AIR MOTOR / 06.3

Instruction for use

- **Fixing:** The motor is secured into its bearings by screws and adhesive.

Dismantling: Never attempt to open or dismantle a motor: this will render the guarantee null and void; furthermore, re-assembly is impossible without special tools.

AIR TREATMENT / 06.4

- **Compressed air:** Supplying a motor from an incorrectly regulated or unserviceable air treatment unit can result in irreversible damage to the motor.
- **Lubrication:** Replenish the oiler with a lubricant suitable for compressed air system: ISO VG 32 or HVI 46.
- Regulate the oil flow to a rate of 1 to 2 drops per minute; lubrication must be **continuous**; over-lubrication is not a problem.
- In the case of high ambient humidity the water separator can fill rapidly. Monitor the water level during cable laying and drain off the water in good time.

Note: Dirt deposited initially around the motor exhaust located on the control valve assembly is normal, and is caused by the molybdenum bisulphide additive used in the lubricating oil.

LIST OF CONSUMABLE PARTS / 06.5

Designation	**Order N°**
Set of half cable seals	see §03.2.9
Set of spacers (see §03.2.14)	N270.120
Rund rubber cord Ø 4 mm x 10 m	N270.118
Rund rubber cord Ø 6 mm x 10 m	N270.119
Motor oil HVI 46 - 0,5 Liter	N270.172
Foam plug Ø 64	P271.067
Foam plug Ø 80	P271.068
Foam plug Ø 100	P271.069
Lubricant Jetting Lube CJL1032	R1SH2L0101

SUPPORT / 07

ADDRESS OF MANUFACTURER / 07.1

PLUMETTAZ SA
Zone Industrielle "En Vannel C"
CH-1880 Bex
Switzerland

contact: ..... SAV

Tel. ..... 024 / 463.06.06
.....From outside Switzerland: + 41-24/463.06.06
Fax ..... 024 / 463 06.07
.....From outside Switzerland: + 41-24/463.06.07
Internet .....http://www.plumettaz.ch

ADDRESS OF YOUR AGENT / 07.2

Head office.....

Road.....

Postcode, Place .....

contact.....

Tel. .....

Fax .....

e-mail .....

Internet .....

CHECKLIST FOR SITE PREPARATION / 07.3

- **Comply with the following points several days prior to proceeding with jetting using CABLE*JET*.**
- Perform these checks on each section before starting jetting.
- In the event of problems with any of the points detailed below (type of duct or cable, steep gradients, difficult access etc., do not hesitate to contact our agent or your After-Sales Service at the above address in order to obtain assistance

ENVIRONMENT / 07.3.1

07.3.1.1. Knowledge of the terrain: high points, low points, gradients, access points, detailed maps, plan and elevation views, profile, terrain and installation drawings.

Total length in m: ..... Number of sections: .....

Plan(s) N°: ..... Site N°: .....

07.3.1.2. For optimal efficiency with an ambient temperature above 25°C you are recommended to use a compressor equipped with an aftercooler.

Ambient temperature °C: ..... Aftercooler required: .....yes ❑ no ❑

State the above data when requesting our assistance.

DUCTS / 07.3.2

07.3.2.1. Technical data of the different types of diameters of the ducts in use:

Type(s) of duct	internal Ø	prelubricated (yes/no)	friction coefficient
Duct 1:	...../	...../	...../ .....
Duct 2:	...../	...../	...../ .....
Duct 3:	...../	...../	...../ .....
Duct 4:	...../	...../	...../ .....

07.3.2.2. If the duct ends are not plugged or inadequately plugged, check the interior for dirt and clean where necessary. Then hermetically seal both ends.

Duct sufficiently clean: .....yes ❑ no ❑

Ducts plugged: .....yes ❑ no ❑

07.3.2.3. In the case of doubt as to the quality of the duct and its installation, carry out the following checks:

Check the integrity of the duct by proper calibration (80% of the duct internal diameter must be free when the use of a sonic head is envisaged).

