electroil

Archimede PUMP-INVERTER BlueConnect

Inverter with Blue Connect radio communication system

IMMP1.1W – IMMP1.5W

Single-phase Inverter for single-phase motor pump

IMMP1.5W-BC
Single-Phase Inverters for Single-phase motor pump with Blue Connect system

IMTP1.5W
Single-phase Inverter for three-phase motor pump

IMTP1.5W-BC
Single-phase Inverter for three-phase motor pump with Blue Connect system

ITTP1.5W-BC
Three-phase Inverter for three-phase motor pump with Blue Connect system

Operation and maintenance handbook
ENG

EC.086.222

INDEX

1. SPECIFICATIONS

The aim of this handbook, we would like to give you the most important information about the correct use and maintenance of the inverter; the models of ARCHIMEDE, different for the voltage output are:
IMMP1.1W: Single-phase Inverter for Single-phase motor-pump, max. 1.1kW (1.5 Hp), current max. of 9A.
IMMP1.5W: Single-phase Inverter for Single-phase motor-pump, max. 1.5kW (2 Hp), current max. of 11A.
IMMP1.5W-BC: Single-phase Inverter for Single-phase motor-pump, max. 1.5 kW (2 Hp), current max. of 11A.
IMTP1.5W: Single-phase Inverter for Three-phase motor-pump, max. 1.5kW (2 Hp), current max. of 7A.
IMTP1.5W-BC: Single-phase Inverter for Three-phase motor-pump, max. 1.5kW (2 Hp), current max. of 7A.
ITTP1.5W-BC: Three-phase Inverter for Three-phase motor-pump, max. 1.5kW (2 Hp), current max. of 4A.
This Inverter is designed specifically for motor-pumps operation, all types, not depending from the flow or the pressure, with a perfect feedback control of pressure (detected with a pressure transducer), a substantial energy savings (up to 40% on respect to the standard on-off system) combined with various security features for the pump that are not possible in common appliances using pressure or flow switch.
The following instructions are about the standard model only.
If you require technical assistance regarding specific parts at Service Sales please do specify the exact name of the model, printed on the label, the serial production number on the upper-left part of the product (fig. 1), and the software version, reading the two numbers showed on the led bar, switching-on the input supply line.

Figure 1: serial number of the inverter

2. WORKING CONDITIONS

	Simbol	Value	Meas. Unit
Ambient working temperature	T_{amb}	0..+40	°c
Maximum relative humidity		50	% (40°C)
Protection grade of the Inverter		IP65	
Protection grade of the pressure transducer		IP67	
Nominal single-phase pump power connected to IMMP1.1W	P_{2n}	1.1 1.5	kW Hp
Nominal pump power connected to IMMP1.5W, IMMP1.5W-BC, IMTP1.5W, IMTP1.5W-BC, ITTP1.5W-BC	P_{2n}	1.5 2	kW Hp
Nominal voltage supply of IMMP1.1W, IMMP1.5W, IMMP1.5W-BC, IMTP1.5W, IMTP1.5W-BC	V_{1n}	230±10%	V
Nominal voltage supply of ITTP1.5W-BC	V_{1n}	400±10%	V
Frequency supply Inverter	f_1	50-60	Hz
Voltage single-phase Output for IMMP1.1W, IMMP1.5W, IMMP1.5W-BC	V_2	V_1	V
Voltage three-phase Output for IMTP1.5W, IMTP1.5W-BC and ITTP1.5W-BC	V_2	$V_{1(THREE-PHASES)}$	V
Fequency Inverter Output	f_2	0..55	Hz
Nominal input current to the Inverter IMMP1.1W	I_{1n}	10	A
Nominal input current to the Inverter IMMP1.5W, IMMP1.5W-BC	I_{1n}	13	A
Nominal input current to the Inverter IMTP1.5W, IMTP1.5W-BC	I_{1n}	13	A
Nominal input current to the Inverter ITTP1.5W-BC	I_{1n}	4.5	A
Maximum output single-phase current for IMMP1.1W (ED100%)	I_2	9	A
Maximum output single-phase current for IMMP1.5W, IMMP1.5W-BC (ED100%)	I_2	11.0	A
Maximum output three-phase current for IMTP1.5W, IMTP1.5W-BC (ED100%)	I_2	7.0	A
Maximum output three-phase current for ITTP1.5W-BC (ED100%)	I_2	4.0	A
Pressure transducer range		0 – 10	Bar
Resolution of pressure measure		0.5	Bar
Storage temperature	T_{stock}	-20..+60	°C

Table 1: Working conditions

- Vibrations and hits: they must be avoided by a correct assemblage;
- For different environment conditions, please contact our Sales Department.

3. WARNINGS AND RISKS

This Inverter can not be installed in explosive environments.
The following instructions give you important information for correct assembling and use of the product. Please do read terms and conditions before installing the device, these instructions should be read by people who assemble or use it; besides, these instructions should be available to all person assigned to device setting and maintenance

The inverter voltage supply is only possible with Inverter closed box, after carefully following all instructions concerning installation and electrical connections of above and after following step by step the connections described in Chapter 4 of this handbook.

Installation workers
The installation, the starting and the maintenance of the product must be done by users that have read this handbook, in order to avoid any danger of an incorrect use.
Risks due to missed respect of the safety laws
Failing to respect the safety regulations, could endangers others and damage the devices, which can lead to the loss of warranty. The results of the non-observance of the security rules can be:

- Malfunctioning of the system
- Danger to others, to electrical and mechanical events

Security for the users
All the accident-prevention laws must be respected.
Security rules for assembling and control
Assembling, controlling and servicing procedures of the device must be read on this handbook. All operations on this device must be done when the system is not in motion and with no voltage supply.
Alterations and spare parts
Every machine, equipment or system alteration must be authorized by the manufacturer. For your safety, it is important to use only original spare parts. The use of non-original components may endanger others and can lead to loss of warranty.
Misdirect working conditions
The working security is guaranteed only for the conditions described in chapter 2 of this handbook. The values shown cannot be exceeded

4. ASSEMBLING AND INSTALLING

Installation operations must be performed only by whom have carefully read this handbook and in particular as described in chapter 3 (Warnings and Risks). Please do observe the health and safety on accident prevention.

If the product shows present any damage signs, do not install it, but contact the assistant service immediately.
Install the device in a place for away from ice, water, rain et cetera. Do respect working limits and be extremely careful with the motor and inverter's cooling.

4.1 Wall Inverter fixing in vertical position

Install the product in place away from frost and weather conditions, mounting the unit on a wall in a *vertical position only,* leaving at least 200mm of space above and below the same so as to ensure sufficient cooling of the heat sink on the back of the inverter. The wall may also be of metal type as long as it is not a heat source and be not directly exposed to the sun.
For wall mounting the inverter using the N° 4 holes 7mm diameter arranged in the pattern of holes in Figure 2.

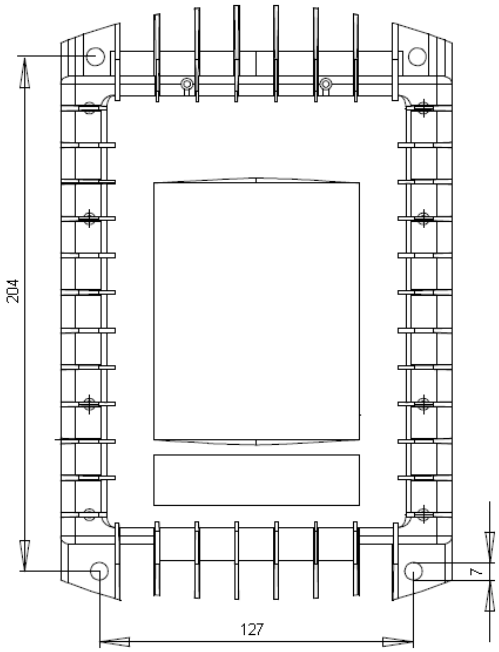


Fig. 2: Fixing holes distances (millimetres)

4.2 Electric and hydraulic connections

1) Inverter voltage supply 230Vac (2P+T, schuko)

2) Pressure transducer

3) Motor pump voltage supply (2P+GND+Schuko plug for single-phase, 3P+GND for three-phases

Fig. 3: Inverter connections

Connect the input voltage supply plug (schuko standard) on the line (N°1, fig.3)
For the feedback pressure control you need to connect to the pump outlet, the pressure transducer supplied (No. 2 fig 3), ¼ "M, coming from the central of the inverter.
Connect the motor supply cable (N°3 of fig.3) to the asynchronous motor of the pump.
The type of transducer supplied may be a different one presented in this handbook, but maintaining the same connection and functioning.

4.2.1 Connecting the pressure transducer to New waterworks system

- Connect the pressure transducer in the hole of the filling cap ¼ "F of the pump provided to the output pressure (depending on the type of pump);

Fig 4: example of priming hole of pump delivery with transducer mounted

- On the delivery of a multistage pump, assembled with a T-fitting is possible to mount the pressure transducer in place of the pressure gauge.
  Be aware that: in multi-stage pumps with the hole filling near aspiration it is not possible to mount the pressure transducer at that hole because it will not do the correct output pressure.

Fig 5: multistage pump outlet with manometer to replace with the transducer

- Use ¼" F hole for the pressure gauge, which can be – in case – removed for connecting the pressure transducer;

Fig. 6: Pressure gauge to replace

- Use any other ¼ "F hole on the pump hydraulics connections, possibly removing the cap (such as a hole for venting air);

Fig. 7: mounting transducer to venting air hole on the delivery pump

4.2.2 Connecting the pressure transducer to Old waterworks system

- Pump comes with PRESSURE-SWITCH with tank or with galvanized steel tank: mount the pressure transducer in place at the pressure switch, using reduction to ¼ "M. In case you need to maintain the switch for maximum pressure additional security, connect the N.C. output of the switch to ENABLE and 0V contacts (poles 2 and 5 of J5 electronic board, fig. 14 and 15)

Fig 8: pressure switch system with pressure switch to replace with transducer

- Pump comes with flow switch device: replace the flow switch with a T-fitting flow and in the central hole screwing the pressure transducer. This allows you to eliminate the problem of any blocking of the valve flow and to eliminate pressure drop, does mean eliminate all the problems inherent the flow switch systems.

Fig 9: Replace old flow switch system

- It is possible to use a valve or other type of output provided at the delivery of the pump.

In case of installation of the check valve on the outlet of the pump, place the pressure transducer after the valve.

4.2.3 Membrane Tank

For an optimal pressure control is recommended to mount a small diaphragm tank (12L are usually good for a pump up to 2Hp).
For a perfect operation of the control of pressure, make sure that the tank is capable of withstanding the pressure and set the correct pressure to pre-load before connecting it to (normally 0.5-1 Bar less than the working pressure) .

Fig. 10: Membrane Tank (recommended)

4.3 Inverter – Pump connection

Do connect the cable of the Inverter (No. 3 of fig. 3nd) to the power plug of the pump, if the pump incorporates the capacitor.
To connect a single phase pump without capacitor incorporates to IMMP1.1W, IMMP1.5W, IMMP1.5W-BC, please connect it following the scheme below (C1, fig. 11, not included).

Figura 11 – Single-phase motor connection

The single-phase input / three-phase output inverter IMTP1.5W, IMTP1.5W-BC must be installed on asynchronous three-phase motor with 230Vac 50/60 Hz voltage supply. Phases must be configured to delta mode if the motor is 230V Δ / 400V λ (most common case, as in Figure 12).

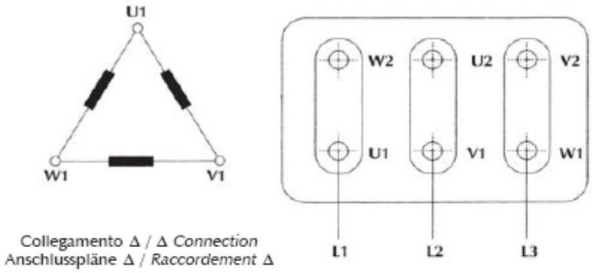


Figure 12 – Delta motor phases connection

The three-phase input / three-phase output inverter ITTP1.5W-BC must be installed on asynchronous three-phase motor with 400 Vac 50/60 Hz voltage supply. The phases must be connected in star mode if the motor is 230V Δ / 400 V λ (most common case, as in Fig 13).