Duct calibrated: .....yes ❑ no ❑

To check the duct sealing, pressurize each of the sections (from manhole to manhole) to a level of 6 - 8 bar, (for this, blank off the end of the duct section with a plug capable of withstanding a pressure of 10 bar).

Leave the duct under pressure for 15 minutes. Loss of pressure indicates the presence of leaks. Pressurize the duct once again and inspect for leaks; in most cases these will be near the unions and connectors. Rectify by fitting new unions, connectors or other means resistant to 10 bar before commencing jetting.

Union(s) used for joining sections: .....yes ❑ no ❑

Typ(en): .....

Duct sealing checked: .....yes ❑ no ❑

State the above data when requesting our assistance.

CABLE / 07.3.3

07.3.3.1. Length of sections (between splices): max.:..... min.: .....

07.3.3.2. Technical characteristics of the different cable types and diameters in use:

Cable type(s):	external Ø	linear weight (N/m)	rigidity (Nm^2)
Cable 1:	.....	.....	.....
Cable 2:	.....	.....	.....
Cable 3:	.....	.....	.....
Cable 4:	.....	.....	.....

07.3.3.3 Soft or pliable cables require special precautions. Assess the rigidity of the cables on the basis of your experience. With very pliable cables, use a sonic head.

Sonic head necessary: .....yes ❑ no ❑

State the above data when requesting our assistance.

DUCT + CABLE ASSOCIATION / 07.3.4

07.4.4.1. Coefficients of friction between duct and cable (in each case): .....
.....

07.4.4.2. Lubricant recommended by the duct manufacturer: .....

ATTENTION: Most standard lubricants for cable laying by pulling (using a winch or blowing with a shuttle) are unsuitable for jetting using CABLE*JET* or SUPER*JET*; our agent or our After-Sales Service can advise you on this matter.

State the above data when requesting our assistance.

You can also send us approximately 0.5 m long samples of each cable and each duct together with the above information; this will enable us to simulate your jetting work and inform you of the distances you can achieve.

INDISPENSABLE EQUIPMENT, TOOLS AND ACCESORIES / 07.3.5

07.3.5.1 1 compressor with each CABLE*JET*.....verified / ordered: yes ❑

Remarks: The size of the compressor is determined by the internal of the duct and the of the cable. Jetting a cable in a duct with an external of 50 mm (internal 42 mm) requires a compressor with a capacity of 10 m3/min., where possible at 12 bar.

07.3.5.2 1 pair of reel stand jacks with spindle or 1 reel stand mounted on a trailer.....verified / ordered: yes ❑

Remarks: At the starting point we recommend the use of high quality accessories fitted with roller bearings and where possible a disk brake.

07.3.5.3 Lubricant (unless the ducts are prelubricated).....verified / ordered: yes ❑

07.3.5.4 Sponges (for distributing the lubricant over the wall of the duct).....verified / ordered: yes ❑

07.3.5.5 Duct connectors and sleeves (for urgent repairs).....verified / ordered: yes ❑

07.3.5.6 Standard tools for ducts (including conduit cutters) .....verified / ordered: yes ❑

07.3.5.7 Diverse wooden planks (for supporting CABLE*JET* in the manhole .....verified / ordered: yes ❑

07.3.5.8 Clean rags (for cleaning the cable).....verified / ordered: yes ❑

07.3.5.9 Complete set of male and female threaded adapters: 1.", 1.1/4", 1.1/2" and 2." BSP.
(for connecting the air hose to compressor).....verified / ordered: yes ❑

MISCELLANEOUS DOCUMENTS / 07.4

- These documents are to assist you with the cable laying operations; they are either attached to this document or can be consulted via our Internet site http://www.plumettaz.ch.

Document designation	**Document N°**
Technical data CABLE*JET*	298.061
Performances CABLE*JET* / SUPER*JET*	298.033
Installation single phase with CABLE*JET* or SUPER*JET*	298.019
Installation double phase with CABLE*JET* or SUPER*JET*	298.020
Spares list	CABLE*JET*
Air-gun	298.049
Spare parts available for CABLE*JET* air-conditioning	298.052