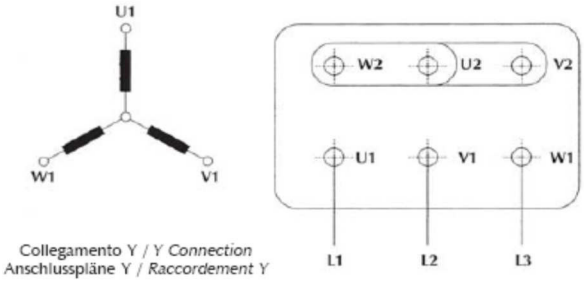


Figure 13 – Star motor phases connection

The unit is equipped with output over-current protection; it is not necessary to install any additional safety device between the inverter and the pump in order to protect the motor in case of failure.

Make sure the pump is in accordance with the operating conditions listed in Chapter 2 of this handbook.

In case of submersed motor pump with a cable length more than 20 meters be sure that the motor-pump is designed to works with inverter (may have a good phase-phase electrical insulation and not conductive rolling bearings) otherwise you need to use the specific output filter (optional – ask our sales service) connecting it between the inverter output and the motor pump voltage supply cable.

WARNING: : it is not possible to use an additional starting capacitor with circuit breaker; if the motor already has this type of capacitor wired, it must be disconnected, and the pump will start normally through the inverter and only the capacitor operating in permanent mode.

4.4 Inverter electric connection to line

The line voltage supply must match with the Inverter limits, described on chapter 3 – WORKING CONDITIONS. Do ensure proper protection from general electrical short circuit on the line.

The plant to which the inverter is connected must be conforms to safety regulations in use:

- Differential automatic switch with IΔn = 30mA: the correct switch is the type A or B, able to recognize leakage currents with pulse components and direct components, immune to the electromagnetic interferences typical of the inverters and cut-wave electronic rectifiers.
- Ground connection with total resistance less than 100 Ω
- If required by local electrical regulations in force, the installation of a differential circuit breaker, make sure it is of a type suitable for installation (see table below).

Pump power kW	Magneto-thermal protection (A) on single-phase 230V version	Magneto-thermal protection (A) on three-phase 400V version
0.5 (0.75 Hp)	6	6
0.75 (1 Hp)	10	6
1.1 (1.5 Hp)	16	10
1.5 (2 Hp)	20	10

Table 2: Magneto-Thermal protections

Before reopening of the inverter box to possible change cable or other components, after functioning, remove voltage and wait at least two minutes, then you can open the box (danger: contact with electric high voltage parts).

The unit is equipped with all those technical arrangements required to ensure a good functioning under normal situations installation.
The control system has a entry-filter, also have a current overload protection which guarantees absolute protection when the Inverter is combined with motors that not exceed the maximum power.
For EMC is good that the power wires of control panel and motor power wires (when the motor are separated from the inverter) are shielded type (or armoured) with individual conductors of appropriate section (current density <= 5 A/mm2). These cables must be the minimum length necessary. The screen conductor must be connected to the ground by both sides. On motor use the metal case for connection to the ground of the screen.
To avoid loops that can create mass disturbances radiated (antenna effect), the motor operated by the frequency converter must be connected on the ground individually, always with a low-impedance using the metallic box of the machine.
The wires from power supply to frequency converter and wires from frequency converter – motor (if the motor is separated to the Inverter) must be spaced as much as possible, not to create loops, not make them run parallel less than 50 cm.
Don't observe these conditions could cancel completely or partially the effect of the filter integrated.

4.5 Access to the electronic board

In case is necessary to change damaged cables, pressure transducer or to add the float switch contact, you need to open the Inverter case.

The operations of a component for the inverter must be performed only by experienced personnel qualified by the manufacturer, using only original spare parts supplied by the manufacturer.

Any action with open box of the Inverter must be made after at least 2 minutes after open line with appropriate switch or the physical separation from the power supply cable;

In case of failure to one of the cables or the pressure transducer, for the replacement of that should be opened by unscrewing the inverter cover the N° 12 screws in the back on the heat sink. For the extraction of a cable, unscrew the three screws that close the cable triangular plate. Remember to always replace the O-ring seal on the cable under the plate. To connect the cables in the appropriate terminals follow the pattern of connections in the electronic board below (fig. 14-15):

- Single-phase Inverter power supply cable for IMMP1.1W, IMMP1.5W, IMMP1.5W-BC, IMTP1.5W, IMTP1.5W-BC: contact 220Vac + GND (J4, fig.14);
- Three-phase Inverter power supply cable for ITTP1.5W-BC: contact L1, L2, L3 + GND (J7, fig. 15);
- Single-phase Motor power supply cable on IMMP1.1W-1.5W-1.5W-BC: contact S, T (J3, fig.14);
- Three-phase Motor power supply cable on IMTP1.5W – 1.5W-BC: contact R, S,T (J3, fig.14);
- Three-phase Motor power supply cable on ITTP1.5W-BC: contact U, V,W (J9, fig.15);
- Pressure transducer with 4-20 mA output: contact +15V, S (J5, fig.14 and 15);
- Float switch: contact ENABLE, 0V (J5, fig.14 and 15);
- Motor ON output signal: Contact MOTOR ON, 0V (J5, fig.14 and 15 - closed when the motor is ON, max. 30V, 3mA)

4.6 Connecting the float contact or other NC contact

To connect an enable Normally Closed contact use the poles 2 (Enable) and 5 (common) of J5 (fig. 14, 15). When the contact open, the Inverter stop the pump; when the contact close, the pump may re-start at previous working condition.
For the connection of the float switch contact, you need to change the three poles cable of the sensor with a four poles cable, passing on the same central exit of the transducer cable.

The new connections of pressure transducer and float switch contact must be done out of the Inverter box, protecting them to humidity, water and dust. Do not practice others holes to the Inverter case to avoid damages or decrease of the protection and insulation grade and *interruption in anticipation of the guarantee.*

4.7 Electronic Board connections:

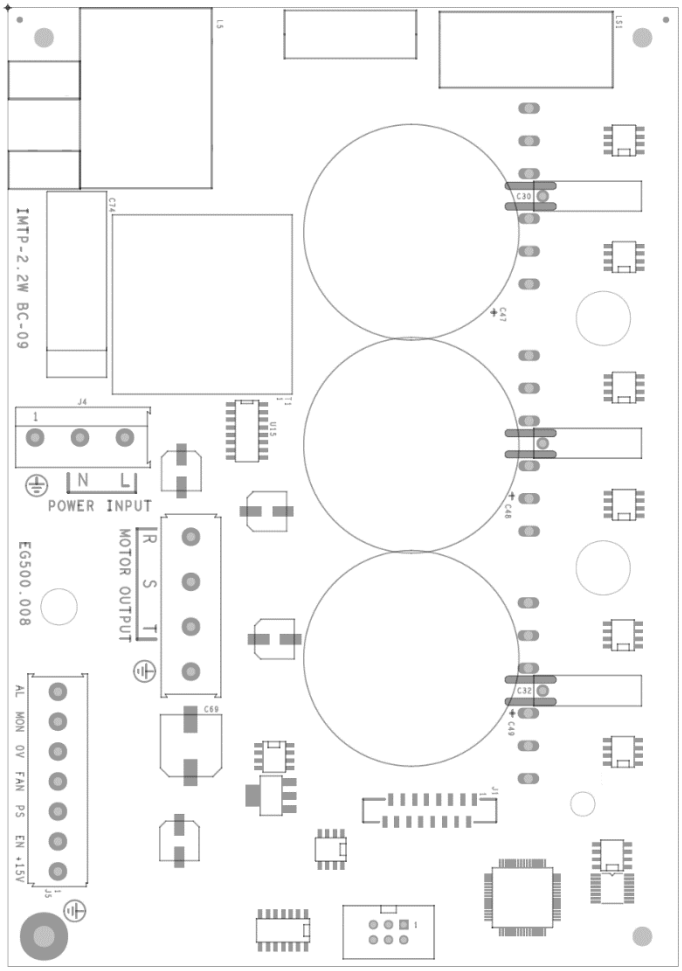


Fig. 14: Board connections IMMP-IMTP1.5W-BC-AW09

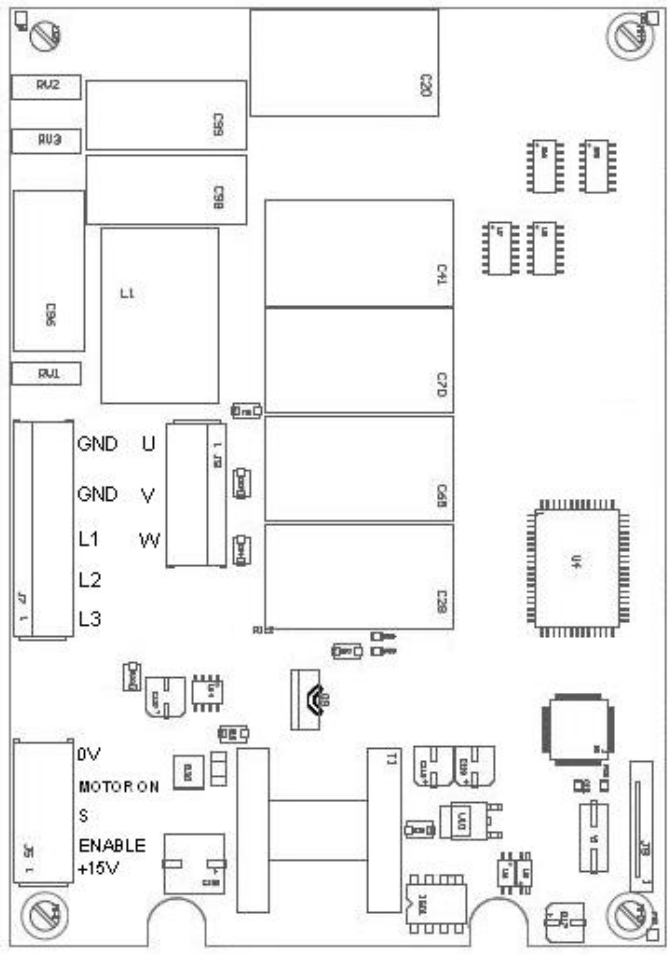


Figura 15: Board connections ITTP1.5W-BC

5. STARTING AND PROGRAMMING

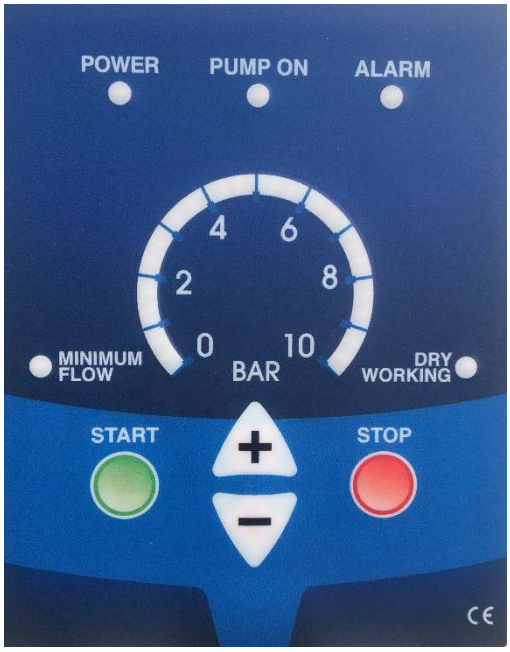


Fig. 16: Control panel

Button	Description
	Allow to increase the reference pressure; it allow to go up on the advanced regulation functions also
	Allow to reduce the reference pressure; it allow to go down on the advanced regulation functions also
	Starting pump; start Self-Regulation Test on the first installation or after a RESET
	Stop of the motor pump

Table 3: Buttons description

LED	Description
	Power: Green fixed: Inverter voltage supply is ON
	Pump On Green fixed: Motor ON Green flashing: Enable OFF condition
	Alarm: Red fixed: Motor stop for a problem that need manual re-start (STOP then START) Red flashing: Motor stop for a problem with auto re-start
	Minimum Flow: Yellow fixed: Motor stop for minimum output flow Yellow flashing: Motor is stopping for minimum flow
	Dry Working: Red flashing: Motor stop for dry working condition of the pump, during one of four re-start of this problem, separated from 15 minuts Red fixed: final stop after 5th consecutive stop for this problem
	Circular Led Bar: Like a manometer shape of 20 Leds to indicate the instant pressure in BAR. On advanced regulation to each group of led correspond a function (see table Advanced regulations). In ALARM condition to each led correspond a different type of alarm (see Alarm table).

Table 4: Led description

NOTE: after connecting the Inverter plug on voltage supply, the panel show on the circular led bar a sequence of three consecutive flash followed by the number of the software version.

5.1 Programming

A) Make sure the pump is charged (full of water); in case the pump is not charged provide it a direct voltage supply (without Inverter) until the complete filling of water, then re-connect the pump to the Inverter;

B) In case the pressure of the system is more than 3 BAR open the delivery to reduce it under this value, then completely close the delivery or all of the valves on the output of the pump (very important condition);

C) Press START to start the self-regulation check. Wait roughly one minute for a completed cycle, and once the flashing Led bar is completed indicate the data saving and the pump stop for null flow condition (Minimum flow);

D) At this point the Inverter is running; It is now possible to open the delivery of the pump and work; the reference default pressure, modifiable, is 3 BAR;

E) If necessary, adjust the working pressure acting on keys  and  on panel; during the reference pressure setting the led bar is flashing up to one second of data saving; the measured pressure is indicated by fixed led bar;

F) For a correct over-current motor-pump protection set the maximum current with F2 on advanced functions (chap. 5.2) reading the nominal motor data value.

The inverters generally comes to the user with the constructor data (default); if for any reason i.e. (such as inverters had been previously tested and configured for another pump) the inverter is pre-regulated, in order to RESET before self-regulation test, is necessary to perform this following:

Command	*Procedure*
RESET (to restore constructor data)	 &  press them simultaneously for 5 seconds
Starting SELF-REGOLATION CHECK	After RESET, press 

Table 5: Reset and Self-Regulation Check starting

During self-regulation check the velocity and pressure of the pump arrive to maximum values; if is necessary, limit the maximum pressure before, modifying F7.

We suggest to repeat the self-regulation check after any variation of parameters, in particular for variation of Maximum Velocity (F4) or Maximum pressure (F7), or in case of variations of the electrical/mechanical pump conditions, that may appear after long time of working.

5.1.1 Checking the pump stop for minimum flow

At the end of the self-regulation check, done with the delivery of the pump completely closed (all of the output valves closed) the pump shall be automatically stopping and the Inverter could show the message "MINIMUM FLOW" by the corresponding Yellow LED. The stop is preceded by a phase of flashing LED “MINIMUM FLOW”. Verify that the pump stopped and after that the pump re-start working when opening any valve on pump delivery.

5.1.2 Checking the stop of the pump for a dry run situation

After installing, if is possible, close the suction/intake line in order to simulate a dry run situation of the pump and check that, after approximately 40 seconds, the pump stop and show the message “DRY WORKING” with corresponding Red Led.

5.1.3 Group Functioning of a group of N°2 Archimede Blue Connect

The Blue Connect version of Archimede Pump Inverter is designed for a totally automatic and very simple installation in a group of two pump inverters on the same room (maximum distance 20 meters between each others).

The default setting (with F17=2) is good for N° 2 pumps connected in group and also for a single pump, without any parameter change, if there isn’t any other BC inverter in the same room.
To connect in group N° 2 pump-inverters Blue Connect:

1. Supply voltage to every Inverter of the group;
2. From the Reset condition, press START and close the delivery, making the Check of the pump for every Inverter, and wait two minutes;
3. When all check are finished, both inverters are connected, working in group, alternating every hour.

The two inverters connected in group define automatically the Master inverter and the slave inverter, without any functioning difference, they will have the same pressure reference (possible to adjust in every inverter of the group using + and – buttons) reading the pressure value on the same pressure transducer of the master and, in case of failure on it, they will read the pressure on the second pressure transducer of the slave. Alternating time for the pump priority is 1 hour.

If you need a single mode functioning of two or more Archimede BC inverters located in the same room, you have to change the parameter F17 setting it on 1 (Single inverter mode) to each inverter.
If you have two or more groups of Archimede BC inverters on the same room set different values of frequency on parameter F20 (example of N°2 groups in the same room: leave F20=800 MHz – default value – for the inverters of the first group and modify F20=810 MHz for the inverters of the second group).

5.2 Advanced regulations and control panel visualization

Command	*Procedure*
Enter on Advanced Regulations	 &  press them simultaneously for 5 seconds

Press  and go up with  to enter on the advanced function request, as show on table 7 regulating the value of the selected function on a variation range indicated, on a scale from 0 to 10.

N°	Visualization	Advanced Function	Description	Range	Default
F1		Minimum flow stop	Adjustment of the minimum flow before pump stop, from the self-regulation value set. (Toward -10 = flow reduction)	-10..+10 Step: 1	0
F2		Maximum motor current	Maximum RMS current setting – limit value for over-current thermal protection (A5)	3..9A for IMMP1.1 3..11A for IMMP1.5 *1..7 A for IMTP1.5* *1..4 A for ITTP1.5* *Step: 0.5 A*	9A 11A *7A* *4 A*
F3		Minimum Motor Velocity	Minimum motor velocity adjustment.	40..80% IMMP1.1 / 1.5 30..70% IMTP-ITTP1.5 Step: 2%	60% IMMP1.1 / 1.5 50% IMTP-ITTP1.5
F4		Maximum Motor Velocity	Maximum value of the motor velocity on respect to the nominal velocity.	90..110% Step: 1%	100%
F5		IMMP1.5W-BC: Starting velocity *IMTP-ITTP1.5W-BC:* *Rotation*	Starting velocity of the motor, before pressure control regulation. *Rotation direction*	60..100% Step: 2% *0/1*	80% *0*
F6		Starting maximum Current *IMTP-ITTP1.5W-BC:* *Rump*	Starting Current – RMS limit value *Velocity ramp acceleration/deceler.*	24..34 A Step: 0.5 A 1000-5000 RPM/s Step: 250	34 A *2000 RPM/s*
F7		Maximum pressure	Maximum security pressure of the system.	2..10 Bar Step: 0.5 Bar	10 Bar
F8		Pressure Hysteresis	Adjustment of the control pressure hysteresis.	0.1 ..2 Bar Step: 0.1 Bar	0.5 Bar IMMP1.1 / 1.5 0.3 Bar IMTP1.5 - ITTP1.5
F9		Pressure ramp	Adjustment of the control pressure ramp on increasing-decreasing.	0.1 .. 2 Bar/s Step: 0.1 Bar/s	1 Bar/s
F10		Minimum output value of the pressure transducer	Adjustment of the minimum output value of the pressure transducer	1..5 mA Step: 0.2 mA	4 mA
F11		Maximum output value of the pressure transducer	Adjustment of the maximum output value of the pressure transducer	10.. 20 mA Step: 0.5 mA	20 mA
F12		Pressure transducer measure range	Adjustment of the pressure transducer range.	10..20 Bar Step: 0.5 Bar	16 Bar

F13		Proportional P.I.D. Factor	Proportional factor on the P.I.D. pressure control	300..6000 Step: 300	3000
F14		Integral P.I.D. Factor	Integral factor on the P.I.D. pressure control	100..2000 Step: 100	1000
F15		Minimum flow stop delay	Delay time on the minimum flow condition before stopping pump	5..25 sec Step: 1 sec	15 sec
F16		Dry working stop delay	Delay time on the dry working condition before stopping pump	10..100 sec Step: 5 sec	40 sec
F17		Master-Slave group communication (only for BC version)	Working mode with N°1 single pump or N°2 or N°3 pumps-group with Blue-Connenct radio system	1: N°1 Single pump 2: N°2 Pumps Master Slave 3: N°3 Pumps Master Slave	1 (locked, for version without BC) 2 for BC version
F18		Check suspension	It is possible to suspend the check using a theoretical pump curve or to repeat the check on next START	0: Theoretical curve 1: Start new check 2: Checked curve	1
F19		Phisical quantity Measures	Measures of different phisical quantity on respect the pressure.	0: Pressure [Bar]] (0÷10, Step: 0,5 Bar*LED) 1: Frequency [Hz]](15÷55, Step: 2Hz*LED) 2: Current [A] (0÷10, 0,5°*LED) 3: Voltage [V] (200÷240 per IMMP-IMTP1.5, 360÷400 per ITTP1.5, Step: 2V*LED) 4: IGBT T[°C] (40÷80, Step: 2°C x LED) 5: Last alarm 6: Motor T [°C] (0÷100, Step: 5°C*LED) 7: Cosϕ (0÷1, Step: 0.05*LED)	0
F20		Radio Frequency transmission (only for BC version)	Frequency of Transmission/Reception of the radio communication of the inverters	861..880 MHz Step: 1 MHz	870 MHz

Table 6: Advanced Functions

WARNING: setting an high Maximum Velocity (function F4) increase the performance of the pump but can also reduce the endurance of the same for the stress of electrical and mechanical parts.

NOTES: *Check suspension* function (F18-0) eliminate the Self regulation check and regulate the pump working using a theoretical approximated curve (minimum flow stop is modifiable with F1);
If the high value of the starting current cause problems on the magneto-thermal switch protection try reduce this current with F6 and verify that the torque remains enough.

6. PROTECTIONS AND ALARMS

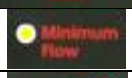
N°	Alarm type with ALARM led ON	Protection	Description
A1		Peak Current	The logic switches off the power instantaneously if this value exceeds a peak that can damage the power electronic components. Possible high starting current or short-circuit on motor.
A2		Over-voltage	The logic switches off the current if the voltage exceeds a maximum instantaneous limit (+15%Vn) beyond that can damage some electronic components of the inverter.
A3		Minimum-voltage	If the voltage goes below the minimum value (-15%Vn) the power supply may provide a under-voltage to some electronic components; for this the logic switches off the current.
A4		Over-temperature IGBT	If the temperature of the power electronic components (IGBT) exceeds 85°C the inverter provide a thermal protection and stops the current. Before this stop protection the Inverter limit the current to 90% of the value imposed (F2)
A5		Motor Over-Current Thermal protection	To over-current beyond a certain time defined by an I^2t algorithm, the inverter limit the current to protect the motor from damage to the insulation. *For the correct functioning of this protection regulate the nominal motor current (F2).*
A6		Pressure transducer problem	In case of a problem or failure of the pressure transducer, the Inverter switches off the motor current. Re-start must be manually, pressing STOP followed by START.
A7		Minimum flow	This protection stop the pump when all output are closed and the flow of water is null. Do not switch on “Alarm” led.
A8		Dry working	This protection stop the pump in absence of input flow of water. After five consecutive re-start, the stop is permanent and switch on also the “Alarm” ledl
A9		Voltage Supply /Motor out inversion *(ITTP1.5W-BC only)*	Probably the input supply phases are inverted with the output. Please verify the correct cable connections (fig. 14-15).
A10		Phase T Peak Current (U6-U5) *(only IMTP-ITTP)*	The logic switches off the power instantaneously if this value exceeds a peak that can damage the power electronic components. Possible high starting current or short-circuit on motor.
A11		Phase S Peak Current (U4-U3) *(solo per IMTP-ITTP)*	The logic switches off the power instantaneously if this value exceeds a peak that can damage the power electronic components. Possible high starting current or short-circuit on motor.
A12		Phase R Peak Current (U2-U1) *(solo per IMTP-ITTP)*	The logic switches off the power instantaneously if this value exceeds a peak that can damage the power electronic components. Possible high starting current or short-circuit on motor.

Table 7: Protections and Alarms

All Alarms from A1 to A6 (table 7) are showed with the corresponding Led on the circular Led bar and the red Alarm Led, that is flashing if the protection have automatic re-start otherwise is fixed if the protection need a manually re-start doing STOP then START.

Protections and Alarm details:

CURRENT PICK PROTECTION (A1): The Inverter stop immediately the current in case this value exceed a maximum value limit for the electronic components

MINIMUM FLOW WORKING PROTECTION (A7): to prevent a closed delivery working, the control logic read the motor's working point condition; if this point is under a setting value, the system switches off the pump, and appears on the display "Minimum Flow". At the end of this condition, the system restarts its normal operation. The pump curve is detected by the initial self-regulation check.

DRY WORKING PROTECTION (A8): To avoid that the pump can continue to operate after a problem in absence of suction/intake water, the system read some information of the electric motor, in a time of 30 seconds, and when they go below a minimum, turn off the pump and show the relative signal of alarm "Dry Working". The inverter tries N°5 consecutive re-start in this condition, one spaced 15 minutes of each other. After the fifth consecutive fault, switch on the led Alarm and the re-start must be manually do, pressing STOP followed by START.

ENABLE OFF: the enable contact (float contact) is open and the led MOTOR ON is flashing.

7. SOLUTION ON THE MOST COMMON INSTALLATION AND WORKING PROBLEMS

N°	Possible Problem	Possible solution
1	Pressing start button the motor don't start or start and stop after few seconds and the inverter show Over-Current alarm or Current Pick alarm	Check if the input/output of the inverter are respectly connected between line and motor, without inversion (Warning: input/output inversion can damage the electronic board of the inverter). Check the correct connection of the pump (star/delta): possible mistake. Check if all the phase-wires to the motor are connected good and the three current are balanced. Check if the motor power size is not so high on respect to the inverter size. Check if the inverter is not on Master-Slave condition (F17)set to slave, without the Master inverter connected and switched on: in this situation waiting 30s after pressing start button, the inverter will start automatically alone.
2	Pressing start button the motor don't start or start and stop immediately and the inverter show Under Voltage alarm	Check that all the input voltage supply wires are connected good on the entrance of the inverter: if the inverter input is three-phases but on the connection there are only two, the inverter switch on and can start the motor, but after haven't enough power to supply it. Check that before the inverter the supply line wires size are good to have a limited voltage drop, then a sufficient voltage value on the inverter.
3	During working at the maximum power the inverter reduce continuously the output power to the motor then stop the motor and the inverter show Over Temperature IGBT alarm /Inverter Temperature alarm	Temperature of the electronic board of the inverter is too high and the inverter must remain stop for few minutes to reduce the internal temperature before the automatic restart. Be sure that the inverter stand on a wall, in vertical position, protected from directly sunlight, and the air flow is totally free; the inverter cannot work continuously at the maximum power with a ambient temperature higher than 40°C and with high temperature can reduce automatically the output power (-10%, -20% then stop for few minutes).
4	Pressure Transducer don't measure the correct pressure value (error > 1 Bar)	Check if the pressure transducer is connected on the delivery of the pump on a correct position, not so close to the impellers and before the valve to close the flow.
5	Pressure Transducer measure a pressure too high when the motor is running then the Inverter reduce the motor velocity at the minimum value (low frequency)	Check that the pressure cable is separated from the motor cable, that is a source of noise; specially when the cable of the pressure transducer is too long (long distance between inverter and motor) it's very important to use a shielded type two wire cable, as far as possible to the motor supply cable. Connect the shield to ground only on one terminal, if possible connect it directly on a metal screw to ground near the motor.
6	The Inverter cannot work because remain in Pressure Transducer Problem alarm condition	Check If the wires of the pressure transducer are correctly connected brown on +, white on S contact on the board. Check wiring connection on the cable of the pressure transducer. Warning: In case you need to cut the pressure transducer cable to add a longer cable be sure to switch off the inverter at least 1 minute before to cut this cable, otherwise you can cause a short circuit on the transducer input of the electronic board (damage) if the internal capacitors are not totally discharged.
7	The distance between Pressure transducer and Pump is high (long pipe) and the pressure continuously go up and down	You must reduce the velocity of the feedback control reducing the Proportional factor (F13) and the Integral factor (F14). Try to set these values to half and test the system, then, if not enough, reduce more and test again until the pressure control remain stable.
8	The Inverter stop the motor for Minimum Flow with a high flow condition and then re-start and stop again, continuously	A small water membrane Tank charged with 1.5-2 Bar air pressure is required for a correct working; check it. The condition may also caused by a not correct pump curve saving during the automatic check: possibly the delivery was not totally closed and the Inverter checked a higher curve of the pump; reset the inverter (STOP and – button during 5 seconds) and repeat the automatic check closing totally the outlet and try again the functioning. Verify if there is a no-return inlet valve on the pump and if it's working good without loses.

		It's possible to reduce the flow before stopping reducing the parameter Minimum Flow Power stop (F1).
9	The inverter don't switch off the pump when the valve on delivery is totally closed	Probably check was done with pump not perfectly filled up; remake the check procedure after a complete filling of the pump and try again if pump switch off correctly in minimum flow condition. If the problem remain, try to grow up the function F1, 2 point every time and testing pump, till find the correct working.
10	The hydraulic system have a big tank (>40 l) and, after check did correctly with closed delivery, the pump stop for minimum flow with a high flow, and then re-start and stop again, continuously	Probably during the automatic check there was a flow of water to full up the big tank, for that the pump curve saved by the inverter is not the correct curve (with null flow and maximum pressure). Maintain full of water the tank (pressure near maximum value); reset the inverter (STOP an – during 5 seconds) then repeat the automatic check pressing start. When the check finish try to work again testing the minimum flow stop condition of the motor that must be with a small flow.
11	The Inverter stop the motor for Dry Working condition	Sometimes the problem is caused by the same Automatic Check error that previous point (see possible solution like above). In other cases possibly there is air mixed with the water on the inlet of the pump (verify pipes and junctions). Warning: this problem can be more often on some types of small pumps where the Power absorbing Vs Flow curve is close to the horizontal (ex: Jet pumps).
12	The pump don't switch off for dry working when the inlet pipe and the pump are empty	In normal working condition, with pump and pipes filled up, make a Reset (Stop and – buttons maintaining pressed at the same time during 5 seconds) and remake a check procedure (Start, maintaining closed delivery). If the problem remain verify that pump haven't any defect (fault seal, impellers, etc) that can cause a big power absorbing also without water, in dry condition.
13	A group of two or more inverters cannot communicate between each other in Master-Slave mode	Check the correct radio connection between the inverters (F17 must be =1). Check also the radio frequency on F20: must be the same for all the inverters on the same group of pumps. The distance between the inverters on a group on the same room cannot be more than 15 meters without shielding iron wall between the inverters.
14	The Inverter conduct on the input voltage supply line electromagnetic noises that disturb other electronic devices	Check Ground cable connections (Ground system must be radial type, with resistance less than 10 Ohm). All the Inverters have an internal Input EMC filtering stadium, but is available also an additional EMC Input filter (various types, contact the service) for bigger noise suppression with sensitive devices connected on the line.
15	With a long cable between Inverter and Motor sometimes the inverter stop the motor in Pick Current alarm	The motor can have high pick voltage value caused by the high frequency of the PWM combined with the high capacitance to ground of the long cable: we suggest to use an additional inverter output filter for cable longer than 40 meters, connecting it directly on the Inverter output. Available various types of output filters, contact the service to receive informations.
16	The Differential Circuit Breaker on the line sometimes switch off the inverter	Check the Ground system resistance (must be less than 10 Ohm). Use only differential circuit breaker type A (specific for Inverters).
17	The Magneto-Thermal Circuit Breaker on the line switch off the inverter when the pump run at the maximum power	All the inverters may have a high pick value of the sinusoidal caused by the harmonics (5^{th} , 7^{th} , $11^{th,}$ etc.) and depending by the resistance of the line, but this condition don't increase the energy absorbing value depending by the area under this current curve. Only you need to use a Magneto-Thermal Circuit Breaker with a higher Current value than the value that you can use for the direct pump controlled. Usually it's enough a switch one step higher than the switch useful for the simple motor (see table of the Magneto-Thermal protection suggested on the handbook).

Table 8: Solution of the most common problems during installation and functioning

8. GUARANTEE

Under the current European low: guarantee of 2 years calculated from the date of delivery of prejudice further provisions of law or contract.

To have service in guarantee, it must submit to the company providing the guarantee certificate completed.

The guarantee is excluded or interrupted in anticipation if the damage is caused to the following: External influences, non-professional installation, non-compliance with instructions, interventions by unauthorized locations, use of not original spare parts and normal wear.

9. DICHIARAZIONE DI CONFORMITA' / DECLARATION OF CONFORMITY

La ditta Electroil s.r.l. con sede in Reggio Emilia - Italia
dichiara, sotto la sua esclusiva responsabilità, che la sua gamma di inverter **IMMP1.1W – IMMP1.5W – IMMP1.5W-BC – IMTP1.5W – IMTP1.5W-BC – ITTP1.5W-BC**
è costruita in conformità con la seguente normativa internazionale (ultima edizione):
Company Electroil s.r.l with seat in Reggio Emilia – Italy
declares, under its exclusive responsibility, that its range of inverters **IMMP1.1W – IMMP1.5W – IMMP1.5W-BC – IMTP1.5W – IMTP1.5W-BC – ITTP1.5W-BC**
is constructed in accordance with the following international regulations (latest edition)

- **EN60034-1**. Macchine elettriche rotanti: caratteristiche nominali e di funzionamento / *Rotating electrical machines: nominal and running characteristics*
- **EN60034-5**. Macchine rotanti: definizione gradi di protezione / *Rotating machines: definition of degrees of protection*
- **EN 60034-6**. Macchine rotanti: sistemi di raffreddamento / *Rotating machines: systems of cooling*
- **EN60034-7**. Macchine elettriche rotanti - Parte 7: Classificazione delle forme costruttive e dei tipi di installazione nonché posizione delle morsettiere / *Rotating electrical machines - Part 7: Classification of types of construction and type of installation as well as terminal box position*
- **EN60034-8**. Marcatura dei terminali e senso di rotazione per macchine elettriche rotanti / *Terminal markings and direction of rotation for rotating electrical machines*
- **EN60034-30**. Macchine elettriche rotanti: classi di efficienza per motori a induzione trifase ad una velocità. / *Rotating electrical machines: efficiency classes of single-speed, three-phase, cage-induction motors.*
- **EN50347.** Motori asincroni trifase di uso generale con dimensioni e potenze normalizzate - Grandezze da 56 a 315 e numeri di flangia da 65 a 740 / *General purpose three-phase asynchronous motors having standard dimensions and powers - Frame numbers 56 to 315 and flange numbers 65 to 740*
- **EN60335-1**. Sicurezza degli apparecchi elettrici d'uso domestico e similare / *Safety of household and similar electrical appliances*
- **EN 60335-2-41**. Sicurezza degli apparecchi elettrici d'uso domestico e similare - Parte 2: Norme particolari per pompe / *Safety of household and similar electrical appliances - Part 2 Particular requirements for pumps*
- **EN 55014-2**, Compatibilità elettromagnetica. Requisiti per gli elettrodomestici, gli utensili elettrici e gli apparecchi similari. Parte 2: Immunità / *Electromagnetic compatibility. Requirements for household appliances, electric tools and similar apparatus. Part 2: Immunity*
- **EN 61000-3-2**, Limiti per le emissioni di corrente armonica (apparecchiature con corrente di ingresso <= 16A per fase). / *Limits for harmonic current emissions (equipments with input current <= 16 A per phase).*
- **EN 61000-3-3**. Limitazione delle fluttuazioni di tensione e dei flicker in sistemi di alimentazione in bassa tensione per apparecchiature con corrente nominale <= 16A. / *Limitation of voltage fluctuations and flicker in low-voltage supply systems, for equipment with rated current <= 16 A*
- **EN 61000-3-4**. Limiti per le emissioni di armoniche di corrente in apparecchiature con corrente nominale <= 16 A / *Limits for harmonic current emissions for equipment with rated current <= 16 A*
- **EN 61000-3-12**. Limiti per le correnti armoniche iniettate nelle reti di distribuzione pubblica a bassa tensione dalle apparecchiature con correnti nominali di ingresso superiori a 16 A e <= 75 A per fase / *Limits for harmonic currents produced by equipment connected to public low-voltage systems with rated input current greater than 16 A and <= 75 A per phase*
- **EN61000-6-4**. Compatibilità elettromagnetica (EMC): Parte 6-4: Norme generiche - Emissione per gli ambienti industriali / *Electromagnetic compatibility (EMC): Part 6-4: Generic standards - Emission standard for industrial environments*
- **EN 50178**. Apparecchiature elettroniche da utilizzare negli impianti di potenza. / *Electronic equipments for use in power installations*
- **ETSI 301 489-3** Compatibilità elettromagnetica per dispositivi Radio SRD operanti sulle frequenze tra 9 kHz e 40 GHz / *Electromagnetic compatibility for devices Radio SRD operating on frequencies between 9 kHz and 40 GHz*

come richiesto dalle Direttive / *as required by the directives*

- Direttiva Bassa Tensione (LVD) 2014/35/EU / *Low Voltage Directive (LVD) 2014/35/EU*
- Direttiva sulla Compatibilità elettromagnetica (EMC) 2014/30/EU / *Electromagnetic Compatibility Directive (EMC) 2014/30/EU*
- Direttiva sulla progettazione ecocompatibile dei prodotti connessi all'energia CEE 2009/125 / *Ecodesign Directive for energy related products EEC 2009/125*
- Direttiva 2011/65/UE RoHS II sulla restrizione dell'uso di determinate sostanze pericolose nelle apparecchiature elettriche ed elettroniche. */ Directive 2011/65/EU RoHS II on the restriction of the use of certain hazardous substances in electrical and electronic equipment*

NB: la Direttiva Macchine (MD) 2006/42/CE espressamente esclude dal suo campo di applicazione i motori elettrici (Art.1, comma 2)
/ *NB: the Machinery Directive (MD) 2006/42/EC expressly excludes from its scope electric motors (Art. 1, paragraph 2)*

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